JoE

Journal of Expertise
2025. Vol. 8(4)

ISSN 2573-2773

Metacognitive Concepts are Central to Understanding Creative Performance and Expertise

Linden J. Ball and Beth H. Richardson
School of Engineering and Computing, University of Lancashire, UK

Correspondence: Linden Ball, LBall@lancashire.ac.uk

The Psychology of Creative Performance and Expertise (Friedlander, 2024) is certain to be celebrated by readers for its unique, rich, and sophisticated synthesis of research and theory on these topics. We find three aspects of the book especially appealing. First, we welcome the close examination of the intersection between expertise and creativity, which is often overlooked but is essential to gain a deep theoretical understanding of both facets of human accomplishment. Second, we applaud the extent to which the coverage of findings and theories transcends well-established fields of enquiry (e.g., chess, music, and sports) to include other areas of endeavour, spanning art, science, technology, engineering, and medicine, and even extending to a consideration of the extraordinary feats of extreme memory athletes. Third, we approve of the author's emphasis throughout the book of the importance of adopting a *multidimensional* approach to addressing the complex set of factors that interact to afford the development and maintenance of expertise.

Notwithstanding the evident strengths of *The Psychology of Creative Performance and Expertise*, we identify one significant limitation, which is the near absence of considerations relating to "metacognition". The latter term refers to the capacity for people to monitor, reflect on, evaluate, and control their mental functioning (Fleming, 2023), with effective metacognitive processing having repeatedly been shown to be essential for the successful development and execution of creative expertise (e.g., Jia et al., 2019; Lebuda & Benedek, 2023; Marshall & D'Adamo, 2018; Puente-Díaz, 2023; Zohar & Barzilai, 2013). Admittedly, metacognition research is still at a foundational stage, which may reflect the author's reluctance to include much reference to it, but the field is burgeoning, as is the recognition that metacognitive considerations are critical for developing a more advanced conceptual understanding of all human behaviour.

Progress in understanding metacognition in reasoning, problem-solving, and decision-making was given significant impetus by Ackerman and Thompson (2017), who published a timely article in which they reviewed empirical research and theorising relating to the metacognitive monitoring and control that arises during goal-directed thinking. A key aspect of their review was their presentation of a "metareasoning framework" to integrate existing findings. According to this framework, metacognitive monitoring occurs continually during task performance and is sensitive to a reasoner's fluctuating feelings of certainty and uncertainty regarding how successfully their ongoing processing is unfolding. Similarly, metacognitive control responds dynamically to shifting levels of experienced certainty or uncertainty—maintaining ongoing processing if it is going well or else triggering strategy change if it is floundering. Metacognitive control is also needed to cease current processing if a

satisfactory outcome is achieved or if an insurmountable impasse is reached.

These latter concepts are highly relevant to understanding expert creative performance, given that domain-based problem-solving is often replete with uncertainty such that strategies need to be deployed flexibly and adaptively to navigate it (Klein, 2017). This is demonstrated in our own research on the metacognitive processes that arise when expert designers are developing innovative product concepts (for reviews, see Ball & Christensen, 2019; Richardson et al., 2023). In our studies of design teams, marked changes in strategic processing co-occur with the appearance in dialogue of "hedge words" (e.g., words or phrases such as "maybe", "perhaps" or "not sure") that reflect uncertainty. Moreover, when faced with such uncertainty, designers often appear to engage in either of the following: (1) analogical reasoning; i.e., drawing upon conceptual ideas from a domain that is different to that of the problem focus and mapping these ideas across to the current domain (Ball & Christensen 2009; Ball et al., 2010); or (2) mental simulation; i.e., "running" a sequence of interdependent events in a dynamic mental model to determine cause-effect relationships and predict possible outcomes (Ball & Christensen, 2009; Ball et al., 2010; Christensen & Schunn 2009).

These latter strategies appear to be under metacognitive control in designers, triggered by heightened uncertainty about how to progress toward a good design solution. When deployed, these strategies enable effective design progress and enhance confidence in evolving ideas. Furthermore, there is evidence that design teams that are better able to identify emerging uncertainty and respond to it flexibly and adaptively can achieve better solution outcomes (e.g., Ball, & Ormerod, 2000). These observations speak to the considerable value of including metacognitive concepts relating to uncertainty monitoring and strategy selection in theorising about the nature of expert performance. As we have noted, such metareasoning concepts are largely absent from the author's coverage, and we feel that this is to the detriment of the high-quality theoretical integration that is provided.

Our observations regarding metareasoning are also not restricted to the design domain, as similar findings have emerged elsewhere. For example, Chan et al. (2012) have demonstrated the existence of a close temporal coupling between uncertainty and the use of analogical-reasoning strategies in the context of scientific problem solving. Other key findings relating to the adaptive role of metacognition in creative thinking can be found in Ball and Richardson (2025). In our own work, we have also taken some initial steps toward articulating a framework for understanding "collaborative metareasoning" (e.g., Richardson & Ball, 2024), given that the original framework espoused by Ackerman and Thompson (2017) was solely targeted at explaining metareasoning at the level of the individual and not the team.

As a final point, we note that developments in understanding the metacognitive dimensions of creative performance and expertise are increasingly reflected in the neuroscience literature (e.g., Abraham, 2018; Bilalić, 2017). Although we accept that neuroscience research often provides correlational rather than causal evidence regarding cognitive and metacognitive processing, this evidence remains important, as it constrains and informs theorising (e.g., Rominger et al., 2022). Although the author makes a nod to neuroscience evidence, more coverage of key findings from brain-imaging and neurostimulation research would have been valuable for a fully multidimensional synopsis of the nature of creative expertise. Nevertheless, we reiterate the importance of *The Psychology of Creative Performance and Expertise* for advancing inquiry and for pointing to important new research directions. Our hope is that metacognitive concepts will feature more centrally in such future research.

ORCID iDs

Linden J. Ball
https://orcid.org/0000-0002-5099-0124

Beth H. Richardson
https://orcid.org/0000-0001-8738-9925

References

Abraham, A. (2018). *The neuroscience of creativity*. Cambridge University Press.

Ackerman, R., & Thompson, V. A. (2017). Meta-reasoning: Monitoring and control of thinking and reasoning. *Trends in Cognitive Sciences*, *21*(8), 607–617.

Ball, L. J., & Christensen, B. T. (2009). Analogical reasoning and mental simulation in design: Two strategies linked to uncertainty resolution. *Design Studies*, *30*, 169–186.

Ball, L. J., & Christensen, B. T. (2019). Advancing an understanding of design cognition and design metacognition: Progress and prospects. *Design Studies*, *65*, 35–59.

Ball, L. J., Onarheim, B., & Christensen, B. T. (2010). Design requirements, epistemic uncertainty and solution development strategies in software design. *Design Studies*, 31, 567–589.

Ball, L. J., & Ormerod, T. C. (2000). Putting ethnography to work: The case for a cognitive ethnography of design. *International Journal of Human-Computer Studies*, 53(1), 147–168.

Ball, L. J. & Richardson, B. H. (Eds.). (2024). *Metareasoning: Theoretical and methodological developments.* MDPI.

Bilalić, M. (2017). *The neuroscience of expertise*. Cambridge University Press.

Chan, J., Paletz, S. B., & Schunn, C. D. (2012). Analogy as a strategy for supporting complex problem solving under uncertainty. *Memory & Cognition*, *40*, 1352–1365.

Christensen, B. T., & Schunn, C. D. (2009). The role and impact of mental simulation in design. *Applied Cognitive Psychology*, *23*, 327–344.

Fleming, S. M. (2024). Metacognition and confidence: A review and synthesis. *Annual Review of Psychology*, *75*(1), 241–268.

Friedlander, K. J. (2024). *The psychology of creative performance and expertise.* Routledge.

Jia, X., Li, W., & Cao, L. (2019). The role of metacognitive components in creative thinking. *Frontiers in Psychology*, *10*, 2404, 1–11.

Klein, G. A. (2017). *Sources of power: How people make decisions (20th anniversary edition)*. MIT Press.

Lebuda, I., & Benedek, M. (2023). A systematic framework of creative metacognition. *Physics of Life Reviews*, *46*, 161–181.

Marshall, J., & D'Adamo, K. (2018). Art studio as thinking lab: Fostering metacognition in art classrooms. *Art Education*, *71*(6), 9–16.

Puente-Díaz, R. (2023). Metacognitive feelings as a source of information for the creative process: A conceptual exploration. *Journal of Intelligence*, *11*(3), 49, 1–12.

Richardson, B. H., & Ball, L. J. (2024). Progressing the development of a collaborative metareasoning framework: Prospects and challenges. *Journal of Intelligence, 12*(3), 28, 1–21.

Richardson, B. H., Ball, L. J., Christensen, B. T., & Marsh, J. E. (2024). Collaborative meta-reasoning in creative contexts: Advancing an understanding of collaborative monitoring and control in creative teams. In L. J. Ball, & F. Vallée-Tourangeau (Eds.). *The Routledge international handbook of creative cognition* (pp. 372–396). Routledge.

Rominger, C., Benedek, M., Lebuda, I., Perchtold-Stefan, C. M., Schwerdtfeger, A. R., Papousek, I., & Fink, A. (2022). Functional brain activation patterns of creative metacognitive monitoring. *Neuropsychologia*, *177*, 108416, 1–10.

Zohar, A., & Barzilai, S. (2013). A review of research on metacognition in science education: Current and future directions. *Studies in Science Education*, *49*(2), 121–169.

Received: 16 October 2025
Accepted: 2 November 2025