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# Thinking is for doing: Project cognition as the foundation of project behaviour

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## A R T I C L E   I N F O

## A B S T R A C T

Cognition, understood as the way the mind acquires, processes, and enacts information, is at the root of all behaviour. Yet, while the interest in behaviour in projects is increasing, these cognitive foundations are often disregarded or only haphazardly investigated in project research. This essay calls for a stronger engagement with cognition in projects, leveraging the insights from general and applied cognition sciences to explore, explain, and predict project behaviour. We emphasise that it is not differences in the thinking itself, but differences in the context in which the thinking is applied, that makes projects a relevant and distinct area in which to study cognition. To sketch a way forward, we establish key terms, illustrate phenomena from project behaviour which might benefit from a study through a cognitive lens, and introduce appropriate theories from cognitive science. The insights generated from such research with attention to 'project cognition' are particularly valuable for practice as they help to design project environments that align with how people in projects make sense of their world and interact with it.

*"My thinking is first and last and always for the sake of my doing."* (William James, 1890)

The behaviour of individuals and teams in projects – also referred to as *Project Behaviour* (Unterhitzenberger, 2021) – has a major effect on project outcomes, e.g., through teamwork, conflict resolution, trust building, and knowledge sharing. A major factor to describe and explain such behaviour is the role of individuals' cognition (Beck, 1979), meaning the '*internal psychological processes that are involved in making sense of the environment and deciding what action might be appropriate*' (Eysenck, 2001, p. 1). However, the project literature is limited in the study of cognition, with a skewed focus on a few concepts, such as cognitive biases, and often lacking a solid grounding in cognitive science theories. Moreover, theories from organizational behaviour which have their theoretical roots in cognition, such as sensemaking (Weick, 1995), are increasingly applied to projects, yet without serious engagement with these cognitive roots. This haphazard engagement with fundamental theories from cognitive sciences leads to a fragmented literature on cognition in projects and consequently an incohesive and sometimes contradictory understanding of how cognition influences project

behaviour and outcomes. The study of cognition in projects would benefit from a more comprehensive and interdisciplinary approach to enhance our understanding of cognitive dynamics in project settings.

This essay aims to establish the term 'project cognition', which we define as the study of cognition in projects, with a focus on unique challenges for information acquisition, processing, and enactment in a project environment. Clarification of this concept should enable better identification of those phenomena within project behaviour, which could be more thoroughly explored, explained or even predicted by attending to how cognition is manifest in these situations. In this essay, we set a course for the future of this research within the project management literature. Specifically, we establish key terms, provide an overview of what has been done in this area to date, and identify avenues for researchers from all disciplines to contribute to the development of this nascent and yet necessary (as evidenced by the body of existing project management literature in this area) concept.

To achieve our aim, this essay has three objectives: first, to illustrate the somewhat fragmented and disconnected nature of current research on cognition in projects and show how this may leave important

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opportunities for novel academic insights and practical implications for project management untapped. Second, to start a conversation around phenomena in projects that may be particularly well suited to the application of a cognitive perspective. It is important to note here that we are not suggesting people in projects think differently, only that they are likely to encounter unique challenges in their project work that may not be as prevalent elsewhere due to the nature of projects. Third, to consider how our understanding of project behaviours can be extended by applying a cognitive perspective through connecting the behaviour with its cognitive underpinnings. In sum, this essay seeks to formulate a common way forward for the study of cognition in projects, grounded in a shared foundation of theory, phenomena, and methods.

Cognitive theory proposes cognition and behaviour are intrinsically connected (Beck, 1979) or, in the words of our epigraph (James, 1890): *Thinking is for doing.* The observable doing, or the behavioural aspect, has been of ongoing interest in project studies (Geraldi & Söderlund, 2018), with a more recent effort to establish 'project behaviour' as a concept with its own identity (Unterhitzenberger, 2021). Within the concept of project behaviour, one school of thought focuses on the behaviour of individuals and groups in projects, inspired by the general research tradition of organizational behaviour.

It is a rich field of research, as projects and their outcomes are shaped by the behaviour of countless people, for example: the politician that does or does not listen to valid concerns, the steering committee member that argues for or against a project, the project contractor that is more or less honest about the status of the project, the project manager that does or does not react to unusual behaviour from her team member, the planner that adds more or less contingency to the plan, or the engineer that does or does not pick up the phone to clarify an ambiguous requirement. Increasingly, project research studies behaviour, from generic issues, such as communication (Foss et al., 2016) or behaviour in concrete decision-making contexts (Stingl & Geraldi, 2017), to specific behavioural patterns, such as corrupt behaviour (Lehtinen et al., 2022) or escalation of commitment (Winch, 2013). However, the theoretical underpinning of these studies is poorly linked to established theories and concepts, which diminishes its potential contribution to the field (Hobbs et al., 2015; Unterhitzenberger, 2021).

Cognitive science offers a body of knowledge that provides such a theoretical foundation, which can both deepen and extend our knowledge of behaviour in projects. Research on cognition has extensively studied the varied mental processes that make up cognition, including attention, perception, learning, memory, language, problem solving, decision making, reasoning and thinking (Eysenck, 2001). Thus, internal cognitive processes are wide-ranging, continuously shaping how project practitioners perceive, interpret, and respond to information. The breadth of cognition topics is indicative of the potential breadth of the project cognition research. Identifying and studying the cognitive processes that sit behind project behaviour can help us to better assess why project practitioners and teams behave the way they do and how they can perform more effectively. Further, a cognition lens allows us to explain and predict behaviour in a certain (project) context based on how an individual acquires, processes, and ultimately enacts the information, through consideration of both the task and the information environment. Through this lens we can link the individual and the observable behaviour with a particular context, in a manner that allows us to explain and predict behavioural differences and patterns. Such insights moreover can serve as a foundation for the design of frameworks, tools, interventions, or environments that support effective project delivery by supporting – rather than opposing – how people in projects make sense of their world and interact with it.

We chose the term 'project cognition' with inspiration from research communities in other domains of managerial and organizational studies, such as entrepreneurial cognition (Mitchell et al., 2014), strategic cognition (Narayanan et al., 2011), and other domains of organizational or applied cognition (Groome & Eysenck, 2016). In these domains of managerial and organizational research, we see that academic

communities on cognition have become more institutionalized with a shared foundation of central theories and research themes, and visibility in specific conferences, conference tracks or academic outlets.

A reason why we have seen the emergence of and sustained interest in these distinct and well received research streams stems from their ability to connect to concrete and characteristic challenges and phenomena of their domain and provide novel explanations for the behaviour of practitioners in face of these challenges. For example, in entrepreneurship, one of the defining characteristics of entrepreneurs is being able to spot market opportunities. This characteristic has created a research focus that has revealed several cognitive strategies entrepreneurs use to identify opportunities (Grégoire et al., 2015). In strategy, research has explored senior managers' ability to make sense of competing – or even paradoxical – strategic objectives through cognitive frames and mental models (Smith & Tushman, 2005). Other researchers have explored which cognitive strategies senior managers use to devise new strategic patterns for an uncertain external environment (Gavetti et al., 2005). Further, applied research on cognition in high stakes operations has explored how a design that takes the practitioner's cognition into account can facilitate safe and effective task execution - from aviation (Rosa et al., 2021), to surgery (Pauley et al., 2011) and nuclear power plants (Lee et al., 2016). Thus, across these fields, a cognitive lens allows zooming in into the tasks, challenges, or phenomena of the domain, and contribute to both academic understanding and practices.

In the project management literature, we do not see such a consolidation of cognitive themes, theories and methods, despite scattered, and yet increasing, interest in cognition over the last four decades. A key question is whether this consolidation is necessary. Why invent yet another term? We argue that projects come with their own distinctive challenges that are shaped, amongst other factors, by the temporary organization around the project, the nature of the tasks typically associated with projects, and the external and internal uncertainty that surrounds all project work. A consolidated approach to the study of project cognition would seek to define the challenges project practitioners navigate and connect them with existing or new theories and research on the cognitive processes, which can help to explain how practitioners act, decide, and/or communicate when facing these challenges. In the following, we present a framework for such a shared foundation and outline a way forward for the future development of an academic community on project cognition. To do so, we first discuss how cognition has been studied in project research to identify the phenomena that might be of particular interest. Thereafter, we discuss, more systematically, the characteristics of projects, which create an interesting new setting for the consolidation and expansion of cognition research. We moreover draw connections to theories and concepts from cognitive science, which can provide new insights into behaviour in the face of these particular demands.

## 1. Existing research on project cognition

Our first objective is to consider the existing research on cognition in projects, to illustrate its somewhat scattered nature, and point to opportunities for better connection across project cognition research and beyond to more general studies of cognition. Cognition as a recurring research area within project studies can be traced back to at least Booker & Bryson, 1985 when Booker and Bryson studied decision analysis. Since then, a variety of topics and themes from cognitive science have popped up across the expanse of project research with studies on perception, creativity, cognitive bias, cognitive mapping, learning, team cognition, and cognitive abilities. Many of the research explicitly relating to cognition explores decision-making behaviour and judgment in and around projects, often explicitly problematizing decision-making behaviour as biased or overoptimistic (e.g., Flyvbjerg, 2021; Shi et al., 2023; see also Stingl & Geraldi, 2017 for a review). These studies typically 'ride the wave' of the general interest in heuristics and cognitive biases, ignited by Daniel Kahneman's Nobel prize and his bestselling

book 'Thinking Fast and Slow' (2011). Maintaining this rather strict view on biased versus good decisions in projects, these authors also seek designs that 'de-bias' or guide practitioners into drawing the 'right' conclusions.

Yet, other project researchers – amongst them some of the authors of this essay – emphasize that any such decision-making behaviour needs to be examined in context. These researchers challenge the black-and-white world of Kahneman and Tversky's psychology lab, which may not apply in the dynamic and partially unpredictable reality of projects. For example, Stingl & Geraldi, 2021 suggest considering when and how project practitioners' heuristics can – in the right context – become an effective strategy for reasoning and decision-making. This argument takes inspiration from Gigerenzer et al., (2011) adaptive heuristics research program that offers a notion of 'ecological rationality' – appraising a heuristic's fit with task and context – as an alternative to an absolute view on rationality. Similarly, Lawani et al. (2023) studied the cognitive roots of intuition, to offer an alternative view on practitioners' intuition in contrast to the often-made dismissal of intuition as biased and faulty.

Beyond explicit decision making, another body of project cognition research is concerned specifically with the future orientation of projects and how practitioners cognitively engage with the uncertain, complex, and dynamic future of projects. Winch and Maytorena, for example, have made several contributions on the topic of cognition for risk identification (Maytorena et al., 2007; Winch & Maytorena, 2011). Others have discussed the role of cognitive traits related to the ability to cope with risk and uncertainty (Rashid & Boussabiane, 2019), or how images of the future need to be cognitively (co-)constructed by people in projects (Pitsis et al., 2003; Stingl & Geraldi, 2023). This line of research also investigated concrete practices such as cognitive mapping as a tool that supports explicating underlying cognitive structures and facilitate group cognition (Ackermann et al., 2014).

A small number of contributions have been concerned with how learning happens in projects – contributing to an old debate as to whether, and if so how, learning between projects is feasible, given the relative uniqueness of each project (Grabher, 2002, 2016). Such studies have pointed to the tacit nature of knowledge in projects, which requires forms of social learning (Hartmann & Dorée, 2015; Sense, 2007). Moreover, they have indicated how experience, experiential learning, or formal training can influence practitioners' cognition during decision making (Rumeser & Emsley, 2019) and judgement (Maytorena et al., 2007).

Another body of project cognition research has been concerned with the social nature of projects with exploration of team cognition. Here, the interest is, in particular, on the heterogeneity of project teams, and the resulting diversity of individual cognitive styles or strategies, and how these can be bridged and mediated during collaboration. Such research has, for example, illustrated the effect of cognitive-artifact use during agile software development (Drury-Grogan, 2021) or project team resilience in the face of uncertainty (Pavez et al., 2021).

The combined challenges of complexity, uncertainty, and the need for contextualized learning of groups, rather than just individuals, connects well to the concept of sensemaking (Weick, 1995), which is an increasingly common lens to theorize on project behaviour (e.g. Bansal et al., 2022; Iftikhar et al., 2024). Yet, these studies typically only mention the cognitive roots of sensemaking in passing, then turning to explore where and when sensemaking happens, rather than how it happens and what shapes the sensemaking process (for exceptions, see e. g. Kutsch et al. (2021) or Stingl & Geraldi, 2023).

As we begin to review the project cognition literature, we can draw several conclusions as to the current state of research on project cognition, regarding both what has been studied, and how. Foremost, the image that emerges is one of scattered spotlights, clustered around researchers who engage in, at times, short-lived excursion into the field of cognition, picking up one specific theme or theory. Popularity in management research certainly plays a role, periodically increasing

interest in topics such as cognitive biases, heuristics, or – in a recent special collection in *Project Leadership and Society* – mindfulness (Daniel et al., 2023). Resultingly, there are only a few theories from cognitive sciences that have been considered more regularly and in more depth. Yet, even amongst those contributions the dialog and cross-fertilization appear to be limited. In turn, many concepts and topics from cognitive science that have driven theorizing and practical insights in other managerial or organizational domains have not, or have just sporadically, been applied in project research. These range from themes such as problem solving and information processing, to temporal cognition or social cognition. Most notably, the rich field of cognition in learning – including constructivist learning and other theories on memory and knowledge (Ormond, 2020) – remains almost entirely untapped. We also see contributions that discuss project cognition or project behaviour without naming the elephant in the room – that is, the cognition itself that informs and shapes the observable behaviour. For example, while there is increasing interest in the ability of project leaders to sense and identify looming crises, the theoretical discussion typically remains at the behavioural level, such as communication (Simard & Laberge, 2018). Here, a cognitive lens, for example grounded in the concept of situation awareness, could provide better explanation to observed behaviour by introducing new questions, such as how individual attention is influenced by organizational factors, how information is sought and acquired, and how such information is processed and interpreted.

In terms of themes, we observe several notions of projects that have guided the research on project cognition, typically linked to uncertainty (about the future and otherwise), the challenge of learning and enacting experience in an everchanging context, and the social component of projects, where much of the thinking serves to guide how practitioners engage with their social environment. None of these themes is unique to projects, yet it is at their nexus where the project comes to life.

## 2. It is the context – not the thinking – that sets project cognition apart

Despite sometimes exceptional skills and expertise, and even with the emergence of Artificial Intelligence (AI), project practitioners still rely on human minds – and thus the same cognitive foundations as their peers in roles such as senior management, administration, and operations. Just like project practitioners, other professionals must make sense of complexity, the ambiguity that stems from diverse social settings, uncertainty about the future, and so forth. Surgeons need to make quick calls in the operating room with only limited information, CEOs must balance conflicting strategic objectives, and investors have to make fast and often only intuitive guesses about future market developments. Yet, as with any profession or domain, project practitioners face their own specific cognitive demands – related to what can be known, what should be known, and why. These challenges can manifest through explicit decisions, such as portfolio choices, but also through ill-defined requirements for judgements, such as whether a change in the environment bodes ill for the project. Other such requirements may relate to planning, the often-times ad-hoc need for action, or the prioritization of work in novel tasks that do not have pre-defined processes and best practices. Consequently, project practitioners need to develop or leverage suitable cognitive strategies to effectively navigate these landscapes. We argue that seven characteristics of projects contribute to shape these unique informational challenges, and which, in their combination, make project cognition an important and distinct topic for study: action orientation, novelty, cross-boundary collaboration, future creation, uncertainty, and social dynamics (Table 1).

The intersection of these characteristics generates unique contexts that define specific challenges in projects. These challenges can be analysed through a cognitive lens to address questions specific to them. As an illustration, consider the decision making of a steering committee on whether to abandon a struggling project. Such a setting can be aptly

**Table 1**
Project characteristics, their effects and relevant cognitive perspectives.

| Project characteristic | Effect on information challenge | Examples of relevant cognitive perspectives |
|---|---|---|
| *Temporariness.* Projects are a temporary organizations, hence do not have an available organizational script to follow | Project leaders need to develop a new script for the project at hand. | Problem solving; Creativity; Decision making under uncertainty Risk perception |
| *Action orientation and situated decision-making.* Attention in projects is towards doing, where decisions serve often to shape one's (next) action | The individual needs to develop novel action alternatives ad hoc and anticipate the consequences of their actions for themselves and their team. | Information processing; Situation awareness; Creativity; Problem solving; Mental simulation |
| *Uniqueness and novelty.* Each project varies in its goals, processes, outputs, outcomes, contexts, stakeholders, etc. | Challenge for learning and knowledge codification, need for contextualizing knowledge rather than executing rules, need for ongoing reflection and innovation. | Transfer of knowledge; Constructivist learning; Memory; Creativity; Problem solving |
| *Cross-boundary collaboration.* Projects often take place across organizations or departments with diverse groups of participants. | Expertise, experience, history, personality, or group-belonging shape different interpretive frames, preferences, and information asymmetries. | Problem solving; Cognitive flexibility; Mental models; Cognitive artifacts; Knowledge translation |
| *Future creation* Projects are about turning vision into reality, as such, there is a "before" and "after" the project. | Activities in projects directly influence future outcomes, creating a highly dynamic and hard to predict setting and require imagining varied futures. | Temporal cognition; Planning; Mental simulation; Creativity; Problem solving; Cognitive reframing |
| *Uncertainty, ambiguity & complexity.* Projects are often highly complex and dynamic and in turn characterized by uncertainty and ambiguity | There may be no right or wrong answer to some questions, predictions are difficult to make, information is sometimes scarce or difficult to acquire. | Decision making under uncertainty and stress; Risk perception/ tolerance; Cognitive load; Cognitive strategies; Heuristics (and biases); Intuition; Information search |
| *Complex social dynamics.* Project teams can have a more dynamic set-up requiring collaborative workstyles such as alliances and fluid leadership, rather than clearly defined decision authorities. | Making sense of the task and the information is a group, rather than an individual activity, where both the purpose of the activity, and the way to accomplish the task need to be (re-)aligned across the members. | Social cognition; Shared mental models; Cognitive flexibility; Cognitive dissonance; Group problem solving; |

framed as a process of social cognition, in which a group of diverse individuals aims to make sense of the past, present, and future of a project. The individuals on the committee are likely to arrive at different conclusions based on the information they have, the information they seek before or at the meeting, their individual experiences, and their cognitive strategies to process such information. Moreover, any decision that they make can have a direct impact on their resources, social relations within the organization, or even career, which they might need to consider when engaging in the decision-making process. In turn, these decisions happen in a context where there might be no right or wrong answer, as the outcomes are hard to predict and possibly even shaped by the decision-making process itself (or the behaviour of the decision makers after leaving the meeting). The cognitive lens focuses our attention on questions such as: How does the individual steering committee member interpret the uncertain, incomplete or ambiguous information they receive about the project's past and present? How do they acquire information through an external search or memory – and to what do they pay attention and why? What do they consider when they imagine what the future might bring? What influences how they arrive at their individual conclusions? How do they align their interpretations with others – and what happens if they can't?

Answers to these questions hold implications for both theory and practice. Academically, they allow a more nuanced explanation to, as per our illustration, the roots of escalation of commitment by investigating how the group cognitively arrives at the judgement that a continuation of the project is in their interest. These questions can also challenge the too-easy notion that the individual is either biased or

opportunistic (Flyvbjerg, 2008) as they seek to answer why individuals arrive at certain conclusions, why those conclusions sometimes align across a group and sometimes not, and thus also how individuals rationalize their behaviour by grounding them in their conclusions. Such considerations can help to bridge different streams in the literature on project behaviour. More concretely, it can provide a cognitive foundation to theories from a contextualist school of thought (Stingl & Geraldi, 2017) that seeks to understand how individuals and groups create or negotiate meaning. It does so by attending not only to sensemaking as a social process, but by discussing how the artefacts and routines in the steering committee – the documentation, questions, preparations, and so forth – shape how the individual and group makes sense of the project's prospects.

Moreover, it also adds more nuance to the pragmatist school of thought (Stingl & Geraldi, 2017) which seeks to explain behaviour in projects as the outcome of bargaining and political gain-seeking of otherwise 'rational' actors. Rather than simply positing that all actors have their intrinsic motivations and will behave to maximize their interests, the cognitive lens asks how actors seek and process information in the context of their own mental models and preexisting knowledge. Thus, we can explore how one steering committee member might *think* continuing the project will serve their interest, but also how changes in information presentation can lead them to an entirely different conclusion. All in all, rather than merely judging or describing the steering committee's eventual decision, attending to the cognitive processes allows us to explain *why* they arrived at their conclusion. More importantly, it permits us to investigate *how* the environment in which the

committee operated – their practices, reports, time-pressure, etc. – directly influenced the outcome of their cognition. This allows us to consider the design and deployment of routines and tools, to facilitate how individuals and groups make sense of the project – and critically engage with those elements that may have a potentially detrimental effect on such a process.

## 3. Building the foundations for the study of project cognition

The previously discussed illustrative case of a project steering committee at the crossroads is just one of many settings that comes to mind where a turn towards project cognition as an avenue of study in and of itself can create meaningful new insights and which, at the same time, are unique settings for the study of cognition in organizations. Moving forward, we seek to invite and inspire project researchers to engage in consolidating and advancing project cognition as a field of research, by establishing a common ground of project-typical phenomena, relevant theories, and methodological approaches.

Attending to the outlined specific characteristics of projects that – through their overlap – create interesting settings for the study of project cognition, we encourage project researchers to identify and describe the unique cognitive challenges of projects. Just as entrepreneurial cognition focuses amongst others on opportunity recognition (Grégoire et al., 2010), or strategic cognition on manager's ability to devise new strategic pathways (Gavetti et al., 2005), we as project researchers need to find and establish our own phenomena of interest. They could be situated in the crucial – yet often criticized – process of planning, where practitioners must face the inherent paradox of projects that the most important decisions are made at the point of least certainty. Or they could relate to the social complexity of projects, where coordination is difficult and uncertain tasks needs to be accomplished across organizational (and other) boundaries. Further, they might focus on the idea of the reflective practitioner (Crawford et al., 2006) who manages to build up competence and knowledge despite an ever changing project environment. To inspire such search of interesting phenomena, Table 2 provides a non-comprehensive list of interesting project behaviours, and the cognitive perspectives that could offer novel insights.

To develop a robust theoretical foundation for project cognition, we recommend identifying key cognitive processes, theories, or concepts that can offer particularly relevant approaches to explore and explain project behaviour. This could involve looking at cognitive psychology, behavioural economics, and neuroscience to understand how cognitive processes are shaped by the project context. And, in turn, how these processes influence project outcomes. For example, insights from cognitive load theory could help us understand how the demands of managing a project affect information processing, while theories of social cognition could help explain how teams collaborate and make decisions in uncertain or complex situations. Referring back to Table 1, we also observe that problem solving – as a body of theory in cognitive science – is a recurring theme that might provide new insights into how practitioners cognitively engage with an uncertain, action-oriented, and future-creating challenge.

To move forward, we also need to develop our methodological toolbox. Cognitive science has strong roots in either experimental methods, conducted in well controlled environments, or surveys with validated constructs. Both surveys and controlled experiments can be, and have been, useful approaches in project research to measure specific cognitive traits or strategies, and their effect on behavioural outcomes. Yet, the multifaceted reality of projects also invites methods that embrace, rather than reduce, the complexity out of which project practitioners need to make sense. Examples such as cognitive task analysis to map the underlying cognitive processes of project practitioners' intuition (Lawani et al., 2023), or observation of practitioners' information search behaviour in risk identification tasks (Stingl & Geraldi, 2023; Winch & Maytorena, 2009) provide a glimpse into potential alternative methods. Such qualitative approaches are essential to build the foundation for new theories or constructs that capture the particularities of project cognition.

Ultimately, this research has the potential to enhance project management practices, improve project decision making, and facilitate better project outcomes across industries – for example through improved evidence-based training or the design of more user-friendly decision support systems. By attending to how people in projects think, how they build their repertoire of cognitive strategies, or how their environment shapes their cognition, we can make concrete recommendations to practice. This can start with fundamental questions of information presentation: How can data visualization help to process complex portfolio information? Or: When do more details on a Gantt-chart lead to cognitive overload and confusion, rather than better alignment within the team? It can also engage with the complex processes of planning and future making, with its numerous nested judgements, decisions, and imaginations. What may act as a barrier for project planners, to come up with novel ideas for the project execution model? Or: Which factors may lead to a skewed attention to some types of project risks compared to others? Eventually, such insights can also inform the development of decision-aids or even AI powered support

**Table 2**
– An inspirational list of themes at the intersection of project behaviour research and cognitive science.

| Project behaviour | Themes for a study using a cognitive lens |
|---|---|
| Teamwork: Collaboration on novel tasks in changing environments | How and when do shared-cognitive frames emerge during teamwork and how do they impact collaboration? How does cognitive load impact a team's ability to effectively collaborate? |
| Conflict resolution and trust building across different groups and organizations | How do project practitioners make sense of conflicts and the emotions of other parties? How does creativity affect an individual or teams' ability to bridge conflicting interests? How is trust cognitively developed through a process of learning? |
| Knowledge sharing and learning across projects | How is project expertise formed as a cognitive process of knowledge construction? How do people in projects seek or communicate knowledge about projects to others? How do project practitioners process and cognitively store project knowledge? |
| Planning, scheduling and making cost estimates under high uncertainty | How do context or cognitive style affect estimates in plans? How do project practitioners "fill in the blanks" in uncertain decisions at the front end? What influences project practitioners' proneness to goal seduction or decision inertia? |
| The dark side of projects (e.g., corruption, strategic misrepresentation and unethical behaviour) | How do project practitioners reason for or justify criminal or otherwise morally grey behaviour? How do project practitioners anticipate and assess the consequences of their behaviour for themselves and others? |
| Innovating processes within the project to adjust to changing conditions and gain a competitive advantage | How does divergent thinking affect a project team's ability to adjust to changing circumstances? What shapes a team's creativity for finding alternative ways of working? How can a problem-solving perspective explain innovation in project work? |
| Leadership as phenomenon that can be disjointed from formal authority, following expertise or personal characteristics | How do teams identify whose leadership to follow? Which factors support the alignment of leadership and team cognition? What are the cognitive traits of people who are considered effective leaders in projects? |
| Behaviour in the face of crises: identifying and assessing issues, devising reactions, deciding to abandon a project | How do people process incomplete information about project status? How and when do teams shift their mental frames to interpret the status of a project? What cognitive traits and strategies support the development of effective ad hoc responses in the face of crises? |

tools, by leveraging or even imitating human cognition in projects.

## 4. Moving forward - Reaching out and inviting in

Project researchers have deep knowledge of the world of projects, the intricate and sometimes problematic behaviour of the people that operate within them, and the challenges of obtaining, processing, or even trusting information that enables people to make sense of the project. Thus, we are aptly suited for identifying phenomena of interest, and starting to ask curious questions related to project cognition. Yet, to truly develop the field of project cognition, we need to invite researchers from other domains in, to connect to, discuss, and contrast the findings of their research. For example, health services researchers could share their findings on related topics, such as how medical staff manage the cognitive load associated with treating multiple patients in an emergency room – a similar but different context to managing multiple concurrent and ongoing activities that every project manager faces. We might also realize how aspects such as the temporal dimension (How quickly do I have to decide?), the difference of stakes (Might people die?), and also the level of routine (Have we seen something like this before?) lead to different patterns of cognition succeeding in these situations. Engaging with literature or – even better – colleagues from organizational, industrial, or general psychology can thus yield enlightening discussions and broaden our insight into topics of cognition beyond those currently trending. We believe researchers from numerous fields such as psychology, management, education, entrepreneurship, social science, health science, language, and culture can contribute to the study of project management and cognition by testing and exploring their cognition-related findings within the unique context of a project.

By bridging these disciplines, we can begin to develop a richer, more integrated understanding of cognition in projects - one that reflects the unique challenges and opportunities of project work. Such collaborations can thus sharpen our own understanding of what makes projects the idiosyncratic, yet special, place of research in which we live and also show to the 'outside world' that projects are valuable contexts for research. The intention of this essay was to create momentum and argument for a consolidated and more fruitful study of project cognition that hopefully resonates with the project research community. We are convinced that cognition does play a critical role in how individuals and teams navigate the complexities of project work, as demonstrated by the substantial body of project management literature on cognition topics, and argue that it is beneficial for researchers and practitioners alike to 'think about thinking'. Yet, as we discuss in this essay, despite its importance, the current status of research on cognition in projects is fragmented, and much work remains to be done to build a cohesive framework for its study. By consolidating and building on existing research on cognition in project management, drawing on the ever-growing body of research in the cognitive sciences, and applying it to the unique context of projects, we can begin to uncover the cognitive processes that drive project behaviour, leading to more effective and resilient project management practices and ultimately to better project outcomes. Moreover, understanding better how the project practitioner's mind makes sense of their tasks and challenges in an uncertain and complex environment can also become an important puzzle piece in the fierce debate whether, and if so, how AI can become a member of the project team.

## CRediT authorship contribution statement

**Verena Stingl:** Conceptualization, Writing – original draft, Writing – review & editing. **Alicia Gilchrist:** Conceptualization, Writing – original draft, Writing – review & editing. **Ama Lawani:** Writing – original draft, Writing – review & editing. **Rhona Flin:** Conceptualization, Writing – original draft, Writing – review & editing. **Ofer Zwikael:** Conceptualization, Writing – original draft, Writing – review & editing.

## References

Ackermann, F., Howick, S., Quigley, J., Walls, L., & Houghton, T. (2014). Systemic risk elicitation: Using causal maps to engage stakeholders and build a comprehensive view of risks. *European Journal of Operational Research, 238*(1), 290–299. https://doi.org/10.1016/j.ejor.2014.03.035

Bansal, A., King, D. R., & Meglio, O. (2022). Acquisitions as programs: The role of sensemaking and sensegiving. *International Journal of Project Management, 40*(3), 278–289. https://doi.org/10.1016/j.ijproman.2022.03.006

Beck, A. T. (1979). *Cognitive therapy and the emotional disorders.* Penguin.

Booker, J. M., & Bryson, M. C. (1985). Decision analysis in project management: An overview. In *, EM-32. IEEE Transactions on Engineering Management* (pp. 3–9). https://doi.org/10.1109/TEM.1985.6447630. IEEE Transactions on Engineering Management.

Crawford, L., Morris, P., Thomas, J., & Winter, M. (2006). Practitioner development: From trained technicians to reflective practitioners. *International Journal of Project Management, 24*(8), Article 8. https://doi.org/10.1016/j.ijproman.2006.09.010

Daniel, C., Hülsheger, U. R., Kudesia, R. S., Sankaran, S., & Wang, L. (2023). Mindfulness in projects. *Project Leadership and Society, 4*, Article 100086. https://doi.org/10.1016/j.plas.2023.100086

Drury-Grogan, M. L. (2021). The Changes in Team Cognition and Cognitive Artifact Use During Agile Software Development Project Management. *Project Management Journal, 52*(2), 127–145. https://doi.org/10.1177/8756972820960301

Eysenck, M. W. (2001). *Principles of cognitive psychology.* Psychology Press.

Flyvbjerg, B. (2008). Curbing Optimism Bias and Strategic Misrepresentation in Planning: Reference Class Forecasting in Practice. *European Planning Studies, 16*(1), Article 1. https://doi.org/10.1080/09654310701747936

Flyvbjerg, B. (2021). Top Ten Behavioral Biases in Project Management: An Overview. *Project Management Journal, 52*(6), 531–546. https://doi.org/10.1177/87569728211049046

Foss, N.j., Frederiksen, L., & Rullani, F. (2016). Problem-formulation and problem-solving in self-organized communities: How modes of communication shape project behaviors in the free open-source software community. *Strategic Management Journal, 37*(13), 13. https://doi.org/10.1002/smj.2439

Gavetti, G., Levinthal, D. A., & Rivkin, J. W. (2005). Strategy making in novel and complex worlds: The power of analogy. *Strategic Management Journal, 26*(8), 691–712. https://doi.org/10.1002/smj.475

Geraldi, J., & Söderlund, J. (2018). Project studies: What it is, where it is going. *International Journal of Project Management, 36*(1), Article 1. https://doi.org/10.1016/j.ijproman.2017.06.004

Gigerenzer, G., Hertwig, R., & Pachur, T. (2011). Heuristics: the foundations of adaptive behavior (G. Gigerenzer, R. Hertwig, & T. Pachur, Eds.). Oxford University Press.

Grabher, G. (2002). Cool Projects, Boring Institutions: Temporary Collaboration in Social Context. *Regional Studies, 36*(3), Article 3. https://doi.org/10.1080/00343400220122025

Grabher, G. (2016). Temporary Architectures of Learning: Knowledge Governance in Project Ecologies. *Organization Studies.* https://doi.org/10.1177/0170840604047996

Grégoire, D. A., Barr, P. S., & Shepherd, D. A. (2010). Cognitive Processes of Opportunity Recognition: The Role of Structural Alignment. *Organization Science, 21*(2), 413–431. https://doi.org/10.1287/orsc.1090.0462

Grégoire, D. A., Cornelissen, J., Dimov, D., & van Burg, E. (2015). The Mind in the Middle: Taking Stock of Affect and Cognition Research in Entrepreneurship. *International Journal of Management Reviews, 17*(2), 125–142. https://doi.org/10.1111/ijmr.12060

Groome, D., & Eysenck, M. (2016). *An introduction to applied cognitive psychology* (2nd ed.). Psychology Press. https://doi.org/10.4324/9781315732954

Hartmann, A., & Dorée, A. (2015). Learning between projects: More than sending messages in bottles. *International Journal of Project Management, 33*(2), Article 2. https://doi.org/10.1016/j.ijproman.2014.07.006

The Importance of Project Teams and the Need for an Interdisciplinary Perspective. In Hobbs, B., Chiocchio, F., Kelloway, E. K ., Chiocchio, F., Kelloway, & Hobbs, B. (Eds.), *The psychology and management of project teams: an interdisciplinary perspective*, (p. 0). (2015) (p. 0). Oxford University Press. https://doi.org/10.1093/acprof:oSo/9780199861378.003.0001.

Iftikhar, R., Davies, A., & Prencipe, A. (2024). Adaptive sense-making for crises in interorganizational projects: The case of International Islamabad Airport project. *International Journal of Project Management, 42*(8), Article 102662. https://doi.org/10.1016/j.ijproman.2024.102662

James, W. (1890). *The principles of psychology.* Henry Holt.

Kahneman, D. (2011). *Thinking fast and slow.* Farrar, Straus and Giroux.

Kutsch, E., Djabbarov, I., & Hall, M. (2021). How managers frame and make sense of unexpected events in project implementation. *International Journal of Project Management, 39*(5), 570–580. https://doi.org/10.1016/j.ijproman.2021.04.002

Lawani, A., Flin, R., Ojo-Adedokun, R. F., & Benton, P. (2023). Naturalistic decision making and decision drivers in the front end of complex projects. *International Journal of Project Management, 41*(6), Article 6. https://doi.org/10.1016/j.ijproman.2023.102502

Lee, S. W., Kim, A. R., Park, J., Kang, H. G., & Seong, P. H. (2016). Measuring Situation Awareness of Operating Team in Different Main Control Room Environments of Nuclear Power Plants. *Nuclear Engineering and Technology, 48*(1), 153–163. https://doi.org/10.1016/j.net.2015.09.008

Lehtinen, J., Locatelli, G., Sainati, T., Artto, K., & Evans, B. (2022). The grand challenge: Effective anti-corruption measures in projects. *International Journal of Project Management, 40*(4), 347–361. https://doi.org/10.1016/j.ijproman.2022.04.003

Maytorena, E., Winch, G., Freeman, J., & Kiely, T. (2007). The influence of experience and information search styles on project risk identification performance. *IEEE Transactions on Engineering Management, 54*(2), Article 2. https://doi.org/10.1109/TEM.2007.893993

Mitchell, J. R ., Mitchell, R.& K., & Randolph-Seng, B. (Eds.). (2014). *Handbook of entrepreneurial cognition*. Edward Elgar Publishing.

Narayanan, V. K., Zane, L. J., & Kemmerer, B. (2011). The Cognitive Perspective in Strategy: An Integrative Review. *Journal of Management, 37*(1), 305–351. https://doi.org/10.1177/0149206310383986

Ormond, J. E. (2020). Introduction to cognitive perspectives. *Human learning* (8th ed., pp. 156–195). Pearson.

Pauley, K., Flin, R., Yule, S., & Youngson, G. (2011). Surgeons' intraoperative decision making and risk management. *The American Journal of Surgery, 202*(4), 375–381. https://doi.org/10.1016/j.amjsurg.2010.11.009

Pavez, I., Gómez, H., Laulié, L., & González, V. A. (2021). Project team resilience: The effect of group potency and interpersonal trust. *International Journal of Project Management, 39*(6), 697–708. https://doi.org/10.1016/j.ijproman.2021.06.004

Pitsis, T. S., Clegg, S. R., Marosszeky, M., & Rura-Polley, T. (2003). Constructing the olympic dream: A future perfect strategy of project management. *Organization Science, 14*(5), Article 5. https://doi.org/10.1287/orsc.14.5.574.16762

Rashid, A., & Boussabiane, H. (2019). Conceptualizing the influence of personality and cognitive traits on project managers' risk-taking behaviour. *International Journal of Managing Projects in Business, 14*(2), 472–496. https://doi.org/10.1108/IJMPB-11-2017-0138

Rosa, E., Dahlstrom, N., Knez, I., Ljung, R., Cameron, M., & Willander, J. (2021). Dynamic decision-making of airline pilots in low-fidelity simulation. *Theoretical Issues in Ergonomics Science, 22*(1), 83–102. https://doi.org/10.1080/1463922X.2020.1758830

Rumeser, D., & Emsley, M. (2019). Can Serious Games Improve Project Management Decision Making Under Complexity? *Project Management Journal, 50*(1), 23–39. https://doi.org/10.1177/8756972818808982

Sense, A. J. (2007). Learning within project practice: Cognitive styles exposed. *International Journal of Project Management, 25*(1), Article 1.

Shi, Y., Hall, N. G., & Cui, X. (2023). Work More Tomorrow: Resolving Present Bias in Project Management. *Operations Research, 71*(1), 314–340. https://doi.org/10.1287/opre.2022.2379

Simard, M., & Laberge, D. (2018). Development of a crisis in a project: A process perspective. *International Journal of Managing Projects in Business, 11*(3), Article 3. https://doi.org/10.1108/IJMPB-08-2017-0093

Smith, W. K., & Tushman, M. L. (2005). Managing Strategic Contradictions: A Top Management Model for Managing Innovation Streams. *Organization Science, 16*(5), 522–536.

Stingl, V., & Geraldi, J. (2017). Errors, lies and misunderstandings: Systematic review on behavioural decision making in projects. *International Journal of Project Management, 35*(2), Article 2. https://doi.org/10.1016/j.ijproman.2016.10.009

Stingl, V., & Geraldi, J. (2021). A research agenda for studying managerial decision making through the lenses of simple heuristics. *Technological Forecasting and Social Change, 162*, 120367. https://doi.org/10.1016/j.techfore.2020.120367

Stingl, V., & Geraldi, J. (2023). Imagining futures: Cognitive processes of desirable or undesirable project prospections. *Technological Forecasting and Social Change, 194*, 122701. https://doi.org/10.1016/j.techfore.2023.122701

Unterhitzenberger, C. (2021). Project Management Journal® Special Issue on Project Behavior. *Project Management Journal, 52*(6), 527–530. https://doi.org/10.1177/87569728211054716

Weick, K. (1995). *Sensemaking in organizations*. SAGE.

Winch, G. (2013). Escalation in major projects: Lessons from the Channel Fixed Link. *International Journal of Project Management, 31*(5), Article 5. https://doi.org/10.1016/j.ijproman.2013.01.012

Winch, G. M., & Maytorena, E. (2009). Making good sense: Assessing the quality of risky decision-making. *Organization Studies, 30*(2–3), Article 2–3. https://doi.org/10.1177/0170840608101476

Winch, G., & Maytorena, E. (2011). Managing risk and uncertainty in projects: A cognitive approach. In P. W .& G. Morris, J. K. Pinto, & J. Soderlund (Eds.), *The oxford handbook of project management* (pp. 345–365). Oxford University Press.