Creative cognition: A collaborative research agenda

Wendy Ross[1], Sergio Agnoli[2.] Matthijs Baas[3], Amory Danek[4], Izabela Lebuda[5], Rakefet Ackerman[6], Artur Ammalainen[7], Mathias Benedek[8], Honghong Bai[9], Linden J. Ball[10], Baptiste Barbot[11], Lorenzo Campidelli[2], Laura Caravona[12], Simon Ceh[8], Giovanni Emanuele Corazza[13], Marta Czerwonka[5], Caroline Di Bernardi Luft[14], Yuval Hart[15], Jakub Jędrusiak[5], Yoed N. Kenett[16], Radwa Khalil[17], Laura Macchi[12], Margaret Mangion[18], Kirill G. Miroshnik[2], Paulina Nawrocka[5], Bernard A. Nijstad[19], Michael Öllinger[20], Thomas C. Ormerod[21], Janet Rafner[22], Moritz Reis[23], Christian Rominger[8], Jan Rummel[4], Carola Salvi[24], Cecilia Segatta[2], Claire E. Stevenson[3], Kadi Tulver[25], Kamila Urban[26], Marek Urban[27], Frédéric Vallée-Tourangeau[28], Selina Weiss[29]

[1] London Metropolitan University

[2] University of Trieste

[3] University of Amsterdam

[4] TUM School of Social Sciences and Technology, Technical University of Munich,

[5] University of Wroclaw

[6] Technion--Israel Insitute of Technology

[7] Institute of Psychology, University of Greifswald

[8] University of Graz

[9] Behavioural Science Institute & Orthopedagogics: Learning and Development, Radboud University, the Netherlands

[10] University of Lancashire

[11] UCLouvain, Psychological Sciences Research Institute

[12] Department of Psychology, University of Milano-Bicocca (Italy)

[13] University of Bologna, DEI Dept., Marconi Institute for Creativity

[14] Brunel University of London, CHMLS, Department of Psychology

[15] Psychology Department, Hebrew University of Jerusalem

[16] Faculty of Data and Decision Sciences, Technion - Israel Institute of Technology

[17] School of Business, Social, and Decision Sciences, Constructor University, Bremen, Germany

[18] University of Malta

[19] University of Groningen

[20] Parmenides Center of the Study of Thinking, Pöcking

[21] School of Psychology, University of Sussex, UK.

[22] Aarhus Institute of Advanced Studies, Aarhus University and Center for Hybrid Intelligence, Department of Management, Aarhus University

[23] University of Wuerzburg

[24] John Cabot University

[25] University of Tartu, Estonia and University of Leiden, The Netherlands

[26] Institute for Research in Social Communication, Slovak Academy of Sciences

[27] Institute of Psychology, Czech Academy of Sciences

[28] Kingston University, London

[29] University of Hildesheim, Hildesheim, Germany

Address correspondence to:

Wendy Ross, London Metropolitan University, w.ross@londonmet.ac.uk

Sergio Agnoli, University of Trieste, sergio.agnoli@units.it

Matthjis Baas, University of Amsterdam, M.Baas@uva.nl

Amory Danek, Heidelberg University, amory.danek@tum.de

Izabela Lebuda, University of Wrocław, izabela.lebuda@uwr.edu.pl

Acknowledgements: The conversations that inspired this research agenda occurred at a workshop funded by the Lorentz Centre, Netherlands. Izabela Lebuda was supported by the National Science Centre, Poland (grant number: 2024/54/E/HS6/00123)

The authors declare no conflicts of interest regarding this manuscript

Creative cognition: A collaborative research agenda

Creative cognition research has flourished in recent decades, revealing how extraordinary creative outcomes emerge from ordinary cognitive processes. However, the field faces fragmentation that hinders consensus and integration. This research agenda, developed through a collaborative workshop of 50 European researchers at the Lorentz Centre, identifies four critical challenges for advancing creative cognition research. Challenge 1 addresses theoretical concerns around defining core research terms like divergent thinking, emotions, and metacognition. Challenge 2 focuses on identifying different types and domains of knowledge that influence creative performance. Challenge 3 emphasizes measuring dynamic interactions between cognitive, affective, and metacognitive processes over time. Challenge 4 calls for incorporating environmental and interpersonal contexts, including collaboration, technology, and embodied cognition. These challenges highlight the need for collaborative approaches to develop standardized measures, synthesize existing findings, and foster methodological innovations. By working together as a research community, we can build more comprehensive theories and effective methods for understanding creativity's cognitive foundations while embracing rather than reducing its inherent complexity

Creative cognition: A collaborative research agenda

Creativity is a complex, multidimensional construct (Sternberg & Lubart, 1999) that is defined as the generation of original and useful ideas or products in a specific context at a given time (e.g., Amabile, 1988; Runco & Jaeger, 2012; Stein, 1953; but see Corazza, 2016; Green et al., 2024 for alternatives). While there are various lenses we can employ to examine this construct, arguably the most influential perspective for research in this area, at least in the psychological domain, has been the processes that underlie the generation of a creative thought – particularly its cognitive underpinnings. For example, even while the initial call for psychologists to take creativity seriously from Guilford (1950) focused on the *personality* of the creative person, it did so by inviting psychologists to identify universal *processes* that may be more developed in those more creative.

Since that call, many process models of creative thinking have been developed (e.g., Bink & Marsh, 2000; Finke et al., 1992, Mumford et al., 1991; Nijstad et al., 2010; Perry-Smith & Mannucci, 2017), many of the basic cognitive processes underlying creative thought have been uncovered (Benedek & Fink, 2019; Danek et al., 2020; Öllinger et al., 2014), and many tasks that measure creative thinking processes have been developed, from the classic Alternative Uses Tasks (AUT; Guilford & Hoepfner, 1971) to newer, more dynamic ones (e.g., creative foraging tasks such as Hart et al., 2017) and real world problem-solving tasks (Benedek & Beaty, 2025; Luchini et al. 2023). Even research which uses other lenses for creativity, for instance those considering creativity from the perspectives of developmental or socio-cultural individual differences, draws on the same pool of tasks developed to map cognitive processes (Glăveanu et al., 2019; Glăveanu et al., 2020). The cognitive level of analysis is therefore central to our understanding of *how* a person in a certain time and place can be creative. To this end, we are proposing a collective focus on research in creative cognition which connects the fragmented research landscape leading to an open, collaborative network of researchers that can drive empirical research to consolidate existing findings and foster entirely new approaches.

In the past decade, creative cognition research has flourished[1] and this flourishing has allowed us to begin to understand the mechanisms behind this seemingly elusive concept. Research has progressively shown how creative cognition emerges as an extraordinary result from *ordinary* processes (Beaty & Kenett, 2023; Benedek et al., 2023; Ormerod, 2024; Sternberg & Lubart, 1999). In line with this view, specific dynamics for the creative process grounded on basic cognitive mechanisms common to all thinking - such as attention, memory, or inhibition – have been proposed, as well as specific frameworks for explaining the cognitive dynamics that lead to the generation of new and valuable ideas (Beaty et al., 2019; Benedek & Fink, 2019; Chen et al., 2025; Jauk, 2019; Nijstad et al., 2010). We now know, for example, that specific semantic memory network structures are associated with higher creative performance (Benedek et al., 2023; Kenett, 2024; Kenett & Fausr, 2019; Ovando-Tellez et al., 2022). We are also closer to understanding the shielding mechanisms towards distractors that are enacted by internally oriented attentive processes during idea generation (Benedek et al., 2014, 2016). Similarly, we are making progress on decomposing complex emotions associated with the creative process (Danek et al., 2014; Ross & Arfini, 2024) as well as understanding the role of metacognitive monitoring and control in creative thinking (Lebuda & Benedek, 2023; Urban & Urban, 2023).

However, as the scope of research in creative cognition matures, alongside these discoveries, we are also faced with the inescapably dynamic and emergent nature of creative thought. This makes research in creative cognition particularly complex and challenging. For example, research has demonstrated the coexistence of inhibitory and spontaneous imaginative drives which stem from both top-down and bottom-up cognitive control mechanisms (Nijstad et al., 2010; Zhang et al., 2020). Likewise, the demonstration of the coupling of apparently antithetical neural networks, as the default mode and executive control networks, during idea generation (e.g. Beaty et al., 2015, 2019) for instance, illustrates the complex cognitive dynamics sustaining creative thinking (Chen et al., 2025). Furthermore, executive functions and creative metacognitive control are intertwined parts of the same self-regulatory loop as both depend on rapid monitoring signals (Roebers, 2017). Moreover, the self-regulatory dynamics in creative cognition are influenced by metacognitive knowledge as well as one's cognitive knowledge base (e.g., Ackerman, 2019;

[1] A Web of Science search using the key words – creative cognition OR creative thinking OR divergent thinking OR convergent thinking yielded 781 research papers for the period 01/01/2024 to 31/12/2024 and 346 papers for the period 01/01/2014 to 31/12/2014.

Lucas, 2015; Nijstad & Stroebe, 2006). However, creative cognition studies seldom measure monitoring and access to (metacognitive) knowledge directly as creative thinking unfolds over time, so their genuine overlap and distinction remains largely unmapped.

This growing research interest, coupled with the complex nature of the phenomenon under investigation, has also resulted in a rather fragmented field, which hinders consensus, integration and standardization of tasks and findings (Glăveanu, 2014; Kenett et al., 2020; Rietzschel et al., 2024). Emergent complexity requires the integration of hitherto siloed domains and research methods if we are to understand it. Moreover, investigations into this complex phenomenon take place against the backdrop of changes within the broader domain of cognitive psychology. For example, the cluster of typically *cold* processes of cognition has widened to include emotional states (Damasio, 2006; Pessoa, 2008) as well as inviting a focus on the role of the body (Chemero, 2011; Matheson & Kenett, 2020). Similarly, field-wide changes in research practices (for example, Open Science practices; Open Science Collaboration, 2015; moving research into the online sphere), as well as gamifying creative tasks to conduct ecological studies outside of the lab (Allen et al., 2024; Rafner et al., 2022) have important implications. Alongside this, the growing use of Generative Models to code and score tasks as well as their use as a collaborator in creative efforts is rapidly changing the topography of the field (Rafner et al., 2023).

A moment of reflection for the scientific community: The Lorentz workshop

These developments were discussed in a week-long meeting of 50 creative cognition researchers at the Lorentz Centre in Leiden in January 2025 (https://www.lorentzcenter.nl/building-a-collective-approach-to-creative-cognition.html). Drawing on a unique grassroots approach, European researchers from various career stages and sub-disciplines of psychology were invited to discuss the current and future state of creative cognition research. Initially, three core topics of discussion were proposed: The role played in the generation of a creative thought by different knowledge domains, emotions, and metacognition. After an introductory day, one full day was devoted to each topic before the group came together to map out a way forward. First, open research questions were identified and presented by topic-specific experts invited by the organizers. Then all attendees discussed those initial research questions and brought up additional questions. The list of questions for each topic was collated and a vote took place to select the top questions (out of the full list) that were of wider interest to the group. Smaller

working groups then formed to brainstorm possible solutions to these questions. Over the course of the week, the discussion saw additional recurring themes that overarched all three initial topics. The results of this vote and the conversations that ensued are synthesized in the research challenges that we define here[2].

These challenges are not intended to be exhaustive, nor are they presented as orthogonally distinct and insurmountable but instead they function as an invitation to work together to generate both answers and new questions. Even if some of these challenges are not new, they emerged as particularly pressing in view of advances in the field. At the time of writing, the workshop has already produced nine collaborative teams that are working to address different aspects of these challenges. These teams are largely made up of researchers who have never collaborated before. They come from different career stages, countries and research labs, as well as from various areas of theoretical and methodological expertise. In writing this agenda, we are placing an open call for more researchers to work together to make meaningful progress in the field of creativity research.

In the remainder of this article, we provide an in-depth discussion of the core challenges we identified along with specific research questions to be addressed in future creative cognition research. We end with research implementation considerations and a vision for the future of our research community.

Challenge 1: Theoretical concerns around the definition and parameters of our research terms

As interest in creativity research grows, there is a marked increase in the number of empirical papers which address core topics. We welcome this increase in diversity in the field, but caution that it is crucial that our community members have similar concrete mental models of the terms, paradigms, measures, and general research practices that are being used. So far, such a consensus is often missing in creative cognition research. This is particularly important because the key concepts are not natural kinds, that is, they do not have clear physical substrates, and so

[2] The full list of research questions generated by the workshop attendees can be found here: https://osf.io/rxe8p/?view_only=b5d9f01b5d35473f97c766e20de0ec56

consensus on the definitions and boundaries of these conceptual objects is essential for fruitful discussion (Star & Griesemer, 1989).

For instance, although divergent thinking and convergent thinking are core constructs in creative cognition, researchers differ in how they conceptualize these terms (Boot et al., 2017; Cropley, 2006; Gabora, 2018). This then relates to how they are measured – the form of measurement supports the definition just as the definition informs how the concept is measured (Boag, 2014). So, although idea generation tasks (such as the Alternative Uses Task) are often used to measure divergent thinking, the outcome measures derived from these tasks vary across labs and research projects (e.g., fluency, average vs. top originality, semantic distance; Saretzki et al., 2024). The lack of standardization makes meaningful comparison and synthesis difficult, and contradictions in evidence harder to reconcile. Even more, some studies have shown how convergent thinking – assessed via the remote associates test – includes an initial divergent phase before convergence, thus questioning the separation of these different modes of thinking (Smith et al., 2013). This challenge is compounded by a lack of agreement on key terms, meaning that it is not always clear *what* is being measured (see Kenett et al., 2020).

Such definitional problems are particularly problematic when the research builds on novel concepts, or concepts that have been developed in other fields. For example, there have been theoretical shifts in the understanding of the make-up of cognition that require researchers to address processes beyond those traditionally considered as "cognitive". As example, the relationship between emotions and creative cognition has recently returned into focus (Sundquist & Lubart, 2022), recognizing that emotions are an integral part of the creative process (Agnoli & Corazza, 2019). However, when studying the effects of emotions on creative performance (and vice versa), it is not clear whether emotions should be better considered separately, in combination, or both. The peculiar feeling of "Aha!" elicited during creative problem solving, for example, is a mixture of different emotions such as happiness and relief (Danek et al., 2014; Wiley & Danek, 2024) and it appears that this ambiguity in emotion extends to other creative tasks (Kumar et al., 2022). The emotions associated with a creative task can also differ in valence across time which makes their dynamics particularly difficult to measure (Ross & Arfini, 2024). A related question is whether emotion and creative thought should be studied separately (in a cause-effect relationship) or in an integrative manner. Sometimes, an individual's emotional state may affect the creative processes someone subsequently engages in (De Dreu et al., 2024),

as much as creative process engagement alters someone's subsequent emotional state (Chermahini & Hommel, 2012). Other times, creative thought seems to be inseparable from emotions or emotion regulation (Perchtold-Stefan et al., 2021), just as emotions may spontaneously emerge during the generation of alternative ideas, sustaining or hampering creative performance (Agnoli et al., 2019); for example, the feeling of inspiration triggered by an insightful idea also functions as a motivation to develop this idea (Thrash et al., 2010).

Other processes, such as metacognition, also seem particularly salient for research in creative cognition but are hampered by the lack of a unified nomenclature. Some models and empirical studies explicitly acknowledge metacognition's role in creativity (Jia et al., 2019; Kaufman & Beghetto, 2013; Lebuda & Benedek, 2023; Pesut, 1990; Puryear, 2016). Additionally, there are recent direct studies of the importance of metacognition to creative performance (De Chantal & Organisciak, 2023; Karwowski et al., 2020; Kenett et al., 2023; Puente-Díaz & Puerta-Sierra, 2025; Sidi & Ackerman, 2024; Urban & Urban, 2023). However, in many other cases, the insight into metacognition is indirect. For example, research on task strategies, instructions, and examples (Forthmann et al., 2019; George & Wiley, 2020; Hart et al., 2022) highlights how metacognitive processes shape creative cognition but does not explicitly refer to metacognitive processes. In other words, theoretical frameworks and empirical studies exist that refer to the same phenomena but are labeled differently, hindering the synthesis of findings.

Beyond terminological inconsistencies, another key research challenge involves clarifying where the boundaries are between concepts. It is unlikely that creative thinking can be neatly parceled, but for scientific investigation such abstraction and reduction plays an important generative role. For example, while the differences between emotions and mood are fairly well delineated, their conceptual overlap with other affective states involved in creativity such as flow or Aha! experience is less clear. One question that emerged during our discussions, for example, was whether the same mechanism of emotion processing could be a common denominator for phenomena such as humor, insight problem-solving and creativity. Similarly, the relationship between metacognition and broader creative self-beliefs (Lebuda & Benedek, 2024) is not always clear. For example, it is uncertain to what extent the metacognitive judgments that are made before task engagement differ (both conceptually and functionally) from creative self-efficacy or whether they are, in fact, informed by this form of self-efficacy (Beghetto & Mangion, 2023; Zielińska et al., 2023). Separating metacognitive processes (monitoring, control,

knowledge) from motivational self-beliefs is required to allow researchers to isolate the unique and shared variance each construct contributes to creativity. Finally, whether and how searching for creative ideas in memory is different from general, non-creative retrieval processes remains largely unknown (Hass, 2017a, 2017b; Ovando-Tellez et al, 2022, Urban & Urban, 2025). Thus, there is a need to clarify the terminology and distinguishing between conceptually related but distinct constructs could help us better understand how creativity unfolds—and to what extent the underlying processes are similar to or different from other cognitive operations.

Some of the research questions generated during the workshop which relate to the challenge of defining, mapping and distinguishing our research terms are:

1. How can we decompose the creative process to different building blocks requiring different task strategies in order to investigate how different individuals balance these different strategies?
2. With creativity represented as a cognitive search problem, how can we decouple the individual landscapes and the individual search algorithms?
3. What is the relationship between emotion regulation strategies (e.g., as an ability or supported by mindfulness-based training) and the mechanisms of creative ideation?
4. How can we develop measures which capture creativity at different levels of analysis, from the micro to the macro level?

Challenge 2: Identifying types and domains of knowledge

Ideas are not generated ex nihilo but build on the combination of existing knowledge (Kenett, 2024; Nijstad & Stroebe, 2006). However, the different forms of knowledge (e.g., declarative, procedural, tacit, embodied and more) that are required for success in creative tasks have not been clearly identified (see Benedek et al., 2023). Aside from research into domain-specific expertise, much of the current research assumes a similar knowledge base across participants through introducing knowledge lean tasks (Yang et al., 2022). However, knowledge is not a unitary concept and should rather be conceived of as operating across different levels and forms - from the individual level to the societal level, passing from the implicit to the explicit level, and with stricter versus fuzzier boundaries (Kapoor et al., 2024: Sternberg, 1999). Moreover,

although some level of knowledge is needed to build creative ideas (Kenett, 2024; Stevenson et al., 2019), some scholars have argued that an extensive and consolidated knowledge base such as that seen in experts may also result in entrenchment, thereby stifling people's ability to consider different problem perspectives (Beaty et al., 2023; Dane, 2010). Such an understanding of knowledge moves beyond the typical arguments on domain generality and specificity. From this perspective, we lack agreement on the knowledge required to perform well in creative tasks, how this knowledge is used and when it paradoxically acts as a constraint.

The analysis of knowledge structures is becoming a central topic in creative cognition especially as a consequence of the increased computational power in the estimation of semantic memory networks (Kenett, 2024). These methods allow us to better understand the fundamental role of semantic knowledge structures in creative performance (Kenett et al., 2014, 2016), showing how these structures can either limit (by reducing flexibility) or enlarge the combinatorial possibilities during idea generation. It is important that inter- and intra-individual differences (Barbot, 2022) in the *structure* as well as the content of knowledge should be considered if we intend to develop and apply universal metrics to the measurement of creative performance (Benedek et al., 2023; Hills & Kenett, 2022; 2025; Kenett, 2024). This can also help us identify if there are domain-general knowledge types and structures.

The intersection between other forms of knowledge should be explored, including, for instance, implicit knowledge or procedural knowledge, and not only in association with the generation of ideas, but in the framework of the entire creative thinking process (starting from problem definition to the implementation of an idea). This exploration is limited in part by the vague conceptual boundaries between different domains of knowledge (Matheson & Kenett, 2020; Yang et al., 2022). Resolving these issues requires our research focus on how different types and quantities of knowledge (experiential, tacit, domain-specific) impact creative performance across various assessment techniques and tasks. Alongside these more traditional knowledge types, we also recognize a need to focus on forms of metacognitive knowledge, such as declarative, procedural, and conditional knowledge that guide the monitoring and control of creative task-work (Lebuda & Benedek, 2024). Alongside this, our knowledge is being impacted by the interaction with Generative Artificial Intelligence as a collaborative tool, and we need to develop a greater understanding of the forms of knowledge that are generated by this interaction. Some of

the questions emerging from the challenge of disentangling the multidimensional role of knowledge on creative cognition are:

1. Should the measurement of creative cognition be controlled for domain or task-specific knowledge variance, to capture "knowledge-free" (or cross-domain) creative cognition, and how?
2. To what extent, when and how is knowledge a constraint or a benefit to creative ideation?
3. How do people understand what is "a good enough" idea to be expressed and examined further?
4. To what extent are different forms of cognition and metacognition explicitly available to introspection during the execution of a creative task or project?
5. What are the implications of the use of Generative Artificial Intelligence in relation to the depth and transfer of knowledge acquired by individuals in creative tasks or projects?

Challenge 3: The importance of measuring an d understanding dynamic strategies, processes and emotional states in creative cognition

It is unlikely that the cognitive, affective and metacognitive processes underlying creativity operate in isolation from each other (Lebuda & Benedek, 2023; Rawlings et al., 2025). This leads to a need to focus on the *dynamics* of creative thought, considering the possible interactions and alternations between cognitive, affective and metacognitive processes, the time course of how these dynamics unfold, as well as methodological innovations to measure these dynamics (e.g., Tolkamp et al. 2023). Over the course of the workshop, the dynamic aspect was identified as being particularly important and is threaded through each of the challenges described in this research agenda.

For example, although both divergent and convergent thinking are essential constructs in creativity research, their relationship still awaits clarification. While the vast majority of research in the field has focused on divergent thinking as ability to generate multiple ideas, the capacity for convergent thinking is required to then select and hone in on specific ideas (Cropley, 2006; Rietzschel et al., 2024). Moreover, even while people are generating ideas, they concurrently

monitor whether their ideas are in line with task instructions and situational constraints (Kleinmintz et al., 2019; Lebuda & Benedek, 2023; Nijstad et al., 2010), which is an important characteristic of convergent thinking. As such, their dynamic interplay is not fully understood yet, but recent work indicates that they may indeed be strongly related (Rawlings et al., 2025).

Similarly, the day we devoted to emotions ended with a clear consensus that the dynamic nature of thought and affective experiences is key to understanding the relationship between emotions and creative thinking. In general, as discussed before, it can be assumed that there is a bi-directional relationship between them. While positive emotions generally favor creative thinking, the effect of emotion on creative performance seems to depend on the stage of the creative process (Botella et al., 2018), the specific emotion in question (Baas, 2019), and how emotions dynamically unfold over time (Bledow et al., 2013). To add complexity, the valence and intensity of an emotion can change depending on the nature of the task – see for example work on the experience of impasse (Ross & Arfini, 2024) – and on the different phases of the creative process (e.g., generation, exploration etc.). This means we need to focus on examining emotion as both a driver and as a result of creative cognition. Even using simple measures like an affective grid (Russell et al., 1989) to pinpoint the ongoing emotions during a creative task would be a good start. By aligning fine-grained measures of mood and discrete emotions with creative phases (e.g., problem definition, generation, evaluation, elaboration, implementation), researchers can deploy experience-sampling and experimental mood-induction designs to test whether within-person affective fluctuations predict or causally influence subsequent creative performance. The question of how affective experiences could be leveraged to foster creative thinking, perhaps by helping to transition from one phase of the creative process to another, could be the subject of future research.

Taking the reverse perspective, it seems important to clarify how emotions triggered by idea generation (such as excitement and pleasure) influence subsequent evaluation, selection, and realization of those ideas. This touches on the dynamic relationship between emotions and metacognitive judgments (Efklides, 2008; Efklides & Schwartz, 2024). These judgements inform evaluation of ideas and thus shape the creative process (Puente-Díaz et al., 2023; Urban & Urban, 2025). Similarly to emotions, metacognitive judgments also fluctuate via a feedback loop over the course of the task (Urban & Urban, 2025). Since metacognitive processes fluctuate over

time and mutually influence key phases such as idea evaluation and selection, understanding creativity requires tracing their evolving interaction throughout the task.

In short, there are critical gaps in our understanding about how this triad—knowledge, emotions, and metacognition—changes dynamically across different types of creative cognition, from divergent thinking and insight problems to real-world problem-solving, and when they support or hinder effective creative thinking (Agnoli & Mastria, 2023; Danek & Kizilirmak, 2021; George & Salvi, 2023; Puente-Díaz et al., 2023). The study of the dynamics across and between these three elements represents a fruitful opportunity to advance our understanding of the emergence of a creative process, and it should be taken as a paradigmatic example of the introduction of a dynamic approach in the analysis of creative thinking. Identifying the dynamic interactions between the building blocks of creative cognition and metacognition could for instance provide better understanding of how metacognition interacts with knowledge and emotions in the creative process.

However, to address the dynamics in creative cognition, it will be critical to have methods that allow highly granular and temporally precise measurement of these dynamics to understand their interaction, while respecting the subjective and individual nature of these complex elements of creative thought. A greater number of temporally precise measurements is thus needed to identify core aspects of creative cognition and how these aspects dynamically adapt during the creative process (Barbot, 2018; Jankowska et al., 2018; Ormerod et al., 2002). There is a promising emerging line of research into the use of games for understanding creative processes that should be built upon to enhance our understanding (Hart et al., 2017, Rafner et al., 2022; 2023). Developing novel measurements would allow for the exploration of how people make decisions during the creative process (Nijstad et al., 2023)—what cues they use to determine whether an idea is good enough (Ackerman, 2019), how they manage multiple goals while thinking creatively and what leads them to conclude or abandon the creative process (Kenett & Ackerman, 2023; Kenett et al., 2023; Sidi et al., 2020). In addition, since it is well known that people's insight into their own cognitive processes—specifically, the accuracy of their assessments of their own creative thinking and ideas—is limited (Guo et al., 2022; Pesout & Nietfeld, 2021; Urban & Urban, 2021), we need ways to mitigate the risk of biases in self-reflection-based studies of the dynamic creative process (Kaufman, 2019).

Some of the open questions that relate to the challenge of mapping and understanding creative dynamics are:

1. How can we explore the dynamic impact of (different forms of) knowledge on creative abilities in day-to-day life?
2. What are appropriate methods for assessing (the dynamics in) creative metacognition?
3. How do emotions triggered by the generation of an idea (e.g. pleasure, excitement) influence subsequent idea execution or decision-making processes?
4. How can we best investigate the causal links between fluctuating emotional experiences and creative cognition in individuals and teams?
5. How are changes in emotional states linked to distinct phases such as exploration and exploitation and how can they be leveraged to facilitate transitions (e.g. overcoming an impasse)?

Challenge 4: Taking environmental and interpersonal context into account

Creative cognition in real-world settings is frequently collaborative, occurring within dyads, teams, and larger groups that vary in structure, hierarchy, and dynamics (De Dreu et al., 2024; Reiter-Palmon & Leone, 2019; Urban & Urban, 2023). This highlights the need to extend research beyond the individual level to encompass co-creativity—the shared creative processes in social settings (Glăveanu et al., 2019; Lebuda & Benedek, 2024; Richardson & Ball, 2024; Urban & Urban, 2025). In addition, the changing environment in which everyday creativity occurs affects both the content of and the access to knowledge the person holds and uses at any one time. Expanding research beyond the lab would also allow for a deeper understanding of how other environmental factors—such as educational, professional, and familial contexts—shape how individuals evaluate and regulate their own creative thinking (Anderson et al, 2014; Beghetto & Mangion, 2023) as well as providing a different range of emotions to those elicited in the laboratory.

The role of the social context as determinant of creative performance could be addressed with the help of novel neuroscientific methods, for example, hyperscanning methods measuring brain correlates of creative performance in two or more individuals simultaneously (Luft et al., 2022).

Collaboration of this kind will affect all three key areas (emotion, knowledge and metacognition). For example, a group with diverse backgrounds would bring different forms of knowledge to creative tasks (cf. De Dreu et al., 2024; Homan et al., 2015), so a comparison of collaborative *vs.* individualistic tasks could potentially elucidate the role of knowledge domains in the cognitive processes sustaining creative ideation.

Furthermore, creative work today is increasingly mediated by technology, with individuals not only collaborating with other people, but also interacting with AI-powered tools, particularly generative AI (Biasutti & Frate, 2018; Rafner et al., 2023; Vinchon et al., 2023). This introduces an additional layer to creative cognition, requiring individuals to adjust their creative processes in response to non-human agents. One of the key questions discussed during the meeting concerned the dynamics of the co-creation process in human–AI dyads, particularly the interaction between emotions, metacognition, and creativity-related beliefs during collaborative creative problem-solving with a non-human agent (Rezwana & Maher, 2023; Tang et al, 2024; Urban et al, 2024). It remains unclear how theoretical assumptions derived from human–human collaboration—such as those proposed in the framework of collaborative meta-reasoning (Richardson et al., 2023; Richardson & Ball, 2024)—translate to interactions involving artificial partners. This remains a largely unexplored area of study.

Similarly, we started the workshop with a discussion with a professional cellist (Jacqueline Hamelink) who emphasized how important her body was in her creative process, regarding both the generation and reception of musical ideas. The relationship between arts-based research (e.g., Balkema & Slager, 2004) and creative cognition should become stronger to understand creative cognition in (artistic) practice (Sawyer, 2018). An embodied cognition perspective could provide valuable insights into how physical and sensory interactions with the environment influence creative cognition (Matheson & Kenett, 2020; Ross et al., 2024; Vallée-Tourangeau & Vallée-Tourangeau, 2020). Strategies that engage gesture, movement, and spatial reasoning may play a role in shaping creative problem-solving and the ability to monitor and guide one's own cognitive processes (Frith et al., 2020; Matheson & Kenett, 2021; Sargent et al., 2023). Alongside this, we also need an increased focus on how the objects and space surrounding the person scaffold and act as partners in creative cognition and metacognitive processes (Ross et al., 2020; Ross & Vallée-Tourangeau, 2021).

However, this adds another level of complexity to measurement. Methods tracking creative performance in everyday life that monitor an individual's creative behavior in association with physical activity, substance use, social environment, emotional state, and subjective experiences can be used to study the dynamic role of knowledge in creative cognition (Rominger, Fink, Benedek, et al., 2024; Rominger, Fink, Weber, et al., 2024). By going outside of the laboratory, we could potentially understand how context shapes the utilization of knowledge and memory in generating original ideas.

On an even higher level of observation, one could ask about the relationship between creativity and well-being. While there is evidence that creative activities promote positive affect and well-being (Chermahini & Hommel, 2012; Conner et al., 2018; Tay et al., 2018), the mechanisms are not well understood. There is emerging evidence that creative activities are more effective for well-being when conducted in groups (Coulton et al, 2015), suggesting that collaboration may be an important aspect of that relationship. Eventually, it might even be possible to capitalize on these findings to enhance societal well-being.

By broadening the scope of research to social, technological, and embodied contexts, we can develop a more comprehensive framework for understanding how emotions, knowledge, and metacognition operate in creative cognition beyond the isolated individual mind.

1. How to study the contextual factors shaping the utilization of knowledge and memory for generating original ideas within individuals and teams?
2. In what ways is the engagement with Generative Artificial Intelligence impacting the creative process?
3. What is the relation between creativity and well-being, and how can we capitalize on such a relationship to enhance societal well-being?
4. How can we extend creative metacognition beyond the individual level to understand forms of co-creativity?

The importance of collaboration

Across all the challenges and open questions, there is a common theme. Measurement of complex, slippery and dynamic concepts needs to be clearly refined at the level of the domain and field for meaningful synthesis to occur. This need is coupled with movements in

methodological reform which have placed an increased focus on replicability and scientific rigor. This is a particular challenge for creativity researchers who often deal with subjective behavioral outcomes (the creativity of a response) and also draw on tasks that, on the one hand require multiple different processes, and on the other hand yield multiple different outcome indicators that have different meaning and implications (e.g., number of ideas, originality of ideas, semantic distance between ideas). Another methodological point which has been largely neglected so far is that there is likely a strong effect of context (as discussed in Challenge 4) on different creative tasks, meaning that large, cross-cultural samples would be required to establish robust and replicable effects.

Developing an agenda for the next stage of research into creative cognition requires a collaborative approach. It is only as a community of researchers that we can both synthesize current knowledge and use it as a foundation for future research. The good news is that we are well placed as a community to respond to these challenges. This requires team members with high creative potential, preferably with complementary though different expertise, who invest their cognitive efforts in constructive debate in a cooperative team climate (Bechtoldt et al., 2010; Nijstad, 2009). Academic researchers are generally regarded as scoring high on creative potential (Feist, 1998) with academic publications representing core creative achievements (Benedek, 2024; Diedrich et al., 2018). Constructive debate is a common practice in academia that is cultivated at lab meetings, conferences and during the publication process. We are, therefore, as a collective, well placed to work together to deliver progress.

The past workshop, along with current (multi-lab) initiatives on the ontology of creativity and recent systematic reviews on creativity measurements and paradigms (Acar et al., 2023; Kenett et al., 2020; Rietzschel et al., 2024; Saretzki et al., 2024, Weiss et al., 2024), achieves this common understanding. This will facilitate the integration of existing theories and findings into new research ideas and the coordination of multi-lab research projects (e.g., adversarial research initiatives, multi-lab replication attempts). At the same time, this will aid the coordination of open science principles. Data reporting, sharing and archiving can be more easily embraced as standard practice. Moreover, if standardized across labs, this will help other researchers to more easily understand, verify, replicate, and extend findings (Banks et al., 2018).

Conclusion

The field of creativity research has evolved dramatically since Guilford's initial call to explore the underpinnings of creativity 75 years ago (Guilford, 1950). Our collaborative research agenda highlights both the substantial progress made and the complex challenges that remain. The four key challenges we've identified—definitional clarity, understanding the role of knowledge domains, measuring dynamic processes, and accounting for environmental contexts—represent not obstacles but opportunities for innovative, collaborative research approaches.

What emerges clearly from the discussions held over the course of the workshop is that creativity research itself requires creativity. The dynamic complexity of creative cognition demands novel methodological approaches and collaboration. It also requires a willingness to embrace this complexity rather than reduce it to simplistic models. The collaborative teams already formed from our workshop exemplify this open-minded approach, bringing together researchers who hitherto have not worked together to tackle some of these challenges.

This collaborative effort, like creativity itself, lies in making novel and useful connections between different groups of researchers. We believe that by addressing these challenges collectively, we can develop more comprehensive theories and more effective methods for understanding the cognitive foundations of creativity.

References

Acar, S., Ogurlu, U., & Zorychta, A. (2023). Exploration of discriminant validity in divergent thinking tasks: A meta-analysis. *Psychology of Aesthetics, Creativity, and the Arts*, *17*(6), 705–724. https://doi.org/10.1037/aca0000469

Ackerman, R. (2019). Heuristic cues for meta-reasoning judgments: Review and methodology. *Psihologijske Teme*, *28*(1), 1–20. https://doi.org/10.31820/pt.28.1.1

Agnoli, S., & Corazza, G. E. (2019). Emotions: The spinal cord of the creative thinking process. In R. A. Beghetto & G. E. Corazza (Eds.), *Dynamic Perspectives on Creativity* (Vol. 4, pp. 47–65). Springer International Publishing. https://doi.org/10.1007/978-3-319-99163-4_4

Agnoli, S., Franchin, L., Rubaltelli, E., & Corazza, G. E. (2019). The emotionally intelligent use of attention and affective arousal under creative frustration and creative success. *Personality and Individual Differences, 142,* 242-248.: https://doi.org/10.1016/j.paid.2018.04.041

Agnoli, S., & Mastria, S. (2023). Going deeper into the feelings in creative metacognition: Comment on "A systematic framework of creative metacognition" by I. Lebuda & M. Benedek. *Physics of Life Reviews*, *47*, 170–171. https://doi.org/10.1016/j.plrev.2023.10.028

Akbari Chermahini, S., & Hommel, B. (2012). Creative mood swings: divergent and convergent thinking affect mood in opposite ways. *Psychological Research*, 76, 634-640. https://doi.org/10.1007/s00426-011-0358-z

Allen, K., Brändle, F., Botvinick, M., Fan, J. E., Gershman, S. J., Gopnik, A., Griffiths, T. L., Hartshorne, J. K., Hauser, T. U., Ho, M. K., de Leeuw, J. R., Ma, W. J., Murayama, K., Nelson, J. D., van Opheusden, B., Pouncy, T., Rafner, J., Rahwan, I., Rutledge, R. B., . . . Schulz, E. (2024). Using games to understand the mind. *Nature Human Behaviour*, *8*(6), 1035-1043. https://doi.org/10.1038/s41562-024-01878-9

Amabile, T. M. (1988). A model of creativity and innovation in organizations. Research in organizational behavior. *Research in Organizational Behavior*, *10*(1), 123–167.

Anderson, N., Potočnik, K., & Zhou, J. (2014). Innovation and creativity in organizations: A state-of-the-science review, prospective commentary, and guiding framework. *Journal of Management*, *40*(5), 1297–1333. https://doi.org/10.1177/0149206314527128

Baas, M. (2019). In the mood for creativity. In J. Kaufman & R. Sternberg (Eds.), *The Cambridge handbook of creativity* (pp. 257-272). Cambridge University Press.

Baas, M., Koch, S., Nijstad, B. A., & De Dreu, C. K. (2015). Conceiving creativity: The nature and consequences of laypeople's beliefs about the realization of creativity. *Psychology of Aesthetics, Creativity, and the Arts, 9*(3), 340-354. https://doi.org/10.1037/a0039420

Balkema, A. W., & Slager, H. (2004). *Artistic Research*. Lier en Boog.

Banks, G. C., Gooty, J., Ross, R. L., Williams, C. E., & Harrington, N. T. (2018). Construct redundancy in leader behaviors: A review and agenda for the future. *The Leadership Quarterly*, *29*(1), 236–251. https://doi.org/10.1016/j.leaqua.2017.12.005

Barbot, B. (2018). The dynamics of creative ideation: Introducing a new assessment paradigm. *Frontiers in Psychology*, *9*, 2529. https://doi.org/10.3389/fpsyg.2018.02529

Barbot, B. (2022). Intra-individual variability in creativity: Nature, measurement, and prospects. *European Psychologist*, *27*(3), 154–164. https://doi.org/10.1027/1016-9040/a000470

Beaty, R. E., Benedek, M., Barry Kaufman, S., & Silvia, P. J. (2015). Default and Executive Network Coupling Supports Creative Idea Production. *Scientific Reports*, *5*(1), 10964. https://doi.org/10.1038/srep10964

Beaty, R. E., & Kenett, Y. N. (2023). Associative thinking at the core of creativity. *Trends in Cognitive Sciences*, *27*(7), 671-683. https://doi.org/10.1016/j.tics.2023.04.004

Beaty, R. E., Kenett, Y. N., Hass, R. W., & Schacter, D. L. (2023). Semantic memory and creativity: the costs and benefits of semantic memory structure in generating original ideas. *Thinking & Reasoning*, *29*(2), 305-339. https://doi.org/10.1080/13546783.2022.2076742

Beaty, R. E., Seli, P., & Schacter, D. L. (2019). Network neuroscience of creative cognition: mapping cognitive mechanisms and individual differences in the creative brain. *Current Opinion in Behavioral Sciences*, *27*, 22-30. https://doi.org/https://doi.org/10.1016/j.cobeha.2018.08.013

Bechtoldt, M. N., De Dreu, C. K. W., Nijstad, B. A., & Choi, H.-S. (2010). Motivated information processing, social tuning, and group creativity. *Journal of Personality and Social Psychology*, *99*(4), 622–637. https://doi.org/10.1037/a0019386

Beghetto, R. A., & Mangion, M. (2023). Beyond 'cold' creative metacognition: Toward a more integrated framework. *Physics of Life Reviews*, *47*, 200–202. https://doi.org/10.1016/j.plrev.2023.10.021

Benedek, M. (2024). On the relationship between creative potential and creative achievement: Challenges and future directions. *Learning and Individual Differences*, *110*, 102424. https://doi.org/10.1016/j.lindif.2024.102424

Benedek, M., Beaty, R. E., Schacter, D. L., & Kenett, Y. N. (2023). The role of memory in creative ideation. *Nature Reviews Psychology,* 2(4), 246-257. https://doi.org/10.1038/s44159-023-00158-z

Benedek, M., & Fink, A. (2019). Toward a neurocognitive framework of creative cognition: The role of memory, attention, and cognitive control. *Current Opinion in Behavioral Sciences*, *27*, 116–122. https://doi.org/10.1016/j.cobeha.2018.11.002

Benedek, M., Jauk, E., Beaty, R. E., Fink, A., Koschutnig, K., & Neubauer, A. C. (2016). Brain mechanisms associated with internally directed attention and self-generated thought. *Scientific Reports*, *6*(1), 22959. https://doi.org/10.1038/srep22959

Benedek, M., Jauk, E., Sommer, M., Arendasy, M., & Neubauer, A. C. (2014). Intelligence, creativity, and cognitive control: The common and differential involvement of executive functions in intelligence and creativity. *Intelligence*, *46*, 73–83.

Benedek, M., Karstendiek, M., Ceh, S. M., Grabner, R. H., Krammer, G., Lebuda, I., ... & Kaufman, J. C. (2021). Creativity myths: Prevalence and correlates of misconceptions on creativity. Personality and Individual Differences, 182, 111068.

Benedek, M. & Beaty, R. E. (2025). Envisioning the future of creative thinking assessment. *The Journal of Creative Behavior*, 59, e70036, https://doi.org/10.1002/jocb.70036

Benedek, M., Saretzki, J., & Lebuda, I. (2025). Why do you think you are creative? An analysis of sources and correlates of creative self-concept judgements. *Thinking Skills and Creativity, 57*, 101813. https://doi.org/10.1016/j.tsc.2025.101813

Biasutti, M., & Frate, S. (2018). Group metacognition in online collaborative learning: Validity and reliability of the group metacognition scale (GMS). *Educational Technology Research and Development*, *66*(6), 1321–1338. https://doi.org/10.1007/s11423-018-9583-0

Bink, M. L., & Marsh, R. L. (2000). Cognitive regularities in creative activity. *Review of General Psychology*, 4(1), 59–78. https://doi.org/10.1037/1089-2680.4.1.59

Bledow, R., Rosing, K., & Frese, M. (2013). A dynamic perspective on affect and creativity. *Academy of Management Journal*, *56*(2), 432–450. https://doi.org/10.5465/amj.2010.0894

Boag, S. (2015). Personality assessment, 'construct validity', and the significance of theory. *Personality and Individual Differences*, *84*, 36–44. https://doi.org/10.1016/j.paid.2014.12.039

Botella, M., Zenasni, F., & Lubart, T. (2018). What are the stages of the creative process? What visual art students are saying. *Frontiers in Psychology*, *9*, 2266. https://doi.org/10.3389/fpsyg.2018.02266

Chemero, A. (2011). *Radical embodied cognitive science*. MIT Press.

Chen, Q., Kenett, Y. N., Cui, Z., Takeuchi, H., Fink, A., Benedek, M., Zeitlen, D. C., Zhuang, K., Lloyd-Cox, J., Kawashima, R., Qiu, J., & Beaty, R. E. (2025). Dynamic switching

between brain networks predicts creative ability. *Communications Biology*, *8*(1), 54. https://doi.org/10.1038/s42003-025-07470-9

Conner, T. S., DeYoung, C. G., & Silvia, P. J. (2018). Everyday creative activity as a path to flourishing. *The Journal of Positive Psychology*, *13*(2), 181–189. https://doi.org/10.1080/17439760.2016.1257049

Corazza, G. E. (2016). Potential originality and effectiveness: The dynamic definition of creativity. *Creativity Research Journal*, *28*(3), 258–267. https://doi.org/10.1080/10400419.2016.1195627

Coulton, S., Clift, S., Skingley, A., & Rodriguez, J. (2015). Effectiveness and cost-effectiveness of community singing on mental health-related quality of life of older people: randomised controlled trial. *The British Journal of Psychiatry*, *207*(3), 250-255. https://doi.org/10.1192/bjp.bp.113.129908

Damasio, A. (2006). *Descartes Error*. Vintage.

Dane, E. (2010). Reconsidering the trade-off between expertise and flexibility: A cognitive entrenchment perspective. *Academy of Management Review, 35*(4), 579-603. https:// doi/10.5465/amr.35.4.zok57

Danek, A. H., Fraps, T., von Müller, A., Grothe, B., & Öllinger, M. (2014). It's a kind of magic: What self-reports can reveal about the phenomenology of insight problem solving. *Frontiers in Psychology*, *5:1408*. https://doi.org/10.3389/fpsyg.2014.01408

Danek, A. H., & Kizilirmak, J. M. (2021). The whole is more than the sum of its parts – addressing insight problem solving concurrently from a cognitive and an affective

perspective. *Journal of Cognitive Psychology*, *33*(6–7), 609–615. https://doi.org/10.1080/20445911.2021.1967962

Danek, A. H., Williams, J., & Wiley, J. (2020). Closing the gap: Connecting sudden representational change to the subjective Aha! experience in insightful problem solving. *Psychological Research*, *84*(1), 111–119. https://doi.org/10.1007/s00426-018-0977-8

De Chantal, P.-L., & Organisciak, P. (2023). Automated feedback and creativity: On the role of metacognitive monitoring in divergent thinking. *Psychology of Aesthetics, Creativity, and the Arts*. https://doi.org/10.1037/aca0000592

De Dreu, C. K. W., Nijstad, B. A., & Baas, M. (2024). Human creativity: Functions, mechanisms, and social conditioning. In *Advances in Experimental Social Psychology* (Vol. 69, pp. 203–262). Elsevier. https://doi.org/10.1016/bs.aesp.2023.11.004

Diedrich, J., Jauk, E., Silvia, P. J., Gredlein, J. M., Neubauer, A. C., & Benedek, M. (2018). Assessment of real-life creativity: The Inventory of Creative Activities and Achievements (ICAA). *Psychology of Aesthetics, Creativity, and the Arts*, *12*(3), 304–316. https://doi.org/10.1037/aca0000137

Efklides, A. (2008). Metacognition: Defining its facets and levels of functioning in relation to self-regulation and co-regulation. *European Psychologist*, *13*(4), 277–287. https://doi.org/10.1027/1016-9040.13.4.277

Efklides, A., & Schwartz, B. L. (2024). Revisiting the metacognitive and affective model of self-regulated learning: Origins, development, and future directions. *Educational Psychology Review*, *36*(2), 61. https://doi.org/10.1007/s10648-024-09896-9

Feist, G. J. (1998). A meta-analysis of personality in scientific and artistic creativity. *Personality and Social Psychology Review*, *2*(4), 290–309. https://doi.org/10.1207/s15327957pspr0204_5

Finke, R. A., Ward, T. B., & Smith, S. M. (1992). *Creative cognition: Theory, research and applications*. The MIT Press.

Forthmann, B., Wilken, A., Doebler, P., & Holling, H. (2019). Strategy induction enhances creativity in figural divergent thinking. *The Journal of Creative Behavior*, *53*(1), 18–29. https://doi.org/10.1002/jocb.159

Frith, E., Miller, S., & Loprinzi, P. D. (2020). A review of experimental research on embodied creativity: Revisiting the mind–body connection. *The Journal of Creative Behavior*, *54*(4), 767–798. https://doi.org/10.1002/jocb.406

Gabora, L. (2018). The neural basis and evolution of divergent and convergent thought. In O.Vartanian & R. Jung (Eds.) The Cambridge Handbook of the Neuroscience of Creativity (pp. 58-70). Cambridge MA: Cambridge University Press.

George, T., & Salvi, C. (2023). Putting the framework to work: Comment on "a systematic framework of creative metacognition" by Lebuda & Benedek. *Physics of Life Reviews*, *47*, 203–206. https://doi.org/10.1016/j.plrev.2023.10.014

George, T., & Wiley, J. (2020). Need something different? Here's what's been done: Effects of examples and task instructions on creative idea generation. *Memory & Cognition*, *48*(2), 226–243. https://doi.org/10.3758/s13421-019-01005-4

Glăveanu, V. P. (2014). The psychology of creativity: A critical reading. *Creativity: Theories – Research – Applications*, *1*(1), 10–32. https://doi.org/10.15290/ctra.2014.01.01.02

Glăveanu, V. P., Gillespie, A., & Karwowski, M. (2019). Are people working together inclined towards practicality? A process analysis of creative ideation in individuals and dyads. *Psychology of Aesthetics, Creativity, and the Arts*, *13*(4), 388–401. https://doi.org/10.1037/aca0000171

Glaveanu, V. P., Hanchett Hanson, M., Baer, J., Barbot, B., Clapp, E. P., Corazza, G. E., Hennessey, B., Kaufman, J. C., Lebuda, I., Lubart, T., Montuori, A., Ness, I. J., Plucker, J., Reiter-Palmon, R., Sierra, Z., Simonton, D. K., Neves-Pereira, M. S., & Sternberg, R. J. (2020). Advancing creativity theory and research: A socio-cultural manifesto. *The Journal of Creative Behavior*, *54*(3), 741–745. https://doi.org/10.1002/jocb.395

Green, A. E., Beaty, R. E., Kenett, Y. N., & Kaufman, J. C. (2024). The process definition of creativity. *Creativity Research Journal,* 36(3), 544-572. https://doi.org/10.1080/10400419.2023.2254573

Guilford, J. P., & Hoepfner, R. (1971). *The analysis of intelligence*. McGraw-Hill.

Guilford, J. P. (1950). Creativity. *American Psychologist*, *5*(9), 444–454. https://doi.org/10.1037/h0063487

Guo, Y., Lin, S., Acar, S., Jin, S., Xu, X., Feng, Y., & Zeng, Y. (2022). Divergent Thinking and Evaluative Skill: A Meta-Analysis. *The Journal of Creative Behavior*, *56*(3), 432–448. https://doi.org/10.1002/jocb.539

Hart, Y., Kosoy, E., Liquin, E. G., Leonard, J. A., Mackey, A. P., & Gopnik, A. (2022). The development of creative search strategies. *Cognition*, *225*, 105102. https://doi.org/10.1016/j.cognition.2022.105102

Hart, Y., Mayo, A. E., Mayo, R., Rozenkrantz, L., Tendler, A., Alon, U., & Noy, L. (2017). Creative foraging: An experimental paradigm for studying exploration and discovery. *PLOS ONE*, *12*(8), e0182133. https://doi.org/10.1371/journal.pone.0182133

Hass, R. W. (2017a). Semantic search during divergent thinking. *Cognition*, *166*, 344-357. https://doi.org/http://dx.doi.org/10.1016/j.cognition.2017.05.039

Hass, R. W. (2017b). Tracking the dynamics of divergent thinking via semantic distance: Analytic methods and theoretical implications. *Memory & Cognition*, *45*(2), 233-244. https://doi.org/10.3758/s13421-016-0659-y

Hills, T. T., & Kenett, Y. N. (2022). Is the mind a network? Maps, vehicles, and skyhooks in cognitive network science. *Topics in Cognitive Science*, *14*(1), 189-208. https://doi.org/https://doi.org/10.1111/tops.12570

Hills, T. T., & Kenett, Y. N. (2025). An entropy modulation theory of creative exploration. *Psychological Review*, *132*(1), 239-251. https://doi.org/10.1037/rev0000511

Homan, A. C., Buengeler, C., Eckhoff, R. A., van Ginkel, W. P., & Voelpel, S. C. (2015). The interplay of diversity training and diversity beliefs on team creativity in nationality-diverse teams. *Journal of Applied Psychology*, 100(5), 1456. https://doi.org/10.1037/apl0000013

Jankowska, D. M., Czerwonka, M., Lebuda, I., & Karwowski, M. (2018). Exploring the creative process: Integrating psychometric and eye-tracking approaches. *Frontiers in Psychology*, *9*, 1931. https://doi.org/10.3389/fpsyg.2018.01931

Jauk, E. (2019). A bio-psycho-behavioral model of creativity. *Current Opinion in Behavioral Sciences*, *27*, 1–6. https://doi.org/10.1016/j.cobeha.2018.08.012

Jia, X., Li, W., & Cao, L. (2019). The role of metacognitive components in creative thinking. *Frontiers in Psychology*, *10*, 2404. https://doi.org/10.3389/fpsyg.2019.02404

Kaufman, J. C. (2019). Self-assessments of creativity: Not ideal, but better than you think. *Psychology of Aesthetics, Creativity, and the Arts*, 13(2), 187–192. https://doi.org/10.1037/aca0000217

Kaufman, J. C., & Beghetto, R. A. (2013). In praise of Clark Kent: Creative metacognition and the importance of teaching kids when (not) to be creative. *Roeper Review*, *35*(3), 155–165. https://doi.org/10.1080/02783193.2013.799413

Karwowski, M., Czerwonka, M., & Kaufman, J. C. (2020). Does intelligence strengthen creative metacognition? *Psychology of Aesthetics, Creativity, and the Arts, 14*(3), 353–360. https://doi.org/10.1037/aca0000208

Kapoor, H., Gurjar, S., Mahadeshwar, H., Rezaei, S., & Kaufman, J. C. (2024). Who is the most creative of them all?: Art bias in laypersons' explicit and implicit beliefs. *Psychology of Aesthetics, Creativity, and the Arts*. https://doi.org/10.1037/aca0000663

Kenett, Y. N. (2025). The role of knowledge in creative thinking. *Creativity Research Journal*, 37(2), 242-249. https://doi.org/10.1080/10400419.2024.2322858

Kenett, Y. N., & Ackerman, R. (2023). Creative metacognition: A much needed bridge between meta-reasoning and creativity. *Physics of Life Reviews*, *47*, 162–164. https://doi.org/10.1016/j.plrev.2023.10.006

Kenett, Y. N., Anaki, D., & Faust, M. (2014). Investigating the structure of semantic networks in low and high creative persons. *Frontiers in Human Neuroscience*, *8*. https://doi.org/10.3389/fnhum.2014.00407

Kenett, Y. N., Beaty, R. E., Silvia, P. J., Anaki, D., & Faust, M. (2016). Structure and flexibility: Investigating the relation between the structure of the mental lexicon, fluid intelligence, and creative achievement. *Psychology of Aesthetics, Creativity, and the Arts*, *10*(4), 377–388. https://doi.org/10.1037/aca0000056

Kenett, Y. N., & Faust, M. (2019). A semantic network cartography of the creative mind. *Trends in Cognitive Sciences*, *23*(4), 271-274. https://doi.org/10.1016/j.tics.2019.01.007

Kenett, Y. N., Gooz, N., & Ackerman, R. (2023). The role of semantic associations as a metacognitive cue in creative idea generation. *Journal of Intelligence*, *11*(4), 59. https://doi.org/10.3390/jintelligence11040059

Kenett, Y. N., Kraemer, D. J. M., Alfred, K. L., Colaizzi, G. A., Cortes, R. A., & Green, A. E. (2020). Developing a neurally informed ontology of creativity measurement. *NeuroImage*, *221*, 117166. https://doi.org/https://doi.org/10.1016/j.neuroimage.2020.117166

Kleinmintz, O. M., Ivancovsky, T., & Shamay-Tsoory, S. G. (2019). The two-fold model of creativity: The neural underpinnings of the generation and evaluation of creative ideas. *Current Opinion in Behavioral Sciences, 27,* 131–138. https://doi.org/10.1016/j.cobeha.2018.11.004 Koriat, A. (2015). When two heads are better than one and when they can be worse: The amplification hypothesis. *Journal of Experimental Psychology: General*, *144*(5), 934–950. https://doi.org/10.1037/xge0000092

Kumar, M., Roy, S., Bhushan, B., & Sameer, A. (2022). Creative problem solving and facial expressions: A stage based comparison. *PLOS ONE*, *17*(6), e0269504. https://doi.org/10.1371/journal.pone.0269504

Lebuda, I., & Benedek, M. (2023). A systematic framework of creative metacognition. *Physics of Life Reviews*, *46*, 161–181. https://doi.org/10.1016/j.plrev.2023.07.002

Lebuda, I., & Benedek, M. (2024). A meta-perspective on the creative metacognition framework. Reply to comments on "A systematic framework of creative metacognition". *Physics of Life Reviews*, *50*, 66–71. https://doi.org/10.1016/j.plrev.2024.06.012

Lucas, B. J., & Mai, K. M. (2022). Illumination and elbow grease: A theory of how mental models of the creative process influence creativity. *Organizational Behavior and Human Decision Processes, 168*, 104107.

Lucas, B. J., & Nordgren, L. F. (2015). People underestimate the value of persistence for creative performance. *Journal of Personality and Social Psychology, 109*(2), 232-243. https://doi.org/10.1037/pspa0000030

Luchini, S. A., N. T, Maliakkal, P. V. DiStefano, J. D. Patterson, R. Beaty, and R. Reiter-Palmon (2023) Automatic scoring of creative problem-solving with Large Language Models: A comparison of originality and quality ratings. *Psychology of Aesthetics, Creativity, and the Arts*. https:// doi. org/ 10. 31234.

Luft, C. D. B., Zioga, I., Giannopoulos, A., Di Bona, G., Binetti, N., Civilini, A., Latora, V., & Mareschal, I. (2022). Social synchronization of brain activity increases during eye-contact. *Communications Biology*, *5*(1), 412. https://doi.org/10.1038/s42003-022-03352-6

Matheson, H. E., & Kenett, Y. N. (2020). The role of the motor system in generating creative thoughts. *NeuroImage*, *213*, 116697. https://doi.org/https://doi.org/10.1016/j.neuroimage.2020.116697

Matheson, H. E., & Kenett, Y. N. (2021). A novel coding scheme for assessing responses in divergent thinking: An embodied approach. *Psychology of Aesthetics, Creativity, and the Arts*, *15*(3), 412–425. https://doi.org/10.1037/aca0000297

Mumford, M. D., Mobley, M. I., Reiter-Palmon, R., Uhlman, C. E., & Doares, L. M. (1991). Process analytic models of creative capacities. *Creativity Research Journal, 4*(2), 91–122. https://doi.org/10.1080/10400419109534380

Nijstad, B. A. (2009). *Group performance*. Psychology Press. https://doi.org/10.4324/9780203872901

Nijstad, B. A., Baas, M., & De Dreu, C. K. W. (2023). Meta-control and navigating creative trade-offs: Comment on "A systematic framework of creative metacognition" by Lebuda and Benedek. *Physics of Life Reviews*, *47*, 168–169. https://doi.org/10.1016/j.plrev.2023.10.016

Nijstad, B. A., De Dreu, C. K. W., Rietzschel, E. F., & Baas, M. (2010). The dual pathway to creativity model: Creative ideation as a function of flexibility and persistence. *European Review of Social Psychology*, *21*(1), 34–77. https://doi.org/10.1080/10463281003765323

Nijstad, B. A., & Stroebe, W. (2006). How the group affects the mind: A cognitive model of idea generation in groups. *Personality and Social Psychology Review*, *10*(3), 186–213. https://doi.org/10.1207/s15327957pspr1003_1

Öllinger, M., Jones, G., & Knoblich, G. (2014). The dynamics of search, impasse, and representational change provide a coherent explanation of difficulty in the nine-dot problem. *Psychological Research*, *78*(2), 266–275. https://doi.org/10.1007/s00426-013-0494-8

Open Science Collaboration. (2015). Estimating the reproducibility of psychological science. *Science*, *349*(6251), aac4716. https://doi.org/10.1126/science.aac4716

Ormerod, T. C. (2024). How many heuristics are enough? Testing a parsimonious theory of possibility generation in problem-solving. *Possibility Studies & Society*, 2(1), 107-124.

Ovando-Tellez, M., Benedek, M., Kenett, Y. N., Hills, T., Bouanane, S., Bernard, M., Belo, J., Bieth, T., & Volle, E. (2022). An investigation of the cognitive and neural correlates of semantic memory search related to creative ability. *Communications Biology*, *5*(1), 604. https://doi.org/10.1038/s42003-022-03547-x

Perchtold-Stefan, C. M., Fink, A., Rominger, C., & Papousek, I. (2021). Creative, antagonistic, and angry? Exploring the roots of malevolent creativity with a real-world idea generation task. *The Journal of Creative Behavior*, *55*(3), 710–722. https://doi.org/10.1002/jocb.484

Perry-Smith, J. E., & Mannucci, P. V. (2017). From creativity to innovation: The social network drivers of the four phases of the idea journey. *Academy of Management Review, 42*(1), 53–79. https://doi.org/10.5465/amr.2014.0462

Pesout, O., & Nietfeld, J. L. (2021). How creative am I?: Examining judgments and predictors of creative performance. *Thinking Skills and Creativity*, *40*, 100836. https://doi.org/10.1016/j.tsc.2021.100836

Pessoa, L. (2008). On the relationship between emotion and cognition. *Nature Reviews Neuroscience*, *9*(2), 148–158. https://doi.org/10.1038/nrn2317

Pesut, D. J. (1990). Creative thinking as a self-regulatory metacognitive process - a model for education, training and further research. *The Journal of Creative Behavior*, *24*(2), 105–110. https://doi.org/10.1002/j.2162-6057.1990.tb00532.x

Puente-Díaz, R., Cavazos-Arroyo, J., & Brem, A. (2023). Editorial: Creative metacognition: the chief manager of accurate decisions. *Frontiers in Psychology*, *14*, 1210053. https://doi.org/10.3389/fpsyg.2023.1210053

Puente-Díaz, R., & Puerta-Sierra, L. (2025). Epistemic activities and epistemic emotions: The necessary yet insufficient conditions to generate, evaluate, and select creative ideas. *Thinking Skills and Creativity*, *56*, 101756. https://doi.org/10.1016/j.tsc.2025.101756

Puryear, J. S. (2016). Inside the creative sifter: Recognizing metacognition in creativity development. *The Journal of Creative Behavior*, *50*(4), 321–332. https://doi.org/10.1002/jocb.80

Rafner, J., Beaty, R. E., Kaufman, J. C., Lubart, T., & Sherson, J. (2023). Creativity in the age of generative AI. *Nature Human Behaviour*, *7*(11), 1836–1838. https://doi.org/10.1038/s41562-023-01751-1

Rafner, J., Biskjær, M. M., Zana, B., Langsford, S., Bergenholtz, C., Rahimi, S., Carugati, A., Noy, L., & Sherson, J. (2022). Digital games for creativity assessment: Strengths, weaknesses and opportunities. *Creativity Research Journal*, *34*(1), 28-54. https://doi.org/10.1080/10400419.2021.1971447

Rafner, J., Wang, Q. J., Gadjacz, M., Badts, T., Baker, B., Bergenholtz, C., ... & Sherson, J. (2023). Towards game-based assessment of creative thinking. *Creativity Research Journal, 35*(4), 763-782.

Rawlings, B., S., Chetwynd-Talbot, D., Husband, E., Nuttall, A., Quinn, E., Taggart, R., & Roome, H. E. (2025). Divergent thinking is linked with convergent thinking; implications for models of creativity. *Thinking & Reasoning*, 1–23. https://doi.org/10.1080/13546783.2025.2485059

Reiter-Palmon, R., & Leone, S. (2019). Facilitating creativity in interdisciplinary design teams using cognitive processes: A review. *Proceedings of the Institution of Mechanical Engineers, Part C: Journal of Mechanical Engineering Science*, *233*(2), 385–394. https://doi.org/10.1177/0954406217753236

Rezwana, J., & Maher, M. L. (2023). Designing creative AI partners with COFI: A framework for modeling interaction in human-AI co-creative systems. *ACM Transactions on Computer-Human Interaction, 30*(5), 1-28

Richardson, B. H., & Ball, L. J. (2024). Progressing the development of a collaborative metareasoning framework: Prospects and challenges. *Journal of Intelligence*, *12*(3), 28. https://doi.org/10.3390/jintelligence12030028

Richardson, B. H., Ball, L. J., Christensen, B. T., & Marsh, J. E. (2023). Collaborative meta-reasoning in creative contexts. In L. J. Ball & F. Vallée-Tourangeau, *The Routledge International Handbook of Creative Cognition* (1st ed., pp. 372–396). Routledge. https://doi.org/10.4324/9781003009351-24

Rietzschel, E. F., Ritter, S. M., & Baas, M. (2024). A systematic review of creativity evaluation and creativity selection measurement tasks. *Psychology of Aesthetics, Creativity, and the Arts*. https://doi.org/10.1037/aca0000638

Roebers, C. M. (2017). Executive function and metacognition: Towards a unifying framework of cognitive self-regulation. *Developmental Review, 45*, 31–51. https://doi.org/10.1016/j.dr.2017.04.001

Rominger, C., Fink, A., Benedek, M., Weber, B., Perchtold-Stefan, C. M., Papousek, I., & Schwerdtfeger, A. R. (2024). Reliability and validity of a novel Ambulatory Battery of Creativity (ABC). *Psychology of Aesthetics, Creativity, and the Arts*, *18*(5), 699–715. https://doi.org/10.1037/aca0000526

Rominger, C., Fink, A., Weber, B., Perchtold-Stefan, C. M., Benedek, M., & Schwerdtfeger, A. R. (2024). It is heart to be creative: Insights from ambulatory monitoring. *Psychology of Aesthetics, Creativity, and the Arts*. https://doi.org/10.1037/aca0000679

Ross, W., & Arfini, S. (2024). Impasse-driven problem solving: The multidimensional nature of feeling stuck. *Cognition*.

Ross, W., Glaveanu, V. P., & Chemero, A. (2024). The illusion of freedom: Towards an embedded notion of constraints. In C. Tromp, R. J. Sternberg, & D. Ambrose (Eds.), *Constraints in Creativity* (pp. 166–181). BRILL. https://doi.org/10.1163/9789004707238

Ross, W., & Vallée-Tourangeau, F. (2021). Kinenoetic analysis: Unveiling the material traces of insight. *Methods in Psychology*. https://doi.org/10.36850/e4

Ross, W., Vallée-Tourangeau, F., & Glăveanu, V. P. (2020). Collaboration. In M. A. Runco & S. R. Pritzker (Eds.), *Encyclopedia of creativity*.

Runco, M. A., & Jaeger, G. J. (2012). The standard definition of creativity. *Creativity Research Journal*, *24*, 92–96. https://doi.org/10.1080/10400419.2012.650092

Russell, J. A., Weiss, A., & Mendelsohn, G. A. (1989). Affect grid: a single-item scale of pleasure and arousal. *Journal of Personality and Social Psychology, 57*(3), 493. https://doi.org/10.2466/pr0.1998.83.2.639

Saretzki, J., Forthmann, B., & Benedek, M. (2024). A systematic quantitative review of divergent thinking assessments. *Psychology of Aesthetics, Creativity, and the Arts*. https://doi.org/10.1037/aca0000691

Sargent, M., LePage, A., Kenett, Y. N., & Matheson, H. E. (2023). The effects of environmental scene and body posture on embodied strategies in creative thinking. *Creativity Research Journal*, *35*(4), 614-628. https://doi.org/10.1080/10400419.2022.2160563

Sawyer, R. K. (2018). How artists create: An empirical study of MFA painting students. The *Journal of Creative Behavior*, 52(2), 127-141. https://doi.org/10.1002/jocb.136

Sidi, Y., & Ackerman, R. (2024). Opting out as an untapped resource in instructional design: Review and implications. *Educational Psychology Review*, *36*(2), 41. https://doi.org/10.1007/s10648-024-09879-w

Sidi, Y., Torgovitsky, I., Soibelman, D., Miron-Spektor, E., & Ackerman, R. (2020). You may be more original than you think: Predictable biases in self-assessment of originality. *Acta Psychologica*, *203*, 103002. https://doi.org/10.1016/j.actpsy.2019.103002

Smith, K. A., Huber, D. E., & Vul, E. (2013). Multiply-constrained semantic search in the Remote Associates Test. *Cognition*, *128*(1), 64-75. https://doi.org/10.1016/j.cognition.2013.03.001

Star, S. L., & Griesemer, J. R. (1989). Institutional ecology, `Translations' and boundary objects: Amateurs and professionals in Berkeley's museum of vertebrate zoology, 1907-39. *Social Studies of Science*, *19*(3), 387–420. https://doi.org/10.1177/030631289019003001

Stein, M. I. (1953). Creativity and culture. *The Journal of Psychology*, *36*, 311–322.

Sternberg, R. J. (1999). *Handbook of creativity*. Cambridge University Press.

Sternberg, R. J., & Lubart, T. I. (1999). The concept of creativity: Prospects and paradigms. In R. J. Sternberg (Ed.), *The Handbook of Creativity* (pp. 3–15). Cambridge University Press.

Sundquist, D., & Lubart, T. (2022). Being intelligent with emotions to benefit creativity: Emotion across the seven cs of creativity. *Journal of Intelligence*, *10*(4), 106. https://doi.org/10.3390/jintelligence10040106

Tang, M., Hofreiter, S., Werner, C. H., Zielińska, A., & Karwowski, M. (2024). "Who" is the best creative thinking partner? An experimental investigation of human–human, human–internet, and human– ai co-creation. *The Journal of Creative Behavior*. https://doi.org/10.1002/jocb.1519

Tay, L., Pawelski, J. O., & Keith, M. G. (2018). The role of the arts and humanities in human flourishing: A conceptual model. *The Journal of Positive Psychology*, *13*(3), 215–225. https://doi.org/10.1080/17439760.2017.1279207

Thrash, T. M., Maruskin, L. A., Cassidy, S. E., Fryer, J. W., & Ryan, R. M. (2010). Mediating between the muse and the masses: Inspiration and the actualization of creative ideas. *Journal of Personality and Social Psychology, 98*(3), 469-487. https://doi.org/ 10.1037/a0017907

Tolkamp, G., Verwaeren, B., Vriend, T., Riekhoff, A. J., & Nijstad, B. (2023). Creativity as it unfolds: An examination of temporality in the creative process. *Creativity Research Journal, 37*(1), 22–43. https://doi.org/10.1080/10400419.2023.2234719

Urban, M., & Urban, K. (2021). Unskilled but aware of it? Cluster analysis of creative metacognition from preschool age to early adulthood. *The Journal of Creative Behavior*, *55*(4), 937–945. https://doi.org/10.1002/jocb.499

Urban, M., & Urban, K. (2023). Orientation toward intrinsic motivation mediates the relationship between metacognition and creativity. *The Journal of Creative Behavior*, *57*(1), 6–16. https://doi.org/10.1002/jocb.558

Urban, M., & Urban, K. (2023). Do we need metacognition for creativity? A necessary condition analysis of creative metacognition. *Psychology of Aesthetics, Creativity, and the Arts.* Advance online publication. https://doi.org/10.1037/aca0000647

Urban, K., & Urban, M. (2025). Don't Let it be! Creative Co-regulation and Socially Shared Regulation in a Case Study of the Beatles: Get Back. *The Journal of Creative Behavior*, *59*(1), e626.

Urban, K., & Urban, M. (2025) Metacognition and motivation in creativity: examining the roles of self-efficacy and values as cues for metacognitive judgments. *Metacognition Learning 20*(16). https://doi.org/10.1007/s11409-025-09421-5

Urban, M., Děchtěrenko, F., Lukavský, J., Hrabalová, V., Svacha, F., Brom, C., & Urban, K. (2024). ChatGPT improves creative problem-solving performance in university students: An experimental study. *Computers & Education*, *215*, 105031.

Vallée-Tourangeau, F., & Vallée-Tourangeau, G. (2020). Mapping systemic resources in problem solving. *New Ideas in Psychology*. https://doi.org/10.1016/j.newideapsych.2020.100812

Vinchon, F., Lubart, T., Bartolotta, S., Gironnay, V., Botella, M., Bourgeois-Bougrine, S., Burkhardt, J., Bonnardel, N., Corazza, G. E., Glăveanu, V., Hanchett Hanson, M., Ivcevic, Z., Karwowski, M., Kaufman, J. C., Okada, T., Reiter-Palmon, R., & Gaggioli, A. (2023). Artificial Intelligence & Creativity: A Manifesto for Collaboration. *The Journal of Creative Behavior*, *57*(4), 472–484. https://doi.org/10.1002/jocb.597

Weiss, S., Wilhelm, O., & Kyllonen, P. (2024). An improved taxonomy of creativity measures based on salient task attributes. *Psychology of Aesthetics, Creativity, and the Arts, 18*(3), 429.

Wiley, J., & Danek, A. H. (2024). Restructuring processes and Aha! experiences in insight problem solving. *Nature Reviews Psychology*, 3, 42–55. https://doi.org/10.1038/s44159-023-00257-x

Yang, W., Green, A. E., Chen, Q., Kenett, Y. N., Sun, J., Wei, D., & Qiu, J. (2022). Creative problem solving in knowledge-rich contexts. *Trends in Cognitive Sciences*, *26*(10), 849-859. https://doi.org/10.1016/j.tics.2022.06.012

Zhang, W., Sjoerds, Z., & Hommel, B. (2020). Metacontrol of human creativity: The neurocognitive mechanisms of convergent and divergent thinking. *NeuroImage*, *210*, 116572. https://doi.org/10.1016/j.neuroimage.2020.116572

Zielińska, A., Czerwonka, M., & Karwowski, M. (2023). Another brick in the wall? Comment on “A systematic framework of creative metacognition” by I. Lebuda & M. Benedek. *Physics of Life Reviews*, *47*, 159–161. https://doi.org/10.1016/j.plrev.2023.10.018