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A Creative Cognition Framework for Generating Breakthrough Ideas

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by

Coral A. McConnon

An Abstract of a Project
in
Creativity and Change Leadership

Submitted in Partial Fulfilment
of the Requirements
for the Degree of

Master of Science

April 2023

Buffalo State University
State University of New York
Department of Creativity and Change Leadership

ABSTRACT OF PROJECT

A Creative Cognition Framework for Generating Breakthrough Ideas

Latest developments in creative cognition, largely informed by neuroscience, give us the ability to debunk pervasive and insidious creativity myths that get in the way of creating breakthrough ideas. This paper, through a review of creative cognition and neuroscience literature derives and synthesises a creative cognition framework focused on engaging metacognition of the creative process, activating creating drive, shifting perspective to gain insight, deploying defocused attention and finally, and only when the other dimensions have been established, sparking remote connections and getting to breakthrough ideas. As practitioners we need to ensure we are strategically deploying this framework, creating the time and space for deep thinking, and that the process seamlessly supports people to be at their creative best. As thinking on creative cognition develops further over time, this framework will be updated and also iterated with practical learnings from deployment.

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Your Signature

21 April 2023
Date

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Dates of Approval:

April 25, 2023

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21 April 2023

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Student

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Acknowledgements

I want to thank: Dr Gerard Puccio for his mentoring and genuine desire to make creativity accessible and practical; The Buffalo State Faculty, in particular, Dr Roger Firestein for his deep expertise, Dr Sue Keller-Mathers for her passion for the historical development of creativity, and Laura Barbaro-Switalski M.S. for her practical expertise; A special mention to Dr Blair Miller for his extensive knowledge of practical creativity and his good-humoured advising and guidance for this project.

In addition, I would like to acknowledge the following thought leaders in the field of creative cognition for giving generously of their time and knowledge, agreeing to be interviewed: Dr Mathias Benedek, Dr Alice Flaherty, Emeritus Professor Ken Gilhooly, Dr Liane Gabora, Dr Yoed Kenett and Professor Fred Vallée-Tourangeau. All were encouraging of a Creativity Practitioner interested in the latest thinking on creative cognition. And thanks to Joe Gammal at Synectics World for enjoyable discussions and training in the Synectics approach.

At a personal level, I would like to thank Sarah for her constant encouragement; Lorna, Ron, Matt and Michelle, Ollie, Mum and Jean for their love and support; My husband Nick for his growth mindset and endless support.

And finally, I want to thank my Father, who epitomised the "Number 8 wire mentality", which refers to the ability to solve problems in an ingenious, resourceful, and pragmatic way. The phrase originates in the New Zealand farming sector, just as I do, referring to no. 8 gauge fencing wire which has been used to not only build fences but also solve a myriad of problems in inventive ways.

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SECTION ONE: BACKGROUND TO THE PROJECT

Purpose of the Project

Creativity, the act of creating novel and useful solutions to complex, ambiguous and ill-defined challenges (Abraham, 2018a; Runco & Jaeger, 2012), is a powerful (and awe-inspiring!) tool to deliver on innovation objectives.

As an experienced practitioner of creativity on demand, I am on a mission to better understand how the latest developments in creative cognition- how our brains operate when we create ideas- can be applied to generating breakthrough innovation ideas. While the latest developments in creative cognition impact the entire creative problem-solving process, for clarity of scope, I am focusing on divergent ideational thinking as it applies to small group creativity rather than on organisational creativity. This will help me better understand why my current approaches are successful and shed light on new approaches to experiment with.

This paper will build on work I have done in *Current Issues in Creativity* (CRS 625) and plan to do for *Independent Study* (CRS 590). In *Current Issues in Creativity*, I synthesized the latest developments in creative cognition, most of which used a neuroscientific approach and provided initial thinking on what this might mean for generating breakthrough ideas. In CRS 590, I have engaged with leading academics in the field of creative cognition to understand the latest developments where research is currently in progress and not yet published. And finally, in my work for this paper, CRS 690, the deliverable is a framework which maps out the practical implications of creative cognition learnings for generating breakthrough ideas. The end user of the framework will be my business, 8 Innovation, for use with the clients I work with.

To provide context, I work on large-scale innovation projects, mainly in the consumer packaged goods (CPG), pharmaceutical, retail and banking sectors. However, my approaches and tools are highly transferable to other sectors. I deploy a hybrid system inspired by Creative Problem Solving, innovation sprint thinking, design thinking and lean start-up approaches. The approach is customised for each project, and bespoke creative stimulus is created to ensure a strategic and broad exploration of innovation territories

occurs. In all my work, embracing a more consumer-centric mindset is vital, i.e., thinking from the end user's perspective and how to meet their needs. My work focuses on the phase of the innovation process that is referred to as front-end innovation, the act of working with a client to define their innovation challenge and getting to consumer-viable propositions. The words "consumer-viable" are important here, as the act of getting to a prioritised pool of potential ideas that have not been eroded by a premature evaluation of feasibility is something many of my clients confide that left to their own devices, they struggle with.

A typical project will include: defining the innovation challenge and dimensionalising it, aligning on what we understand about consumers and risky assumptions to explore in consumer immersions before the workshop, designing inspirational stimulus and the process to stretch people's thinking beyond their category and the world they know in advance of the workshop, then leading teams of generally 20-25 working across multiple innovation territories through an intensive innovation sprint including the project briefing, ideation, idea prioritisation and articulation, challenge, concept crafting, consumer test and learn sessions and concept iteration and aligning on a potential roadmap to then present to senior stakeholders for their feedback and fast track commitments.

In every project, I am testing new approaches, so the principle of "test and learn" and iteration not only applies within the client project but also to the approach and thinking I bring to them. The context for exploring creative cognition and breakthrough ideas in this paper is influenced by the type of work I do. However, this paper's learnings and practical implications could easily be applied to other public and third-sector organisations.

It also needs to be noted that I work with clients over a 3-4 month period on a specific innovation challenge. The explicit objective of the project is not to build team capability; however, this is often a secondary benefit of the project. Due to the strategic importance of the project, the client wants to partner with an agency with external best practice front-end innovation expertise, to get to consumer viable ideas. The organisation then internalises idea development.

Specifically, my learning objectives include:

- To revisit and explore **foundational thinkers** and their writing on creative cognition and generating breakthrough ideas.

- A comprehensive review of **best practice ideation tools to generate breakthrough ideas,** including specific approaches, e.g., Synectics (Prince, 1970), lateral thinking (de Bono, 1993), design thinking (Brown, 2019), as well as overviews of tools, e.g., Gryskiewicz & Taylor (2003), Michalko (2006).

- **Develop an integrated approach** grounded in smart thinking on creative cognition, pragmatic and gets results, reflecting the values of my company, 8 Innovation: creativity, pragmatism, results.

- Package learnings into formats that are **inspiring and practical** to share with clients.

Description of the Project

In a previous literature review, I explored creative cognition through four lenses: (1) The Dual Process Model of Creativity: associative and controlled thinking; (2) Creating remote associations; (3) Deploying defocused attention; and (4) Activating creative drive. These lenses are not mutually exclusive; there are many connections and some degree of overlap between them.

Revisiting these findings, focusing on my CRS 690 purpose of producing a practical framework for generating breakthrough ideas deeply rooted in creative cognition, five areas (or lenses) emerge organically. I have mapped these out in the order they need to be considered when generating breakthrough ideas: (1) Metacognition and the creative process; (2) Activating creative drive; (3) Shifting perspective to gain insights; (4) Deploying defocused attention; (5) Sparking remote connections. What's important to note about this sequence is that what is traditionally considered the ideation work happens in step 5, only after a lot of deep thinking and preparation has been completed. In section two of this paper, I will restructure and build on the literature review I synthesised for *Current Issues in Creativity*.

Metacognition and the Creative Process

Starting with metacognition, the dual process model of creativity tells us that we use both our associative (spontaneous) and attention control (executive) networks in both divergent and convergent thinking (Abraham, 2018b). This highlights the importance of ensuring participants have an awareness and metacognition of the creative process and how this complements the way our brains work. In addition, we need to consider how the process feels for participants. Here we need to consider the three affective skills which span the Creative Problem Solving Thinking Skills Model: openness to novelty, tolerance for ambiguity and tolerance for complexity (Puccio et al., 2005). We need to foster and fuel the natural curiosity adults embarking on a creative process will have and, in doing so, build their creative capabilities and their positive experiences of creativity.

Activating Creative Drive

Activating creative drive and creating the right creative climate for creativity to flourish need to be baked into the design from the very outset of the project. In crafting the creative climate, we need the right balance of approach motivation to activate cognitive flexibility and the right amount of avoidance motivation to activate cognitive persistence (Flaherty, 2018; Flaherty, 2019; Nijstad et al., 2010). And this needs to occur with people in an expansive mental state, engaged by the challenge but not hyper-aroused to the point that they can't focus their attention.

In the optimal creative climate, people are in an effortless focused state of consciousness, Csikszentmihalyi's (2013) creative flow. It would be naïve not to acknowledge that in our increasingly busy and stressful work lives, we need to ringfence the time and space for dedicated creative problem-solving and fight hard to protect this time. It is only then that we can give people the space and time they need to indulge their curiosity, focus their attention, and allow their minds to wander, that ideational creativity thrives.

Shifting Perspective to Gain Insight

The latest developments in creative cognition shift our associative thinking perspective in several fundamental ways. First, getting to insightful shifts in our thinking is a slow burn contrary to the "aha" myth that paints creativity as immediate and spontaneous. It

also challenges us to explore multiple contexts when we dissect a challenge to ensure our thinking is truly divergent (Acar & Runco, 2019). Within each context, the psychological entropy this creates needs to be harnessed (Gabora, 2018). Fostering and feeding openness to experience is critical, particularly when modern work environments are high in stress and often low on discretionary time to allow for curiosity. Providing stimulus and experiences is vital to cue new contexts and broaden people's thinking.

Deploying Defocused Attention

We need to actively create space for cleverly designed delayed incubation "time-wasting" activities to allow for mind wandering and idea incubation. Deploying both delayed and immediate incubation processes is critical to make the most of the way our brains work (Gilhooly, 2022).

There is also an opportunity to better harness internal attention by increasing the proportion of individual ideation exercises in creative problem solving processes. This has the secondary benefit of granting people with a preference for introversion some reprieve from external stimulus, creating the space for deep internal attention and conceptual restructuring.

Sparking Remote Connections

Sparking remote associations requires conceptual expansion and manipulation. This is a catalyst to think more deeply about ideation tools to expand semantic distance. There is a need to move beyond simple approaches and an overreliance on brainstorming. Creative manipulation of semantic distance can utilise tools like analogical reasoning to help people break free of creative blocks. Another route is to manipulate unusualness and appropriateness indirectly. There is value in exploring approaches including de Bono's lateral thinking (de Bono, 1993), Synectics, in particular analogies and absurdities (Prince, 1970), and techniques at the breakthrough end of the ideation spectrum (Gryskiewicz & Taylor, 2003).

Rationale for Selection

The existing research to better understand the theoretical underpinnings of creative cognition in the last 20 years is of unquestionable value. My background as a Creativity Practitioner, and possibly my very practical upbringing on a New Zealand Dairy Farm, make me want to push this even further. Practically applying these exciting theoretical findings to my work with clients has the potential to further solve challenges, help people optimise their creativity, democratise access to creativity and reinforce that creativity gets results.

Creativity Skills

Three of the creativity skills this paper will deploy are important to me personally and in exploring creative cognition: incubation, intuition, and insight. All three are interrelated.

Incubation is called out by Wallas (1926) as being an essential phase of the creative process following preparation and then followed by illumination and verification. The value of incubation is that by being deeply immersed in a problem and then setting it aside, unconscious thoughts will allow for new connections to be formed. I have structured my work on this project to allow for periods of immersion and incubation.

Intuition, the feeling of knowing, the sense of a connection or tension, even if you cannot fully articulate it, plays an important role in creativity. As an experienced Creativity Practitioner who has chalked up 10,000+ hours in my field, I have well-developed intuition. Along with incubation and insight, it feels like there is an opportunity for intuition to have a more explicit role in the creative process, which I will reflect in the framework and in my own creative process creating the framework.

Insight occurs over time when a collection of observations and experiences are restructured, much like a kaleidoscope, and new connections come into focus. This is important not only for problem definition but also for dimensionalising a problem and helping create new contexts to explore in divergent thinking. I will create the conditions for insightful shifts in perspective with exposure to fresh thinking on creative cognition to add to the existing work I have completed in this area.

Note: British English Spelling and conventions have been applied in this document.

SECTION TWO: PERTINENT LITERATURE

What Do the Latest Developments in Creative Cognition Mean for Generating

Breakthrough Ideas?

Innovation, fuelled by creativity, is the lifeblood of many businesses, with breakthrough innovation held up as the gold standard. Yet, the creativity needed to generate breakthrough innovation is often stifled (Amabile, 2020). Why is this? Often because the nature of creativity is misunderstood (Puccio & Schwartz, in progress) or the scientific theory is not translated into practical approaches to generate breakthrough ideas.

Creativity is defined as producing ideas that are novel, useful, and surprising (Boden, 2004) to answer complex, ambiguous and ill-defined problems, often where there is no one correct answer (Abraham 2018a). The creativity or quality of ideas is usually measured using fluency, flexibility, and originality. Fluency enables individuals to produce multiple solutions (which is important because fluency has been linked to higher originality), flexibility allows them to switch between categories and truly think divergently (Yoruk & Runco, 2014), and originality leads to novel and unique solutions. The multidimensional nature of creativity makes it challenging to measure (Simonton, 2018). For this paper, we are assuming that more creative ideas are likely to "break the set" and be breakthrough. This is the innovative creativity which will break-set, paradigm shift, and be discontinuous (Kirton, 1976).

According to Land (1973) and Christensen et al. (2015), true disruptive thinking will render an existing industry obsolete and see a seismic shift in a category. However, I am referring to breakthrough innovation within the context of an existing category. For example, was the iPhone a breakthrough innovation across categories? Yes. Within a category, e.g., Beauty, is a new "game-changing" pro-ageing ingredient delivering relevant consumer benefit breakthrough innovation? Yes, but at a different level of magnitude (Keeley et al., 2013).

How Creative Thinking Has Evolved

A good place to begin is understanding creativity within the context of the development of human problem-solving ability and how human brains evolved to solve problems in a specific context. There are thought to be three significant shifts. In the first shift, which happened around 2 million years ago, the onset of primitive tool use resulted from localized concept clustering. This enabled a limited form of divergent thinking, making close associations (Gabora, 2018).

The second shift, which delivered contextual focus, is thought to have occurred around 200,000 years ago (Mithen, 1998). This entailed the ability to shift along a spectrum of thought from convergent to divergent thinking, making use of both close and distant associations. This created the conditions for cognitive fluidity and integration, accommodating the assimilation of new experiences and accumulating a network of previous experiences (Gabora, 2018).

There is, of course, a third shift, the creative explosion which occurred 40,000 years ago when visual language through the arts began to evolve, with implications for the socialisation of ideas. This is referred to as the creative explosion (Puccio & Modrzejewska-Świgulska, 2022). The development of contextual focus, cognitive fluidity and integration and the ability to communicate and spread ideas laid the foundation for creativity as we know it today.

The Development of Creativity and Creative Cognition as a Field Of Study

Modern creativity was born in 1950 with J. P. Guilford's 1949 Presidential address to the American Psychological Association, which challenged psychologists to study creativity scientifically (Runco, 2014). This foundation then saw practical thinking on applied imagination emerge from Alex F. Osborn (1953), Sarnoff Mednick's associative theory of creativity (Mednick, 1962), Koestler's (1964) thinking of colliding planes of knowledge from different disciplines, which he referred to as bisociative connection-making, the idea of defamiliarisation and 'making the strange familiar and the familiar strange' with William J. J. Gordon and George M. Prince using Synectics in the 1960s (Prince, 1970), lateral thinking from Edward de Bono (1993), which was specifically concerned with changing concepts and

perceptions and Csikszentmihalyi's thinking on creative flow, creative personality, creative energy, curiosity and incubation (1996).

In the 1990s, the cognitive components of creativity started being studied using empirical approaches. This large-scale adoption of a creative cognition approach was critical in the understanding of creativity: "Studying the components of creativity using generative (rather than receptive) tasks within the larger framework of cognitive psychology was instrumental in the conceptual and methodological maturation of creativity as a scientific discipline" (Jung & Vartanian, 2018, p. 2).

Methods used by cognitive scientists have included experimental research, computational models, e.g., neural network models, mathematical models, and neuroscientific approaches (Gabora, 2016). Two common neuroscientific approaches are EEG (Electroencephalogram) which measures electrical signals in the brain, and fMRI (functional Magnetic Resonance Imaging), which measures the small changes in blood flow that occur with brain activity. EEG was first applied to cognition in 1975, and fMRI began to be used in the 1990s. Yoruk and Runco (2014) reflected that most work in the neuroscience of divergent thinking has occurred in the last ten years, so viewing this from the vantage point of 2023 means most work has happened over the previous twenty years. And in a fast-developing field such as this, there are likely many in-progress studies that are currently not accessible that will help to advance thinking even further.

The latest developments in neuroscience make it possible to move beyond self-reporting and subjective observation to track how our brains work more accurately. By better understanding these developments, we can better help people be at their creative best. It is easy to see how the impact of neuroscience on our foundational knowledge about creativity is profound, contemporary, and incredibly relevant.

Understanding Creative Cognition

Lens One: The Creative Process and Metacognition

Lens one includes an investigation of whether creative thinking is indeed special, what this means for divergent and convergent thinking, attention control processes,

implications for divergent thinking guidelines, implications for affective skills, and revisiting the need for divergent approaches to divergent thinking. For each area I explain latest thinking on creative cognition and begin to highlight what these learnings might mean for the practice of creativity.

It's Complex, but It's Not Special

Whilst there has been debate in the past about whether creativity deploys a special process, there are no unique brain structures or network/s solely dedicated to creativity. What the neuroscientific evidence shows is that the existing default (associative) and executive (control) networks of the brain are both used (Abraham, 2018b) in creative thinking. This is referred to as the Dual Process Model of Creativity: "…this might indeed be what is singular about creativity in relation to brain function – that unlike other aspects of psychological function, it necessitates the combined operations of cognition and imagination as facilitated by large scale brain networks" (Abraham, 2018b, p. 197). Sternberg and Lubart (1996) talk about "creativity as an extraordinary result of ordinary [cognitive] processes" (p. 681).

What's also important about the Dual Process Model of Creativity is that both associative and controlled networks are being deployed (Chrysikou, 2018). This has been better understood through neuroscientific studies in the last ten years (Abraham, 2018b). The default (associate) mode is automatic, implicit, unconscious, bottom-up, spontaneous, intuitive, and more reflexive. The executive (attention control) network is controlled, explicit, conscious, top-down, deliberate, analytical, or reflective (Abraham, 2018b).

The Dual Process Model of Creativity can be viewed as an integration of previous models. The Associative Theory of Creativity (Mednick, 1962) emphasises that creative thinking involves making connections between remote concepts stored in semantic memory. The Controlled Attention Theory of Creativity (Beaty et al., 2014; Beaty et al., 2023; Frith et al., 2021) puts the emphasis on how creative thought benefits from being able to direct attention, e.g., strategically searching memory, executing complex searches, and inhibiting common ideas.

Dual process models of creativity offer an integrated view, acknowledging both the role of semantic distance and accessing memory and the contribution of executive functions. For example, Simonton's Blind Variation and Selective Retention (BVSR) model, based on Campbell's 1960 evolutionary theory of creativity, talks about creativity as involving blind generation of exploratory ideas and selection that retains only the relevant ideas (Kenett, 2018). Another example is the GENEPLORE model of creative cognition (Finke et al., 1996), which asserts that creativity is an iterative process alternating between the generation of a pre-inventive structures and pre-inventive exploration and interpretation.

The Dual Process Model of Creativity argues that creativity is a function of both cognitive flexibility and cognitive persistence and that these factors can be influenced by mood states (Nijstad et al., 2010). This is reiterated by Simonton (2018): "The only genuine requirements for creativity are cognitive flexibility and motivational persistence" (p. 16). Mood states will be explored later in this paper, specifically their role in activating creative drive. Given the complexity of the dual process model of creativity, this highlights the need for a clear creative problem-solving process to guide thinking.

Both Networks are Needed for Divergent and Convergent Thinking

However, it is not as simple as divergent thinking only deploys the associative network and convergent thinking only employs the control network. It is not known how the two networks are coupled; however, it is known that multiple dualities occur at once (Khalil et al., 2019). The default (associative) network is active during convergent thinking (Ellamil et al., 2012), and controlled processing may co-occur with spontaneous cognition (Khalil et al., 2019).

The Dual Process Model of Creativity also debunks the myth that creativity is solely a right-brain endeavour (Khalil et al., 2019; Yoruk & Runco, 2014). Breaking free of the restraints of the right brain equals creativity myth is important as it reinforces that creativity can be nurtured and that deliberate creativity is possible.

Unpacking the Attention Control Processes

Associative processes are often seen as the more glamorous side of creativity; however, their attention control sibling is no less critical. The top-down executive function view focuses on the processes operating on memory that facilitate creativity, not how the structure of memory facilitates creativity (Beaty & Silvia, 2012; Benedek et al., 2014).

The executive functions include recruiting fluid intelligence, broad retrieval ability and inhibitory control. Fluid intelligence correlates with working memory capacity, providing attention control and the capacity to maintain and manipulate multiple concepts in active storage. Fluid intelligence predicts increased originality of divergent thinking responses. Broad retrieval ability includes strategically searching memory, shifting between broad conceptual categories, and selecting between competing alternatives. Inhibition involves suppressing more obvious close associations. Originality is also associated with updating/inhibition (Beaty & Schacter, 2018). The ability to focus attention, facilitate retrieving and manipulating concepts and inhibit more obvious responses is clearly critical for divergent thinking.

Revisiting the Divergent Thinking Guidelines

It is also relevant to revisit the divergent thinking guidelines in the context of these learnings. Avoiding, or at least seeking to mitigate premature judgement, allows ideas to flow and exploration to flourish. Building on others' ideas encourages associative thinking and conceptual expansion and also helps provide permission for offering something that may appear "half-baked". Go for quantity has been validated by additional studies on the serial order effect (Girotra et al., 2010; Jung et al., 2015). Runco (2014) notes that while originality has been observed to increase in the second half of ideas generated, ideas are no more flexible or varied. The importance of seeking novelty is highlighted by the role a high openness to experience plays and to the control network inhibition of more obvious close-in associations that occurs.

Affective Skills Spanning the Creative Problem Solving Process

Beyond the ideational thinking affective skill of playfulness, which we will reflect on when considering creative drive, we should also reflect on the impact of the latest

developments in creative cognition on the three affective skills which span the Creative

Problem Solving Thinking Skills Model. These skills are openness to novelty, tolerance for

ambiguity and tolerance for complexity (Puccio et al., 2005). High openness to experience

(assuming we can use this as a proxy for openness to novelty) positively impacts creativity

(Christensen et al., 2018; Vartanian, 2018). Tolerance for ambiguity and complexity may be

dimensions of intelligence (both IQ and EQ), i.e., high levels of intelligence make it easier to

navigate complexity and ambiguity and manage expectations around these factors. And

cognitive persistence would also seem to have a role to play when navigating ambiguity and

complexity. These skills support cognitive flexibility and persistence.

Some people view cognition as "cold" and independent of emotions (Runco, 2014).

However, the opposite is true. Creative cognition is a mix of what has traditionally been seen

as cognitive skills and also affective skills. Emotions are central to the brain's functions

(Davidson, 2010). Based on what we know about the dual processes operating in the brain

when we think creatively, there is a role for both structured and non-structured, more

intuitive processes. Some of these more intuitive approaches fuel incubation and feed a

shift in perspective and the insight that comes with this. This also highlights the importance

of fostering not only the cognitive but also the affective skills needed for creative problem

solving, such as tolerance for ambiguity (Burnett & Francisco, 2020).

The energy, excitement and dynamism of creative cognition are beautifully brought

alive by William James, who is considered to be America's first psychologist:

> Instead of thoughts of concrete things patiently following one another in a beaten
>
> track of habitual suggestion, we have the most abrupt cross-cuts and transitions from
>
> one idea to another, the most rarefied abstractions and discriminations, the most
>
> unheard of combination of elements, the subtlest associations of analogy; in a word,
>
> we seem to be suddenly introduced into a seething cauldron of ideas, where
>
> everything is fizzling and bobbling about in a state of bewildering activity, where
>
> partnerships are loosened in an instant, treadmill routine is unknown, and the
>
> unexpected seems only law (Schilling, 2005, p. 456).

Divergent Thinking Requires Divergent Approaches

The principle of separating divergent and convergent thinking, creative problem solving and "creativity on demand" comes from the cognitive, rational semantic school of creativity thought (Burnett & Francisco, 2020). The benefit of a structured process is that it creates the space for unstructured thinking and the right environment for a seething cauldron of ideas to emerge.

Divergent thinking is simply about creating lots of varied ideas that go in many directions. It is not prescriptive about the approaches that are used to get there. When deployed mechanistically, any approach, including creative problem solving, can be one-dimensional, devoid of depth and emotion. A recent article promoting narrative as an alternative to divergent thinking is right to call out the power of techniques such as world building, perspective shifting and action generation. However, these are simply different approaches to divergent thinking, not alternatives to divergent thinking (Fletcher & Benveniste, 2022).

Lens Two: Activating Creative Drive

Lens two explores the dimensions of creative climate, motivation, approach motivation and intrinsic motivation, progress and reward, an expansive mental state, psychological safety, openness to experience and playfulness. For each area I explain latest thinking on creative cognition and begin to highlight what these learnings might mean for the practice of creativity.

The Dimensions of Creative Climate

Before investigating creative drive with a focus on the latest developments in creative cognition, it is useful to be grounded in what we already know about creating the optimal creative climate for divergent thinking. Ekvall's (1996) components of the creative climate model provides a valuable framework for dissecting creative climate. Ekvall sought to develop an instrument to measure the organisational structure and the climate for creativity and innovation. The ten factors identified were challenge, freedom, ideas support, trust/openness, dynamism/liveliness, playfulness/humour, debates, conflicts, risk taking and

idea time. The definitions and manifestations for each of these behaviours are detailed in

Table 1 below.

Table 1

Ekvall's (1996) Creative Climate Dimensions

Dimension	Definitions	High and low manifestations
Challenge	The emotional involvement of the members of the organization in its operations and goals.	A high-challenge climate is seen when the people are experiencing joy and meaningfulness in their job, and, therefore, they invest much energy. Low challenge means feelings of alienation and indifference; the common sentiment and attitude is apathy and lack of interest for the job and the organization.
Freedom	The independence in behaviour exerted by the people in the organization.	In a climate with much of this kind of freedom people make contacts and give and receive information; discuss problems and alternatives; plan and take initiatives of different kinds; and make decisions. The opposite climate would include people who are passive, rule-bound and anxious to stay inside established boundaries.
Idea Support	The ways new ideas are treated.	In a supportive climate, ideas and suggestions are received in an attentive and supportive way by bosses and workmates. People listen to each other and encourage initiatives. Possibilities for trying out new ideas are created. The atmosphere is constructive and positive. When idea support is low, the reflexive "no" prevails. Every suggestion is immediately refuted by a counter-argument. Fault finding and obstacle raising are the usual styles of responding to ideas.
Trust/ Openness	The emotional safety in relationships.	When there is a strong level of trust, everyone in the organization dares to put forward ideas and opinions. Initiatives can be taken without fear of reprisal and ridicule in case of failure. Communication is open and straightforward. Where trust is missing, people are suspicious of each other and are wary of making expensive mistakes. They also are afraid of being exploited and robbed of their good ideas.
Dynamism/ Liveliness	The eventfulness of life in the organization.	In the highly dynamic situation, new things are happening all the time and alterations between ways of thinking about and handling issues often occur. There is a kind of psychological turbulence which is described by people in those organizations as "full speed", "go", "breakneck", "maelstrom", and the like. The opposite situation could be compared to a slow jog-trot with no surprises. There are no new projects; no different plans. Everything goes its usual way.

Dimension	Definitions	High and low manifestations
Playfulness/ Humour	The spontaneity and ease that is displayed.	A relaxed atmosphere with jokes and laughter characterizes the organization which is high in this dimension. The opposite climate is characterized by gravity and seriousness. The atmosphere is stiff, gloomy, and cumbrous. Jokes and laughter are regarded as improper.
Debates	The occurrence of encounters and clashes between view- points, ideas, and differing experiences and knowledge.	In the debating organization many voices are heard and people are keen on putting forward their ideas. Where debates are missing, people follow authoritarian patterns without questioning.
Conflicts	The presence of personal and emotional tensions (in contrast to conflicts between ideas) in the organization.	When the level of conflict is high, groups and single individuals dislike each other and the climate can be characterized by "warfare". Plots and traps are usual elements in the life of the organization. There is gossip and slander. In the opposite case, people behave in a more mature manner; they have psychological insight and control of impulses.
Risk Taking	The tolerance of uncertainty in the organization.	In the high risk-taking case, decisions and actions are prompt and rapid, arising opportunities are taken and concrete experimentation is preferred to detailed investigation and analysis. In a risk-avoiding climate there is a cautious, hesitant mentality. People try to be on the "safe side". They decide "to sleep on the matter". They set up committees and they cover themselves in many ways before making a decision.
Idea Time	The amount of time people can use (and do use) for elaborating new ideas.	In the high idea-time situation, possibilities exist to discuss and test impulses and fresh suggestions that are not planned or included in the task assignment; and people tend to use these possibilities. In the reverse case, every minute is booked and specified. The time pressure makes thinking outside the instructions and planned routines impossible.

Note: This table is sourced from Ekvall (1996) and describes ten dimensions of creative climate. Ekvall sought to develop an instrument to measure the organisational structure and the climate for creativity and innovation. The ten factors identified were challenge, freedom, ideas support, trust/openness, dynamism/liveliness, playfulness/humour, debates, conflicts, risk taking and idea time.

Motivation is Critical for Creativity and it is Limited

"Above a certain IQ, typically estimated at around 120, personality factors such as motivation may have more effect than intelligence on creativity" (Sternberg & O'Hara, 1999, as cited in Flaherty, 2018, p. 20).

However, motivation is a limited resource. Difficult mental work depletes blood glucose. In Kahnemann's dual process theory of cognition, routine decisions utilising the fast, intuitive system 1 saves motivation needed for conscious and effortful system 2 (Kahnemann, 2003, as cited in Flaherty, 2018). The attention control network also assists with our ability to recover from distractions, facilitating cognitive persistence (Zabelina, 2018). Anecdotally, people find the intense focus on a creative problem-solving task cognitively tiring, perhaps because they are simultaneously activating two large brain networks in parallel. This serves as a reminder that as Creativity Practitioners, we must be choiceful about where we direct participants' energy.

The Approach Motivation and Intrinsic Motivation

It is useful to think of motivation as a function of two factors: goal (direction) and intensity. The goal direction can be positive, i.e., approaching a goal or negative, i.e., avoiding a situation, e.g., fear. Regardless of whether individuals are more approach or avoidance oriented, creativity can be enhanced by giving people a clear role for achievement which motivates them to exert additional effort (Khalil et al., 2019). The second aspect of motivation is the level of intensity, which can vary from sedate to excited (Flaherty, 2018).

The approach motivation may be extrinsic or intrinsic. Amabile and Pratt (2016), in their revisions to the 1988 componential model of creativity, explain: "Intrinsic motivation is conducive to creativity; controlling extrinsic motivation is detrimental to creativity, but informational or enabling extrinsic motivation can be conducive, particularly if initial levels of intrinsic motivation are high" (p. 177).

In everyday human behaviour people have a stronger motivation to avoid negative outcomes. In creativity, individuals have a stronger approach motivation. When nearing your goal, approach motivation produces pleasure and an increased effort (Flaherty, 2018; Kenett

et al., 2023). A level of avoidance motivation and fear is thought to be helpful for creativity (Flaherty, 2019). Ekvall (1996) acknowledges the role of emotional involvement in the organisation's goals as an essential factor in the creative climate. Finke et al. (1996) went as far as saying, "the most important motivator for creative thought is the joy of discovery" (p. 36).

Our brains are not simply computers; they also have an emotional life, and mood is important. Overall, activating mood states are more helpful for creativity, this includes happiness, elation, anger, and fear (De Dreu et al., 2008; Khalil et al., 2019). "When positive emotion energizes us, we are better able to concentrate, to figure out the social networks…, to broaden our thinking so we can creatively integrate diverse information, and to sustain our interest in a task so we can persevere" (Davidson 2010, p. 89). Being in a positive mood facilitates flexible thinking, producing unconventional and flexible ideas, and is helpful for divergent thinking (De Dreu et al., 2008; Khalil et al., 2019; Yamada & Nagai, 2015). And being in a negative activating mood state is thought to be more helpful for convergent thinking (De Dreu et al., 2008). The environment we seek to create is much more subtle and nuanced than just making sure everyone is simply happy. A happy mood lasts only about four minutes and then dissipates (Ivcevic, 2023).

A Sense of Progress and Reward

Amabile and Pratt (2016) also emphasised the importance of being engaged in meaningful work and having a sense of progress as a significant determinant of the positive psychological states that facilitate creative behaviour. Progress feeds positive affect and intrinsic motivation, which further feeds creative progress. There is empirical support that perceptual and mental feedback influences motivational perseverance and positive affect (Cseh et al., 2015, 2016). Ekvall (1996) refers to this as dynamism/liveliness and idea support.

Dopamine is thought to be the neurotransmitter with the strongest influence on creativity (Abraham, 2018b; Khalil et al., 2019). It fosters an approach motivation, including rewards-based drive, curiosity, and vivid mental imagery. Looking to psychopathology,

increased dopamine leads to cognitive disinhibition, novelty-seeking, and hyperconnectivity but needs to be mitigated by protective factors: high IQ, cognitive flexibility, and high working memory capacity (Carson, 2018). Moderate levels of dopamine are positively linked to divergent thinking, whereas convergent thinking benefits from low levels of dopamine (Chermahini & Hommel, 2010). Dopamine increases when we are rewarded. Interestingly, it has been shown to increase to an even higher level in anticipation of a reward and to increase further still with unexpected rewards (Sapolsky, 2017).

Balance: An Expansive Mental State

When considering creative drive, the goal is to get to the perfect balance where the motivation to achieve the goal is higher than the fear-driven drive: "Just as both low and very high arousal hinder the ability to successfully complete a task, both disinterest and overintense desire to do creative work can inhibit the open-ended exploration needed for creativity" (Flaherty, 2018, p. 24). The ideal for creative thinking is to have a mental sense of well-being and be in an expansive mental state (Huberman, 2021). We are aiming for an optimal flow state which is "an almost automatic, effortless, yet highly focused state of consciousness" (Czikszentmihalyi, 1997, p. 110).

Not only do we need balance to sustain our motivation, but we also need variety. People work best when they alternate between different states. "This is true in creativity, which seems to require the alternation of idea generation and editing, divergent and convergent thinking, but also the alternation of physical states such as sleep and wakefulness, exercise and stillness" (Flaherty, 2018, p. 40).

Psychological Safety

In considering creative drive, we need to reflect on the need for psychological safety. Psychological safety refers to an environment where it is safe to generate ideas and share thoughts without the risk of censure or social judgement (Rock & Cox, 2012). In Maslow's hierarchy of needs, physiological needs are at the base of the pyramid. They are closely followed by safety needs and social esteem (critical ingredients for psychological safety), then ego and, ultimately, self-actualisation needs (Maslow 1943, as cited in McLeod, 2020).

Goleman and Boyatzis (2008) highlight the work of the British physician and psychoanalyst John Bowlby, who emphasised the importance of a secure foundation from which people can then pursue goals, take risks without unwarranted fear, and freely explore new possibilities. Reinforcing the importance of psychological safety, Rock and Cox (2012) highlight how acutely we feel social pain: "social pain is processed by the brain in much the same way as physical pain" (p. 3). In Ekvall's (1996) thinking on creative climate, he highlights the need for freedom, idea support and trust/openness, as well as the positive impact of the environment that is open to debate and has an absence of personal and emotional tensions (conflict), as well as risk taking. All six factors appear to be relevant dimensions of psychological safety which serves to emphasise its complexity.

At a simple level, our brains have three different systems in operation: the brain stem, the limbic system, and the neo-cortex (McLean, 1973, as cited in Miller et al., 2011b). We need to acknowledge our reptilian brains and ensure the basic needs for *fight or flight* safety needs are met (brain stem), so we can activate the feeling (limbic system) and learning and creative (neocortex) parts of our brain. This is also referred to by Miller et al. (2011b) as up-shifting thinking. Eckert and Vehar (2000), in their book on how to energise innovation teams, repeatedly (with good cause) draw attention to meeting the safety needs of the reptilian brain to ensure it does not get in the way of higher-order creative thinking.

Only when people feel psychologically safe will they be open to new experiences and novelty, an essential affective skill for creativity. To help people psychologically navigate divergent thinking and how it can feel, it is useful to acknowledge potential highs, e.g., excitement at creating lots of ideas when the connections start sparking, and the potential lulls, e.g., we now have so many ideas I feel cognitively overloaded (Ivcevic, 2023). Levels of hope and confidence will come and go across the creative problem solving process (Brown, 2009).

Openness to Experience

The link between high openness to experience, flexibility and remote associations is also useful to explore. People high in openness to experience tend to seek new experiences

and be more sensitive to novelty in experiences (Vartanian, 2018). Recent studies have shown these diverse experiences enhance cognitive flexibility and enable people to break out of old mental patterns, overcome functional fixedness, and make novel associations between concepts, a core component of creativity (Christensen et al., 2018).

However, if openness to experience is a big five personality factor, can it be strengthened? Here it is helpful to dissect openness to experience: "Among the relevant traits are tolerance of ambiguity, low dogmatism, need for variety, aesthetic sensitivity, absorption, unconventionality, intellectual curiosity, and intuition" (Spielberger, 2004, p. 707). It would definitely appear possible to foster and feed intellectual curiosity.

Playfulness

The affective skill supporting ideational thinking is playfulness. A sense of playfulness allows people to relax, be more open to experience and ultimately have a more rewarding human experience. In addition, the arc of humour can take thinking in unexpected directions (de Bono, 1993). Playfulness/humour was also included by Ekvall (1996) as one of the critical components of a creative climate.

Lens Three: Shifting Perspective to Gain Insight

Lens three digs into perceptual change and transformation, the role of the unconscious and preconscious, restructuring the context and changing focal points. For each area I explain latest thinking on creative cognition and begin to highlight what these learnings might mean for the practice of creativity.

Perceptual Change and Transformation: Insight

A change in perspective casts fresh light on a problem and provides insight. Beyond problem definition, dimensionalising the problem so that multiple contexts, linear and non-linear, are being explored is critical to ensure that thinking is truly divergent. Runco (2014) talks about shifting perspectives to uproot mentally and physically and break free of routines, turning situations around (literally or figuratively) to change focal points and deviation amplification to explore the major impacts of minor adjustments or tweaks.

At its heart, divergent thinking is about making connections. To make connections, we need to transform thinking. An insight or a substantive shift in perception may be the "result of forging connections along a path that the individual perceives as atypical; …the perceived significance…may be a function of both the unexpectedness of the connection and the magnitude of change it creates in the network of representations" (Schilling, 2005, p. 26).

Insight leads to discovering a new interpretation of a problem, and then seemingly incongruent or irrelevant elements may come together to create a solution (Vallée-Tourangeau, 2018). Combining and reconciling opposites, contradictions and seemingly incompatible ideas has been referred to as a "magic synthesis" (Arieti, 1976, as cited in Runco, 2014). The very thinking skills that are often viewed as sources of decision-making error for reason and decision making, the type 1 automatic, unconscious, and associative processes, drive, or at the very least, make a considerable contribution to generating insights in creative thinking (Gilhooly et al., 2019). Making use of these unconscious processes that are driven by the spontaneous associative network is complementary to other approaches that use the more systematic attention control network of the brain.

Often in creativity insights are associated with an "aha" or eureka moment which is spontaneous and instantaneous. This myth is particularly unhelpful as it takes the focus off the importance of time in the creative process to allow for unconscious/preconscious connections to form and surface. Creativity is a slow burn and hard work (Weisberg, 2020).

Leaps of insight can often seem sudden; however, are thought to be the result of prolonged incubation (Finke et al., 1996). Schilling (2005) identified five potential explanations for insights: a schema (cognitive structure) is completed; visual information is reorganized; a mental block is overcome; an analogy for the problem is found; and information is randomly recombined. Restructuring is often seen as a process of sense-making or meaning-making and is tied to gestalt theory. Gestalt psychology emphasises perceptual processes and that humans tend to make sense of our experiences and

construct meaning from partial information (Runco, 2014). At its heart, creativity is about creating meaning.

The Role of the Unconscious and Preconscious: Intuition

If the goal is to bring about new meanings, the limitation of only relying on conscious, rational, and structured thinking becomes rapidly apparent:

The use of preconscious or unconscious processes allows the individual to utilize different reasoning processes, processes that, by virtue of their being beyond conscious awareness, are able to value and explore those things that allow original thinking. In this light the preconscious and unconscious are not actually irrational; they just have a rationality of their own (Runco 2014, p. 24).

Runco (2014) goes on to say that these processes, which operate beyond conscious awareness, may well help explain intuition, hunches and the "feeling of knowing". We may have a good idea but not know where it came from, and we react emotionally to it, hence the feeling of knowing.

Neurological studies have uncovered evidence of intuition as a literal "gut feeling" where the gut-brain axis is activated. Heuristics in the brain associated with emotions, feelings and intuition provide feedback in new and uncertain situations (Burnett & Francisco, 2020).

Thinking about how intuition plays out in the ideation process, protocol analysis, and asking people to think aloud whilst ideating to help better understand their thinking process yields some interesting learnings. Khandwalla (1993) showed that ideating is negatively correlated with feeling, restructuring and search. This indicates that if you feel in a rut while ideating, you would be wise to recognise your feelings/the disconnect and restructure your approach.

One of the biggest challenges identified in applying deliberate intuition has been the lack of intuitive tools. Isaksen and Tidd's (2006) observation may still be very relevant today:

There is a gap that exists in the availability and use of tools that go beyond the rational, cognitive and semantic-based approach… While some additional tools have

been created that are based on upon the irrational, affective and visual, the number of practitioners including these tools in their work and general acceptance of these 'softer' approaches is lacking, particularly in the business world (Isaksen & Tidd, 2006, p. 248).

Restructuring the Context Fuels Truly Divergent Thinking

Gabora (2018) proposes thinking about divergent thinking in a similar fashion to divergent light. It is a diffuse beam, not a series of small, focussed beams: "…divergent thought is characterized not by the generation of multiple solutions, but by playing with the "halo of potentiality" surrounding concepts – new affordances yielded by new contexts – to hone as few as a single idea." (p. 58). This is the honing theory of creativity. Restructuring the context leads to a perceptual shift and a fresh view of conceptual relations. As thought proceeds, separate ideas become manifestations of the same underlying mental representation (Scotney et al., 2020).

The challenge must be ideated through multiple contexts to ensure thinking is truly divergent. This brings to mind Acar and Runco's reminder that we need to be exploiting genuinely divergent thinking that branches out and diverges rather than following linear pathways (Acar & Runco, 2019). The importance of framing the right challenge (Markman, 2017) and the right contexts to shift perspectives is critical (Gabora, 2018).

Changing Focal Points to Shift Perspective

Connecting with the purpose of the work and being engaged in meaningful work has been shown to fuel intrinsic motivation (Amabile & Pratt, 2016). A powerful way of shifting perspective is to put yourself in the shoes of the people you seek to serve, your consumers. Exploring the deeper underlying human motivations of consumers, observing their behaviours, how they then navigate and make sense of their world and the challenges that exist within it, the emotions this gives rise to, and how they interact in social contexts provides fuel for not only shifting perspectives but also sparking ideas. This is central to the Design Thinking approach (Brown, 2009). Other ways to shift perspective include engaging

with provocateurs from different walks of life and exploring how other brands/organisations have solved similar unmet consumer needs in other industries.

Lens Four: Deploying Defocused Attention

Lens four delves into broad/leaky attention, the value of incubation, how to "do" incubation and internal vs. external attention. For each area I explain latest thinking on creative cognition and begin to highlight what these learnings might mean for the practice of creativity.

Broad/Leaky Attention

We know that cognitive flexibility, alternating between broad/leaky attention when the mind wanders to focused attention, is needed for creative thinking. However, broad/leaky attention is often not given sufficient focus, given that 25-50% of our waking hours are spent in this state (Benedek, 2018).

Leaky attention is crucial because it means people are more sensitive to and make connections between distantly related concepts and ideas. They also have a larger repertoire of potential stimuli for producing unusual/creative ideas (Zabelina, 2018). High openness to experience has been linked to leaky/broad attention (Christensen et al., 2018). Einstein's reminder highlights the value of mind wandering: "You don't get anywhere by not wasting time" (Zabelina, 2018, p. 55). People need space and time for mind wandering to occur. Ekvall (1996) refers to this as "idea time". Rietzschel et al. (2007) refer to this as deep exploration.

The Value of Incubation

Often stopping conscious work on a problem and allowing it to incubate can help shed fresh light on the challenge. Wallas (1926) considered incubation a critical stage in the creative process of preparation, incubation, illumination, and verification. This is a period of time that is wholly unconscious and focuses on rest, disengaging and distraction. Guildford believed that incubation allowed promising associations to be formed by providing the time necessary for cognitive transformations (Runco, 2014).

Meta-analyses, narrative reviews and empirical evidence support that incubation is helpful for creative, particularly divergent, thinking (Gilhooly, 2022). Incubation is thought to be beneficial due to unconscious task-related processing, such as spreading activation. This means when one concept is activated, other concepts immediately linked to it are also activated (Abraham, 2018a). This changes a person's representation of the task and possibly generates valuable connections and associations. This is supported through laboratory research (Gilhooly, 2022; Volle, 2018). However, others believe that incubation combines unconscious and conscious processes (Yuan & Shen, 2016). Some of the same things that stimulate incubation are thought to stimulate the production of dopamine (Flaherty, 2018).

There are two types of incubation, delayed incubation, where a period of time passes between working on the problem and then coming back to it and immediate incubation where the task is set aside immediately after it is introduced and returned to after a distraction period. Both waking and sleeping incubation are thought to occur (Gilhooly, 2022).

Francisco and Burnett (2008) advocate identifying opportunities for incubation, which they also refer to as passive intuition. This includes problem-solving is at an impasse, groups are not incubating during breaks, at the end of the session the group feeling like there are still unexplored territories but are unable to define rationally what's missing, the group not dealing with the situation at hand/making the time to deal with it and the gap between divergent and convergent thinking is not producing additional intuitive contributions.

How to "Do" Incubation

A review of the literature provides a range of techniques shown to yield results. These techniques, their benefits, and practical examples have been summarised in Table 2 below.

Table 2

Different Types of Immediate and Delayed Incubation Exercises

Type of incubation	Benefits	Authors
Brain Breaks	Allows for a break from the current problem.	Gilhooly et al., 2013 Microsoft Human Factors Lab, 2021
Meditation	Unfocused meditation increases mindfulness, cognitive flexibility and unconscious connections.	Müller et al., 2016 Fujino et al., 2018 Henriksen et al., 2020 Huberman, 2022
Deliberate mind wandering	Positively impacts creative performance, impacting idea originality.	Müller et al., 2016 Shin & Grant, 2021
Do something different	Verbal tasks benefit from spatial (mental rotation) ideation tasks.	Francisco & Burnett, 2008 Gilhooly et al., 2013 Lu et al., 2017
Mild physical activity	Moderate-intensity physical exercise enhances divergent thinking fluency and originality.	Oppezzo & Schwartz, 2014 Zhou et al., 2017
Change of environment	This presents a person with interesting stimuli with few challenges to navigate. Directed attention is replenished, and concentration improves.	Francisco & Burnett, 2008 Gilhooly et al., 2013
Sleep (or task reactivation during sleep)	Sleep inspires creative insight, enhances cognitive flexibility and the ability to find remote associations.	Müller et al., 2016

Note: This table details different kinds of immediate and delayed incubation exercises that have been shown to impact positively on divergent thinking.

Internal vs. External Attention

Another perspective to consider is the role of external attention compared to internal attention. "Being fully engaged with internal cognitive processes and not distracted by external interference may enable the generation of more elaborate and favoured mental representations, which may ultimately result in more creative ideas" (Benedek, 2018, p. 184).

In hybrid ideation structures where individuals worked independently and then worked together as a group, they generated more ideas, better ideas and were better able to discern the quality of the ideas generated (Girotra, 2010). This provides a valuable reminder to ensure that in collaborative small-group ideation, we are creating the space for individual ideation exercises. Osborn (1953) was a proponent of using a mix of individual and group

ideation exercises. It is also worth remembering we have limited conscious information processing, and external and internal attention are competing mental states (Benedek, 2018).

Lens Five: Sparking Remote Connections

Lens five takes us into remote associations, conceptual expansion, creative blocks, brainstorming, lateral thinking, going beyond creative, rational and semantic approaches, design thinking, start-up thinking and making connections. For each area I explain latest thinking on creative cognition and begin to highlight what these learnings might mean for the practice of creativity.

Remote Associations Matter

Revisiting Mednick's (1962) associative theory of creativity, he believed what differentiated highly creative people from less creative people was the structure of their semantic network and the strength of the connection between concepts. Creative individuals were thought to have flatter associative networks, more associative links in their semantic memory network and could therefore activate a broader range of associations.

New techniques for mapping and measuring semantic distance include those that are frequency-based, Latent Semantic Analysis (LSA)-based, and network-based (Kenett, 2018) and have enabled the process of creating remote associations to be better understood. Associative abilities have been found to account for up to 50% of inter-individual variance in divergent thinking scores (Marron & Faust, 2018).

In a recent revision of Mednick's model, evidence shows that associative fluency and uncommon responses are not due to associative hierarchies but due to how that knowledge is accessed. More creative people are faster in creating associative responses, generating more responses (Benedek & Neubauer, 2013). Highly creative people may have more associative links and be able to activate associate relations faster than less creative individuals (Rossman & Fink, 2010). Making remote associations and generating unexpected ideas and solutions takes more time than generating more obvious, closer-in associations (Acar et al., 2019). Highly creative people also have defocused attention, which

gives them access to more concepts (Mendelsohn, 1974, as cited in Abraham, 2018a; Mendelsohn & Griswold, 1964, as cited in Abraham, 2018a). So, what's important is not just associative combinations but also deliberate dissociation.

Conceptual Expansion

Not only do we need to access remote associations, but we also need to combine and synthesize them. This is referred to as conceptual expansion, the ability to expand acquired conceptual structures to include novel elements (Kenett, 2018). In the GENEPLORE model, this is referred to as generating pre-inventive structures. It includes combining thinking from previously unrelated related domains, e.g., bisociative thinking (Koestler, 1964). Einstein's term for this process was combinatory play (Benedek & Neubauer, 2013). This is also a good reminder that during combinatory play, some ideas are simply a means to an end. Gonçalves and Cash (2021) identified eight idea archetypes: shaping ideas, incremental ideas, tangent ideas, bridging ideas (balanced, foresight, hindsight), combinatorial ideas and final combinatorial ideas.

So, what role does existing knowledge play? Divergent thinking benefits not just from some domain-specific knowledge but also from domain-generic knowledge (Amabile & Pratt, 2016; Scotney et al., 2019; Simonton, 2018). This knowledge comes from our semantic and episodic memory (Benedek et al., 2023). There is an optimal level of knowledge beyond which thinking is less insightful (Martinsen, 1995). Hindsight bias means that people often think creativity seems more knowledge-based than it actually is (Simonton, 2015). They undervalue the importance of the combinatory process of analogical reasoning and mental synthesis. Studies have also shown that it is possible to dissociate the brain activation related to generating new original ideas from retrieving old, more common ideas (Benedek et al., 2014). "Originality may be a by-product of making mental leaps among different conceptual categories" (Acar et al., 2019). As people move from relying on memory search to utilising imagination, the originality of ideas should increase (Runco, Okuda & Thurston, 1991, as cited in Acar et al., 2019).

Relational combinations have been shown to increase connectivity and lower structure, whereas attributive combinations do not increase connectivity. Creating novel conceptual combinations also changes the information-processing system of the brain, making it more conducive to creativity (Kennet & Thompson-Schill, 2020).

Creative Blocks

The first creative block to dismantle is inhibition, the fear of being wrong and making mistakes (de Bono, 1993). Overcoming this block through activating creative drive and an environment that fosters psychological safety was discussed earlier. However, simply removing inhibitions will only result in moderate creativity.

When creating remote associations, we need to overcome complex creative blocks (Abraham, 2018a). Experience can prime the mind to overemphasise the familiar features of a problem and not be able to see beyond these, diagnose a common solution and block more creative solutions, creating "functional fixedness" (Abraham, 2018a). This is not so dissimilar to viewing every problem as a nail that needs to be hammered when the most readily accessible tool in your mental toolbox is a hammer. This is also called the Einstellung effect (Bilalić et al., 2008). A vivid example of this comes from Finke et al. (1996), who found in an experiment that despite an open-ended brief to draw life forms from outer space, the drawings created were not that far removed from the human form. Another example comes from the limits of brainstorming in therapeutic settings: "…brainstorming techniques are unlikely to be sufficient to enable individuals to overcome complex creative blocks, of which they might not even be consciously aware" (Marron & Faust, 2018, p. 273).

Another factor to consider is cognitive load (demands on working memory). A high cognitive load negatively impacts the ability to retrieve remote associations by narrowing attention control, and a low cognitive load results in broader associations (Abraham, 2018a). This is essential to consider as people increasingly are (and feel) time-starved in their day jobs, let alone having the cognitive bandwidth to join a cross-functional innovation sprint. Our brains are hardwired to opt for the path of least resistance, the most cognitively efficient way of solving a problem (Finke et al., 1996), which might not always be the optimal approach for

creative thinking. This highlights the importance of being guided by a best practice process to ensure we keep our brains on track and avoid lazy, path of least resistance decisions.

We also need to consider that, according to George Land, non-creative behaviours are learned, and our ideation muscles and ability to form connections become atrophied as we become adults (TEDx Talks, 2011). This highlights the need for rebuilding our creative, connective muscles using tools like generating alternate uses and forced connection exercises (Nielsen & Thurber, 2016).

In addition to the fear of getting it wrong, functional fixedness, cognitive overload and learned non-creative behaviours, company culture can block people's creativity in a range of ways. Based on my anecdotal experience, this could include bureaucracy that stifles new initiatives resulting in apathy and low confidence in making decisions and a lack of walking the talk when it comes to a growth mindset culture.

We Need to Talk About…Brainstorming

A conversation about ideation techniques that do not call out brainstorming would be incomplete — brainstorming when it was popularized democratised creativity. However, it has suffered from being clumsily deployed and misrepresented as the only technique for divergent thinking. Osborn (1953) offered several cautions about brainstorming, including following the recommended procedures, ensuring a problem had been clearly defined/there were clear expectations, and that some individuals are more creative individually than in groups, and brainstorming should supplement individual ideation.

De Bono says of brainstorming:

This was a genuine and useful attempt to provide a more relaxed setting in which to generate ideas without immediate fear of rejection…Unfortunately, brainstorming has become synonymous with deliberate creative effort and has blocked the development of serious creative thinking skills (de Bono, 1993, p. 6).

With this in mind, we need to explore a range of tools that go beyond the familiar and obvious and challenge us to change perceptions and, in doing so, overcome creative blocks.

Categories of Ideation Tools

Since this paper focuses on applying the latest thinking on creative cognition to generate breakthrough ideas, exploring categories of tools/key characteristics is a useful approach. See Table 3 for a sampling of ideation approaches. An excellent place to start is Welling (2007), who maps out the mental operations for generating ideas into application, analogical, combinatorial and abstraction categories. He believed that application is about applying existing knowledge to a problem. Brainstorming would be a good example of this. Analogical thinking involves transferring structures from one domain to another using defamiliarization. However, it requires no new conceptual structures. Analogical thinking could include Synectics approaches: nature analogies, e.g., looking for parallels in nature through using tools like biomimicry; personal analogies, e.g., you become the virus that you are seeking to develop solutions for; and metaphoric/symbolic analogies, e.g., oxymorons to represent implicit tensions: sophisticatedly simple. Combinatory thinking combines existing concepts but does not create new conceptual structures. Examples of combinatory thinking could include Campbell's 1960 blind variation selection retention model (Simonton, 2015), Mednick's associative thinking (1962), Koestler's (1964) bisociative thinking and Finke et al.'s (1996) GENEPLORE theory. Abstraction was defined as the creation of entirely new classes of concepts — for example, Einstein's ideas of a continuity of space and time. In general, Welling believed high-quality creativity was more likely to come from creating new concepts, i.e., combinatorial and abstract thinking. However, he emphasised this was not always the case. Welling also pointed out that often a creative product might be the result of more than one mental operation. Some end ideas are the result of incremental transitions over time, e.g., the transition from figurative to abstract to art that can be seen by viewing Mondrian's painting over time. And assessments of originality depend on the current climate, so originality and importance are not always the same thing. Welling's work complements Lassig's (2013) empirical analysis, which categorised techniques into adaption, transfer, synthesis and genesis. Despite the different labels, the two systems map quite neatly to each other (Davis & Woodward, 2020).

Another helpful categorisation to consider comes from Gryskiewicz and Taylor (2003), who mapped out four creative paths from incremental through to breakaway, which were labelled as direct, supplementary, modification and tangential. Their assessment of tools included that brainstorming results in a higher proportion of ideas falling in the middle, delivering a mix of moderately incremental and moderately breakthrough ideas. Brainwriting produces a higher percentage of direct responses and can generate a more restrained style of creativity, sitting at the incremental end of the spectrum. Restating the problem can lead to new perspectives and new approaches. Metaphors can reduce censorship, introduce a novel mindset and lead to new ideas, often breakthroughs. They highlighted excursion techniques as often generating a high proportion of breakaway ideas. This grouping included techniques that take you to another place, whether literal or metaphorical, including visual connections, field trips and novel/fantasy scenarios. Within the Synectics approach, fantasy scenarios may fit better in this category than under analogies.

Another perspective is to look at ideation tools is based on their components. Van Gundy (1982) offered a classification that included individual/group, verbal/silent, forced relationships/free association and related stimuli/unrelated stimuli. He then grouped tools based on whether they were a good fit for broad, medium or narrow challenges. The exercises he classified as valuable for broad challenges included analogies, reversals, attribute association to break a problem down, and visual and co-creation exercises.

Lateral Thinking

Lateral thinking is an approach popularised by Edward de Bono (1993). He believed that human perception behaves as a self-organising pattern-making system. Lateral thinking, as he defines it, is specifically concerned with changing concepts and perceptions. De Bono's view is that lateral thinking includes but is not limited to divergent thinking. He proposes three broad approaches to lateral thinking: challenge, alternatives, and provocation. The creative challenge challenges the status quo: why is it done this way?; why does it have to be done this way?; are there other ways of doing it? Exploring alternatives includes asking: is there another way?; what are the alternatives?; what else

can be done? Provocations can be seen as thought experiments. They provide a discontinuity and force us outside of the boundaries of reasonableness. De Bono describes that "with a provocation, there may not be a reason for saying something until after it has been said" (de Bono, 1993, p. 216). Viewing this with Welling's (2007) continuum in mind, lateral thinking seems to reside in the combinatorial and abstraction categories.

It is useful to reflect on the differences between lateral thinking and Synectics. Lateral thinking is concerned with changing concepts and perceptions. Synectics is concerned with "making the familiar strange and the strange familiar". The defamiliarization aspect of Synectics can break up regimented and rigid problem-solving techniques to provide a fresh lens to view or revisit a problem state (Prince, 1970; Davis & Woodward, 2020). Synectics seems to sit in Welling's (2007) analogical (direct, personal and symbolic analogies) and abstractive (fantasy analogies) thinking categories.

Going Beyond Cognitive, Rational and Semantic Approaches

Returning to the 2006 challenge from Isaksen and Tidd to go beyond a rational, cognitive and semantic approach, intuitive and narrative techniques are important additions to consider.

Intuitive tools operate on the basis that, at some level, you already know the answer to your challenge and that you will perceive insights and "whole solutions" from your unconscious (Michalko, 2006). In *Thinkertoys,* Michalko (2006) groups ideation tools as linear and intuitive. Intuitive tools use techniques including relaxation, intuition, incubation, analogies, fantasy questions, creative visualization, dreams, drawing, hypnagogic imagery, psychosynthesis and hieroglyphics. These tools appear to sit in Welling's (2007) abstraction category.

In *The Art and Practice of Breakthrough Thinking*, Cabane and Pollack (2017) discuss tools to help the spontaneous, intuitive associative network be at its best. They talk about tools to foster defocused attention, for example, walking ideation, hypnagogic (the transitional state from wakefulness to sleep), hypnopompic (the state immediately preceding waking up) ideation. Creative walking has also been explored by Francisco (2008).

Narrative cognition taps into the brain's ability to conceive original actions and is open to non-logical approaches (Fletcher & Benveniste, 2022). Narrative approaches include world-building, perceptual shift and action generation (Fletcher & Benveniste, 2022). World building focuses on a novel causal agent which prompts people to hypothesise new opportunities for action. With perspective shifting techniques, the motives of a character or a narrator are presented, and people then hypothesise how the character/narrator would react. Action generation occurs when two causal agents are collided to produce a plot. Possibility thinking and prospective thinking, both narrative approaches, are based on the premise that we suffer from a projection bias when anticipating the future, assuming that the same trends can be extrapolated. We only need to reflect on the seismic changes during the Covid pandemic to reveal how rapidly the world can change in ways that confound a straightforward extrapolation of that which we know. These approaches fit in Welling's (2007) abstraction category.

The ideation approaches discussed above are summarised in Table 3 below.

Table 3

A Sampling of Ideation Approaches

Approach	Components	Authors
Mental operations	Application Analogical Combinatorial Abstraction	Welling, 2007
Incremental to breakthrough	Direct Supplementary Modification Tangential	Gryskiewicz & Taylor, 2003
The type of tool	Individual/group Verbal/silent Forced relationship/free association Related stimulus/unrelated stimulus	Van Gundy, 1982
Lateral thinking	Challenge Alternatives Provocation	de Bono, 1993
Synectics	Analogies: direct, nature, personal, fantasy Metaphors Absurdities: get fired, illegal/immoral scenarios.	Prince, 1970

Approach	Components	Authors
Intuitive tools	Relaxation, intuition, incubation, analogies, fantasy questions, creative visualization, walking ideation, dreams, drawing, hypnopompic/hypnagogic imagery, psychosynthesis and hieroglyphics	Cabane & Pollack, 2017; Michalko, 2006
Narrative	World building Perceptual shift Action generation	Fletcher & Benveniste, 2022

Note: This table summarises a sampling of different ideation approaches including mental operations, the impact of the ideas, the type of tool, and specifically mentions lateral thinking, Synectics, intuitive and narrative tools.

What About Design Thinking?

As a Creativity Practitioner, I often encounter clients who want to use a "design thinking" approach and tools. This is worth further dissecting to ensure we are not overlooking a magic elixir that will instantly get us to breakthrough ideas. Design thinking, with its constant iterative cycles, uses an iterative Creative Problem Solving model, diverging, and converging for each of problem definition (assessing the situation and clarification), generating potential solutions (transformation) and implementation (Brown, 2009). Design thinking holds the consumer at its heart, as discussed in shifting perspectives, in the same way, that people who are really plugged into consumer needs do. It does a great job of iterating and prototyping skills that fans of lean start-up approaches will already be deploying in innovation sprints. Reviewing the tools in *The Design Thinking Toolbox* (Lewrick et al., 2020) includes a mix of brainstorming, brainwriting, prioritisation and voting tools, reverse/figurative/body-storming tools, analogies, and blue ocean tools for identifying white spaces. This reveals a solid spread of tools. However, there is no magic elixir that we have overlooked.

Another sense check is to look at corporate innovation guidebooks, as sometimes clients can become quite evangelical about these approaches. A MNC client recently asked for a proposal that used the tools in *The Innovators Toolbox* (Silverstein et al., 2009). The

tools do a good job of covering all bases, perhaps with more of an emphasis on cognitive, rational, and semantic tools, but also no magic elixir.

How About Start-Up Thinking?

And finally, to ensure we have left no stone unturned in the search for a magic elixir, we need to consider start-up thinking. When you peruse crowdfunding sites like Crowdcube or Seedrs, it never fails to amaze how clever and yet intuitive some of the ideas are. How is it that many start-up ideas are breakthroughs? To start with, around 95% of start-ups fail (Tredgold, 2017), and according to Clayton Christensen (2015), 95% of new product ideas fail (let's take this as a proxy for corporate innovation), so the failure rates are similar. So perhaps there are lower levels of inhibition. Often start-ups have a healthy growth mindset where failure is simply a method to learn, they are less encumbered by fixed thinking, and their company environment is not stuck in learned non-creative behaviours that value efficiency at the expense of creativity. However, it must be about more than simply having lower creative blocks.

Where do these ideas come from? My hypothesis is that it is about being observant and empathetic about latent consumer needs, deeply immersing yourself in the problem area and incubating, trusting your intuition to get to new insights, and then making new connections to create new concepts, the very same approaches we have already discussed. Moving into developing the framework in section 4, one thing to consider is using fantasy analogies: "Imagine a world where this problem remains unsolved, you are an agile start-up with a blank sheet of paper…".

It's About Making Connections

Ultimately all the tools surveyed are about making connections. Steve Jobs beautifully articulated the importance of making connections for creativity:

> Creativity is just connecting things. When you ask creative people … they were able to connect experiences they've had and synthesize new things. And the reason they were able to do that was that they've had more experiences, or they have thought more about their experiences than other people. Unfortunately, that's too rare a

commodity. A lot of people in our industry haven't had very diverse experiences. So, they don't have enough dots to connect, and they end up with very linear solutions without a broad perspective on the problem. The broader one's understanding of the human experience, the better design we will have (Wolf, 1996).

SECTION THREE: PROCESS PLAN

This section details the plan to achieve, timeline and evaluation plan agreed in the concept paper. This plan has been achieved with the final paper and summary video submitted in mid-April 2023.

Plan to Achieve and Project Timeline

CRS 690 is a three credit graduate course, which translates to 135 hours of working time. It is proposed there are four check-ins with Dr Miller, with the flexibility to schedule other ad hoc sessions if required. Table 4 maps out the tasks, estimated time, and the timeline for the project. Note that this is a deliberately accelerated timeline to ensure the bulk of work is completed pre-Easter 2023. If professional commitments interfere with this timeline, the timeline will be revised with Dr Miller to still ensure the required course submission date of 1 May 2023 is met.

Table 4

Plan to Achieve and Project Timeline

Task	Estimated time	Timeline
Confirm direction and create concept paper	16 hours	
• Map out initial thinking on background, pertinent literature, and process plan to create a first draft and email Dr Miller.		
• Meet with Dr Miller to discuss.		11 Jan 2023
• Iterate with feedback from Dr Miller.		12 Jan 2023
		16 Jan 2023
Create sections 1-3	16 hours	
• Complete writing for (1) Background, (2) Pertinent Literature and (3) Process Plan. Send to Dr Miller by 9am CST.		6 Feb 2023
• Meet with Dr Miller to discuss.		8 Feb 2023
• Iterate with feedback from Dr Miller.		13 Feb 2023
Create sections 4-6	67 hours	
• Send work-in-progress overview to Dr Miller.		6 Mar 2023
• Discuss with Dr Miller.		9 Mar 2023
• Complete writing for (4) Results, (5) Insights into key learnings and (6) Conclusions. Send to Dr Miller by 9am CST.		20 Mar 2023
• Meet with Dr Miller to discuss.		23 Mar 2023
Synthesise	16 hours	
		2 Apr 2023

Task	Estimated time	Timeline
• Iterate with feedback from Dr Miller. Synthesize sections and refine the overall flow. Completed document uploaded for review by EOD GMT. • Meet with Dr Miller to discuss. • Iterate with feedback from Dr Miller and submit.		6 Apr 2023 14 Apr 2023
Socialise • Produce a 7-minute summary video to meet course requirements	4 hours	14 Apr 2023
Total time	135 hours	

Note: This table maps out the phases of tasks, specific tasks, timing and timelines as agreed

at concept paper stage. The paper was delivered according to these timelines.

Evaluation Plan

The evaluation plan in Table 5 below is linked to the learning objectives in section one.

Table 5

Key Evaluation Assessments Towards Learning Goals

Learning Goals	Deliverable
Robust foundations: Revisiting foundational thinkers and their writing on creative cognition and generating breakthrough ideas.	Knowledge of foundational thinkers is included in the metacognition and the creative process section.
Best practice tools: A comprehensive survey of best practice ideation tools to generate breakthrough ideas, including specific approaches, e.g., Synectics (Prince, 1970), lateral thinking (de Bono, 1993), design thinking (Brown, 2019), as well as overviews of tools, e.g., Gryskiewicz & Taylor (2003), Michalko (2006).	A range of tools to spark remote associations, resulting in breakthrough ideas, are selected.
Integrated: Develop an integrated approach grounded in smart thinking on creative cognition, pragmatic and gets results, reflecting the values of my company, 8 Innovation: creativity, pragmatism, results.	The approach integrates creativity, pragmatism, and a clear path to get to results.
Elegant and socialisable: Package learnings into inspiring and practical formats to share with clients.	Learnings are delivered in a way that is elegant, i.e., "pleasingly ingenious and simple," and inspire an appetite for engaging in the creative process.

Note: The table above maps out the learning goals and specific deliverables the paper will

be evaluated against, as agreed at concept paper stage. These learnings goals are

assessed in section five, learnings.

SECTION FOUR: OUTCOMES

In this section, we change tack, summarising the key learnings and their practical implications. Then for each of the five lenses, I will share example content to bring alive the framework. It is worth noting that some practical implications are focused on acknowledging myths and misconceptions so we can move past them, and others are practical things that can be done. And a useful reminder going into this section is that the intended audience is my company and clients. Some pieces of the example content will be used with the client, and others will be participant-facing.

Lens One: Engaging Metacognition - Practical Implications

There are three key learnings in this area: creative cognition is both spontaneous and controlled, the mental processes underpinning creativity are complex, and that creativity is both a cognitive and affective journey. For a summary of learnings and practical implications, see Table 6.

Metacognition of the Creative Process

Starting with the fact that creative cognition employs both the spontaneous and controlled attention network, the practical implications include the existing best practice of introducing the creative problem solving process. This provides adult participants with certainty to help them navigate the process and with an awareness and understanding of their journey, allowing them to engage their own metacognition. Rock and Cox (2012) highlight the importance of some degree of certainty for adults, which applies even when solving complex, ambiguous and ill-defined problems. What's different here is that the latest developments in creative cognition are succinctly and practically explained, and how the design of the innovation sprint reflects these learnings. This positions optimising creativity as a shared challenge and treats participants as genuine co-creators in the process, explaining how the process has been spaced out over time to help people optimise their creative cognition as well as separating divergent and convergent thinking. It is also essential to land the point that the structured process creates the time and space for unstructured thinking.

Best Practice Creative Behaviours

The complexity of the mental processes at play for creativity highlights the value of "chunking up" phases of the project as well as separating divergent and convergent thinking, which are supported by best practice behaviours. There is value in getting practical fast and giving people first-hand experience of ideating on a hypothetical warm-up challenge. This allows people to derive the best practice behaviours, internalise them, and increase confidence in their ability to think divergently in a low-risk way. The best practice behaviours for divergent thinking include avoiding premature judgment, building on ideas, seeking novelty, and going for quantity. At this point, I would highlight the importance of being consumer-centric (or focused on the needs of whoever the end user is) to increase empathy and keep people focused on creating consumer-viable ideas. And I would acknowledge the importance of playfulness for ideational thinking. Particularly in more serious corporate cultures, the explicit permission to be playful can often be enough to help people take themselves a little less seriously, be more cognitively flexible, relax inhibitions and create social bonding in the group. Having established and reflected on best practice behaviours, they must be reinforced consistently. The acknowledgement that this will be different to BAU (business as usual) is important, particularly as most people, regardless of whether they join from consumer insights, marketing, brand, R&D, technical or other functions, will generally spend much of their work life in convergent thinking mode, and their divergent thinking muscles are likely to atrophied.

Establishing and Supporting Affective Skills

An implicit part of creative cognition is that it is both a cognitive <u>and</u> affective journey. Specifically for ideation, we are deploying the cognitive skill of ideational thinking and the affective skill of playfulness, as noted above. In addition, three affective skills span the creative problem solving process: openness to novelty, tolerance for ambiguity and tolerance for complexity. These skills need to be acknowledged and discussed. In particular, it is helpful to call out the role of intuition as we navigate ambiguity. While it is important we listen to our intuition, we need to do this with an understanding that intuition is not always right. Often participants reflect that they find the transformation phase of the

creative problem solving process rewarding but also surprisingly mentally draining. This is

likely to be due not only to atrophied divergent thinking muscles but also to the importance of

the challenge and the mental load of navigating an ambiguous and complex challenge.

Table 6

Lens One: Engaging Metacognition Summary and Practical Implications

Learning	What's Included	Practical Implications
Creative cognition is both spontaneous and controlled	• There are no unique brain networks solely dedicated to creativity. • The dual process model of creativity shows that both the associative spontaneous and attention control brain networks are used.	• A clear creative problem solving process allows for both brain networks to be engaged. • Feed the natural curiosity of adults, explaining how this process will help them optimize their creativity and how we have created time and space for deep, quality thinking. • The value of a structured process is that it creates time and space for unstructured thinking.

The mental processes underpinning creativity are complex	• Creativity is a function of cognitive flexibility (associative spontaneity) and cognitive persistence (attention control).
	• Both networks are needed for both divergent and convergent thinking.
	• For most adults, divergent thinking muscles are often atrophied.
		• We separate divergent and convergent thinking to navigate complexity.
		• We then establish and elaborate on best practice divergent thinking behaviours:
		  o Mitigate premature judgment
		  o Build on other ideas
		  o Seek novelty
		  o Go for quantity
		• The guidelines are best experienced and internalised by ideation participants through a hands-on ideation warm-up.
		• Clearly signal, we will be thinking differently to people's day jobs, so this experience will feel different to BAU.
		• Acknowledge the value of playfulness.

Creativity is a cognitive and affective journey	• The affective skills which span the whole creative problem solving process are openness to novelty, tolerance for ambiguity, and tolerance for complexity. • While creative problem solving comes from the cognitive, rational, and semantic school of	• Openness to novelty: create time to promote, feed and reward curiosity. Role model openness. Stimulate an approach motivation. • Tolerance for ambiguity: acknowledge ambiguity is inevitable, permission to explore

Learning	What's Included	Practical Implications
	thought, it is simply a framework that can accommodate cognitive/affective, rational/intuitive, semantic/narrative, and visual approaches to forge new connections.	intuition. Mitigate an avoidance approach. • Tolerance for complexity: to navigate the complexity, we have a structured approach designed to deliver on objectives with clear milestones. Mitigate an avoidance approach. • Deploy a range of tools that span a range of techniques, including cognitive/affective, rational/intuitive, semantic/narrative, and visual approaches to forge new connections.

Note: This table summarises key learnings for lens one, engaging metacognition, from section two as well as summarising the practical implications detailed in this section, outcomes.

Lens Two: Activating Creative Drive - Practical Implications

Activating creative drive has elevated importance for corporate innovation projects where teams are often overworked and under-resourced. Can a one-off project on a strategically important innovation challenge change corporate culture? Probably not. However, it can help people be at their creative best for the duration of the project and also give them some transferable skills to take into other projects and even into their personal lives. The key learnings on creative drive focused on the role of motivation, dopamine and the approach motivation and psychological safety. For a summary of learnings and practical implications, see Table 7.

Meaningful Connection and Creative Flow

Creative climate is easy to talk about yet hard to craft. Perhaps because it is so tricky and intangible, many less experienced facilitators default to icebreaker techniques that can often derail an innovation sprint's meaningful connection, energy, focus and dynamism.

In crafting the creative climate, we need the right balance of approach motivation to activate cognitive flexibility and the right amount of avoidance motivation to activate

cognitive persistence. And this needs to occur with people in an expansive mental state, engaged by the challenge but not hyper-aroused to the point that they can't focus their attention. In the optimal creative climate, people are in an effortless focused state of consciousness, Csikszentmihalyi's (2013) creative flow. As Creativity Practitioners, our role is to help connect people with meaning to activate their intrinsic interest and approach motivation. A sense of creative tension or challenge must be established to engage participants and tap into an avoidance approach. There are several dimensions to the challenge: the job to be done, the broader implications of delivering on the brand's purpose and helping consumers live better lives, the personal connection participants feel with the objective and crucially, their role in delivering on the challenge. Finke et al. (1996) emphasise that "one needs to become deeply committed to and involved with a problem in order to solve it effectively" (p. 35). At a very practical level, we know that the deployment of two large-scale brain networks is cognitively draining, and motivation is limited, so being smart about providing high-energy healthy snacks along with brain breaks to rest and reset is critical.

Meaningful Progress and Rewards

We know that dopamine is the neurotransmitter most associated with creativity. This drives people to pursue novelty and engage in information-seeking behaviours, motivated by the reward and the anticipation of reward, especially unexpected rewards (Sapolsky, 2017). The wanting for dopamine drives people to pursue novelty.

Mentally and physically breaking free of routine is important to consider here. Creating a novel physical environment or reconfiguring existing meeting rooms and visually bringing alive the consumer and their unmet needs in the room signals that we will be collaborating in a way that is novel and very different from BAU (business as usual). However, it is easy to overweight the physical environment, perhaps because it is more tangible and underweight the mental environment. In life, we tend to shy away from negative emotions, so it is really valuable to establish the expectation that we will be facing into frustration, at times feeling like we are at an impasse. When this happens, we need to get

curious and reflect on where we are in the process and whether we would benefit from stepping away from the challenge and incubation.

What does a reward look like in this setting? Cultivating friendly competition between innovation squads that rewards divergent/convergent thinking behaviours (in a way appropriate for adult participants), celebrating what a joyful activity we are engaged in, and celebrating progress through the process. This then needs to be maintained with a sense of positive momentum and achievement. Each small win motivates the group to go on and achieve further progress, feeding their intrinsic motivation, like a self-charging battery, incredibly energy efficient! In addition, we want to arouse people's anticipation for what is to come, providing unexpected surprises to reinforce this is not BAU and increase cognitive arousal.

Creating the Right Environment to Foster Openness to Experience

Psychological and social safety needs to be established to reassure people that it is safe to generate ideas and share their thinking without the risk of censure or social judgement. Establishing psychological safety requires more thought than simply saying: "It's OK, we are all psychologically safe here; let's crack on…". First, people need to feel acknowledged and respected in a creative climate which celebrates diversity and is inclusive. Next, people need clarity on the challenge, how things will work and what's required of them. And then ground rules for working together need to be established, for example, divergent thinking guidelines. Given the stressors and micro-stressors, everyone faces each day; this needs to be an environment where we are kind to each other, role modelled by the facilitator. Roger Firestien articulates this clearly: "The greatest influence on a group's creative behaviour is your behaviour as a facilitator. Be a model for what you want the group to be" (Miller et al., 2011a, p. F34). This kindness is important because by engaging in the creative process, we make ourselves vulnerable, offering up partly formed ideas and navigating the emotional rollercoaster of excitement, joy, satisfaction, frustration, disappointment, and fear, and hopefully finishing in elation. A seamless experience where instructions are clear, and logistics inconspicuously operate in the background allows

participants to focus what we know are finite resources of motivation and attention on the

challenge at hand and being at their creative best to respond to it.

I want to take some time to explore this further, as often the value of creating an

"oasis of calm", even if only for the duration of a project, can be undervalued. The big

challenge here is that most corporate environments are in flux, whether through

restructuring, new CEOs landing, changes in strategic direction, arduous planning cycles or

hiring freezes resulting in increased workloads. We respond to big sources of stress through

allostasis, the biological mechanism which protects the body from stress (Cross & Dillon,

2023). However, microstress, small moments of stress, e.g., misalignment between

collaborators on roles or priorities, as well as collaborative demands that are diverse and

high in volume, that seem manageable but are also never-ending, slip under the radar of our

fight or flight system and therefore don't activate the self-protective allostasis mechanism.

These microstresses result in reduced bandwidth for paying attention to an activity or solving

problems and also on our mood (Cross & Dillon, 2023). An awareness of the perception and

reality of collaboration overload is important when designing a collaborative innovation

sprint. I am always transparent with a team that my objective is to make every minute of our

time together count and that there will be a reason for everything we do so they are

reassured their time will be well spent and respected.

The same considerations about the creative climate are important when considering

virtual or hybrid workshops. It is even more important in what can seem a more impersonal

environment to establish a human connection first. And the technology platforms, whether

using Zoom, Mural, Kahoot, Flickr, need to operate seamlessly and quietly in the

background. The technology is not the star; the creative collaboration process is the star.

It is vital to start preparing for psychological safety from the outset of the project.

This includes exploring tensions or personalities that might impact the creative climate and

understanding the source of the conflict. These issues can then be dealt with proactively

with practical measures to acknowledge, mitigate or align. Thinking back to Ekvall's

dimensions of creative climate, he found that debate positively impacted the environment,

whereas personal conflicts and tensions had a detrimental impact. In my experience, a skilled facilitator establishes psychological safety, keeps energy up and maintains this by being plugged into the project's strategic objectives and reinforcing the meaningful connection and progress toward the objective in a dynamic, energised, respectful, playful, and purposeful environment. When this is done well, a conversation about energisers is not really necessary.

Table 7

Lens Two: Activating Creative Drive Summary and Practical Implications

Learning	What's Included	Practical Implications
Motivation is critical and limited	- Beyond a certain level of IQ, motivation is thought to be more important than intelligence for creativity. - Motivation is a limited resource. - Motivation facilitates cognitive flexibility and persistence. - Positive and activating moods are important. Managing our mood across the process helps maintain motivation. - Creativity can be enhanced by giving people a clear role for achievement.	- Create a cognitive and emotional connection: - The innovation challenge. - The deeper purpose of the work, identifying at a professional and personal level. - Connecting with your role and the individual contribution you will make. - Physically feed and rest the brain.
Dopamine and the approach motivation	- A sense of progress feeds positivity and intrinsic motivation, which further fuels progress. - Dopamine fosters an approach motivation. - Increased dopamine leads to cognitive disinhibition, novelty seeking and hyperconnectivity. - Anticipating the reward is just as powerful as the reward. - Unexpected rewards are more motivating than expected rewards. - People work best when alternating between different states.	- Reflect on the joyfulness of the creative process. - Actively call out great effort and the right behaviours. - Have deliberate progress check-ins to maintain momentum. - Deliver on novelty: engage people in a variety of modes: sitting, standing, walking, stretching; vary session delivery, e.g., interviews, rotations, excursions; use a variety of ideation and other exercises. - Create a sense of anticipation for what is to come. - Add unexpected surprises, e.g., multi-sensory unboxing and creative excursions.
Psychological safety	The challenge is to overcome fear, failure and uncertainty.	To create a diverse and inclusive creative environment, offer

Learning	What's Included	Practical Implications
	• Social pain is processed in the same way as physical pain. • A secure foundation enables people to upshift thinking and be open to experience, which is key for cognitive flexibility. • Playfulness further encourages openness to experience and cognitive flexibility. • Corporate environments suffer from collaboration overload and perpetual 'small asks," which create microstress and impact on mood and problem solving bandwidth.	personal acknowledgement and respect for all individuals. • Create an environment of kindness. • Create a deliberately playful environment: gentle humour, permission to laugh at our own foibles. • Craft a seamless experience that allows for 100% focus on the creative challenge. • Signal that this is not another "collaboration overload" event and that the role of the facilitator is to help everyone optimize their creativity and make the most of every minute.

Note: This table summarises key learnings for lens two, activating creative drive, from section two as well as summarising the practical implications detailed in this section, outcomes.

Lens Three: Shifting Perspective - Practical Implications

Shifting perspectives is about debunking the aha myth, exploring multiple contexts for new meaning and changing focal points. For a summary of learnings and practical implications, see Table 8.

Insight is a Slow Burn

The practical implication here is acknowledging the eureka myth that insight is often seen as arriving in a spectacular flash. However, the reality is that it is much more of a slow burn. Divergent thinking, the transformation and mental restructuring that occurs with it, is hard work and needs dedicated time. Ekvall (1996) refers to this as "idea time". Immediate thinking is often relatively superficial and benefits from being rendered and iterated (Chater, 2018; Gabora, 2018).

The role of intuition over time in creative problem solving includes establishing it as a key skill during the process, giving people permission to voice and follow their intuition, e.g., exploring something that does not feel right. Once the eureka myth is acknowledged, the

importance of having space and time to ideate is further reinforced. Note that this is not about infinite periods of time; we are talking about the choiceful use of perhaps 3-4 days over a 2-3 week period.

Multiple Contexts for New Meaning

Dimensionalising the challenge into specific innovation territories ensures we explore multiple contexts. Sometimes this might be based on unmet consumer needs, trends or specific dimensions of the problem. To allow for deep thinking and proper due diligence, having small, dedicated squads of 3-5 people working on each territory, with a dedicated squad lead/table facilitator, ensures the whole group is "dividing and conquering" and exploring multiple angles is a productive approach for generating disruptive ideas (Azoulay, 2019).

Changing Focal Points

As Steve Jobs highlighted (Wolf, 1996), creativity is simply about connecting things, and to do that, people need diverse experiences to draw from. He also emphasised that unfortunately, most people have fairly narrow experiences and perspectives. To shift perspective, we want to break mentally free of existing routines. Breaking mental routines has at least two dimensions. One dimension is the sense of psychological safety to explore unfamiliar perspectives (which was also dealt with in the previous segment), and another, once it is safe, is providing catalysts for people to shift perspective. Our role as Creativity Practitioners is to make this perspective shift compelling, exciting, rewarding and accessible.

The practical implication here is creating inspirational stimulus for squads to digest in advance of ideation, allowing opportunities for delayed incubation. In our search to create connections and meaning, we must connect with the needs and lives of the people we seek to serve. This not only establishes a human connection but also allows people to connect with the deeper purpose of the project and their work. Empathy is a powerful tool for shifting perspective. This involves deeply exploring what is going on in consumers' lives (or end users' lives), where this unmet need fits and how they currently solve for it, including workarounds and substitutions. Here it is useful to separate facts and hypotheses so the

later risky assumptions can be explored as part of the innovation process. To ensure we are feeding in breakthrough inputs working with extreme consumers who are on the fringes sparks thinking in more interesting directions (Avery & Norton, 2014). The empathy we establish as part of the inspiration immersion before formal ideation begins is then rekindled as we check in with consumers to test assumptions during the process, including consumer "test and learn" concept iteration, a form of co-creation.

Once we have established empathy, we also want to broaden perspectives further. Just telling busy people to "be curious" leaves too much up to chance; for participants with a full to-do list and overflowing inbox, this instruction is likely aggravating and a source of microstress. However, by providing curated stimuli to explore, we can broaden people's perspectives and also whet people's appetite for further self-exploration. This could include provocateurs discussing the challenge from different perspectives and dissecting examples from other industries of brands or nature (biomimicry) responding to similar challenges.

The objective here is to ask provocative questions and shift perspective, not try to cram as much new knowledge as possible into people's memory. Broad knowledge has been shown to be beneficial (Amabile & Pratt, 2016; Simonton, 2018) when ideating. However, the caveat on knowledge is that it is common to suffer from hindsight bias and see ideas as a function of knowledge rather than a function of remote conceptual combination. The inspiration immersion at the start of the innovation sprint needs to be a choicefully curated collection of provocations specifically designed to spark shifts in perspectives and even first ideas. It is essential to act quickly to disabuse any well-meaning individual from sending out the densely packed 100-page small print "absolutely everything we know about subject x" document.

Table 8

Lens Three: Shifting Perspective Summary and Practical Implications

Learning	What's Included	Practical Implications
Insight & intuition	• Insight occurs over time; it is not spontaneous and immediate.	• The innovation sprint has been designed to create time and

Learning	What's Included	Practical Implications
	• Intuition is literally a gut feeling when the gut-brain axis activates. • Preconscious/unconscious connections help explain intuition/hunches/ a "feeling of knowing". • Intuition is often overlooked.	space for insight, intuition, and incubation. • Acknowledge the role of intuition and exploring ideas based on gutfeel. However, it must be remembered that intuition might not always be right.
Multiple contexts for new meaning	• Exploring multiple contexts is needed for true divergent thinking. • Insight: making atypical connections to result in a new interpretation of the problem • Unconscious/preconscious processes to construct meaning	• Dimensionalise the innovation challenge into multiple contexts: innovation territories. • Have dedicated innovation squads of 3-5 people working on each innovation territory. • Have a Squad Lead who also acts as table facilitator for that squad.
Changing focal points	• Busy work lives lead to narrower perspectives, to counteract this, provide exposure to fresh, challenging and perhaps even slightly uncomfortable viewpoints. • Empathy provides a means to shift perspective.	• Curate inspiration to broaden perspectives (with scheduled time to digest). • Be grounded in consumer unmet/latent needs to tap into empathy/reconnect with brand purpose. Then consider iterating solutions with consumers/ provocateurs later in the process. • Be exposed to the fringes: extreme consumers and provocateurs.

Note: This table summarises key learnings for lens three, shifting perspective, from section two as well as summarising the practical implications detailed in this section, outcomes.

Lens Four: Deploying Defocused Attention - Practical Implications

The key findings to explore through this lens include broad/leaky attention, delayed and immediate incubation and internally directed attention. For a summary of learnings and practical implications, see Table 9.

Embracing the Value of Defocused Attention

The first job to be done here is to actively challenge the perception that mind wandering is a waste of time. First of all, it's a fact our minds spend 25-50% of their time in this state (Benedek, 2018); secondly, this contributes to the preconscious and unconscious restructuring of concepts so important for generating breakthrough ideas; and thirdly, we can

actively use this time for our innovation challenge. Often the corporate environments we seek to do this in have an infatuation with busyness, with calendars stuffed full of meetings and workshops, but often the quality of that collaboration time is dubious. This means that most people have a fair bit of baggage about workshops, including an understandable resistance to poorly planned and/or poorly explained techniques that don't seem to contribute anything to the outcome.

Deliberate Mind Wandering and Resets

Our challenge is to reset expectations about the value of defocused attention and then provide practical methods to utilise this time. Actively creating space for cleverly designed "time-wasting" activities allows for mind wandering and idea incubation. Delayed incubation can be fuelled in advance of ideation sessions by providing inspirational stimulus to shift and broaden perspectives. The critical thing here is to also provide provocative questions that force people to **actively** start thinking about the challenge, fresh perspectives and perhaps even sparking first ideas. This means that by the time you get to the formal ideation session, people's minds are already fizzing and bobbling with ideas, and the depth and quality of thinking in the workshop then benefits. To support this active incubation, it is important to provide a visible and central location for capturing ideas, images, and meaningful language. Participation in pre-workshop incubation is not optional, it's a mandatory part of participating in the innovation sprint.

Reflecting on earlier learnings, we know that the production of creative ideas is neither spontaneous nor immediate, it requires work over time. In my experience, what's critical here is positioning incubation as a smart way to make the best use of our brains so it is not seen as another additional requirement that creates collaboration overload. Other ways to remove barriers include ensuring that the time for digesting inspiration and incubating is scheduled in people's calendars so it does not become a source of micro-stress. If the time is already scheduled, the innovation challenge is one that people meaningfully connect with, they are motivated by the desire to succeed and catalysed by the challenge, and the task is clear and compelling, all that remains is to get started. While pre-

COVID, I would include a pre-workshop task to get people mulling over the challenge in advance, during COVID when innovation sprints went virtual overnight, I started exploring and activating incubation much more purposefully. Anecdotal evidence shows this approach does result in better quality thinking and that people appreciate the opportunity to have deep thinking time.

Another easy and accessible delayed incubation opportunity is an overnight break between sections. This is easier to accommodate in chunked-up virtual innovation sprints, where the maximum session length per day is 3-4 hours. Arguably, the necessity to chunk up sessions for virtual over several days or weeks is better aligned with the way our brains work compared to full-day face-to-face workshops. Research shows that our brains generally have two to four approximately 90-minute ultradian cycles during the day when we can do deep, concentrated work (Huberman, 2022).

Let's now turn our attention to immediate incubation, the short breaks we take after the challenge has been established. Research shows that guided meditation and moderate exercise, e.g., walking, yoga, dancing or a change of environment, are sufficient to distract the mind, escape functional fixedness and allow unconscious remote associations and restructuring to start forming. A 10-15 minute incubation exercise is often enough for people to reset. An important caveat is to avoid the temptation to cram as many of these exercises as possible into brain/bio breaks, a brain/bio break needs to allow people to refuel and engage in conversation with colleagues, taking their minds off the challenge. It is worth noting that delayed incubation exercises can often be easy targets to cull for clients from hyper-productive corporate cultures. However, when the value of the exercise for optimised creativity is clear, it is easy to preserve this time.

A Balance of Individual and Group Ideation

Next, we'll consider internally directed attention. I would advocate for the pre-workshop inspiration immersion to be conducted individually so people can fully develop diverse thinking. Another opportunity to harness internal attention is increasing the proportion of individual ideation exercises during the workshop. This has the secondary

benefit of granting people with a preference for introversion some reprieve from external

stimulus, creating the space for deep internal attention and conceptual restructuring.

Reflecting on the need to alternate between different states and deliver on novelty-seeking,

the alternation between individual and group exercises also adds variety.

Table 9

Lens Four: Deploying Defocused Attention Summary and Practical Implications

Learning	What's Included	Practical Implications
Broad/leaky attention	• Broad/leaky attention takes up 25-50% of our waking hours. • Increases sensitivity to connections between distantly related concepts. • High openness to experience has been linked to broad/leaky attention.	• Mindset change: align on the importance of broad/leaky attention in corporate cultures often obsessed with busyness. • Establish the value of "idea time"/ "wasting time" for cognitive transformation.
Delayed & immediate incubation	• Incubation allows for unconscious task-related processing. • Delayed incubation is where a period of time passes in-between working on the problem and setting it aside. • For Wallas, delayed incubation occurs after preparation and before illumination; it is a vital part of the creative process. • Immediate incubation involves setting the problem aside briefly before coming back to it.	• Deliberate mind wandering (incubation) is designed into the innovation sprint before the formal ideation sessions. • Spread sessions over several days or weeks to allow for overnight incubation. • Deliberately use immediate incubation techniques: meditation, moderate movement, do something different, change of environment within the workshop. • Ensure you still take brain/bio breaks, allowing people to turn off and refuel completely.
Internally directed attention	• Being fully engaged in internal processes allows for more elaborate mental representations, which may ultimately lead to more creative ideas.	• Individual delayed incubation occurs through an inspiration immersion in advance of the formal ideation session. • Use a mix of group and individual exercises for ideation in the workshop.

Note: This table summarises key learnings for lens four, deploying defocused attention, from

section two as well as summarising the practical implications detailed in this section,

outcomes.

Lens Five: Sparking Remote Connections - Practical Implications

Sparking remote associations comes from creative cognition learnings focused on accessing and restructuring memory, overcoming creative blocks and conceptual expansion. For a summary of learnings and practical implications, see Table 11.

Breakthrough ideas do not appear out of nowhere; they are the product of remote conceptual combinations and restructuring across our semantic and episodic memory (Benedek et al., 2023). This fact needs to be publicly acknowledged early on in the project journey. There are three dimensions to consider here, what's in our memory, how we search our memory and how we flexibly restructure it. What's in our memory is an important input, reflecting on Steve Jobs's assertion that creativity is just about connecting things and the people who are good at it have a broad range of experiences (memories) to draw up and recombine. (Wolf 1996). As discussed earlier, we can expose people to additional inspiration and experiences as part of the innovation sprint process to help broaden their perspectives. It is also important to acknowledge the phenomenon of hindsight bias. In most corporate environments, more data is seen as a desirable thing, which does cause paralysis by analysis and sometimes results in people becoming focused on pursuing more data, seldom synthesising what they know and becoming decision-averse. Tracking the origin of the ideas, including both the stimulus and the ideation exercise that prompted the idea, is useful to reinforce this point.

In terms of search, we are cueing this by focusing on specific innovation territories and cueing specific components that are important within this while keeping an open mind if new angles arise, assessing if that's in scope or not. Search is also cued by specific ideation exercises, which also activate flexible restructuring.

Warm-Up and Optimising Ideation Time

Before we can effectively ideate, we need to limber up our ideation muscles. I referred earlier to the fact that most people's divergent thinking muscles are atrophied. The good news is that this can be quickly overcome. First, we need to reassure people that our objective in this process is to get to consumer-viable ideas; this is the front-end innovation phase before we begin considering feasibility, the focus is on consumer desirability and

uniqueness. This allows the team to focus on ideating free of a niggle in the back of their minds that they need to feasibility-filter every idea before speaking it aloud. This is often quite an entrenched belief, so this guidance needs to be reiterated. In preparation for the ideation warm-up, I have recently been experimenting with getting people to download what's on their minds as a silent, anonymous ideation exercise at the start of the workshop. This covers three angles: life in general, project-specific concerns, and ideas they need to get out of their heads. Only when we have people ready with clear and focused minds can we begin.

I referenced earlier that often, our divergent thinking muscles are out of shape. The best way to reinforce a new behaviour is to experience it practically, reflect on the experience, engage in metacognition, and reflect on how it feels. Dr Roger Firestien introduced me to this idea, which I have been using for over two years, and anecdotally, it improves engagement and the quality of divergent thinking (Miller et al., 2011a). By engaging in a hypothetical ideation exercise that is removed from their own business, for example: "How might we help Rapunzel free herself from the tower?" people concentrate on the skill of divergent thinking without the interference of their domain-specific knowledge and corporate processes. As mentioned earlier, when discussing best practice guidelines, actively debriefing the exercise then flushes out best practice divergent thinking behaviours: avoid premature judgement, build on others' ideas, seek novelty and go for quantity. In addition, this causes people to reflect on the importance of seeking to solve for their consumers (not their own technical capabilities) and the need for playfulness for divergent thinking. Do not assume that people have a working knowledge of the best practice divergent thinking guidelines, even if they say they do. There is value in having these important behaviours reinforced as well as value in the group collectively aligning on them.

In section two, it was established that creative problem solving is both a cognitive and affective journey. When asking people to reflect on how they felt when ideating, the response was overwhelmingly positive: happy, excited, and curious, with some level of trepidation. However, at points in the creative problem solving process, it is natural to feel

frustrated, disappointed, and even overwhelmed. Acknowledging this affective journey at the beginning of the sprint is important because it means we can then check in on how people are feeling, reminding them that ups and downs during the process are natural. This ties into earlier comments on intuition and helping people determine if the frustration they are feeling is a natural part of giving birth to new ideas or because there is a disconnect or an avenue that has been overlooked that we need to explore.

Breakthrough Ideation Tools

At the risk of stating the obvious, we need to use breakthrough tools if our objective is to get to breakthrough ideas. The importance of conceptual expansion and manipulation is a catalyst to think more deeply about ideation tools to expand distance and move beyond an overreliance on group brainstorming. Here it is useful to think about the level to which we can suspend reality to help people break free of creative blocks.

Often ideation manuals suffer from offering up a list of techniques as long as your arm without identifying the main underlying mechanisms. By combining thinking on the mental operations and the level of breakthrough solutions being pursued, it is possible to create a simple spectrum: (1) top-of-mind ideas, (2) new points of view, (3) forcing combinations, (4) analogies/metaphors and (5) exploring the fringes. Due to the power of defamiliarization for casting new light on a challenge, I have made deliberate choice to swop the order of analogies/metaphors and combinations compared to the order Welling (2007) uses. Beyond the fringes, transcendental and psychedelic approaches potentially provide interesting opportunities; however, they sit outside the scope of this paper. See Table 10 on the following page for a spectrum of ideation techniques.

Table 10

*A Spectrum of Divergent Thinking Techniques*

Type of technique	(1) Top of mind ideas	(2) New points of view	(3) Combinations	(4) Analogies/ Metaphors	(5) Exploring the fringes / abstract
Description	Mapping out top of mind ideas with no/minimal new stimulus or techniques.	Viewing the problem from a new point of view to unlock previously overlooked solutions.	Combining previously unrelated perspectives and knowledge to create new concepts.	By making the strange familiar and the familiar strange new perspectives are gained.	By suspending logic and rationality we can challenge assumptions.
Example techniques	• Brainstorming • Brainwriting	• Attribute mapping e.g., SCAMPER • TRIZ • Checklists: e.g., Van Gundy's try to / make it think of; Leff's adaptions • New perspectives: consumer's shoes, provocateurs • De Bono's alternatives & challenge	• Forcing connections between seemingly unrelated worlds e.g.: art, culture, science, nature, fashion, architecture.	• Direct analogies • Personal analogies • Nature analogies (biomimicry) • Visual analogies • Metaphors e.g., pain is like a tsunami	• Absurdities including get fired, fantasy analogies, illegal and immoral scenarios. • Creative excursions and free association exercises • Narrative techniques • Waking/sleeping transitions • De Bono's provocations
Pros	Purging top of mind connections allows us to assess the starting point.	Runco highlights the importance of breaking routines, shifting the focal point and amplifying deviation.	Relational combinations increase connectivity.	Uses defamiliarization to help break free of creative blocks.	Creates the environment for unconscious connections to surface.
Cons	Likely to result in incremental ideas.	Attributive combinations don't increase connectivity.	Requires preparation in advances to ensure deep thinking and sound concepts are being combined.	Need to guide coming back to the original challenge as it is easy to get stuck.	If not framed correctly easy to fall into obvious and shallow connections e.g., Finke et al's (1996) aliens. Need to guide coming back to the original challenge as it is easy to get stuck.
Examples from science	Bell: Telephone	Viagra: developed originally to increase blood flow and then later applied to erectile dysfunction	Chemical structure of DNA	Kekule's discovery of the circular structure of Benzine	Dawkin's theory of the Selfish Gene
Examples from the arts	Craftsmanship	Pop Art, Street Art	Picasso	The transfer of surrealism from literature to the arts e.g., Dali	Transition from figurative to abstract art e.g., Rothko, Mondriaan

Note: This table is derived from Welling (2007) and is also influenced by the following authors: Davis and Woodward (2020), de Bono (1993), Finke et al. (1996), Gryskiewicz and Taylor (2003), Prince (1970), Runco (2014), Van Gundy (1988). In (2) new points of view, Van Gundy's checklist includes try to/make it/think of (Van Gundy, 1988), and Leff's adaptions include techniques like everything is alive, reverse causation, the perspective of an animal, aesthetically beautiful, boring things, something you would not normally notice (Davis and Woodward, 2020).

      In Figure 1, this spectrum of techniques is visualised.

Figure 1

Spectrum of Ideation Techniques
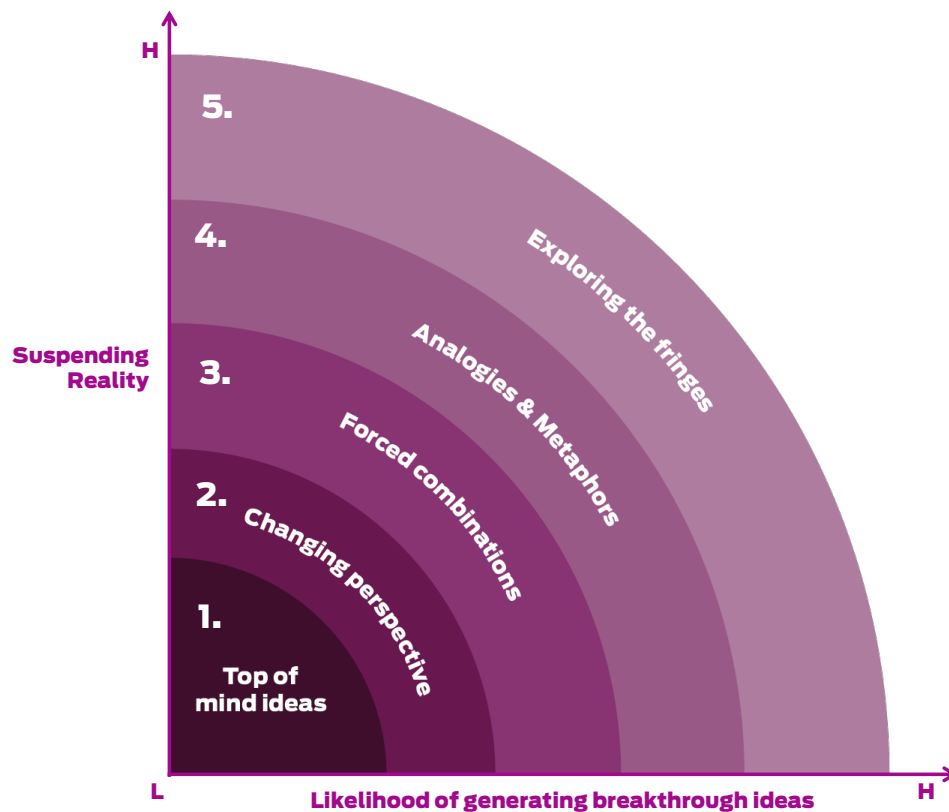
Note: This figure visualises the degree to which different ideation techniques suspend reality and are likely to generate breakthrough ideas. As Welling (2007) astutely observed of his mental operations model, this is a generalisation. This figure is an adaption of a figure that appeared in a Synectics article. (Roberts, n.d.).

The take-home message here is to use a deliberate mix of techniques and move from more incremental to breakthrough approaches, building on ideas across successive rounds of ideation. For example, in an innovation sprint, the team could be immersed in inspiration before the formal ideation sessions to stretch thinking. This would then allow them to use (1) top-of-mind ideas, as well as explore new perspectives. Within (2) new points of view, there are two main approaches: rational and emotional. More rational-based attribute or morphological approaches, e.g., SCAMPER (substitute, combine, adapt, modify, put to another use, eliminate and reverse) (Eberle, 1971), can be helpful when the objective is to create more incremental solutions. More emotionally-grounded approaches include being empathetic to consumers' needs and considering fresh perspectives from others outside of your own industry (which can be more emotional due to deliberately challenging entrenched perspectives). Then in the formal workshop, ideation rounds could include more on (2) new points of view, as this often benefits from ensuring people stay true to the fresh perspectives and do not default to their own more comfortable views and insular thinking. Then the team can be moved into (3) forced combinations, (4) analogies/metaphors, and (5) exploring the fringes. In particular, the last two types of techniques which involve being mentally removed from the challenge, benefit from the in-the-moment guidance and instructions to get people into the right headspace, and just as importantly, people then need to return to the problem to practically apply what they have learned, ultimately creating ideas to solve the problem.

As noted in section two, because the process of generating and then exploring ideas is iterative, checking in with consumers and provocateurs when ideas have been further developed is another opportunity to ensure we have remained true to the unmet consumer need/essence of the idea or alert to the perils of ideas that have lost their way, been watered down, or lost distinctiveness as the team have inadvertently removed all the uncomfortable (and most interesting) dimensions of it.

By being deliberately choiceful about the kinds of ideation exercises we are utilising and playing across the spectrum from more accessible techniques to get warmed up and

then exploring techniques which begin to suspend reality and offer a liberating distance from

the challenge and the accompanying creative blocks that surround it, we are helping people

optimise their ability to think truly divergently.

Table 11

Lens Five: Sparking Remote Associations Summary and Practical Implications

Learning	What's Included	Practical Implications
Conceptual expansion	• Associative abilities account for up to 50% of the variation in divergent thinking. • More creative people have more associative links and use defocused attention. • Remote associations require more time than closer in connections as combination and synthesis is needed. • Hindsight bias means the role of knowledge is often overestimated.	• Acknowledge the importance of not only broad experiences but also combination/restructuring. • Emphasise that time and space for defocused attention and the time for combination and synthesis have been built into the process.
Overcoming creative blocks	• Inhibition • Functional fixedness • Cognitive load • Learned non-creative behaviours • Company culture and collaboration overload	• Use ideation warm-up exercises to reactivate divergent thinking muscles and derive and align on best practice divergent thinking behaviours: mitigate premature judgement, build on other ideas, seek novelty, and go for quantity. • Deploy a variety of ideation and immediate incubation exercises to help escape functional fixedness. • Have time and space for the innovation sprint scheduled in where people are free from cognitive overload. • Provide reassurance that some stimuli and techniques will resonate more for some people, which is why we use a variety of exercises. • Ensure senior leaders endorse and role model new best practice behaviours.
Breakthrough techniques	• Brainstorming only results in moderate creativity and overcomes the entry-level creative block of disinhibition,	• Use a progression of exercises starting with closer-in exercises for independent ideation in advance of the workshop. This will purge top of mind more

Learning	What's Included	Practical Implications
	assuming the creative climate is supportive. • Welling (2007) mapped out four mental operations: application, analogy, combination, and abstraction. • Gryskiewicz & Taylor (2003) mapped out types of ideation techniques from incremental through to breakthrough. • Van Gundy dissected the types of tools, including individual/group.	obvious ideas in advance of the workshop. • Then use exercises that benefit from in-the-moment instruction and guidance in the workshop, e.g., new points of view, combinations, analogies/metaphors and exploring the fringes.

Note: This table summarises key learnings for lens five, sparking remote connections, from section two as well as summarising the practical implications detailed in this section, outcomes.

The Integrated Approach

The integrated creative cognition approach prepares for success by engaging metacognition, activating creative drive, shifting perspective to gain insight, deploying defocused attention, and finally sparking remote connections. Taking a strategic approach to the innovation journey creates the conditions for extraordinary results to be produced. This integrated approach is summarised in Figure 2 below.

Figure 2

Integrated Creative Cognition and Breakthrough Ideas Framework
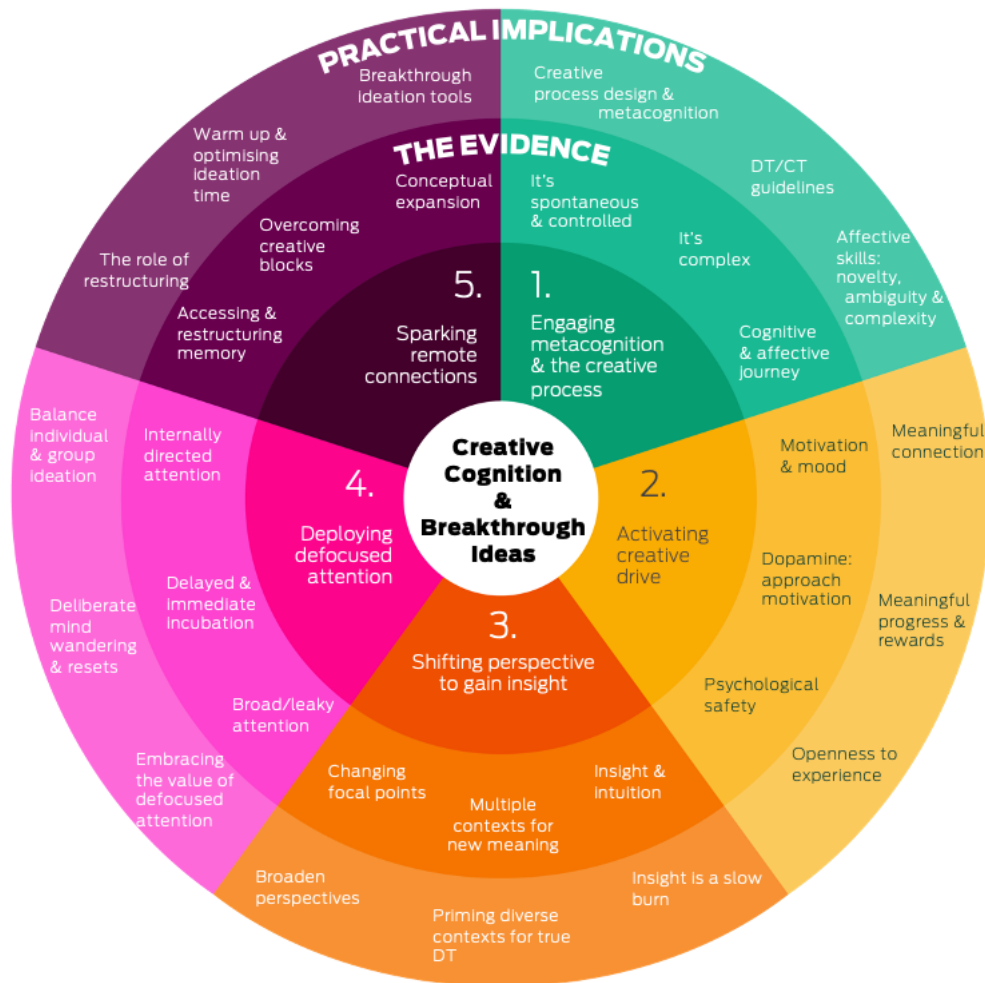
Note: This figure summarises the key findings about creative cognition, as well as mapping out some of the practical implications. Note that the findings do not map directly to implications. In some cases, the implications are a synthesis of several findings. Each section of the figure should be navigated clockwise. Abbreviations: divergent thinking (DT); convergent thinking (CT).

SECTION FIVE: LEARNINGS

In this section, I will reflect on the creativity myths this paper dispels, discuss the next steps and revisit my learning goals.

Creativity Myths to Dispel

This paper contributes to the application of creative cognition learnings, largely from neuroscience, to the practice of creating breakthrough ideas. One important contribution the paper makes is that it helps dispel pervasive and insidious myths that hinder robust approaches to creative thinking in the corporate world (Benedek et al., 2021). These myths, the actual facts and the practical implications regarding how we need to act differently are summarised in Table 12 below.

Table 12

Creativity Myths Dispelled by this Project

The Myth	The Facts	How we need to act differently
1. Creativity is a mystical phenomenon.	Creative thinking is the result of two large-scale brain networks acting in tandem – the spontaneous and attention control networks.	Applying a structured process for divergent and convergent thinking and guidelines creates space for unstructured thinking.
2. You must be pumped up!	Creativity benefits from being in a broad, expansive frame of mind. A meaningful connection with the challenge, with a sense of progress, feeds intrinsic motivation. Anticipation of reward/novelty is also powerful. A positive activating mood is beneficial for divergent thinking. A negative activating mood is beneficial for convergent thinking.	This emphasizes the importance of ensuring the creative climate (at least for the duration of the project but ideally at an organizational level) helps people optimize their creativity.
3. Eureka!	Creativity is a slow burn and requires preparation and shifts in perspective over time.	The process needs to create time for incubation and shifting perspective. We need to be choiceful about what is in scope and within the context. We want to explore and actively broaden people's perspectives.

The Myth	The Facts	How we need to act differently
4. 100% Collaboration	Internally direct thinking time and deliberately planning for mind wandering allows us to engage in unconscious thinking.	Individual ideation and incubation are an essential complement to group ideation exercises.
5. All brainstorming, all the time.	Getting to breakthrough ideas requires more than simple brainstorming.	Do warm-up atrophied divergent thinking muscles and collectively align on divergent thinking guidelines. Exploring different points of view, combinations, analogies/metaphors and abstractions is vital.

Note: This table summarises important myths about creativity, that are dispelled by the five lenses in the creative cognition and breakthrough ideas framework: engaging metacognition, activating creative drive, shifting perspective, deploying defocused attention and sparking remote associations.

Revisiting Learning Goals

My initial ambition was to create a toolkit; however, a framework approach is more appropriate for the kind of bespoke work I do with clients; this will be iterated over time and constantly changing; however, the fundamental principles will remain the same. In this project, I have given some examples of the framework. Some of these approaches have already been created, deployed, and iterated within the lifetime of my Master's study.

This project delivers against my motivation for my Master's study, which was to better understand why the things I do work and to explore new techniques and messaging for further helping the clients I work with optimise their creativity. I could not find an integrated practical model for getting to breakthrough ideas informed by the latest thinking on creative cognition, so that is what I have created in this project. The depth of theoretical knowledge I now have to draw on, the practical framework I have derived, combined with my practical experience and on-the-job testing and iterating this approach will ensure the power of creativity is being unlocked in a practical way to help my clients to get to breakthrough thinking. This delivers on my purpose of helping people solve problems and, in doing so, create rewarding human experiences.

Refer to Table 13 for a review of learning goals.

Table 13

April 2023 Assessment of this Project Compared to Learning Goals

Learning Goals	Deliverable
Robust foundations: Revisiting foundational thinkers and their writing on creative cognition and generating breakthrough ideas.	The metacognition and creative process section includes knowledge of foundational thinkers, including Osborn, Mednick, Koestler, Abraham, Beaty, Chrysikou, Flaherty, Kenett, Benedek, Gabora and Vallée-Tourangeau.
Best practice tools: A comprehensive survey of best practice ideation tools to generate breakthrough ideas including specific approaches, e.g., Synectics (Prince, 1970), lateral thinking (de Bono, 1993), design thinking (Brown, 2019), as well as overviews of tools, e.g., Gryskiewicz & Taylor (2003), Michalko (2006).	A range of ideation tools has been reviewed with a particular focus on those to create breakthrough ideas, which has involved reviewing thinking from Synectics (Prince, 1970), lateral thinking and other ideation approaches and spectrums, including Gryskiewicz & Taylor (2003), Michalko (2006) and Van Gundy (1982).
Integrated: Develop an integrated approach grounded in smart thinking on creative cognition, pragmatic and gets results, reflecting the values of my company, 8 Innovation: creativity, pragmatism, results.	This approach integrates the latest developments in creative cognition and their implications in a practical framework. The power of the approach is it creates an integrated ecosystem over the life of a project for creating breakthrough ideas.
Elegant and socialisable: Package learnings into inspiring and practical formats to share with clients.	The learnings have been delivered in an elegant and socialisable format in the context of the Master's paper. As noted in next steps, additional work will be required for the approach and thinking to be deployed commercially. This project delivers a prototype of the breakthrough ideas framework.

Note: This table assesses the learning objectives that were specified in January 2023 (see section three) and maps out how they have been met/addressed by this paper.

What Happens Next

The headline here is continual learning and practical application. Specifically, the next steps include:

- Create the complete practical toolkit for use with clients Q2, 2023.

- Further exploration of Synectics Q3, 2023.

- As a reflective practitioner, I also want to keep pace with the latest developments on a quarterly/twice-yearly basis. I see this framework being iterated as I test and refine techniques and incorporate in latest developments in creative cognition.

- Whilst the objective of this paper has been to focus on divergent thinking, I am also interested in exploring convergent thinking with a focus on latest developments in creative cognition.

SECTION SIX: CONCLUSION

The empirical approach that the latest developments, including neuroscientific studies, bring has allowed studies of creativity to move beyond purely observational or self-reported methods and the cognitive biases and post-rationalisation that comes with this. This shift in approach has helped demystify the way our brains work. And it needs to be noted that this is a journey; there is still much about creative cognitive correlates and processes that is not fully understood.

Certainly, providing evidence to support the dual process model of creativity appears ground-breaking. Dismantling the myth that creativity is a right brain only activity is crucial as it reinforces that creativity can be nurtured and that deliberate creativity is possible. And the learnings on activating creative drive, shifting perspective to gain insights, deploying defocused attention, and sparking remote connections on the surface are a catalyst for reviewing the existing best practice thinking that underpins each of these areas. The latest findings are liberating, and they remove some of the guesswork and allow us to be rooted in how our brains actually work, which may be different from how we would ideally like our brains to work.

There is, of course, a question here, does this framework impact materially on how we deploy and deliver creativity at the corporate coal-face, or do they simply back up anecdotal evidence? My experience is that even small shifts and nuances in how we apply and frame the creative problem solving process, the messaging we emphasise, the inspirational stimulus, and ideation tools can have huge implications when ideating against strategic opportunity platforms with a targeted impact £100m+ in revenue. However, these learnings need to be applied in a strategic and integrated fashion, assessing the individual requirements of specific innovation challenges, industries and team/corporate cultures.

Pervasive myths distort people's expectations of creativity, making it appear less than it actually is and giving it a taint of being a bit "woo woo" (based on beliefs without scientific basis). With creativity myths debunked and a clear understanding of creative cognition, the joy of discovery, the fizzing and bobbling dynamism and the power of

beautifully curated divergent thinking can be harnessed for creating truly extraordinary

breakthrough ideas.

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21 April 2023
Date