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The Shape of Things Unseen: A New Science of Imagination

by Adam Zeman (Bloomsbury Publishing, 2025)



Adam Zeman's book [URL1], *The Shape of Things Unseen: A New Science of Imagination* [URL2] summarizes current scientific research on imagination, tracing its development throughout history and in individual life, and its relationship with creativity. Professor Zeman [URL3], a cognitive and behavioural neurologist at the University of Exeter, together with his colleagues, coined the term *aphantasia* to describe the absence of a 'mind's eye' (p. 13). The considerable public interest generated by his research has drawn attention to the difference between imagination and imagery. Imagination, and our ability to share it with others, is what makes us uniquely human and shapes our culture.

With the help of ever-evolving methods of studying imagination, we are learning more about the vital role it plays in our lives. Some of the themes discussed in Zeman's book also appear in earlier works, such as Agustín Fuentes's *The Creative Spark. How Imagination Made Humans Exceptional* [URL4] (2017), and Oliver Sacks's *The Mind's Eye* [URL5] (2010) – Sacks himself had aphantasia (p. 302) – and also in works that included studies related to imagination, such as *The Cambridge Handbook of the Imagination* [URL6] (edited by Anna Abraham, 2020). Zeman's book, structured into three parts and twelve chapters, reviews the functioning and significance of imagination, presenting the most recent scientific findings in a captivating and accessible style, regardless of the reader's background. The book's cover introduces its theme – the close relationship between imagining and perceiving – through a visual metaphor.

Introduction

The Introduction opens with an exercise that illustrates the diversity of imagination (p. 1): '*Imagine: An apple. The sound of thunder. A dinosaur. The look of your kitchen. The map of France. The scent of thyme. Your mother's eyes. Your first kiss. The touch of velvet. Your plans for your next vacation. Winning the lottery. The interior of an atom. The interior of the Earth.*' The timeliness of the subject is underscored by recent research showing that imagination is not only employed in solving creative tasks, but we also immerse ourselves in our thoughts while doing things. That perception can be understood

as '*controlled hallucination*' (p. 2), shaped by our knowledge and predictions. Research enables us to better understand how our imagination works and control it more effectively. Importantly, imagination is not only private but, because we evolved into social beings, also shared.

First part

The first part of the book explores the scope of imagination, examining its everyday, creative, and social aspects. Humans spend approximately half of their awake time engaged in an imaginative activity, occasionally using special strategies to connect with the present '*for a while*' (p. 17). The biblical story of Adam and Eve's eating from the tree of knowledge, Zeman argues, '*symbolizes the alienation that flows from our detachment of the epistemic innocence of the here and now*' (p. 15). While imagination removes us from the present, sharing imaginative experiences enables us to connect with others. Adam and Eve's act of naming '*all cattle, and ... the fowl of the air, and ... every beast on the field*' (p. 45) reflects the need to communicate their imaginative representations. Though imagination can be mistaken for reality, perception itself is not without imaginative processes; it is based on predictions and internal models. Vision, for example, is generative and sometimes leads to false conclusions.

The creative use of imagination carries responsibility. Zeman illustrates this with the example of cosmologist Martin Rees, who, while studying the '*multiverse*', realized that artificial intelligence might evolve in directions independent of human interests. This recognition led him to found the *Centre for Existential Risk*, years before widespread public interest in AI (p. 41). As Martin Luther King Jr. demonstrates, Rees also exemplifies the '*unreasonable man ... who persist in trying to adapt the world to himself*' (p. 63), on whom social progress depends.

Visionary leaders, often artists, must make decisions in the face of crises, such as climate change or pandemic management, decisions that depend heavily on how they imagine the future. Communication and information transfer using language relies on our '*truth-default*' or '*truth-bias*' (p. 55). However, we already live in a '*post-truth society*' (p. 62), where, according to research, neither the presidents of great world powers nor the shared news on social platforms can be trusted as reliable. To shape our path to the future, though, imagination must be grounded correctly, for '*truth is not the enemy of imagination: it is its fuel*' (p. 67).

Second part

The second part describes the science of imagination, its reproductive and productive aspects, its neural correlates, its evolution in human history, and its development in the individual lifespan.

The components of human imagination can be classified in multiple ways: they may be voluntary, involuntary, or fall somewhere in between, as in the case of reading a novel. Imagination enables us to evoke absent emotions and sensory experiences, to engage in purposeful mental activity or problem-solving during dreams, and to generate phenomena such as illusions and hallucinations. Visual imagery is the most studied domain.

Until recently, imagery was assessed primarily through questionnaires. Over the past decade, however, several objective methods have been developed to measure visual imagery, and parallel approaches are emerging for auditory and olfactory imagery. For instance, pupil dilation reflects the vividness with which light and dark objects are imagined, while galvanic skin responses indicate physiological arousal during the mental visualization of frightening narratives. In binocular rivalry experiments, where each eye is presented with a different image, visually imagining one of the stimuli can bias perception toward it. Individuals with stronger imagery tend to exhibit greater susceptibility to such perceptual misinterpretations.

The '*imagery debate*', lasting nearly half a century, arose partly because '*people who lack a form of imagery are prone to deny its existence*' (p. 91). One of the memorable anecdotes in the book – especially for readers with aphantasia, such as myself – comes from Stephen Kosslyn's early experiments. When asked to evaluate the statement '*A flea can bite,*' two participants judged it false. Asked to explain, '*the*

first answered 'I looked for a mouth, but I couldn't find one.', the second: 'I looked but I couldn't see any teeth'" (p. 82). Though in their case, visual thinking was not the well-chosen method leading to a goal, Einstein described his own imaginative process as grounded not in words but in voluntary manipulation of images: 'the words of the language, as they are written or spoken, do not seem to play any part in my mechanism of thought. The physical elements which seem to serve as elements in thought are certain signs and more or less clear images which can be voluntarily 'reproduced' or combined (p. 93). With this form of thought, Einstein imagined that for somebody travelling on a beam of light, time would stand still (p. 107).

Both science and art rely on imagination – science to describe what is, and art to express what is felt. As Mihály Csíkszentmihályi observed, *'to be human is to be creative'* (p. 102). Research shows that in the case of our everyday creative activity, *'external reward reduces both enjoyment and creative output'* (p. 113) – a point that, in my opinion, raises questions about educational practices such as grading in elementary school.

Neuroimaging methods, including EEG, fMRI, and MEG, reveal that the brain is often more active during rest than during externally directed tasks. The resting state, 'default mode network', is relevant to the imagination; it is active when our mind can wander, visit memories, and plans. During creative processes, it interacts with the 'executive, task-control network' and with the 'salience network'. Arthur Koestler, the Hungarian-British thinker's theory of *'bisociation'* (p. 103) – the connection of *'self-consistent but habitually incompatible frames of reference'* (p. 135) – in the creative process is supported by these findings.

The evolution of imagination paralleled the evolution of the human brain. Homo sapiens has the highest encephalization quotient, the relatively largest extra brain area for cognitive purposes. Other species with high encephalization quotients also tend to be long-lived, reach sexual maturity slowly, live in social groups, and, in some cases, use tools and attribute mental states to others. Chimpanzees, for example, are capable of mental simulation and hypothesis testing. Archaeological evidence – such as cave paintings, tools, and carvings – indicates that our ancestors' consciousness was comparable to ours. Their minds were not unreflectively self-centred but reflectively social. While apes exhibit limited forms of shared cognition, humans are *'ultrasocial'* and have a *'deep social mind'* (p. 163).

Tool use and tool making, together with remembering the locations of raw materials and the methods for transforming them, as well as the need to symbolize absent objects, required the emergence of language – most likely beginning with gestures, which we still employ today. Mime serves as an iconic form of representation, in contrast to most words. Nevertheless, in many languages, we use back vowels for terms describing *round* or *huge* objects, or *those that are far*, and front vowels for *spiky*, *teeny* objects, or for *this one near here*, a phenomenon known as the 'kiki-bouba effect' (p. 169). Language functions both to share knowledge and ideas with others and to structure thought within the self, and it can be used to inform as well as to deceive. Human bodies and brains evolved for language and culture. *'We have evolved to share what we imagine'* (p. 180).

Imagination is not *'primitive, solitary, driven by wish-fulfilment, distorting of reality'* (p. 200), as Freud and Piaget proposed, but rather social and sophisticated, enabling us to understand, control, and shape reality. Infants develop 'cultural intelligence' (p. 195) by learning the art of imagination from their caregivers: first by describing, then by misdescribing, by pretending, and ultimately by internalizing their cultural environment. The capacity for imagination is genetically grounded, but its development depends on critical time windows for acquiring specific skills. Just as animals raised in enriched environments develop more interconnected brains than their peers, children raised in emotionally neglectful environments tend to exhibit reduced neural connectivity, smaller brain volume, and lower cognitive capacity. As Zeman observes, *'Childhood adversity shrinks possibility – in part by stealing the tools of imagination'* (p. 205).

Third part

The third part addresses the '*maladies, remedies and extremes of imagination*' (p. 6). The author frequently emphasizes that perception is a form of 'controlled hallucination': what we see, hear, and sense depends on internal models constructed from our prior experiences of the world. When this regulatory process is disrupted, or under conditions of sensory deprivation – such as flotation chambers or even being blindfolded for an hour – hallucinations may arise. In the absence of external input, the brain's intrinsic activity intensifies, and its internal models generate creative predictions. Emotions, sleep, drugs, or other factors may also trigger hallucinations.

Another way in which imagination can blur reality is through delusions – false beliefs that arise when the ability to evaluate possibility is impaired. The brain is constantly generating and testing hypotheses by constructing internal models, and these predictions (imaginative processes) shape perception. Functional illnesses may result from imaginative mechanisms operating outside of conscious awareness. As Reynolds observed in 1869, '*an idea ... takes possession of the mind and leads to its own fulfilment*' (p. 258). While delusions may sometimes be linked to underlying emotional factors, this is not always the case. Sometimes we mistake the imagined for the real, which is why, in exceptional cases, we ask ourselves whether something actually happened. The frontal pole of the prefrontal cortex, with its especially dense connections to other brain regions, plays a decisive role in this evaluative process.

In contrast to its potentially disruptive forms, imagination can also support learning, healing, and problem-solving. Mental practice – whether during wakefulness or sleep – can enhance performance in different skill domains, enabling musicians to refine their playing, surgeons to rehearse procedures, gymnasts to perfect movements, or chess players to plan moves. Both pain and pain relief can be simulated through imagination. Placebo effects, mediated by the exact neural mechanisms as pharmacological treatments, have been shown to alleviate not only pain but also depression and anxiety. In Parkinson's disease, they can reduce immobility and tremor by triggering dopamine release.

Imagination can act as a powerful remedy, but also as a potent curse (p. 276). Because visual imagery intensifies emotions, post-traumatic stress disorder can be reduced by weakening the association between imagery and memory – for example, through tasks such as playing Tetris. Similarly, cravings and symptoms of bipolar disorder may be relieved by engaging competing imagery.

Remarkably, about one-fifth of individuals once believed to be in a vegetative state can communicate through mental imagery. Their responses can be detected with brain imaging techniques such as fMRI or EEG: imagining playing tennis can signal 'yes,' while imagining walking around one's home can signal 'no' (p. 282). This form of communication is enabled by our fundamentally social nature, which relies on language to externalize and share imagination.

The imaginative visions of novelists can at times prove prophetic, as exemplified by works such as *Around the World in Eighty Days* or *Nineteen Eighty-Four*.

The closing section of the chapter may prompt readers to reconsider the imagery exercise presented in the Introduction. It emphasizes that both extreme responses are possible, equally normal, and imperceptible to others. The section concludes with interviews featuring hyperphantastic and aphantastic artists. Ed Catmull, the recently retired president of Pixar, Disney, and Turing Prize recipient, who described his role as '*protecting the new*' (p. 118), recounted to Zeman a revealing conversation with Glen Keane, one of the most excellent living animators. To Catmull's surprise, Keane disclosed that he has never been able to visualize mental images. He even recalled arguing with a senior colleague who found it inconceivable that an animator could work without 'seeing' images in advance. Keane explained that while he held something in his mind, it was not a picture – he had to interact with the paper to externalize it. Catmull noted that he experienced the same: he too had mental content, but no imagery (p. 296).

The epilogue discusses the role of human imagination in individual lives and society.

Both imagination and perception are shaped by conscious and unconscious imaginative processes, which refine the brain's internal models. Uniquely in humans, imagination can be influenced by the imaginations of others through the use of symbols, such as language, art, music, mime, algebra, or computer code. The book demonstrates how this capacity for sharing and regulating imagination emerged over millions of years of evolution and through individual developmental processes in childhood.

Zeman achieves his stated goal of making '*the insights into our nature accessible to you, whatever your background*' (p. 2) by including a two-page overview of the **brain regions** discussed, a forty-two-page **bibliography**, and sixteen **color pages** of illustrations ranging from prehistoric to modern art, and from Cajal's neuron sketches to contemporary neuroimaging.

The author introduces us to scientists and artists, individuals who experience hallucinations or delusions, those with imagery as vivid as perception, and those without any sensory imagery, presenting them in a way that allows readers to connect with his subjects, gain insight into how their brains function, understand their thought processes - imaginations, and appreciate what occupies their minds. This approach helps us understand and accept the origins of unusual thoughts *and* imaginations in ourselves and others, potentially serving as a starting point for personal or social improvement.

In a presentation[URL7] the author discusses the topic of his book more engagingly and in greater depth than I can convey in this review. Even though he does not refer to it, for me – perhaps because I have aphantasia – the title suggests that even without sensory imagery, one can still comprehend the shape of objects; spatial imagery can be, and often is, highly developed even in the absence of object imagery. As the author notes, Aristotle was incorrect in claiming that '*the soul never thinks without a/an image/phantasma*' (pp. 71, 93, 297). However, he was right in asserting that '*humans are deeply "mimetic beings": we have a strong urge to represent our experience of ourselves, of one another, and of the world, and to share those representations*' (p. 37).

Links:

- URL1 - <https://www.bloomsbury.com/uk/author/adam-zeman/>
- URL2 - <https://www.bloomsbury.com/uk/shape-of-things-unseen-9781526609779/>
- URL3 - <https://experts.exeter.ac.uk/1385-adam-zeman>
- URL4 - <https://www.penguinrandomhouse.com/books/531544/the-creative-spark-by-agustin-fuentes-phd/>
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