Imagination, the Brain's Default Mode Network, and Imaginative Verbal Artifacts

Joseph Carroll

1 Introduction

Until very recently, discussion of imagination was for the most part relegated to speculation in philosophy, literary scholarship, aesthetic theory, and intuitive, non-empirical psychology like that of Freud and Jung (Abrams, 1953; Eichner, 1982; Freud, 1959; Jung, 1966; Roth, 2007; Stevenson, 2003; Thomas, 2014). In the past two decades, that situation has changed decisively. Imagination is now the subject of intensive empirical research in multiple overlapping disciplines—in, for instance, the evolution of human cognition, developmental psychology, the psychology of self-narratives, the psychology of fiction, and, above all, cognitive neuroscience. We need no longer merely speculate about what imagination is and wonder whether it exists at all as a distinct cognitive apparatus separate from other cognitive mechanisms, or, assuming it exists, whether it serves any adaptive function. We can now say with confidence that the imagination is a neurological reality, that it is lodged in specific parts of the brain, that it consists of an identifiable set of components and processes, that these components and processes have adaptive functions, and that in fulfilling its functions imagination has been a major causal factor in making *Homo sapiens* the dominant species on earth.

The purpose of this chapter is to explain how imaginative verbal artifacts are produced by the imagination and in turn influence the imagination. For convenience, the term “literature” is here used synonymously with the term “imaginative verbal artifacts,” but “literature” in this usage should be understood to include also the oral productions of non-literate peoples. The main forms of literature are poems, plays, and stories, but reflections on literature can often be extended to other media such as historical narratives, imaginative essays, songs, film, opera, cartoons, or video games. In the usage intended here, “literature” implies no distinction between

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prestigious canonical works and works of popular culture. Literature can range from best sellers and pulp fiction to the works of Homer, Shakespeare, or Tolstoy. All such works, low or high, match the definition of “literature” used in this chapter: *imaginative verbal artifacts, often but not always fictional, that depict human behavior and the conditions of human life, evoke the subjective quality of experience, communicate authors’ attitudes and beliefs, and elicit responses from readers that engage their own imaginations.*

Developmental psychologist Marjorie Taylor offers an incisive definition of imagination that corresponds well with the formulations of other researchers. “Imagination refers to the capacity to mentally transcend time, place, and/or circumstance to think about what might have been, plan and anticipate the future, create fictional worlds, and consider remote and close alternatives to actual experiences” (2013, p. 791). The various aspects of imagination described by Taylor all involve a common feature: the activity of the brain turned inward to mentally generated representations decoupled from the immediate external environment. That conception of imagination corresponds with descriptions of the brain’s default mode network (DMN)—a neural system that has been aptly characterized as the “imagination network” (Kaufman & Gregoire, 2015, p. xxvii; also see van Mulukom, this volume). As Edward Pace-Schott describes it, “the default network consists of regions that, in the absence of exteroceptive [externally oriented] attention or narrowly focused mental effort, support self-directed concerns, immersion in one’s inner life (e.g., daydreaming) or imagining the inner life of others (Theory of Mind)” (2013, p. 159). Reflecting on the varied functions of the DMN, Randy Buckner and his colleagues postulate that their common feature is to “simulate an alternative perspective to the present” (Buckner, Andrews-Hanna, & Schacter, 2008, p. 23). Drawing up memories from one’s personal past, envisioning the future, intuiting the thoughts and feelings in other minds, and evaluating moral alternatives “rely on a common set of processes by which mental simulations are used adaptively to imagine events beyond those that emerge from the immediate environment” (p. 23).

Because literature depicts all aspects of human life, it also depicts the processes of imagination. Those processes are central to human experience and characterize much of what is most distinctively human about human mental life. To a degree unparalleled in the inner lives of other animals (Suddendorf, 2013), humans reflect on their own experiences, imagine the inner lives of others, and imagine themselves reflected in the minds of others. In the human mind, the present flows out of memories of the past, and both past and present flow into imagined futures. Humans fashion their experiences into life narratives modulated by dramatic structures and dominant themes. They locate their own individual life stories within multi-generational stories that include their ancestors, their extended families, their imagined descendants, and the lives of their communities—tribal, ethnic, religious, ideological, regional, vocational, socioeconomic, cultural, or national (McAdams, 2015; McLean, 2016; and see McAdams & Cowan, this volume). Humans form imaginative conceptions of the world, invest those conceptions with moral codes and systems of value, and often populate their imagined worlds with supernatural agents and spiritual forces. In human experience, the value and meaning of behavior

are seldom simply physical and immediate. Behavior takes on a definite value and meaning only within an imaginative structure: some emotionally charged order of symbols made vividly present to the mind's inner eye (Carroll, 2012, 2018; Dissanayake, 2000; Wilson, 1998, ch. 10). That is why the arts penetrate so deeply into religions and ideologies.

The second section of this chapter describes the evolution of modern brain shape and suggests the role imagination has played in producing the complex of behaviors that characterize neurologically modern *Homo sapiens*. The third section describes the current neuroscientific understanding of the brain's default mode network—the neurological locus of imagination. The fourth section describes three core processes of imagination used in constructing imaginative verbal artifacts: simulation, mental time travel, and perspective taking (also known as “Theory of Mind” and “mentalizing”). The three processes are illustrated with reference to a modern American novel, Wallace Stegner's *Angle of Repose*. The fifth section describes four specialized forms of imagination that deploy the core processes: dreaming, mind-wandering, autobiographical narratives, and counterfactual thinking. That section explains how these forms are involved in writing or reading literature and identifies a few literary works that illustrate them. The final section sums up the argument for the adaptive functions of literature.

2 Globularization, Imagination, and Behavioral Modernity

Humans became anatomically modern between about 200,000 and 150,000 years ago. But they did not consistently display the full array of behaviorally modern traits until roughly 50,000 years ago, approximately the same time at which they began to leave Africa and colonize the rest of the world (Klein, 2008). The evidence for behavioral modernity ranges from “worked bone, ornaments, pigments, and complex multicomponent lithic technologies to material indicators of manipulations of symbols and abstract thought such as unequivocal art” (Neubauer, Hublin, & Gunz, 2018, p. 1). Paleontologist Richard Klein argues that the various traits that characterize behavioral modernity are “related outcomes of the innovative burst behind the Out of Africa expansion” (2008, p. 270). At around the time of the exit from Africa, humans begin consistently to display “substantial growth in the diversity and standardization of artifact types,” a “rapid increase in the rate of artifactual change through time,” and “an increase in the degree of artifact diversity through space” (Klein, 2008, p. 270).

Why the time lag between anatomical modernity and full behavioral modernity? Scientific debate on this question has been divided between those who postulate some neurological change and those who emphasize the gradual accumulation of behaviorally modern activities through demographic, ecological, and cultural factors (Carroll, 2006; Hatfield & Pittman, 2013; McBrearty & Brooks, 2000; Mellars, 2007; Mellars & Stringer, 1989; Mithen, 1996, 2001; Powell, Shennan, & Thomas, 2009). Klein, a chief proponent for the hypothesis of neural change, acknowledges

that neural change is difficult to pinpoint “because the putative change was in brain organization, not size, and fossil skulls provide little or no secure evidence for brain structure” (Klein, 2008, p. 272). In 2018, a team of paleontologists analyzing endocranial casts of 20 fossil *Homo sapiens* skulls found new evidence for neural change (Neubauer et al., 2018). Their analysis indicates that while brain size for humans has remained relatively stable for the past 300,000 years, the shape of the brain has gradually evolved. This change in brain shape culminated between 100,000 and 35,000 years ago, thus running parallel with the emergence of fully modern behavior.

As modern *Homo sapiens* evolved, the brain assumed a more globular shape. “From geologically older to younger *H. sapiens*, the frontal area becomes taller, the parietal areas bulge, the side walls become parallel, and the occipital area becomes rounder and less overhanging” (Neubauer et al., 2018, p. 2). There are also changes in the cerebellum. The parietal areas are involved in imagery, social awareness, working memory, and long-term memory. Parietal bulging did not increase outer parietal surface, so the bulging implies an increase in the size of inner parietal regions. One such region is the precuneus, which is “a central node of the default-mode network and an important hub of brain organization” (Neubauer et al., 2018, p. 5). The precuneus is involved in mental imagery concerning the self, episodic memory, and modeling other people’s views—all of which are main components of the DMN. Benedek and Jauk, psychologists specializing in research on creativity, note that “higher creativity is consistently associated with higher gray matter density in DMN regions, especially the precuneus” (Benedek & Jauk, 2018, p. 290; also see Chen et al., 2015). The cerebellum, which is involved in working memory, social cognition, and affective processing, is also functionally connected with the DMN (Alves et al., 2019).

The evolution of modern brain shape suggests that enhanced imagination is a defining feature of *Homo sapiens*. As archaic humans were evolving into *Homo sapiens*, and as *Homo sapiens* were becoming behaviorally modern, they were becoming more imaginative. Yet further, the evolution of modern brain shape suggests that becoming more imaginative was a crucial precondition for behavioral modernity. The causal logic seems clear. The modern human imagination enables the uniquely human powers of cognitive and behavioral flexibility (Buckner et al., 2008; Margulies et al., 2016; Schacter, 2018; Schacter, Carpenter, Devitt, Roberts, & Addis, 2018; Suddendorf, 2013; Suddendorf & Corballis, 2007). Flexibility is closely allied with creativity, and both flexibility and creativity are preconditions for the power of innovation that characterizes behaviorally modern humans.

3 The Brain’s Default Mode Network

When the brain is not engaged in specific tasks requiring exteroceptive perception and directed action, it is not merely resting. It defaults to activity in a well-defined neural network—hence the term “default mode network.” That network uses a substantial proportion of the total energy consumed by the brain. Studies suggest that

nearly half our waking thoughts are directed towards topics other than the task at hand, but the proportion could be larger, since task-related thoughts can recruit the DMN (Andrews-Hanna, Smallwood, & Spreng, 2014; Christoff, Irving, Fox, Spreng, & Andrews-Hanna, 2016; Killingsworth & Gilbert, 2010; Smallwood, Margulies, Bernhardt, & Jefferies, 2018; Smallwood & Schooler, 2015). Studies of the brain when it is not responding to external stimuli began about 40 years ago, but in the past two decades, as neuroimaging techniques have become increasingly sophisticated, research on the DMN has increased many times over, and its general functions are now well understood. By constructing autobiographical memory as an emotionally modulated narrative, projecting the self into future scenarios, considering multiple alternative scenarios valenced by emotion and moral value, and simulating the mental lives of other people, the DMN creates subjectively meaningful models of the self and its relations with the world (Alves et al., 2019; Andrews-Hanna, Reidler, Sepulcre, Poulin, & Buckner, 2010; Andrews-Hanna, Saxe, & Yarkoni, 2014; Andrews-Hanna, Smallwood, et al., 2014; Buckner, 2012; Buckner et al., 2008; Buckner & DiNicola, 2019; Immordino-Yang, Christodoulou, & Singh, 2012; O'Callaghan & Irish, 2018; Raichle, 2015; Stan & Christoff, 2018).

The parts of the brain making up the DMN are spread wide in cortical and subcortical regions. The main cortical regions of the DMN are the medial prefrontal cortex, the posterior cingulate cortex, the lateral parietal and temporal association cortices, and the medial temporal lobes (Andrews-Hanna et al., 2010; Buckner & DiNicola, 2019; Molnar-Szakacs & Uddin, 2013). The cortical regions of the network interact with subcortical regions, in particular the amygdala, which modulates emotion and detects salience, and the hippocampus, which is involved in associative thinking, novelty detection, semantic memory (general factual memory), and episodic memory (personal, chronologically sequential memory) (Alves et al., 2019; Christoff et al., 2016; Kernbach et al., 2018; Margulies et al., 2016; Raichle, 2015). The various neural regions of the DMN are differentially involved in activities such as episodic memory, registering emotional tone, reflecting on moral relationships, and peering into other minds. Neuroimaging at the higher levels of resolution available in intraindividual studies suggests that the DMN “comprises multiple distinct but interwoven networks” (Buckner & DiNicola, 2019, p. 597). Nonetheless, the regions within the DMN often coactivate both during periods of rest (Binder et al., 1999; Raichle et al., 2001) and also while performing complex tasks such as perspective taking and constructing self-narratives (Andrews-Hanna, Saxe, et al., 2014; Buckner & DiNicola, 2019).

Neuroscientists are still debating how many neural networks exist, what their boundaries are, and what functions they serve (Mineroff, Blank, Mahowald, & Fedorenko, 2018; Power et al., 2011). Even so, many researchers agree that a large proportion of cognitive labor is performed by three main networks: the frontoparietal control network (FPCN), the DMN, and the dorsal attention network (DAN). The control network flexibly coordinates with other brain networks depending on the nature of the task demands. If the task involves effortful and coordinated internal thought, the control and default networks are coordinated. If the task involves effortful and coordinated external attention, the control and attention networks are

coordinated and are decoupled from the default network (Andrews-Hanna, Saxe, et al., 2014; Andrews-Hanna, Smallwood, et al., 2014; Beaty, Benedek, Silvia, & Schacter, 2016; Buckner & DiNicola, 2019; Spreng, Stevens, Chamberlain, Gilmore, & Schacter, 2010; Zabelina & Andrews-Hanna, 2016). The mind perpetually oscillates between attending to the world outside and attending to the inner world of imagination.

Several researchers in creativity argue that creativity depends on the cooperative interaction between the DMN and the control network (Beaty et al., 2018; Beaty & Jung, 2018; Benedek & Fink, 2019; Jauk, 2019; Jung & Vartanian, 2018; Kaufman & Gregoire, 2015; Zabelina & Andrews-Hanna, 2016). One team of researchers characterizes the activity of the DMN as “spontaneous” thought and the activity of the control network as “deliberate” thought (Andrews-Hanna, Irving, Fox, Spreng, & Christoff, 2018; Christoff et al., 2016). They distinguish among three levels of spontaneity—dreaming, mind-wandering, and creativity—that are differentiated by degrees of interaction between the two networks. When a person is dreaming, the control network shuts down, and the imagination runs riot, unimpeded by external stimuli or the need to complete a task (Hartmann, 2007). The term “mind-wandering” is synonymous with “daydreaming.” When one daydreams, the world is still there, on the horizon of conscious awareness, but attention is withdrawn from it and turned inward; the mind wanders as it will, without effort, prompted by memory, anticipation, and association (Andrews-Hanna et al., 2018; Corballis, 2014). Creative thought, in this three-point scale of spontaneity, involves both spontaneous and deliberate mental activity. Deliberate attention to a topic can provide information and analysis—materials for imaginative reflection. If deliberate thought is intense and sustained, it can also make the subject of deliberation “salient and personally relevant,” thus placing it within the province of the DMN (Benedek & Jauk, 2018, p. 293). Spontaneous thought, working on the products of deliberate attention, generates new ideas by making connections and inferential leaps among existing ideas. In turn, deliberate, goal-directed thought selects among those new ideas, organizes them, and executes the skill-based actions necessary to put them into practice—in the laboratory, in engineering or business, or on paper, canvas, film, or other media.

Scientific views about the role the DMN plays in brain dynamics have changed dramatically within the past two decades. The change in the status of the DMN parallels a plot trajectory displayed by many fairy tales: the protagonist begins life poor and obscure but then is revealed to be of royal blood and eventually gains the crown. The DMN was discovered by accident and was for several years largely ignored (Buckner, 2012). It was regarded as merely a passive state—what the brain does when it isn’t doing anything in particular. As research progressed, the adaptive functions of the DMN gained increasing recognition. The crowning moment for the DMN could be said to have occurred in an innovative study published in 2016. Daniel Margulies and his colleagues combined connectome data and topographic

measurements of distances between brain regions along the cortical surface. (A connectome is a map of neural connections.) The connectome and spatial distance data converged to produce a “gradient” or scale. At one end of the gradient, the components of sensory and motor networks cluster closely together in the brain and are least connected to other networks. At the other end, the DMN is the most spread out and the most widely connected. In yet a third dimension, that same gradient characterizes a range from specialized informational content to widely divergent content—“a spectrum from unimodal to heteromodal activity” (Margulies et al., 2016, p. 12574). “Mode” refers to the kind of informational content processed by a neural network—for example, visual perception or bodily movement. “Unimodal” means that sensory and motor networks are the most focused on single kinds of informational content. The DMN, in contrast, synthesizes the most diverse kinds of information. Moreover, in concordance with its “heteromodal” character, the central nodes of the DMN are equidistant from the centers of the sensory and motor networks, thus ideally positioned to integrate information from diverse sources. In sum, then, four kinds of data converge in this gradient: connectivity, internal spatial distance of components, informational mode, and spatial location relative to other networks. “These results suggest that the default-mode network consists of regions at the top of a representational hierarchy that describe the current cognitive landscape in the most abstract terms” (p. 12574). The top of a representational hierarchy—the crown of cognition. To put that designation in less romantic terms, the DMN is the brain’s most comprehensive network for the integration of information (Buckner & DiNicola, 2019; Kernbach et al., 2018; Raichle, 2015).

The adaptively functional significance of the DMN is inversely reflected in the pathologies that characterize disturbances in the network. Such disturbances have been implicated in “depression, anxiety, schizophrenia, obsessive compulsive disorder, psychopathy, substance abuse, attention deficit hyperactivity disorder (ADHD), autism, Tourette’s syndrome, Alzheimer’s disease, semantic dementia, and chronic pain (among others)” (Andrews-Hanna, Saxe, et al., 2014, Andrews-Hanna, Smallwood, et al., 2014, p. 15). In autism, failures of perspective taking (“Theory of Mind”) reflect damage in the DMN or dysfunction in mechanisms in controlling systems that regulate it. In schizophrenia, the kind of spontaneous thought manifested in dreams breaches the space of exteroceptive perception, producing hallucinations and delusions. The main regions of the brain damaged in Alzheimer’s disease are part of the DMN. Alzheimer’s results in large-scale mental deterioration that includes a loss of episodic memory, impaired future thinking, and a severely diminished sense of personal identity (Addis, Sacchetti, Ally, Budson, & Schacter, 2009; Alves et al., 2019; Andrews-Hanna, Saxe, et al., 2014, Andrews-Hanna, Smallwood, et al., 2014; Broyd et al., 2009; Buckner, 2012, 2013; Buckner et al., 2008; O’Callaghan & Irish, 2018). A healthy brain has a DMN that is working efficiently to integrate information, interact in adaptively functional ways with other neural networks, understand other minds, and maintain a sense of personal identity.

4 Core Processes of Imagination

4.1 *Simulation, Mental Time Travel, and Perspective Taking*

Three core processes of imagination—simulation, mental time travel, and perspective taking—form the basis for more complex or specialized forms of imagination such as dreaming, mind-wandering, autobiographical narratives, counterfactual thinking, fantasizing, moral reflection, comprehending narratives, and producing intentional fictional constructs. The three core processes can themselves be broken down into parts with distinct features and discrete neurological locations. Simulation can be divided into “embodied simulation”—a process that uses “mirror neurons” to activate sensations like those being observed or read about (Bergen, 2012, 2016; Gallese, 2017)—and the constructive, recombinatory activity of the DMN (Addis, Pan, Vu, Laiser, & Schacter, 2009; Geiger et al., 2019; Molnar-Szakacs & Uddin, 2013). Mental time travel can be divided into episodic memory and future thinking (Schacter, 2018; Suddendorf & Corballis, 2007). Perspective taking can be divided into affective and cognitive processes (Healey & Grossman, 2018; Kanske, 2018; Vogeley, 2017).

Simulation, perspective taking, and mental time travel are not irreducible categories, but they occupy a level of functional organization particularly useful for the analysis of imaginative verbal artifacts. Simulation is the basis of both mental time travel and perspective taking. Mental time travel is the basis for the conscious awareness of personal identity as a continuous stream of experience over time. Perspective taking is the basis for an imaginative awareness of other people as conscious agents moved by desires, fears, thoughts, and beliefs.

“Simulation,” understood broadly as “representation” is prerequisite to all imaginative experience (Buckner et al., 2008; Molnar-Szakacs & Uddin, 2013; Oatley, 2016; Roese & Epstude, 2017; Schacter, 2018; Tamir, Bricker, Dodell-Feder, & Mitchell, 2015). To project a future scenario, imagine a past different from the actual past, create an imaginary scene, or envision what some other person is thinking, one must have a mental representation. It can be visual, auditory, tactile, or olfactory. It can involve physical motion, geometrical configurations, or abstract shapes that are either static or dynamic. For a combination of such simulations to construct a scene—a component in a scenario—imagination must specify a “what,” “when,” and “where” (Hassabis & Maguire, 2007, 2009). The dimensions of space and time determine the basic ontological properties of a scene.

Mental time travel is to simulation as movies are to photographs. All cognitively healthy people inhabit an imaginative temporal continuum. Mental time travel uses episodic memory to make sense of the present and construct scenarios of possible futures. Memory and anticipation channel purposeful action. Researchers have converged in proposing that flexible planning for future contingencies has acted as a selective force driving the expansion of imagination in *Homo sapiens* (Andrews-Hanna, 2012; Buckner, 2012; Schacter, 2018; Suddendorf, Addis, & Corballis, 2009; Suddendorf & Corballis, 2007). An imaginative construction of

interconnected causal events makes for more effective action in the real world. It also provides a model for plot more sophisticated than that in a simple sequence of causally unconnected events—the picaresque mode of narrative (Forster, 1927; Harris, 2000). Satisfaction in the outcome of fictive scenarios depends in some measure on the sense of rightness in a causal sequence. Tragedy, especially, has a feel of an inevitable doom, an inescapable causal process.

Humans are ultra-social. Effectively negotiating the human social environment requires being able to envision the perspective of others: to understand their beliefs and values, anticipate their thoughts, respond to their feelings, and evaluate their motives. That kind of perspective taking is also a precondition of literature as a communicative activity (Carroll, 2018; Mar & Oatley, 2008; Oatley, 2011, 2016; Zunshine, 2006). Authors presuppose readers capable of registering the author's intentional meanings. Successful authors are good intuitive psychologists, capable not only of creating believable characters but also of manipulating the responses of readers—producing excitement, surprise, laughter, or tears. Readers read the minds of depicted characters, making inferences about their sensations, emotions, perceptions, and thoughts. They also read the author's mind, registering not only what the author explicitly says but also what the author feels about the characters and events being depicted. An author's attitude toward his or her imaginary world is an essential part of the meaning of that world (Carroll, 2018, 2019; in this volume see also Clasen; Jonsson; Saunders). That meaning can be conveyed only if readers are capable of reading the author's mind.

Simulation, mental time travel, and perspective taking are closely intertwined. Both mental time travel and perspective taking are forms of simulation. Episodic memory, the basis for mental time travel, provides materials for simulating future scenarios. In mental time travel, one has to bring scenes of the past before the mind's eye or simulate some future scenario. In perspective taking, one must imagine what someone else is thinking; one must simulate the other person's imaginative simulations. Mental time travel often includes simulating other minds in the past or future. A memory or anticipation of a romantic encounter or heated exchange involve seeing the other person in that scenario and imagining what the other person thought or might think. To imagine other minds is also to imagine how those other minds remember the past or envision the future.

We can point to plausible adaptive benefits of simulation, mental time travel, and perspective taking: linking the present to the past, making future plans, and interacting effectively with other people (Buckner et al., 2008; Stan & Christoff, 2018; Suddendorf & Corballis, 2007). But even if we could not identify plausible adaptive benefits, the logic of natural selection would strongly suggest that those processes have adaptive value. Otherwise, their considerable costs would have eliminated them in the course of evolution. Those costs include the substantial amounts of metabolic energy consumed by the DMN. They also include the risks attendant on guiding behavior in light of mistaken models of reality. Simulation uses elements derived from memory and association to create imaginative facsimiles. Those facsimiles can generate both original insights and bizarre distortions—hallucinations and delusions. Mental time travel allows imagination to expand beyond the present

moment and form units of imaginative experience that include the bygone past and futures not yet realized. It can give veridical information about the past, make accurate predictions about the future, and even help determine the course of the future. But both memory and prospection are constructive (Hassabis & Maguire, 2007; Schacter et al., 2018). Like simulation, memory often gives false reports, and predicting the future is a notoriously risky game—in the stock market, in war, and in love. Perspective taking can give authentic impressions of what other people think and feel, but it relies on inferences made from imperfect perceptions and sometimes rickety inferences. We constantly read each other's minds, but often get it wrong, misunderstand, fail to connect.

Imagination is both valuable and vulnerable. Producing and consuming stories, poems, and plays exercise imagination, strengthening it and thus rendering it more valuable and less vulnerable. Humans are a neotenous species—prolonging childhood features into adulthood (Thiessen, 1997; Wrangham, 2019). The young of many species play in order to exercise their adaptively functional powers. Humans continue to play in various ways throughout their lives. One plausible account of literature describes it as a form of imaginative play (Boyd, 2009; Corballis, 2014; and see van Mulukom, this volume). When we take in poems, stories, or dramas, we are refining our own imaginative powers. We learn from literature, in the simplest and most direct way, by assimilating information about the human behavior depicted in literature (see Saunders, this volume), but we also learn indirectly, and perhaps more importantly, by vicariously participating in the imaginative processes in the minds of both characters and authors. To engage in that vicarious experience, we have to deploy our own powers of simulation, mental time travel, and perspective taking.

4.2 *Stegner's Angle of Repose: Simulation, Mental Time Travel, Perspective Taking*

The three forms of imagination described in subsection 4.1 speak to aspects of literature that are more or less self-evident—literature represents, includes conscious awareness of time, and involves an interaction of perspectives among authors, readers, and characters—but the description of these forms has been abstract, theoretical. An illustrative example should help bridge the gap between abstraction and self-evidence. Wallace Stegner's *Angle of Repose*, published in 1971, won a Pulitzer Prize and is widely regarded as a major work of modern American fiction (a judgment with which I concur). The novel is constructed as a story within a story. The fictional first-person narrator is a retired professor of history poring over his grandmother's letters and writing an account of her marriage with a mining engineer. Part of the story is set in the narrator's present (the end of the 1960s in a California town). The narrator describes his own circumstances and his interactions with his neighbors, his housekeeper, his secretary, and his adult son, a sociology professor at

Berkeley. The narrator is suffering from a bone disease, confined to a wheelchair, partially paralyzed, in physical pain, and emotionally preoccupied with bitter resentment against the wife who has abandoned him. The bulk of the novel, though, consists in the story he is himself writing—the history of the marriage between his grandparents. Stegner based the embedded story about the grandparents' marriage on the letters written by an actual person, Mary Hallock Foote (1847–1938), a writer and magazine illustrator married to the mining engineer Arthur de Wint Foote (1848–1933). Stegner uses many actual passages from the letters and interweaves them with his own fictional passages.

The grandparents' marriage stages a conflict between two major phases of American cultural life: the settled life of the eastern seaboard, and the western expansion. Susan Burling, the grandmother, begins life as a member of the east coast intelligentsia. She is not of patrician origin but is intimately bound up in patrician culture. Her husband, Oliver Ward, begins life in the same milieu but spends his whole adult career in the West—mostly in mining towns in California, Colorado, and South Dakota, but with one period in San Francisco, an excursion to Mexico, and a long stay outside Boise, Idaho. Ward commits himself both professionally and emotionally to the West, despite its cultural rawness and severe privations. As an engineer, he is enthralled with visions of infrastructure development. After multiple failed enterprises, he stakes his family's fortunes on a years-long dam-building and irrigation project in Idaho. His wife, Susan, remains a reluctant Westerner, feeling herself an exile from the refinement, comfort, and cultivated conversation of the East. The tensions between the two are exacerbated by his repeated setbacks. He is a talented engineer and an honest man, but is often thwarted by the greed and corruption of less worthy men. Because of the setbacks in his career, his family's income is heavily dependent on Susan's successful career as a magazine writer and illustrator—a situation that conflicts with their shared belief that the male should be the primary provider for a family. Their story culminates in a crisis: disappointed with her husband's career and exhausted by her own privations, Susan yields emotionally to the romantic entreaty of his assistant and friend. While distracted by the assistant, she neglects to watch her young daughter, who falls into a canal and drowns. The marriage is eventually patched up, but Oliver never forgives his wife, and the deep romantic bond that had characterized their early years is ruined.

The fictional narrator is using his reconstruction of his grandparents' lives to try to make emotional and imaginative sense of his own life. He was raised by his grandparents and regards them more as parents than as grandparents. Reconstructing the story of their marriage helps him think about the failure of his own marriage. Ultimately he comes to no real conclusion about his own marriage. Instead, he lives vicariously in theirs, in its romance, its tragedy, and its stoic renunciations.

This is an unusually complicated setup for a story, but the embedded main story about the grandparents' marriage has so much amplitude and verisimilitude that the framing narrative does not obstruct the force of the historical narrative. The qualities of simulation deployed in this novel make the scenes set in the historical past more vivid than the scenes set in the narrator's present time. The historical scenes set in the East, where the grandparents meet and occasionally visit, are adequate for

ordinary novelistic purposes. The scenes set in the West—Stegner made his career as a writer of the American West—are extraordinarily rich in sensory detail and atmosphere. The many locations in which the family lives are each brought alive to the reader's mind. Stegner captures their sights and sounds, the shape of the land and vegetation, the qualities of light, the characteristic odors, the feel of the air and wind, moisture or dryness, heat or cold. Readers can feel the hot breath of air in the arid grasslands outside Boise, Idaho, and can share the sense of stifling confinement in a log cabin in Leadville, Colorado, during endless winters consumed by tending sick and injured people. All that is "simulation." It is making available for the reader's imagination the sensations that in reflection and retrospect would be in the imagination of the people who experienced it. What is it like to stand on a mountain-top in the Rocky Mountains, on a bright, fresh day, looking out over a cluster of rough, hastily constructed wooden buildings scattered among raw gashes in the earth, piles of mining debris, and huge pieces of smoking, clanking machinery tended by busy, eager, greedy men? Stegner makes it possible for readers to feel what that would be like.

In making his embedded first-person narrator a professional historian, Stegner was choosing to make a complex imaginative awareness of time into a central subject of his novel. The novel is full of particularized, concrete images, but the ultimate imaginative shape the story takes in the narrator's mind is closer to abstract art than to representational painting. The organization of temporal sequences becomes an imaginative abstraction impregnated with aesthetic sensations.

The picture of Leadville is part of a scene, one of many such scenes in multiple, vividly realized settings. All the scenes together, in chronological sequence, create a historical panorama that takes in the settling of the far West and produces an impressionistic portrait of a continental nation undergoing expansion and transformation. In the fictional present time of the story—the few months in which Lyman Ward is reading his grandmother's letters and composing a narrative about her life—he is living in the house in which his grandparents spent their last several decades, and in which he spent his childhood. The house is situated in Grass Valley, California, in the Sierra Nevada foothills northeast of San Francisco. His grandfather became manager of a mine in that town and had the house built. The movement of time in the story—of Lyman Ward's own mental time travel—thus extends over a century, from the 1870s, when his grandparents first met, to the 1960s, but with flashbacks to the grandmother's childhood in the 1850s. This stretch of time forms an imaginative continuum for the narrator. He sums up his grandparents' lives in temporal units, each connected to a place with its own distinctive topography and mood, but all together accumulating the stress that leads to a marital collapse.

In telling the story that leads to this collapse, the narrator must negotiate between his own temporal perspective and that of his characters. At any given point in their story, the historical characters are caught in time. For them, the future with all its hopes and fears is still in doubt. From the narrator's perspective, all doubt is resolved. He knows how the story ends. His characters look to an uncertain future. For him, their whole span of life has the fixity of a sequence that has reached an almost inevitable conclusion. His own future, though, remains suspended,

uncertain. At the very end of the novel, the narrator has a long, realistic dream in which he imagines his wife coming to see him, seeking a forgiveness he does not know whether he can give. In the last line of the novel, he lies in bed, “wondering if I am man enough to be a bigger man than my grandfather.”

The narrator devotes little attention to the last several decades of his grandparents' marriage. The dynamic of the marriage has already culminated in the collapse of trust and intimacy. But the quietude and stability of those last several decades form part of the total temporal impression made in Lyman Ward's imagination. The rough years of pioneering in the West settle into comfortable domesticity in Grass Valley, and the passion and anguish of the marriage settle into resignation and endurance. The title of the novel, *Angle of Repose*, is an engineering term designating the angle at which loose debris settles to rest. That image serves as a motif in the narrator's evaluation of the marriage. The novel thus simultaneously produces an impression of long, slow movement through time and of a synchronous, summary impression of a process that has already settled into stability. That stabilized continuum of mental time that spans more than a century is complicated in the narrator's own personal life by flashbacks to his childhood and his marriage. The novel ends on an unresolved tension between a placid but melancholy composure on the scale of historical time and an agitated, unsettled present—a personal agitation complicated by the sociocultural upheavals of late-1960s America.

To convey an imaginatively coherent mental experience spanning more than a century and stretching across the North American continent, Stegner creates multiple levels of “intentionality” (Dennett, 1987)—the reading of one mind by another. For this novel, as for all novels, the author must read his expected readers' minds in order to determine how best to convey the story: where to start, how much to reveal at any given moment, how to keep readers interested and oriented. In this particular novel, the embedded first-person narrator is himself emotionally invested in the story he tells. He knows roughly the final phases of the story—the several decades the grandparents spent in Grass Valley. But he is only gradually bringing the full narrative alive in his own mind as he reads his grandmother's letters and compares their images with his remembered impressions of the older couple. He has a mind closely attuned to but distinct from Stegner's own. He has his own struggles and griefs, his own confusions and uncertainties. As he probes historical documents and personal memories, he is struggling to find his way into the minds of people long dead. While writing their story, he also engages in dialogue about his grandparents with his son the sociology professor and the young woman who is serving as his secretary. To understand his characters, he must shift from his own perspective, and to understand how his characters must look to people with perspectives very different from his own perspective or that of his grandparents, he must shift again. The son is a radical social constructionist who, like Henry Ford, thinks history is bunk. The secretary is a hippy with attitudes toward sexual promiscuity that could be considered, depending on one's own perspective, as either loose or liberated. The contemporary mores evinced by the secretary are set in tension with the attitudes toward monogamous fidelity that governed the grandparents' lives. While negotiating between the attitudes of the past and the present, the narrator also meditates on how

he himself must look to people with very different perspectives. He imagines how his attitudes toward his grandparents influence the way his son and secretary envision his own mind.

Each of the characters in the story—in both the historical narrative and the narrative of the fictional present—is occupied in reading the minds of other characters, and they read those minds in good part by intuiting what they themselves and other people look like in those minds. Each character has a partial, incomplete view of the whole story. The narrator has the most complete view but is himself subsumed in Stegner's own imaginative vision. That vision encompasses the minds of all the characters, including the narrator's, and it also contains Stegner's intuitions about the minds of his readers. Those readers, in turn, take in the whole range of Stegner's simulations of other minds moving through time. Moreover, readers are aware that Stegner has intuitions about their own minds. They can sense that Stegner uses those intuitions to elicit their emotions—suspense, anxiety, affection, fear, relief, or dismay. Stegner's readers have to decide how much to trust him—whether to accept his insights, share his interests and sympathies, and live in the imaginative world he creates.

Many readers of this or any novel consult with other readers—talking about the novel with friends, or reading blurbs, book reviews, and critical essays. Those consultations affirm impressions, clarify them, add to them, or correct them. When reading critical essays or listening to friends, readers of the novel assess the minds of the friends or critics, evaluating how their diverse temperaments and tastes affect their views of Stegner and his novel. If meaning is what happens in minds (Carroll, 2018), the total meaning of Stegner's book includes not only the complicated forms of perspectival interplay he depicts but also the perspectival interplay radiating outward from people who read the novel and discuss it.

5 Literary Forms of Dreaming, Mind-Wandering, Autobiographical Narrative, and Counterfactual Thinking

Literature depicts human behavior and evokes subjective experience. Because imagination is so important a part of human behavior and experience, literature also depicts the imagination at work. Literature and imagination interact in a causal spiral: imagination produces literature, and literature, in turn, depicts the processes of imagination. By depicting those processes, literature alters and enriches the imagination of writers and readers. It thus extends and develops the adaptive functions of imagination.

The previous section describes how simulation, mental time travel, and perspective taking work in just one novel. That novel is particularly complex, but the three core processes at work in it are at work in all imaginative verbal artifacts. This current section offers a few examples of literary works that depict four forms of imagination that use the core processes for more specialized purposes: dreaming,

mind-wandering, autobiographical narrative, and counterfactual thinking. Unlike simulation, mental time travel, and perspective taking, these four forms of imagination do not appear in all imaginative verbal artifacts, but they do appear in many.

Dreaming combines recent memories with remoter memories and with general (“semantic”) knowledge. That process contributes to the consolidation of memories, which is vital to creating and sustaining a sense of a personal identity (Hartmann, 2007, 2011; Pace-Schott, 2013; Wamsley, 2018). Literature contains numerous examples of dream narratives such as the medieval poem *Piers Plowman*, Lewis Carroll’s Victorian novel *Alice’s Adventures in Wonderland* (1865), and Alan Lightman’s modern novel *Einstein’s Dreams* (1992). It contains even more frequent examples of episodes in which characters have emotionally significant dreams, as in Charles Dickens’s “A Christmas Carol” (1843), Emily Brontë’s *Wuthering Heights*, Fyodor Dostoevsky’s *The Brothers Karamazov* (1880), and Stegner’s *Angle of Repose* (1971).

Dreams are important in literature because they are important, adaptively functional, parts of human experience. They are also important because dreams deploy imaginative processes similar to those the imagination uses in symbolic and fantastic literature (Domhoff, 2018; Freud, 1959; Rupprecht, 2007, offers numerous examples of dreams in literature and also quotations from imaginative writers likening stories to dreams). Shakespeare points toward this connection between the modes of dreaming and the modes of symbolic fantasy in the title of his play *A Midsummer Night’s Dream*. A large subgenre of literature, both in poetry and prose, consists in surreal, dreamlike narratives. Examples include Nathaniel Hawthorne’s “Young Goodman Brown” (1835), George MacDonald’s hallucinatory fantasias *Phantastes* (1858) and *Lilith* (1895), Franz Kafka’s “A Country Doctor” (1917), Jorge Luis Borges’s “The Circular Ruins” (1940), William Burroughs’s *Naked Lunch* (1959), and Philip K. Dick’s nightmare dystopian fantasies *Do Androids Dream of Electric Sheep?* (1968) and *Ubik* (1969).

Like dreaming, mind-wandering is a form of spontaneous thought that is prompted by emotionally salient concerns and moves associatively (Andrews-Hanna et al., 2018; Christoff et al., 2016; d’Argembeau, 2018). Mind-wandering is translated into literature as “stream of consciousness,” a term coined by the psychologist William James (1890), brother of the novelist Henry James. High modernist fiction—literary fiction written between the two world wars—specialized in developing techniques for mimicking stream of consciousness. That method is the single most distinctive common feature in the novels of James Joyce, Virginia Woolf, William Faulkner, and Henry Miller. It is also used in the most famous and influential modernist poem, T. S. Eliot’s “The Waste Land” (1922).

Much of daydreaming is dedicated to providing material for autobiographical narratives. We all construct a story of ourselves (Andrews-Hanna, Saxe, et al., 2014; Andrews-Hanna, Smallwood, et al., 2014; Buckner, 2012; Buckner et al., 2008; d’Argembeau, 2018; McAdams, 2016; O’Callaghan & Irish, 2018; and see McAdams & Cowan, this volume). Because creating a coherent sense of self moving through time is so vital a part of human imaginative work, it is not surprising that first-person fictional autobiographies are a pervasive feature of narrative

literature, ranging from what many consider one of the first true novels (Daniel Defoe's *Robinson Crusoe*, 1719), through classic nineteenth-century novels such as Charlotte Brontë's *Jane Eyre* (1847), Dickens's *David Copperfield* (1850), and Mark Twain's *Huckleberry Finn* (1884), to modern novels such as Saul Bellow's *The Adventures of Augie March* (1953), Wallace Stegner's *Angle of Repose* (1971), William Boyd's *The New Confessions* (1987), and Mark Haddon's *The Curious Incident of the Dog in the Night-Time* (2003). First-person speech is even more frequent in the personas of lyric poetry. "I'm so lonesome I could cry" (Hank Williams, 1949). "I walk through the long schoolroom questioning/ ... — the children's eyes/In momentary wonder stare upon/A sixty-year-old smiling public man" (W. B. Yeats, "Among School Children," 1928). The English Romantic poet William Wordsworth used autobiographical narrative as the chief form for his longer poetry.

Counterfactual thinking consists in meditating on how things would have turned out if only this had happened rather than that—if only John had stayed home with Margie rather than going out with his friends, he might not have died in a car wreck before finishing his novel; or if Margie had gone with John rather than staying at home, she might not have survived to write the next great American novel (Abraham, 2016; Byrne, 2016, 2017; Roese & Epstude, 2017). Thinking counterfactually traces out alternative causal sequences and is thus closely connected to considering alternative plans for future action. Since humans routinely engage in counterfactual thinking, literature frequently depicts episodes of it. In *Angle of Repose*, Susan Burling Ward looks back constantly to her decision to marry Oliver Ward. In the early years, she can bask in the sense of having made a decision that allowed her fulfillment as a wife and mother. But she yearns toward the life that would have been open to her—travel in Europe and the constant companionship of cultivated people—if only she had not married. At any given point, the conflicting visions of her actual and her counterfactual past influence her decisions about what she will do in the future.

As a large-scale literary technique, counterfactual thinking is the basis for a specialized genre of fantasy: "alternate history." What would have happened if Japan and Germany had won World War Two (Philip K. Dick, *The Man in the High Castle*, 1962)? If Martin Luther had become Pope rather than breaking from the Church of Rome (Kingsley Amis, *The Alteration*, 1976)? Or if the Confederate states had possessed automatic weapons (Harry Turtledove, *The Guns of the South*, 1992)? More broadly, counterfactual thinking—thinking of scenarios different from the actual—is a necessary precondition for all fiction.

6 Conclusion: The Adaptive Functions of Imagination and of Literature

Intentional fictional constructs such as poems, plays, and novels are produced by the imagination and include among their subjects the forms of imagination. Those forms have adaptive functions: creating the self as a values-directed, goal-oriented

agent, understanding other people both for cooperative endeavor and for competitive manipulation, integrating individual identity and social group identity, creating new linkages among ideas, and understanding multiple alternative possible courses of action. Those particular functions add up to one overarching adaptive function: creating an imaginative virtual world, an inner world, that guides our behavior in the actual, physical world. Literature assimilates all the forms of imagination and fulfills their adaptive functions. Works of literature influence readers' imaginative world views, shape their self-images and personal narratives, and inform the values that determine their goals. In all these ways, literature influences behavior. It is a major part of the total adaptive repertoire of the human species.

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References

- Abraham, A. (2016). The imaginative mind. *Human Brain Mapping*, 37(11), 4197–4211. <https://doi.org/10.1002/hbm.23300>
- Abrams, M. H. (1953). *The mirror and the lamp: Romantic theory and the critical tradition*. New York: Oxford University Press.
- Addis, D. R., Pan, L., Vu, M.-A., Laiser, N., & Schacter, D. L. (2009). Constructive episodic simulation of the future and the past: Distinct subsystems of a core brain network mediate imagining and remembering. *Neuropsychologia*, 47(11), 2222–2238. <https://doi.org/10.1016/j.neuropsychologia.2008.10.026>
- Addis, D. R., Sacchetti, D. C., Ally, B. A., Budson, A. E., & Schacter, D. L. (2009). Episodic simulation of future events is impaired in mild Alzheimer's disease. *Neuropsychologia*, 47(12), 2660–2671. <https://doi.org/10.1016/j.neuropsychologia.2009.05.018>
- Alves, P. N., Foulon, C., Karolis, V., Bzdok, D., Margulies, D. S., Volle, E., & Thiebaut de Schotten, M. (2019). An improved neuroanatomical model of the default-mode network reconciles previous neuroimaging and neuropathological findings. *Communications Biology*, 2(1), 370. <https://doi.org/10.1038/s42003-019-0611-3>
- Andrews-Hanna, J. R. (2012). The brain's default network and its adaptive role in internal mentation. *The Neuroscientist*, 18(3), 251–270. <https://doi.org/10.1177/1073858411403316>
- Andrews-Hanna, J. R., Irving, Z. C., Fox, K. C. R., Spreng, R. N., & Christoff, K. (2018). The neuroscience of spontaneous thought: An evolving interdisciplinary field. In K. C. R. Fox & K. Christoff (Eds.), *The Oxford handbook of spontaneous thought: Mind-wandering, creativity, and dreaming* (pp. 143–163). New York: Oxford University Press.
- Andrews-Hanna, J. R., Reidler, J. S., Sepulcre, J., Poulin, R., & Buckner, R. L. (2010). Functional-anatomic fractionation of the brain's default network. *Neuron*, 65(4), 550–562. <https://doi.org/10.1016/j.neuron.2010.02.005>
- Andrews-Hanna, J. R., Saxe, R., & Yarkoni, T. (2014). Contributions of episodic retrieval and mentalizing to autobiographical thought: Evidence from functional neuroimaging, resting-state connectivity, and fMRI meta-analyses. *NeuroImage*, 91, 324–335. <https://doi.org/10.1016/j.neuroimage.2014.01.032>
- Andrews-Hanna, J. R., Smallwood, J., & Spreng, R. N. (2014). The default network and self-generated thought: Component processes, dynamic control, and clinical relevance. *Annals of the New York Academy of Sciences*, 1316(1), 29–52. <https://doi.org/10.1111/nyas.12360>

- Beaty, R. E., Benedek, M., Silvia, P. J., & Schacter, D. L. (2016). Creative cognition and brain network dynamics. *Trends in Cognitive Sciences*, 20(2), 87–95. <https://doi.org/10.1016/j.tics.2015.10.004>
- Beaty, R. E., Chen, Q., Christensen, A. P., Qiu, J., Silvia, P. J., & Schacter, D. L. (2018). Brain networks of the imaginative mind: Dynamic functional connectivity of default and cognitive control networks relates to openness to experience. *Human Brain Mapping*, 39(2), 811–821. <https://doi.org/10.1002/hbm.23884>
- Beaty, R. E., & Jung, R. E. (2018). Interacting brain networks underlying creative cognition and artistic performance. In K. C. R. Fox & K. Christoff (Eds.), *The Oxford handbook of spontaneous thought: Mind-wandering, creativity, and dreaming* (pp. 275–283). New York: Oxford University Press.
- Benedek, M., & Fink, A. (2019). Toward a neurocognitive framework of creative cognition: The role of memory, attention, and cognitive control. *Current Opinion in Behavioral Sciences*, 27, 116–122. <https://doi.org/10.1016/j.cobeha.2018.11.002>
- Benedek, M., & Jauk, E. (2018). Spontaneous and controlled processes in creative cognition. In K. C. R. Fox & K. Christoff (Eds.), *The Oxford handbook of spontaneous thought: Mind-wandering, creativity, and dreaming* (pp. 285–298). New York: Oxford University Press.
- Bergen, B. K. (2012). *Louder than words: The new science of how the mind makes meaning*. New York: Basic Books.
- Bergen, B. K. (2016). Embodiment, simulation, and meaning. In N. Riemer (Ed.), *The Routledge handbook of semantics* (pp. 142–157). Abingdon, UK: Routledge.
- Binder, J. R., Frost, J. A., Hammeke, T. A., Bellgowan, P. S. F., Rao, S. M., & Cox, R. W. (1999). Conceptual processing during the conscious resting state: A functional MRI study. *Journal of Cognitive Neuroscience*, 11(1), 80–93. <https://doi.org/10.1162/089892999563265>
- Boyd, B. (2009). *On the origin of stories: Evolution, cognition, and fiction*. Cambridge, MA: Harvard University Press.
- Broyd, S. J., Demanuele, C., Debener, S., Helps, S. K., James, C. J., & Sonuga-Barke, E. J. S. (2009). Default-mode brain dysfunction in mental disorders: A systematic review. *Neuroscience & Biobehavioral Reviews*, 33(3), 279–296. <https://doi.org/10.1016/j.neubiorev.2008.09.002>
- Buckner, R. L. (2012). The serendipitous discovery of the brain's default network. *NeuroImage*, 62(2), 1137–1145. <https://doi.org/10.1016/j.neuroimage.2011.10.035>
- Buckner, R. L. (2013). The brain's default network: Origins and implications for the study of psychosis. *Dialogues in Clinical Neuroscience*, 15(3), 351–358.
- Buckner, R. L., Andrews-Hanna, J. R., & Schacter, D. L. (2008). The brain's default network: Anatomy, function, and relevance to disease. *Annals of the New York Academy of Sciences*, 1124, 1–38. <https://doi.org/10.1196/annals.1440.011>
- Buckner, R. L., & DiNicola, L. M. (2019). The brain's default network: Updated anatomy, physiology and evolving insights. *Nature Reviews Neuroscience*, 20(10), 593–608. <https://doi.org/10.1038/s41583-019-0212-7>
- Byrne, R. M. J. (2016). Counterfactual thought. *Annual Review of Psychology*, 67(1), 135–157. <https://doi.org/10.1146/annurev-psych-122414-033249>
- Byrne, R. M. J. (2017). Counterfactual thinking: From logic to morality. *Current Directions in Psychological Science*, 26(4), 314–322. <https://doi.org/10.1177/0963721417695617>
- Carroll, J. (2006). The human revolution and the adaptive function of literature. *Philosophy and Literature*, 30(1), 33–49. <https://doi.org/10.1353/phl.2006.0005>
- Carroll, J. (2012). The truth about fiction: Biological reality and imaginary lives. *Style*, 46(2), 129–160.
- Carroll, J. (2018). Minds and meaning in fictional narratives: An evolutionary perspective. *Review of General Psychology*, 22(2), 135–146. <https://doi.org/10.1037/gpr0000104>
- Carroll, J. (2019). Death in literature. In T. K. Shackelford & V. Zeigler-Hill (Eds.), *Evolutionary perspectives on death* (pp. 137–159). Cham: Springer.

- Chen, Q.-L., Xu, T., Yang, W.-J., Li, Y.-D., Sun, J.-Z., Wang, K.-C., ... Qiu, J. (2015). Individual differences in verbal creative thinking are reflected in the precuneus. *Neuropsychologia*, 75, 441–449. <https://doi.org/10.1016/j.neuropsychologia.2015.07.001>
- Christoff, K., Irving, Z. C., Fox, K. C. R., Spreng, R. N., & Andrews-Hanna, J. R. (2016). Mind-wandering as spontaneous thought: A dynamic framework. *Nature Reviews Neuroscience*, 17, 718–731. <https://doi.org/10.1038/nrn.2016.113>
- Corballis, M. C. (2014). *The wandering mind: What the brain does when you're not looking*. Auckland, New Zealand: Auckland University Press.
- d'Argembeau, A. (2018). Mind-wandering and self-referential thought. In K. C. R. Fox & K. Christoff (Eds.), *The Oxford handbook of spontaneous thought: Mind-wandering, creativity, and dreaming* (pp. 181–191). New York: Oxford University Press.
- Dennett, D. C. (1987). *The intentional stance*. Cambridge, MA: MIT Press.
- Dissanayake, E. (2000). *Art and intimacy: How the arts began*. Seattle: University of Washington Press.
- Domhoff, G. W. (2018). *The emergence of dreaming: Mind-wandering, embodied simulation, and the default network*. New York: Oxford University Press.
- Eichner, H. (1982). The rise of modern science and the genesis of romanticism. *Publications of the Modern language Association of America*, 97(1), 8–30. <https://doi.org/10.2307/462237>
- Forster, E. M. (1927). *Aspects of the novel*. London: E. Arnold.
- Freud, S. (1959). Creative writers and daydreaming (J. Strachey, Trans.). In J. Strachey (Ed.), *Writings on art and literature* (Vol. 9, pp. 142–153). London: Hogarth.
- Gallese, V. (2017). Visions of the body. Embodied simulation and aesthetic experience. *Aisthesis*, 1(1), 41–50. <https://doi.org/10.13128/Aisthesis-20902>
- Geiger, A., Bente, G., Lammers, S., Tepest, R., Roth, D., Bzdok, D., & Vogeley, K. (2019). Distinct functional roles of the mirror neuron system and the mentalizing system. *NeuroImage*, 202, 116102. <https://doi.org/10.1016/j.neuroimage.2019.116102>
- Harris, P. L. (2000). *The work of the imagination*. Oxford: Blackwell Publishers.
- Hartmann, E. (2007). The nature and functions of dreaming. In D. Barrett & P. McNamara (Eds.), *The new science of dreaming: Content, recall and personality correlates* (Vol. 3, pp. 171–192). Westport, CT: Praeger.
- Hartmann, E. (2011). *The nature and functions of dreaming*. New York: Oxford University Press.
- Hassabis, D., & Maguire, E. A. (2007). Deconstructing episodic memory with construction. *Trends in Cognitive Sciences*, 11(7), 299–306. <https://doi.org/10.1016/j.tics.2007.05.001>
- Hassabis, D., & Maguire, E. A. (2009). The construction system of the brain. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 364(1521), 1263–1271. <https://doi.org/10.1098/rstb.2008.0296>
- Hatfield, G. C., & Pittman, H. (2013). *Evolution of mind, brain, and culture*. Philadelphia: University of Pennsylvania Museum of Archaeology and Anthropology.
- Healey, M. L., & Grossman, M. (2018). Cognitive and affective perspective-taking: Evidence for shared and dissociable anatomical substrates. *Frontiers in Neurology*, 9(491). <https://doi.org/10.3389/fneur.2018.00491>
- Immordino-Yang, M. H., Christodoulou, J. A., & Singh, V. (2012). Rest is not idleness: Implications of the brain's default mode for human development and education. *Perspectives on Psychological Science*, 7(4), 352–364. <https://doi.org/10.1177/1745691612447308>
- James, W. (1890). *The principles of psychology*. New York: Henry Holt.
- Jauk, E. (2019). A bio-psycho-behavioral model of creativity. *Current Opinion in Behavioral Sciences*, 27, 1–6. <https://doi.org/10.1016/j.cobeha.2018.08.012>
- Jung, C. G. (1966). On the relation of analytical psychology to poetry (R. F. C. Hull, Trans.). In S. H. Read, M. Fordham, G. Adler, & W. McGuire (Eds.), *The collected works of C. G. Jung* (pp. 65–83). Princeton: Princeton University Press.
- Jung, R. E., & Vartanian, O. (2018). *The Cambridge handbook of the neuroscience of creativity*. Cambridge, UK: Cambridge University Press.

- Kanske, P. (2018). The social mind: Disentangling affective and cognitive routes to understanding others. *Interdisciplinary Science Reviews*, 43(2), 115–124. <https://doi.org/10.1080/03080188.2018.1453243>
- Kaufman, S. B., & Gregoire, C. (2015). *Wired to create: Unraveling the mysteries of the creative mind*. New York: Penguin Random House.
- Kernbach, J. M., Yeo, B. T. T., Smallwood, J., Margulies, D. S., Thiebaut de Schotten, M., Walter, H., ... Bzdok, D. (2018). Subspecialization within default mode nodes characterized in 10,000 UK Biobank participants. *Proceedings of the National Academy of Sciences of the United States of America*, 115(48), 12295–12300. <https://doi.org/10.1073/pnas.1804876115>
- Killingsworth, M. A., & Gilbert, D. T. (2010). A wandering mind is an unhappy mind. *Science*, 330(6006), 932–932. <https://doi.org/10.1126/science.1192439>
- Klein, R. G. (2008). Out of Africa and the evolution of human behavior. *Evolutionary Anthropology: Issues, News, and Reviews*, 17(6), 267–281. <https://doi.org/10.1002/evan.20181>
- Mar, R. A., & Oatley, K. (2008). The function of fiction is the abstraction and simulation of social experience. *Perspectives on Psychological Science*, 3(3), 173–192. <https://doi.org/10.1111/j.1745-6924.2008.00073.x>
- Margulies, D. S., Ghosh, S. S., Goulas, A., Falkiewicz, M., Huntenburg, J. M., Langs, G., ... Smallwood, J. (2016). Situating the default-mode network along a principal gradient of macroscale cortical organization. *Proceedings of the National Academy of Sciences of the United States of America*, 113(44), 12574–12579. <https://doi.org/10.1073/pnas.1608282113>
- McAdams, D. P. (2015). *The art and science of personality development*. New York: Guilford Press.
- McAdams, D. P. (2016). From actor to agent to author: Human evolution and the development of personality. In J. Carroll, D. P. McAdams, & E. O. Wilson (Eds.), *Darwin's bridge: Uniting the humanities and sciences* (pp. 145–163). New York: Oxford University Press.
- McBrearty, S., & Brooks, A. S. (2000). The revolution that wasn't: A new interpretation of the origin of modern human behavior. *Journal of Human Evolution*, 39(5), 453–563.
- McLean, K. C. (2016). *The co-authored self: Family stories and the construction of personal identity*. New York: Oxford University Press.
- Mellars, P. (Ed.). (2007). *Rethinking the human revolution: New behavioural and biological perspectives on the origin and dispersal of modern humans*. Cambridge, UK: McDonald Institute for Archaeological Research.
- Mellars, P., & Stringer, C. B. (Eds.). (1989). *The human revolution: Behavioural and biological perspectives on the origins of modern humans*. Princeton, NJ: Princeton University Press.
- Mineroff, Z., Blank, I. A., Mahowald, K., & Fedorenko, E. (2018). A robust dissociation among the language, multiple demand, and default mode networks: Evidence from inter-region correlations in effect size. *Neuropsychologia*, 119, 501–511. <https://doi.org/10.1016/j.neuropsychologia.2018.09.011>
- Mithen, S. J. (1996). *The prehistory of the mind: A search for the origins of art, religion, and science*. London: Thames and Hudson.
- Mithen, S. J. (2001). The evolution of imagination: An archaeological perspective. *SubStance*, 30(1), 28–54.
- Molnar-Szakacs, I., & Uddin, L. Q. (2013). Self-processing and the default mode network: Interactions with the mirror neuron system. *Frontiers in Human Neuroscience*, 7, 571–571. <https://doi.org/10.3389/fnhum.2013.00571>
- Neubauer, S., Hublin, J.-J., & Gunz, P. (2018). The evolution of modern human brain shape. *Science Advances*, 4(1), eaao5961. <https://doi.org/10.1126/sciadv.aao5961>
- O'Callaghan, C., & Irish, M. (2018). Candidate mechanisms of spontaneous cognition as revealed by dementia syndromes. In K. C. R. Fox & K. Christoff (Eds.), *Oxford handbook of spontaneous thought* (pp. 495–508). New York: Oxford University Press.
- Oatley, K. (2011). *Such stuff as dreams: The psychology of fiction*. Chichester, UK: Wiley-Blackwell.
- Oatley, K. (2016). Fiction: Simulation of social worlds. *Trends in Cognitive Sciences*, 20(8), 618–628. <https://doi.org/10.1016/j.tics.2016.06.002>

- Pace-Schott, E. F. (2013). Dreaming as a story-telling instinct. *Frontiers in Psychology*, 4, 159. <https://doi.org/10.3389/fpsyg.2013.00159>
- Powell, A., Shennan, S., & Thomas, M. G. (2009). Late pleistocene demography and the appearance of modern human behavior. *Science*, 324(5932), 1298–1301. <https://doi.org/10.1126/science.1170165>
- Power, J. D., Cohen, A. L., Nelson, S. M., Wig, G. S., Barnes, K. A., Church, J. A., ... Petersen, S. E. (2011). Functional network organization of the human brain. *Neuron*, 72(4), 665–678. <https://doi.org/10.1016/j.neuron.2011.09.006>
- Raichle, M. E. (2015). The brain's default mode network. *Annual Review of Neuroscience*, 38, 433–447.
- Raichle, M. E., MacLeod, A. M., Snyder, A. Z., Powers, W. J., Gusnard, D. A., & Shulman, G. L. (2001). A default mode of brain function. *Proceedings of the National Academy of Sciences of the United States of America*, 98(2), 676–682. <https://doi.org/10.1073/pnas.98.2.676>
- Roose, N. J., & Epstude, K. (2017). Chapter one—The functional theory of counterfactual thinking: New evidence, new challenges, new insights. *Advances in Experimental Social Psychology*, 56, 1–79. <https://doi.org/10.1016/bs.aesp.2017.02.001>
- Roth, I. (2007). Imaginative minds: Concepts, controversies, and themes. In I. Roth (Ed.), *Imaginative minds* (pp. xix–xxxvi). Oxford: Oxford University Press.
- Rupprecht, C. S. (2007). Dreaming, language, literature. In D. Barrett & P. McNamara (Eds.), *The new science of dreaming: Cultural and theoretical perspectives* (Vol. 3, pp. 1–34). Westport, CT: Praeger.
- Schacter, D. L. (2018). Implicit memory, constructive memory, and imagining the future: A career perspective. *Perspectives on Psychological Science*, 14(2), 256–272. <https://doi.org/10.1177/1745691618803640>
- Schacter, D. L., Carpenter, A. C., Devitt, A., Roberts, R. P., & Addis, D. R. (2018). Constructive episodic simulation, flexible recombination, and memory errors. *Behavioral and Brain Sciences*, 41, e32. <https://doi.org/10.1017/S0140525X17001510>
- Smallwood, J., Margulies, D. S., Bernhardt, B. C., & Jefferies, E. (2018). Investigating the elements of thought: Toward a component process account of spontaneous cognition. In K. C. R. Fox & K. Christoff (Eds.), *The Oxford handbook of spontaneous thought: Mind-wandering, creativity, and dreaming* (pp. 71–83). New York: Oxford University Press.
- Smallwood, J., & Schooler, J. W. (2015). The science of mind wandering: Empirically navigating the stream of consciousness. *Annual Reviews*, 66(1), 487–518. <https://doi.org/10.1146/annurev-psych-010814-015331>
- Spreng, R. N., Stevens, W. D., Chamberlain, J. P., Gilmore, A. W., & Schacter, D. L. (2010). Default network activity, coupled with the frontoparietal control network, supports goal-directed cognition. *NeuroImage*, 53(1), 303–317. <https://doi.org/10.1016/j.neuroimage.2010.06.016>
- Stan, D., & Christoff, K. (2018). Potential clinical benefits and risks of spontaneous thought: Unconstrained attention as a way into and a way out of psychological disharmony. In K. C. R. Fox & K. Christoff (Eds.), *The Oxford handbook of spontaneous thought: Mind-wandering, creativity, and dreaming* (pp. 479–491). New York: Oxford University Press.
- Stevenson, L. (2003). Twelve conceptions of imagination. *The British Journal of Aesthetics*, 43(3), 238–259. <https://doi.org/10.1093/bjaesthetics/43.3.238>
- Suddendorf, T. (2013). *The gap: The science of what separates us from other animals*. New York: Basic Books.
- Suddendorf, T., Addis, D. R., & Corballis, M. C. (2009). Mental time travel and the shaping of the human mind. *Philosophical Transactions: Biological Sciences*, 364(1521), 1317–1324.
- Suddendorf, T., & Corballis, M. C. (2007). The evolution of foresight: What is mental time travel, and is it unique to humans? *Behavioral and Brain Sciences*, 30(03), 299–313.
- Tamir, D. I., Bricker, A. B., Dodel-Feder, D., & Mitchell, J. P. (2015). Reading fiction and reading minds: The role of simulation in the default network. *Social Cognitive and Affective Neuroscience*, 11, 215–224. <https://doi.org/10.1093/scan/nsv114>

- Taylor, M. (2013). Imagination. In P. D. Zelazo (Ed.), *The Oxford handbook of developmental psychology* (pp. 791–831). New York: Oxford University Press.
- Thiessen, D. D. (1997). *Bittersweet destiny: The stormy evolution of human behavior*. New Brunswick, NJ: Transaction Publishers.
- Thomas, N. (2014). The multidimensional spectrum of imagination: Images, dreams, hallucinations, and active, imaginative perception. *Humanities*, 3(2), 132.
- Vogeley, K. (2017). Two social brains: Neural mechanisms of intersubjectivity. *Philosophical Transactions of the Royal Society B: Biological Sciences*, 372(1727), 20160245. <https://doi.org/10.1098/rstb.2016.0245>
- Wamsley, E. J. (2018). Dreaming and waking thought as a reflection of memory consolidation. In K. C. R. Fox & K. Christoff (Eds.), *The Oxford handbook of spontaneous thought: Mind-wandering, dreaming, and creativity* (pp. 457–468). New York: Oxford University Press.
- Wilson, E. O. (1998). *Consilience: The unity of knowledge*. New York: Knopf.
- Wrangham, R. W. (2019). *The goodness paradox: The strange relationship between virtue and violence in human evolution*. New York: Pantheon Books.
- Zabelina, D. L., & Andrews-Hanna, J. R. (2016). Dynamic network interactions supporting internally-oriented cognition. *Current Opinion in Neurobiology*, 40, 86–93. <https://doi.org/10.1016/j.conb.2016.06.014>
- Zunshine, L. (2006). *Why we read fiction: Theory of mind and the novel*. Columbus: Ohio State University Press.

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