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Mental imagery as a hidden engine of creative expertise

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Expertise research in creative fields: beyond reliability and practice

For cognitive scientists, expertise research has tended to prioritise reliability. Decades of work on practice effects, deliberate practice, and the so-called 10,000-hour rule (Ericsson et al., 2007; Ericsson & Ward, 2007) have reinforced an approach which defines expert performance in terms of skill, accuracy, and consistency. This paradigm is powerful, but becomes less convincing when we explore domains beyond practice-intensive areas such as chess, sport, and learning a musical instrument. This is especially evident in the performing arts, where excellence is marked not just by technical skill, but by aesthetic qualities such as expressiveness, communication, immersion, transcendence, sensitivity, and innovation (Friedlander, 2024). After all, we don't go to watch a Shakespeare play just to check whether the actors remember their lines!

All the same, the study of expertise has recently moved into an exciting phase. While previous research had a narrow focus on deliberate practice versus innate aptitude, recent multifactorial models of expertise development (e.g. Gagné, 2014; Hambrick et al., 2016; Ullén et al., 2015) have breathed new life into contemporary research, highlighting a far wider range of influences that may contribute to expert performance. Yet even so, the role

of creativity and aesthetics has generally been overlooked.

One reason for this may be that performers are sometimes cast as mere replicators rather than as creative contributors in their own right (Friedlander, 2024). While writers, composers, choreographers, sculptors and painters are universally recognised as creators, the interpretative creativity of actors, soloists, dancers or conductors can go unrecognised. Yet interpretation, improvisation and re-imagining are themselves creative acts, central to the aesthetic power of live performance. To understand them, we therefore need to expand the cognitive lens through which we study creative expertise. In this piece, I argue that mental imagery is a promising but under-explored avenue for understanding expertise in applied creative domains, and I highlight some directions where cognitive science could make a distinctive contribution.

Mental imagery: definition and scope

Mental imagery can be defined as the ability to generate perceptual or motor experience in the absence of external input (Moulton & Kosslyn, 2009). Visual and auditory imagery are most frequently studied, but research shows that olfactory, gustatory, tactile and bodily imagery also play a role in human cognition (Lacey & Lawson, 2013). Instruments such as the Plymouth Sensory Imagery Questionnaire (Andrade et al., 2014) have begun to capture this wider range.

Cognitive psychology has a long tradition of studying visual imagery. However, the field has often focused on debates concerning the mechanisms of form and measurement: for example, whether images in the mind are propositional or pictorial (e.g. Reisberg et al.,

2003); the fragility and limitations of the generated images (e.g. Chambers & Reisberg, 1985; Pearson et al., 2013); and how vividness of mental imagery can be assessed (e.g. Lacey & Lawson, 2013). What is now generally accepted is that mental imagery appears to use many of the same neural pathways as real perception (e.g. Jakubowski, 2020, auditory imagery; Pearson et al., 2015, visual imagery).

Within expertise research, mental imagery is typically treated as a rehearsal tool. Musicians, dancers, actors and athletes all report using it to refine technique, consolidate memory, or prepare for performance under pressure (Fine et al., 2015). For example, musicians 'audiate' across numerous situations - that is, they hear and comprehend music in their mind's ear even when no sound is physically present. This may help them to play back a tune they have heard, sight read an unfamiliar piece of music, or mentally rehearse performance cues such as expressive markers or journey paths through the score. Performers can also quell nerves ahead of competitive performance by anticipating situational demands (Woody, 2022); and the vast literature on visualisation techniques in sports psychology attests to its utility in helping performers achieve peak readiness (Lindsay et al., 2019; Lindsay et al., 2023). These lines of enquiry are of course valuable, but they also risk narrowing the focus of what imagery can do in expert performance domains.

Mental imagery beyond rehearsal techniques

When visual imagery has been examined in cognitive research, the emphasis has usually been on vividness (the "brightness of its colours and the sharpness of the outline and details"), together with its liveliness ("how dynamic, vigorous and alive the image is", Marks, 1999, p.570). For this reason, measures such as Marks' Vividness of Visual Imagery

Questionnaire (1973) ask respondents to rate the clarity and brightness of their everyday mental pictures, rather than exploring how visual imagery is actually used (Lacey & Lawson, 2013). While these measures are useful in measuring the intensity of the imagery experienced, they tend to treat it as a unidimensional capacity. In doing so they risk overlooking the multifactorial nature of visual imagery, and the creative utility of its more conceptual forms.

In a recent paper (Friedlander et al., 2022) we argued that the kinds of imagery most relevant to creativity are not necessarily the sharpest or brightest. They are the forms that allow people to play out scripts in their mind, to explore transformational ideas, and to mentally recombine components. As Abraham (2016) noted, imagination and other closely allied constructs, including mental imagery, involve processes such as counterfactual reasoning and conceptual expansion, which move far beyond simple rehearsal or recall of everyday faces, actions, and settings. Meyer and colleagues (2019) drew similar distinctions between proximal, episodic imagery (such as recalling going shopping, making a cup of coffee, or the appearance of your next door neighbour) and distal imagery (such as imagining what it might be like to live in the next century, or at the bottom of the ocean). Blazhenkova and Kozhevnikov's (2009) distinction between object (ventral) and spatial (dorsal) imagery also suggests that the type of visual imagery that leads to excellence in the arts (high fidelity, colourful, focusing on shape and texture) may differ from that in the sciences (rotational, focusing on depth, perspective and angles).

In line with this, the next sections will review a number of forms of mental imagery that I believe lie at the heart of creative expertise. They are what enable novelists to inhabit

a living, breathing fictional character, radical innovators to break through the constraints of existing knowledge, or inventors to drive scientific innovation using spatial manipulation and recombination. I believe that these facets of mental imagery deserve much closer attention within cognitive psychology.

Mental 'story-boarding'

In our paper (Friedlander et al., 2022) we coined the term ‘mental story-boarding’ to identify a volitional and purposeful form of mental imagery used to develop key elements of a narrative art form. Much like the physical story-boarding used in the film industry (Simon, 2012), mental story-boarding plays out the story arc in a creative writer’s mind, allowing fictional characters to be developed, revealing their diction, conversational pace and tone, and their facial and bodily reactions to events. Similarly, the setting and atmosphere of the work can be mentally generated. As an artist in a study by Piechowski and Cunningham (1985) observed, thinking “almost isn’t thinking but a silent movie inside my head most of the time; sometimes I feel my brain is like a movie camera” (p.162).

Many of the processes described above presuppose that creative writers are driven to explore rich mental fantasies, alternative realities and inner worlds (paracosms). In common with other artists (e.g. dancers, actors, fine-art students) writers do appear to score highly on measures of intense absorption, fantasy-proneness and paracosm (Friedlander, 2024). Indeed, the authors in Doyle’s (1998) study described seeing, hearing and even smelling their characters, speaking of them as if they were real-life personalities that they had come to know. Other writers experienced the illusion of independent agency, reporting that their fictional characters spoke to them, and guided the direction of their

creative output (Thomson et al., 2009). This implies a heightened ability to use multimodal mental imagery.

The writers in Doyle's (1998) study were deeply affected by their characters, reporting sadness and episodes of weeping or chills as they wrote. This ability to 'live the part truthfully' is shared by actors following the teachings of Stanislavsky (method acting). Here too, mental story-boarding allows the actor to imagine the nuances of movement, meaning-making, and perspective-taking for the character they are to inhabit, and to retain this part faithfully in their memory (Friedlander, 2024). Audiences share in these processes, too. When we are absorbed in fiction, whether at the cinema, the concert-hall, the art-gallery, or tucked up in bed, we find ourselves sucked into the work and simulate experiences internally. Goosebumps, shivers, and tears testify to the embodied authenticity of these mental simulations as we surrender to the fiction in a state of 'consensus hallucination' (Carr, 2014, p.459).

Conceptual expansion - conceiving the impossible

Our model of mental imagery (Friedlander et al., 2022) also proposed the use of imagery in exploring 'what-could-be'. Unlike story-boarding, which tends to remain within the rules and conventions of an existing art-form, counterfactual thinking and conceptual expansion (Abraham, 2016; Abraham et al., 2012) allow us to conceive the impossible, and explore unbounded territories. Meyer and colleagues (2019) argue persuasively that this type of distal simulation is more likely to lead to creativity. Using neuroimaging, their studies indicate that truly creative experts recruit different neural mechanisms while generating alternative temporal, spatial, social and hypothetical simulations, distinguishing

them from less imaginative counterparts. As Boden (1995) points out, this ability to transcend the 'here-and-now' encompasses exploratory and transformational ways of thinking: whether "ways of writing prose or poetry; genres of sculpture, painting, or music; theories in chemistry, biology, or mathematics; habits of couture; systems of choreography" (p.75). In other words, the type of thinking that might lead to 'Big C' levels of creativity (Kaufman & Beghetto, 2009), or the type of innovation which marks out a 'Master' practitioner (Hoffman, 2017).

Mental imagery in science and applied domains

As Boden alludes to in the quotation above, the use of imagery to transform conceptual spaces in the mind is not limited to artists alone. It also underpins scientific and technical innovation, where imagery enables creators to model, manipulate and explore conceptual spaces. For example, Einstein's famous thought experiment of riding on a beam of light contributed to the development of relativity theory. As proposed by Blazhenkova and Kozhevnikov (2009), spatial reasoning may be particularly important for scientists. For example, Kekulé's reverie of a snake swallowing its own tail famously led him to the ring structure of benzene. And Feynman's diagrams describing the behaviour of subatomic particles began as visual models of particle interactions in space-time.

We might also hypothesise that film professionals likewise rely on spatial imagination to plan shots, sets, and edits. Whether director, cinematographer, production designer, cutting room editor, or special effects engineer, the ability to visualise perspective, framing, depth, continuity, and multiple viewpoints can reasonably be assumed to confer

advantage.

Future directions for cognitive science

Where might cognitive psychology contribute most usefully to the future study of imagination? If mental imagery is indeed a hidden engine of expertise, cognitive psychology faces several challenges.

The first is measurement. Existing tools such as the VVIQ capture only proximal, everyday visual imagery (Friedlander et al., 2022). Liveliness and vividness of visual imagery may indeed be important for artists and designers (Kozhevnikov et al., 2013; Piechowski & Cunningham, 1985), potentially translating into striking recall of colour, texture and pattern, fuelling the vibrancy of their work. But to explore the full range of functions of visual imagery, we need instruments that can assess distal, conceptual and spatial forms as well, as suggested by our Multifactorial Model of Visual Imagery (Friedlander et al., 2022).

A second challenge is to examine the link between spontaneous mind-wandering, imagination and creativity. While mind-wandering is often seen as relevant to creativity, it is most often explored as a facilitator of insight moments through incubation and the promotion of divergent thinking. Yet there is potential to investigate its role in providing inspiration to artists and scientists alike as we disengage attention to the external world and allow our minds to wander through a cognitive landscape (Salvi & Bowden, 2016, p.1, quoting Paul Gauguin, ‘I shut my eyes in order to see.’).

Opportunities also exist to explore other more neglected forms of mental imagery.

Charles Spence (2022) recently reminded us that chemosensory mental imagery might lead to ‘taste imagination’, and it is a short step from this to propose that olfactory and gustatory imagery could be part of the toolkit of wine buffs, expert cocktail mixologists, and experimental chefs such as Heston Blumenthal.

We might also benefit from the study of aphantasia. Individuals such as Glen Keane (animator) and KJ Zagabria (children’s book author) who report an absence of visual imagery can nonetheless succeed as creative professionals, often through compensatory strategies such as external scaffolding or propositional reasoning. Understanding the costs and adaptations associated with these work-arounds could illuminate how, and to what degree, mental imagery contributes to expertise.

Imagination, creativity, and AI: concluding thoughts

My final thoughts concern the future of human imagination and the use of AI. With Generative AI now embedded in virtually every software application we use, we may be increasingly tempted to rely on it for creative ideas that short-cut the journey.

Yet as I have argued above, unscaffolded human imagination is embodied. When we engage our own imagination and ‘live the part truthfully’, this activates multiple sensory and emotional systems, allowing us to experience the moment authentically and intensely. This in turn contributes to the richness of our imagination, which thrives on intrinsic motivators such as playfulness, curiosity, flow, and the forging of associative leaps. From this immersive engagement arise our creative abilities to plan, recombine, disrupt, run thought experiments, and push beyond existing constraints. Will this cascade of imaginative

processes still be triggered if we are presented with an effortless, ready-made solution? Or would ‘Aha!’ be replaced by a blander ‘Uh-duh!’ moment (Bowden et al., 2005, Box 2), with the resulting output potentially lacking the depth, engagement, and dimensionality of an authentic human creation?

A further issue with GenAI, as currently delivered, is that it is built on pattern prediction: it recombines, it does not disrupt. This risks replacing genuine counterfactual thinking with safe, averaged pastiche. In the end, AI is not a creative producer; it is a replicator and, however brilliant, a forger and compiler of material scraped from existing human achievement. Indeed its primary objective is to produce outputs which resemble existing models as closely as possible (Franceschelli & Musolesi, 2022). While those in the creative and performing arts place high store on authenticity - the ability to express one’s inner being, and to communicate one’s values, emotions and beliefs to the world faithfully (Kharkhurin, 2014) - AI has no self to express, no imagination to bring to bear, and no experiences, emotional ‘baggage’ or social intelligence on which to draw (Runco, 2023).

In short, there is concern that widespread use of AI may “homogenize our lives, and flatten our reality” (Samuel, 2023, subtitle) - a closed loop of regurgitated output leading to a regression to the mean. Imagination, unlike AI, is forged in the act of striving: in the trial and error, the false starts and the persistence that give human creation its vitality, and the ‘Aha!’ moment its sweetness. Creativity is not defined by the final product alone but by the process that leads to it: the revisions, the persistence through uncertainty, the struggle to turn nothing into something that resonates. These struggles are where growth and meaning reside. If we outsource that process to AI, we may bypass the difficulty, but we also risk

losing our appetite for the very experiences that give human imagination its depth and significance.

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