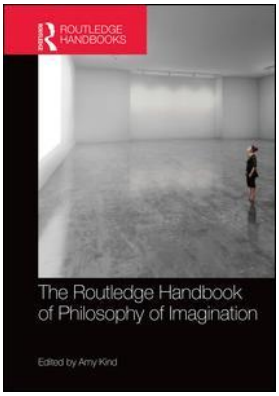

The Routledge Handbook of Philosophy of Imagination

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Imagination and creativity

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IMAGINATION AND CREATIVITY

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If I ask you to imagine the sun setting over the sea, you will easily comply; and there is nothing creative about this familiar image. But while imagination and creative behavior come apart, it is nonetheless true that some of our most creative minds are also some of our most imaginative minds. This chapter attempts to identify some of the central ways that they relate by asking what roles imagination plausibly plays in human creativity.

For purposes of this discussion, a liberal characterization of the concept of imagination can be assumed. Imagination is typically, though not always, a voluntary mental activity that involves mental representation of subjectively nonpresent objects and events. It often involves an image, sensory in character, but perhaps it need not. That is, perhaps there is imageless propositional imagination.

"Creativity" requires a bit more clarification, but here again commitments can be kept sparse. Competent users of the concept will attribute "creative" to persons (the artist, the scientist), to products (the artwork, the theory), and to processes (whatever means by which the individual made the product). In each case, there is a convergence in the historical and contemporary literature upon two conditions for creativity attribution. First, creativity requires novelty. To be creative, an *x* must be novel *relative to* some comparison class. Note that this last qualification affords flexibility: some *x* might be novel relative to human history, or to some particular spatial or temporal locale, or even to an individual's history of thought.[1] And this flexibility implies that creativity is a degree concept: the *x* that is novel relative to the whole of human history is *more* creative than an *x* novel relative only to some smaller comparison class. Secondly, most theorists maintain that creativity requires value. As Kant put it, "there can also be original nonsense" (Kant 1781/2000, 186), and nonsense is not creative. So, creativity requires, in addition to novelty, that an *x* be of some value to its maker and/or its context of making.[2] Beyond a novelty and a value condition, theorists vary substantially. Some argue that creativity requires agency: there are no accidental instances of creativity.[3] Some argue that creativity must involve some substantial psychological or computational breakthrough, perhaps where the individual manages to think or do something that she *could* not have done before.[4] Some recent accounts isolate the creative process, and argue that what's distinctive about it is the way it is experienced or acted.[5] Here only the novelty and value conditions are assumed.[6]

While there has recently been some increase in philosophical research on creativity, it remains a largely underexplored subject matter. Similarly, research on imagination focuses

largely on its use for *recreating*, as one does when imagining along with a narrative or thinking of a pleasurable past event, rather than its uses for creating something new and valuable.[7] Plausibly, the same (broadly typed) imaginative processes can be *used* in these two different ways: in ways guided by a goal of mentally mirroring or recreating, or as motivated to some end of creativity or discovery. This is an important qualification for anyone interested in researching creativity: much of recent philosophical and psychological work on imagination (in either use) is plausibly relevant to the more neglected topic of the two.

The chapter proceeds as follows. Sections 1 and 2 focus on two traditional philosophical treatments of imagination and creativity. Section 3 focuses on imagination in the context of science. Section 4 concludes with a brief review of some recent work on conceptual and empirical relations between imagination and creativity.

1 Kant

Immanuel Kant's discussion of creativity focuses centrally on artistic genius. Artistic creativity essentially involves originality for Kant, and accordingly the genius engages in non-rule-bound imaginative activity. Kant suggests that the faculty for creativity in art is innate and unteachable, and that processes of artistic creation are ineffable to artist and audience both. In one famous passage, Kant writes:

> Genius is the talent (natural gift) that gives the rule to art. Since the talent, as an inborn productive faculty of the artist, itself belongs to nature, this could also be expressed thus: Genius is the inborn predisposition of the mind (*ingenium*) through which nature gives the rule to art.
>
> *(Kant 1781/2000, 186)*

Here Kant echoes an idea traceable to Plato, namely, that the creative individual is a conduit for some kind of uncontrolled force, be it a deity or nature. Accordingly, creativity cannot be learned, and it cannot be explained. This general claim – that creativity is inexplicable if not magical – influenced much romantic theorizing about creativity in the two centuries that followed, accordingly discouraging theorists of an analytic, naturalistic, or generally scientific approach.[8] That said, Kant's analysis of creativity is rich and varied, and lessons for explaining creativity can still be learned from his discussion of imagination in creative behavior.[9]

In many respects, Kant's account of artistic creativity mirrors his account of aesthetic judgment. To begin, note that Kant claims that judgments of taste – that an object is beautiful – are importantly different from cognitive judgments. When one judges that, say, an event is a sunset, one places one's sensory impressions under a concept, following a kind of rule. By contrast, when one judges beautiful a sunset or a painting of a sunset, this judgment does not itself involve application of any rule or concept. Instead, one recognizes the "purposiveness of form" of the object. In the case of an art object, one represents the object's form as exemplifying a kind of purpose but, necessarily, without identifying any particular purpose – as Kant sometimes puts it, "*as if* it were a mere product of nature" (Kant 1781/2000, 185; emphasis added). And this mental representation involves a balanced use of imagination and understanding which, as we will see, is the "free play" also required of the creative artist.

Before discussing how this account of aesthetic judgment informs the account of artistic creativity, it is worth briefly noting how some of the same claims serve to exclude scientists from the realm of genius. Kant takes as a platitude that acts of genius, since they essentially involve originality, logically oppose acts of imitation. He then argues:

> [S]ince learning is nothing but imitation, even the greatest aptitude for learning, facility for learning (capacity) as such, still does not count as genius. But even if one thinks or writes for himself, and does not merely take up what others have thought, indeed even if he invents a great deal for art and science, this is still not a proper reason for calling such a great mind … a genius, since just this sort of thing could also have been learned, and thus still lies on the natural path of inquiry and reflection in accordance with rules, and is not specifically distinct from that which can be acquired by means of imitation.
>
> *(Kant 1781/2000, 187)*

From this line of thought, Kant concludes that a scientist like Newton, although possessing "a great mind," is not a genius. Newton's discovery can be recounted in stepwise fashion, and accordingly learned and codified into rules. By contrast, great art, although based in some fundamental skill, falls under no determinate rules and so cannot be imitated, taught, or learned.

Whatever this argument's success,[10] let us grant that there *are* geniuses in the context of art making, and then ask about the theory of mind Kant offers. So, Kant does acknowledge that the artist must learn some skills, namely, those foundational to her chosen artistic medium. In addition to this cognitive understanding, the artist must execute aesthetic judgment (understood as per above). Indeed, the artist is the first to judge the beauty of the work, and for Kant this judgment is

> the discipline … of genius, clipping its wings and making it well behaved or polished; … it gives genius guidance as to where and how far it should extend itself if it is to remain purposive; and by introducing clarity and order into the abundance of thoughts it makes the ideas tenable, capable of enduring and universal approval …
>
> *(Kant 1781/2000, 197)*

Although not wholly rule-bound then, understanding and judgment constrain the artist's process; in particular, they constrain her *productive imagination*.

The *reproductive imagination* is, for Kant, largely the traditional empiricist imagination: it involves mental representation of an object or event that is not present to the senses. It further involves placing items from the sensory manifold under concepts and so is essential for knowledge acquisition and bound by empirical laws. Productive imagination, by contrast, is comparably unconstrained, involving what Kant often calls "rapid" and "free play," and transcends concept and language.[11] It is the "spirit" of genius, animating the artistic mind and providing new materials for cognizing, materials that are not amenable to strict conceptualization. Kant calls these materials "aesthetic ideas," which eventually make up the ineffable content of a work of art. The genius is able to harness this raw and unwieldy material, through her understanding and taste, and thereby to "express what is unnameable … to make it universally communicable, whether the expression consist in language, or painting, or in plastic art" (Kant 1781/2000, 195). In turn, this expressive content is what one properly appreciates in judging the work as beautiful, a purposiveness without an applicable concept.

For Kant, what distinguishes the mental activity of genius, then, is this exceptionally free play between imagination and understanding. This is richly productive imagination, enjoyed only by the artistic genius by contrast to the merely competent artist. Without it, one will fail to create a work that is both original and appropriate for the Kantian judgment of beauty – one of wide if not universal appeal that provides "a standard … for judging" (Kant 1781/2000,

187). It is here that Kant departs most clearly from his empiricist predecessors. The productive imagination of the genius is transcendental and a priori: it goes beyond what has been previously given in experience and provides new concepts (Kant even sometimes says "rules") for experience without being determined by any existing concepts.[12] And it is neither willed nor predicted, but instead the inspiration provided by nature. The romantic goes too far, however, if she generalizes this feature to Kant's entire account. The artistic genius manages to guide these materials into a finished product using the imagination "powerful in creating, as it were, another nature, out of the material which the real one gives it" (Kant 1781/2000, 192). So while artistic creativity involves for Kant some uncontrolled inspiration, it also involves what some have called a "mastery of nature."[13]

2 Sartre

There are some surprising points of overlap between Kant's analysis and the one given by Jean-Paul Sartre in his various texts on the imagination.[14] Sartre also distinguishes the (empiricist) reproductive imagination from a productive imagination, and further argues that it is the latter that enjoys the flexibility needed for creativity. And, like Kant, Sartre maintains that the imagination serves a role in everyday activity, for example in our aesthetic appreciation of artworks and literature. Unlike Kant, however, Sartre maintains that the latter kind of activity – say, reading a novel – is a genuinely creative one. And this activity exemplifies a much bigger and more important existentialist role for the imagination, namely, the creation of the self.

Part of Sartre's project is to distinguish imagination from perception, but in a way that does not commit to the reification that Sartre charges early modern analyses with. Descartes, Leibniz, and Hume all committed to what Sartre called "thingism," an assumption that mental images are, like the environmental objects that we perceptually experience, *things* in their own right. This assumption is then echoed, as Sartre traces it, throughout nineteenth- and twentieth-century philosophical and psychological theorizing.[15] Sartre's view is that once this assumption is made, there is no logically consistent method to vindicate our pretheoretic, phenomenologically grounded distinction between perception and imagination. And so we must reject the assumption – the only objects are the objects of perception: people, tables, chairs, and so on – and mark the distinction in some other way.

Sartre identifies four characteristics of images. His starting assumption anticipates what philosophers of perception today call the "transparency of experience."

> [I]t is certain that when I produce in myself the image of Pierre, it is Pierre who is the object of my current consciousness. So long as that consciousness remains unaltered, I can give a description of the object as it appears to me as imaged, but not of the image as such. To determine the characteristics of the image as image, it is necessary to turn to a new act of consciousness: it is necessary to *reflect*. So the image as image is describable only by a second-order act in which the look is turned away from the object and directed at the way in which the object is given.
>
> *(Sartre 1940/2004, 4)*

So a mental image for Sartre is an intentional relation: a way of being conscious *of* an object or event, where this awareness is transparent in the first order. One enjoys an "imaging consciousness of" – rather than *perceptual* consciousness of – Pierre. Second, imagery is *quasi-observational*; an image is impoverished relative to a perceptual experience in the sense that it

contains only those features that the imaginer gives it, while perceived objects "overflow consciousness" in their features. Third, perceived objects come as present to oneself, while images give their objects, phenomenally, as a "nothingness," as not being present (to the imaginer). Fourth, and as a counterpart to this last feature of images, Sartre contrasts the passivity of perception with the voluntary spontaneity of imagination, claiming that "an imaging consciousness gives itself to itself as an imaging consciousness, which is to say as a spontaneity that produces and conserves the object as imaged" (Sartre 1940/2004, 14).

It is the combination of these four characteristics that gives images, for Sartre, their distinctively creative power. Absent the phenomenal commitment to the presence of an imaged object, the imaginer engages in the voluntary production of objects-as-imaged, as existing or nonexisting, but never as present. The freedom that allegedly comes with the active *doing* of imagining comports well with a pretheoretical feature of imagining, namely, that it is richly playful. Furthermore, because imaged contents are quasi-observational, one is responsible for them in a way different from the contents of perception and thought. And because imagery is transparent, imaged contents enjoy similar mental consequence, where one can become attentively and emotionally engaged with one's own imaginative productions. Thus,

> The consciousness appears to itself as creative, but without positing as object this creative character. It is thanks to this vague and fugitive quality that the image consciousness is not given as a piece of wood that floats on the sea, but as a wave among the waves. It feels itself to be consciousness through and through and homogeneous with the other consciousnesses that have preceded it and with which it is synthetically united.
>
> *(Sartre 1940/2004, 14)*

Representing in imagination, then, is a creative conscious activity for Sartre: "In the image, that [representative] element … is the product of a conscious activity, is shot through with a flow of creative will" (15).

Sartre applies this account to our uptake of literary and performance arts. When one reads a novel, there is a series of explicit statements describing the characters and events of the story. But as many contemporary philosophers have noted, the story is not exhausted by these descriptions. Rather, the author will rely upon the reader to "fill in" details left out of the explicit descriptions. For example, it may never be stated in a story that a human character's blood is red, but if the reader is explicitly told that the character entered the room with blood stains on her shirt, the reader will infer that there are red stains on the character's shirt.[16] Sartre anticipates this in his own theorizing, but also notes how the reader bears, for her own conscious experience, the responsibility for filling out the sensible details like those that give an analogous nonfictional situation its rich character or, as Sartre would say, its irreality. He writes, "To read is to realize contact with the irreal world on the signs. In this world there are plants, animals, fields, towns, people: initially those mentioned in the book and then a host of others that are not named but are in the background and give this world its depth …" (Sartre 1940/2004, 64). Importantly for Sartre, this imaginative activity, although guided by the text (by "the signs" or "words"), is richly creative. The artist's creative act is "an incomplete and abstract moment in the production of a work" (Sartre 1947b/1988, 52). The completed work requires the reader to be complicit in creation of the fictional world. This creative collaboration explains why different readers sometimes enjoy markedly different experiences of the same text. It also explains, given Sartre's account of imagination as described just above, why our engagement with narrative arts can be so powerful.

Productive imagination is free and spontaneous, allowing for much flexibility even when guided by a narrative. But it is also transparent in the sense described above, so that we "see through" our images to the irreal world partly of our own creation.

The creative imagination is of even deeper importance for Sartre's broader philosophy. A central subject for discussion in *Being and Nothingness* (Sartre 1948) is "bad faith," where individuals practice methods of self-deception in order to avoid the responsibility that comes with free will. This practice is enabled by the imagined scenarios and roles that an individual creates in order to "blind" oneself from the reality of free choice. But in a positive light, imagination also seems essential to how we become, how we create and identify as, individual selves. The world comes to us in a certain way, but on Sartre's view we are free and accordingly how we organize our experiences of the world, and how we identify as selves in that world, are a constant opportunity for creativity. As Jonathan Webber describes it, freedom for Sartre is intimately bound up with imagination: "We can imagine the world or any part of it being different from the way it in fact is. This ability is necessary to motivate changing the world. We can imagine it, moreover, as being different in any number of ways, and so can present ourselves with any number of ways that we might try to mould it. We are therefore not compelled to live in the world as we find it. We can and do act to change it, and this involves imagination" (Webber 2004, xxvi). In turn, these imaginative doings are central to how we create, through an imagined narrative, our selves. Therefore, imagination plays a core role in Sartre's existentialist philosophy.[17]

3 Imagination, scientific discovery, and experiment

As discussed above, Kant excluded scientists from the category of genius which, by Kant's analysis, was to exclude them from acting in any richly creative ways. One of Kant's arguments is that scientific discovery can be described procedurally and therefore learned. Newton, Kant suggested, could "make all the steps that he had to take, from the first elements of geometry to his great and profound discoveries, entirely intuitive not only to himself but also to everyone else, and thus set them out for posterity quite determinately" (Kant 1781/2000, 187). Great artists, by contrast, act in ways that are not captured in steps or rules, and so are not teachable.

A fundamental point for Kant was that the scientist's discovery is perfectly rational. This connects in interesting ways with a distinction familiar in early twentieth-century philosophy of science. As first explicitly marked by Hans Reichenbach (1938), one can distinguish the *context of discovery* from the *context of justification*. The insights involved in constructing a new scientific hypothesis or theory are of mere psychological or sociological interest, but not of genuine import to the epistemic value of the resultant theory. As Karl Popper (1934/1959) understood it, a philosophy of science should focus not on the insight stage of discovery involving creator and context, but instead only on the context of justification where an hypothesis is made testable and the logical relations between evidence and hypothesis can be independently evaluated. Notice how this is grounded in a reason that inverts Kant's: the stage of scientific insight according to these theorists is rationally unconstrained. What's common to both is that scientific discovery, at the stage of insight and innovation, is not particularly interesting vis-à-vis creativity – for Kant, because it is simply procedural, for Reichenbach and others, because it is simply too unconstrained.

From the perspective of philosophy of mind, both hypotheses are unsatisfying since, in a clear sense, the insight stage is where much of the mental action occurs. And philosophers of science too, especially beginning in the 1960s, have rejected the discovery/justification

distinction, at least in the sense that the study of science will be impoverished if and to the degree that it eschews any discussion of the psychology and sociology that, as a matter of fact, underpin scientific innovation. This is perhaps most famously argued by Thomas Kuhn (1962) in his work on scientific revolutions, but there are some less frequently discussed theorists, and ones that well highlight the possible role of imagination in scientific discovery.

Michael Polanyi's work casts doubt on both Kant and Reichenbach. He denies the Kantian view that a scientific discovery is rational and stepwise. And Polanyi resists the assumption that theory commitment and explanation in science is a strictly logical matter. Across nearly four decades of publications, through consideration of examples from Copernicus to Kepler, Einstein to Planck, Darwin to Mendel, Polanyi motivates the claim that "the capacity rightly to *choose* a line of thought the end of which is vastly *indeterminate*, is as much part of the scientific method as the power of assuring the exactitude of the conclusions eventually arrived at" (Polanyi 1974, 62; emphasis added). Two important bases for Polanyi's analysis are these: (1) theoretical decisions are often underdetermined, both in terms of the exactness of the problem and in terms of the relation between observation and hypothesis; (2) scientific theories have been, on countless occasion across the history of science, accepted as "fact" or as "true" on rather shaky evidential ground. The first is a version of the now-called Quine–Duhem thesis of underdetermination, the second mirrors a broadly Kuhnian claim about scientific change.[18]

Throughout his work, Polanyi describes science as an extension of perception, describing scientific discovery as a kind of "indeterminate vision." Of Copernicus, he writes, "The vast indeterminacy of the Copernican vision showed itself in the fact that discoveries made later, in the light of this vision, would have horrified its author. Copernicus would have rejected the elliptic planetary paths of Kepler and, likewise, the extension of terrestrial mechanics to the planets by Galileo and Newton" (Polanyi 1966/2009, 149). Polanyi then generalizes this suggestion in a number of ways: scientific vision is responsive to the hidden reality of nature, vision can be shared or "picked up" and extended by later scientists, and the clues that trigger and guide the vision are themselves indeterminate.

Plausibly, science is indeterminate all the way down. So, theory commitment, hypothesis verification or falsification, and observation are none of them exact or, as we might say, deductively closed. But this is also true, Polanyi argues, at the earliest stages, where the scientist is identifying a problem and possible means for solution. The general puzzle here can be traced to Plato's *Meno*. One cannot inquire into what one does not know since one does not know what one seeks, and one cannot inquire into what one knows since one already knows it; thus genuine inquiry appears impossible. Meno's alleged paradox applies no less to scientific innovation, since in identifying and solving a new problem, the scientist must somehow cross this abyss between known and unknown and land on something sufficiently stable for commitment, some new theory or hypothesis that is cogent and coherent. This suggests a role to be played by some mental faculty or faculties and Polanyi's suggestion is that this role is served by imagination and intuition. Polanyi understood imagination broadly as thoughts about nonpresent events or actions. And he understood intuition, as a skill "for guessing with a reasonable chance of guessing right, a skill guided by an innate sensibility to coherence" (Polanyi 1966/2009, 155).

Polanyi offers frequent analogies with both muscle learning and visual perception. Consider a child learning to ride a bike. The child forms an intention to ride the bicycle, but of course because she doesn't yet know how to do this, she has only a loose imagining of the aim or outcome. This "imaginative intention" is a rough, nonstepwise way of pushing the agent toward her goal, aided by the feedback that comes with combining different actions (turning

the handlebar this way or that, pedaling versus not pedaling), plus losing her balance, falling, managing some distance without falling, and so on. As one may recall, at some point, something spontaneous happens, something clicks. All of this feedback between world and agent provides clues (most of which the average person could never articulate) and these clues guide one closer to the aim, toward a coherent method for riding the bicycle. According to Polanyi, intuition is the faculty that responds to these clues, and that ultimately provides the spontaneous click – the "this is how I do it!" for the learner. Polanyi identifies the same structure in visual perception. Consider perceiving some ambiguous figure. One imagines that there is *some* appropriate interpretation and this narrows the scope of possible visual interpretations. Intuition then guides one toward a coherent interpretation, responsive to clues that are many of them below the surface of conscious awareness. One's deliberate efforts eventually effect a spontaneous, coherent visual experience (one suddenly sees the Dalmatian in the ambiguous figure). So, even at this mundane level, one breaks out of Meno's paradox through the use of imagination and intuition.

Polanyi identifies this same structure, involving the interplay of imagination and intuition, as crucial to scientific discovery. The scientist has some vague vision of a problem and solution space. Imagination serves the role of fixing attention on some global, but yet unknown, result. Intuition serves the role of guiding the scientist's pursuit, in two senses. *Strategic intuition* clues in on the long-range viability of attempting to solve certain (sub)problems, which lines of inquiry to pursue, and so on. *Dynamic intuition* is responsive to the clues provided by nature, and moves the scientist toward deepening coherence, to understanding some reality hidden to ordinary observation. Imagination then refines the pursuit in a way sensitive to what insight clues in on. This interplay between imagination and intuition will continue for some time until, in the best of cases, the scientist lights on something that completes the coherence, that amounts to some full-fledged discovery (recall the bicycle analogy). Polanyi describes the process as follows.

> Discovery is made therefore in two moves: one deliberate, the other spontaneous, the spontaneous move being evoked in ourselves by the action of deliberate effort. The deliberate thrust is a focal act of the imagination, while the spontaneous response to it, which brings discovery, belongs to the same class as the spontaneous coordination of muscles responding to our intention to lift our arm, or the spontaneous coordination of visual clues in response to our looking at something. This spontaneous act of discovery deserves to be recognized as *creative intuition*.
>
> *(Polanyi 1966/2009, 159)*

In some respects, Polanyi's picture has an air of mystery to it, but in fact the motivation for his account lies in its explanatory power. The "focal" use of imagination explains how a scientist sets out on a pursuit, in a context involving so much indeterminacy, with only a rough vision of the problem and perhaps none of the solution. It also explains the phenomenology of sustaining this pursuit, where even in spite of still lacking a clearly coherent understanding, the scientist feels some kind of "hunch" or a feeling of getting closer to solution. Polanyi offers as one example Einstein's self-reports regarding years of pursuing the discovery of relativity: "there was a feeling of direction, of going straight towards something definite … clearly to be distinguished from later thoughts about the rational form of the solution" (Polanyi 1966/2009, 157). Polanyi's account explains this as the interplay of imagination and intuition: imagination refines and narrows the vaguely understood solution space in response to the coherence sensed by intuition, and this reflexive process continues as the

coherence deepens. This largely deliberate effort, "racking our brain," as encouraged by the feeling of getting closer, ultimately gives way to some spontaneous insight – an Ah-ha! moment. On Polanyi's account, this feeling that the idea has come unbidden is analogous to the spontaneous bit of muscle learning or perceptual disambiguation; it is the result of the refinement – the narrowing of appropriate "moves" – afforded by imagination and intuition. It is the final hunch or clue. Importantly, its causal ancestral structure is the same in kind as these more basic cases as well. Learning to ride a bicycle and discovering relativity both involve a great deal of deliberate toil, regular use of the imagination, and intuitive judgments. So although the final insight may involve a phenomenology of spontaneity, it is causally dependent upon work for which the agent is responsible. This keeps creative discovery in the realm of naturalistic explanation.[19]

Finally, Polanyi's account goes some way to explaining the backlash that many of our greatest scientific discoveries suffer upon initial presentation. Copernicus, Kepler, Darwin, Einstein, and countless others did not immediately succeed in convincing the folk *nor* scientific community of their most important hypotheses. If Polanyi is right, this gap in understanding (which comes close to what Kuhn and others sometimes mean by "incommensurability") is a result of a gap in imagination and intuition between discoverer and the rest of the community. These creative discoveries involved applications of learned skills, theoretical principles, and so on, but they were not, contrary to Kant's claims, rational, stepwise cognitive achievements. Crossing the abyss to scientific discovery, with all of its indeterminacy, requires a probing imagination and highly sensitive intuition. On Polanyi's account, this is what the richly creative scientist – the genius – possesses and others lack. Accordingly, receipt of a discovery achieved by and imbued with such imagination will not be immediately well understood by the less imaginative.

Polanyi's emphasis, and one standard in much of the literature on scientific discovery, is on insight involving some hypothesis or other theoretical postulate. But scientific discovery typically involves experimentation, both in thought and in the laboratory, and here too imagination is greatly important. Consider thought experiments first. Much of the literature focuses on how a thought experiment is used to criticize an existing theory, or to argue for or present a new theory.[20] But thought experiments can be an indispensable component of the discovery process as well.

Tim De Mey (2006) offers an extended analysis of William Harvey's "quantitative argument," arguing that it is not merely a presentation of but an essential component in Harvey's discovery of the circulation of blood in humans. Harvey challenged Galen's long-dominant model, which maintained two kinds of blood, one originating at the liver and transmitted through the veins and the other originating at the heart and distributed through the arteries, all of it supposedly regularly consumed by the body. In attempting to square this model with anatomical observation (including rapidity of blood loss upon incision), Harvey inquired how this system could possibly create and distribute a sufficient amount of blood, and sufficiently quickly. Harvey famously suggests that after much reflection, he encountered the following dilemma. On Galen's model "we would have veins empty and altogether drained dry and arteries, on the other hand, burst open with the too great intrusion of blood, unless this blood should somehow flow back out of the arteries once more into the veins and return to the right ventricle of the heart" (Harvey 1628/1976, 74–75, cited in De Mey 2006, 233–234). Although informed by observational data from medical examination, Harvey's considerations were performed in thought. At this stage of medical knowledge, the dilemma can be solved only by use of the imagination. Harvey reports this imagining, "I began to bethink myself whether it might not have a kind of movement as it were in a circle" (ibid., 234). And this

merely imagined possibility is then later confirmed by empirical investigation, Harvey thus being the first to discover the human cardiovascular system.[21]

As De Mey notes, it is controversial among historians and philosophers of science whether Harvey has accurately reported his methods of investigation and discovery. But for our purposes it suffices as at least a possible example of how imagination and thought experiment might contribute to creative scientific discovery. In Polanyi's terms, Harvey was able to make coherent his vision of the phenomenon by imagining some novel possibility, then sustaining and closing the inquiry by some intuitive sense for the ultimately coherent theory he devised. Imagination, in the form of thought experimentation, is plausibly essential to this creative discovery.

Now consider what we might call, for lack of a better term, empirical experimentation, taking perceptual psychology as the example. Experimental psychologists are regularly faced with challenges that can be placed under the broad rubric of *experimental confounds*. The human mind is a complex and a messy thing, and often enough the phenomenon that one would like to isolate is not easily separated from other observable phenomena, and/or the data that one collects is consistent with a variety of explanations. Accordingly, the experimenter must devise ever more sophisticated ways to *control for* those variables that are possible confounds in a way that ideally isolates the target phenomenon. These methods are far from straightforward. They are often remarkably innovative, and on at least two distinct levels. First, once possible confounds have been identified, the experimenter must imagine possible ways to work around them. And because time and resources are always limited, she must imagine how these possible ways of experimenting are likely to play out. Second, often enough the methods envisaged are not embodied by some existing technologies. And so the experimenter must, literally, build new technology. In this way, it is appropriate to describe the experimental psychologist as a kind of tinkerer: she tinkers with both experimental strategy and technology construction. And this tinkering often involves imagination.

Of course one might note that in the psychological sciences, like any other science, there are standard experimental methods or "paradigms." And these can often be used to address confounds. But these do not come ready-made by nature. For example, the now standard method of *visual masking* had to be initially envisaged and then constructed into a workable technology.[22] In its most general form, the technique involves augmentation of visual awareness of an initially presented target stimulus by presenting a second "masking" stimulus. The broad method is now widely used to study a wide range of perceptual phenomena, including, scene and face recognition, cognitive, emotional and attentional effects on vision, and conscious versus unconscious visual information-processing. So visual masking has been put into service of discoveries about the human visual system, but it is itself a creative innovation in its own right. This subject matter – creativity in experimental method – is one ripe for new research.[23]

4 Conceptual and empirical relations

This final concluding section briefly discusses recent philosophical analyses that offer some additional treatment of the question *why* imagination may serve in the various creative roles as described above.

Berys Gaut (2003, 2009, 2010) and Dustin Stokes (2014) have both recently argued, on conceptual grounds, that imagination is especially well-suited to creative behavior (while remaining cautious about any necessary conceptual connection). Gaut's emphasis is on instances of creativity where one is actively pursuing a solution or a new idea. Both theorists

agree that imagination is "non-truth-bound" (Stokes 2014) and decoupled from action (Gaut 2003). This freedom or playfulness of imagination is crucial to the novelty required of creativity, since it allows one to safely "try out" hypotheses, conceptual combinations, strategies for solution, and so on, without epistemic or behavioral commitment. And because imagination connects in important ways with inferential systems, as well as affective systems, the thoughts it produces can often be integrated with knowledge and skills to formulate an innovative strategy or solution to a problem. Finally, as Stokes argues, this role for imagination in creativity is not exclusive to the rich creativity of artists and scientists, but indeed seems to characterize the minimally creative behavior that we all enjoy. This claim is partly motivated by empirical research on cross-category task performance (e.g., drawing a house with person-like features) and learning of figurative language in children. Here, as in the more radical cases, instances of novel achievement or learning by subjects requires more than rote memorization; it requires "cognitive manipulation" of the information in the relevant conceptual space (e.g., combining concepts about houses and persons). This kind of cognitive activity is best done by using the imagination.[24]

Peter Carruthers (2002, 2006; see also Picciuto and Carruthers 2014) argues for connections between imagination and creativity on evolutionary grounds. He too focuses on the playfulness of imagination. Pretend play normally develops early in childhood in humans.[25] And imagination in adults, as also argued by the above theorists, provides an appropriate mental mechanism for generating and exploring ideas.[26] Carruthers hypothesizes that imagination serves the evolutionary function for practice of adult creativity – and may have been accordingly selected for in a way that accords with the putative creativity explosion of 40,000 years ago. To his mind, this is the most parsimonious explanation of both the emergence and the ubiquity of creativity in the human species.[27]

Carruthers (2011) also offers a related but distinctive "act-first" account of creativity. Again drawing on recent empirical evidence, Carruthers suggests that a locus of creativity is in action – the construction and conscious activation of action schemata – rather than conceptual thought. These schemata involve mental imagery of motor sequences for bodily movement, and good evidence suggests that this occurs without any prior cognitive planning in the form of beliefs or intentions. Carruthers suggests that, at the very least, this model will better explain the presentation and phenomenology of the kind of "online" creative behavior found in musical improvisation and dance performance. He further suggests that the act-first model might even be extended to explain all of human creativity.

Conclusion

This last discussion was brief for one simple reason: there has been little recent philosophical research on imagination and creativity. However, as this chapter as a whole suggests, this neglect is not for lack of interesting subject matter nor interesting theoretical precedent to be revived and studied. The pictures given by Kant, Sartre, and Polanyi are vastly different. However, one common thread which runs from Kant all the way through the contemporary theorists just discussed is that imagination can be remarkably productive, and productive *because* playful. Kant isolated this creative productivity to the artistic genius, but his arguments for excluding scientists, among others, are questionable. Polanyi provides one plausible counterexample, with an emphasis on scientific discovery in a context riddled with indeterminacy. Sartre is the most emphatic in bringing creativity down to the ground level, but does not thereby acquiesce in its being banal or trivial: on his theory, we are regular creators of the original narratives that frame our lives and determine how we self-identify. In each

case, the imagination is central to this kind of productivity. And the recent theorists discussed offer additional conceptual and empirical reasons to think that this very playfulness is partly explanatory of the imagination's workfulness: from the everyday to the historically monumental, the imagination has unparalleled powers to create, to enable thoughts, actions, and products that are both novel and valuable.

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Notes

1 Margaret Boden (1990/2004) marks this distinction in one clear way, distinguishing *historical creativity* from *psychological creativity*. The first involves novelty relative to the history of ideas, while the second involves novelty only relative to the psychology of the agent in question. The fundamental point is that an *x* is novel relative only to some comparison class, and this can vary substantially in broadness.
2 Some have been critical of inclusion of a value condition for creativity. See Stokes 2011 and Runco 2010.
3 See Gaut 2010, 2012; Stokes 2007, 2011, 2014.
4 See Boden 1990/2004; Stokes 2011.
5 See Nanay 2014; Carruthers 2011.
6 Attribution of "creativity" to persons requires some qualification. It isn't that the person herself is judged novel and/or valuable, at least not centrally, but rather that she regularly engages in a process, or produces products, that satisfy the discussed conditions of creativity.
7 For example, see Currie and Ravenscroft (2002), who explicitly draw the distinction between creative and recreative imagination and then focus exclusively on the latter.
8 "Romantic" here is used not to denote a particular school of thought or criticism, but a broad category of theorizing creativity whereby it comes out as largely magical or inexplicable. Examples include Bergson 1911/1998, 1942/1992; Collingwood 1938; Dewey 1958; Schelling 1809/1936; Schopenhauer 1969. More recently, see Hospers 1985 and Kivy 2001.
9 For extended discussion of Kant's theory of imagination, see Samantha Matherne's Chapter 4, in this volume.
10 For two recent examples of criticism, see Cohen 2003 and Gaut 2014. The topic of imagination and scientific discovery will be discussed again, and in a more positive light, in Section 3.
11 Again, with the exception of constraints imposed by understanding of the chosen artistic media, and a non-rule-bound judgment of purposiveness of form.
12 See Crawford 1982 for discussion of this point.
13 On this last point see Crawford 1982, see also his 2001. For other recent commentary on Kant and the creative imagination, see Cohen 2003; Gaut 2003; Guyer 2005; Kivy 2001; Ostaric 2012.
14 Sartre wrote two texts, typically neglected by analytic philosophers, devoted exclusively to imagination and imagery. Both have been recently retranslated into English, with helpful introductions from the translators/editors. The first, *The Imagination*, was originally published in 1936 and recently translated by Kenneth Williford and David Rudrauf (Sartre 1936/2012). This text is a largely critical examination of philosophical and psychological theories of imagination, with a final positive section focused on Husserl. The second, *The Imaginary*, was originally published in 1940 and recently translated by Jonathan Webber (Sartre 1940/2004). This text attempts to provide a comprehensive theory of imagination, mental images, and imagistic representation generally. There are additional places throughout Sartre's writing where he discusses the imagination (as suggested below, it is arguably essential to his existentialism), but one text of clear significance (and one that influenced the discussion in this chapter) is his *What Is Literature?* (Sartre 1947a/1988).
15 Indeed, one might think of sense-datum theories of perception as making the same commitment, some of these theories articulated after Sartre's 1936 analysis.
16 For philosophical discussion of truth in fiction, and fiction generally, see Searle 1975; Lewis 1983; Currie 1990; Walton 1990. See also Kathleen Stock's Chapter 15, in this volume.
17 For more on Sartre and imagination, see Robert Hopkins' Chapter 6, in this volume, and Levy 2014.

18 One should not assume, however, that Polanyi just borrowed these points from such figures and their writings. Indeed, some of his publications, with these very insights, predated (or were at least closely contemporary with) the publications most commonly credited. In addition to those publications discussed explicitly above and below, see Polanyi 1936, 1946, 1950, 1958.
19 See Kronfeldner 2009; Stokes 2007, 2011; Stokes and Paul forthcoming. See also various papers in Paul and Kaufman 2014.
20 For general discussion of imagination and thought experiments, see Roy Sorensen's Chapter 31, in this volume.
21 For more detailed historical and philosophical discussion of Harvey's discovery, see De Mey 2006; Mowry 1985; and Wear 1990.
22 Breitmeyer and Öğmen's *Visual Masking* (Breitmeyer and Öğmen 2006) discusses both the history and the state of the art of the method. They cite McDougal (1904), Sherrington (1897), and Stigler (1910) as the innovators of the method in the late nineteenth and early twentieth century.
23 To qualify, there has been a good deal of related work in the history and philosophy of science, on experiment in science generally (though rarely with explicit emphasis on creativity and/or imagination). For two original monographs, see Hacking 1983 and Galison 1987. And for a collection of original papers, see Gooding et al. 1989.
24 Stokes also attempts to extend the account of imagination's role in creativity to Ah-ha moments, or what Gaut calls "passive creativity." See Stokes 2014, 170–178.
25 For discussion of pretending, see Elizabeth Picciuto and Peter Carruthers' Chapter 23, in this volume; and for imagination in children, see Deena Skolnick Weisberg, Chapter 22.
26 Carruthers endorses the "geneplore" model of creative ideas. See Finke et al. 1992 and Ward et al. 1999.
27 See Gaut 2009 for a critique of Carruthers' analysis.

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