

“Minding the Gap”: Imagination, Creativity and Human Cognition

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Abstract Inquiry into the nature of mental images is a major topic in psychology where research is focused on the psychological faculties of imagination and creativity. In this paper, we draw on the work of L.S. Vygotsky to develop a cultural-historical approach to the study of imagination as central to human cognitive processes. We characterize imagination as a process of image making that resolves “gaps” arising from biological and cultural-historical constraints, and that enables ongoing time-space coordination necessary for thought and action. After presenting some basic theoretical considerations, we offer a series of examples to illustrate for the reader the diversity of processes of imagination as image making. Applying our arguments to contemporary digital media, we argue that a cultural-historical approach to image formation is important for understanding how imagination and creativity are distinct, yet inter-penetrating processes.

Keywords Image · Imagination · Creativity · Vygotsky · Cultural-historical theory

“All that is the work of the human hand, the whole world of culture, is distinguished from the natural world because it is a product of human imagination and creativity based on imagination.” – L.S. Vygotsky (1992 (1930))

Introduction

The relation of human imagination to thought and action has been of interest to scholars at least since the time of the early Greek philosophers, who pondered the

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relationship between the statues (images) in their public squares and the mental processes of representation. The predicament of the inhabitants of Plato's cave, revisited by Descartes in his meditations, continues to vex philosophers, psychologists, and scholars in the social sciences and humanities because it raises important questions about the relation between a subject's experience of the world and the reality of the world itself (Boulding 1956; Kosslyn et al. 1979a, b; Merleau-Ponty 1964; Paivio 1976; Sartre 1962). Today, these crucial questions are of no less importance to the study of imagination. Indeed, since the 1950s, the empirical study of imagination has become a broad field of study in its own right (see Markman et al. 2009 for one comprehensive review).

Given this long and broad historical field, we cannot hope to cover all of the relevant issues. To orient ourselves, however, we may begin with the definition of imagination provided by the Oxford English Dictionary:

(noun) The power or capacity to form internal images or ideas of objects and situations not actually present to the senses, including remembered objects and situations, and those constructed by mentally combining or projecting images of previously experienced qualities, objects, and situations. Also (esp. in modern philosophy): the power or capacity by which the mind integrates sensory data in the process of perception.

We suggest that the two parts of this definition need to be combined in a systematic way and that the restriction of imagination to "situations not actually present to the senses" is a cardinal error. Our emphasis will be on the process (not the power or capacity understood as a faculty) of image formation, which, we suggest, can fruitfully be thought of as a dynamic process of "gap" filling from which emerges what we might call "the world as experienced."

When we turn to contemporary cognitive psychology, we find that research has been heavily weighted toward the first part of the definition concerning "mentally combining." It is characteristic of this research that it focuses on how already-formed images relate to other psychological processes, such as remembering or planning. For example, there is a good deal of work in cognitive psychology on the functioning of "the mind's eye," showing that it takes longer to scan a mental image depending upon the distance between points on objects being imagined and other perceptual characteristics such as whether mental images are processed in two or three dimensions (Kosslyn 1978; Pylyshyn 1973; Robertson 2002). All such work presupposes the presence of an image as its starting point. But what about the process of image formation?

This question relates closely to the assumption, in the dictionary definition as well as in contemporary cognitive psychology, that imagination is about the invisible or non-present. We will argue that imagination is fundamental to experiencing the world in the here and now. This focus means that we have, so to speak, "crossed over" and are now in the realm of the second definition of imagination as a process of "integrating sensory data" which, for our purposes, we can think about as a process of integrating the self and the world. The dictionary tells us that this topic has been relegated to philosophy. We hope to provide empirical evidence that helps us understand this integrating process in more detail, and a theoretical framework that helps us generalize our findings in productive ways.

With respect to the theoretical framework we have chosen as our starting point, the epigraph from Vygotsky makes it obvious that we draw heavily upon his ideas. Although Vygotsky has attracted considerable attention for his ideas about the importance of cultural mediation in the constitution of higher psychological processes, his work on imagination has only recently become widely available in translation, and so far been its influence has been restricted (see Gajdamaschko 2005; Moran and John-Steiner 2003; Nilsson 2010; Smolucha 1992; Connery et al. 2010). Vygotsky is worth our attention, however, because he offers a nuanced reading imagination-as-a-process through which the world is made and, at the same time, through which the self emerges to experience that world.

With this in mind, we can initially define the process of imagination as follows: imagination is the process of resolving and connecting the fragmented, poorly coordinated experience of the world so as to bring about a stable image of the world. Thereby a feeling of oneself in relation to the world emerges. The fragmented nature of human experience ineluctably exists, we argue, from the fact that the human mind is simultaneously constrained by phylogeny (biology), cultural history, and ontogenesis (individual development) all operating on their own time scales and in accordance with differing mechanisms of change. We therefore characterize imagination as a “gap-filling” process. While “images” are our catch-all term for the products of imagination, the image is itself heterogeneous and heterochronous, since it depends on the conditions and constraints in which the process of gap-filling unfolds; i.e., on the conditions on which a stable image can be produced by a individual who begins to sense their self *as a self* in that world.

Our discussion naturally leads us to consider the closely related process of creativity. We will not go deeply into a discussion of creativity, itself the subject of a very large, diverse, literature (Csikszentmihalyi 1988; Csikszentmihalyi 1997; Sternberg 1988; Miettinen 2006; Connery et al. 2010). As the epigraph of this paper makes clear, Vygotsky characterizes creativity as a process that arises from imagination. We emphasize that creativity is literally a form of *making*, the making of “the whole world of culture” based on the products of imagination. Because our focus is on the process of imagination, it is primarily the sense in which creativity is “based on” the products of imagination that we touch on creativity in the discussion to follow. We will return to expand upon this idea when concluding our discussion.

Fixed Image Experiments: The Three Parts of the Image

As we noted above, it is widely assumed that imagination comes into play only when an object is absent from the senses. This starting point also unwittingly assumes that “presence to the senses” is a condition of perception. Existing evidence indicates that both assumptions are untenable and that the reduction of imagination to perception or fantasy is mistaken. Imagination is present in a primitive, yet clear, form even when an object *is* present to the senses (our argument here is focused on vision, but the point, we believe, is quite general). Our alternative conception compels us to understand imagination as a basic, pervasive, and distributed faculty of materially embodied thought and action, as opposed to a marginal, specialized activity of the mind.

The counter-intuitive conclusion that imagination is involved when we perceive objects available to the senses has been clearly demonstrated by studies that fixate one's visual system on an object in a highly constrained manner (Pritchard 1961; Inhoff and Topolski 1994). In brief, the facts are as follows: human eyes and those of many animals are in constant motion. This motion results not only from voluntary movements of the eyes and the head (for example when one tracks an object through the visual field while walking), but more fundamentally because of involuntary saccadic eye movements of 20 to 200 milliseconds in duration, as well as even briefer micro-saccades. As a consequence of saccadic movements, the eyes move with respect to a stationary object *even if* a maximum effort is made to stare at the object without moving one's eyes. And, as it turns out, the constant movement of the eyes (which aims at producing gaps in the information received by the brain) is central to perception of the world, as experiments that arrange for perfect coordination between the movements of the eye and movements in the environment show. This kind of procedure is referred to as a "fixed image" experiment.

In a fixed image experiment, visual images are projected and stabilized on the retina using a special apparatus that moves in perfect coordination with the retina. When a perfect alignment between saccadic eye movements and the projected images is achieved, the visual field goes gray. It fades into gray slowly and as it does so, the images break up before they disappear. If there is then a slight slippage in the apparatus, such that eye movements break free of their coordination with the projected image, fragments of an image in the world reappear. The *full* image, however, reappears *only* when there is a free play of light from the world across the retina. The physiological mechanism that explains the phenomenon of total fading of the image is unproblematic: the cells of the retina respond to *changes and differences* in luminance. These cells lose responsivity ("bleach out") when luminance is invariant (i.e., when there is perfect coordination).

Facts about the physiological structure of our visual apparatus, however, have some interesting implications when considering the nature of images. They suggest that constant discoordination *with* the world is a necessary, constitutive aspect of our perception *of* the world as individuals that behave *in* the world. These facts raise, among others, a crucial question: what goes on between intervals of total fixation on an object which is but a single moment within the total eye movement itself? If, as seems the case, it is essential to perception that our eyes remain un-fixed from the image it is trying to perceive, then what is going on in the moments of discoordination, and is discoordination itself necessary for this function?

In seeking to answer this question, some additional facts are necessary. It appears that no useful visual information is obtained during the saccadic eye movements. All the effective information is obtained during the moments when the eye is fixed on its target (Matin et al. 1970). But this does not mean that there is no processing of the information during the saccades. The existence of time intervals between saccades when the eye is fixed on a target indicate that a discontinuity in sensory input about the object must exist. The passage of time between the fixations ensures that when we fixate on an object we necessarily see it from a different angle and on a different physical background than in the moment previous to that fixation. Our experience of the world is discontinuous. Despite, however the presence of objective physical discontinuity, we experience the world as continuous. How is this possible?

To answer this question, we need yet additional information by examining the patterning of the slow fading and emergence of images in fixed image experiments (Martinez-Conde et al. 2008; Summerfield et al. 2010). The results of the relevant research indicate that the manner in which image fragments disappear or appear is not entirely random; it is not the case that arbitrary bits of the image fade, as though a lense were losing focus. Instead the ways in which an image fragments or reappears depends on the *kind of* stimulus presented to the retina in the experiment. Two classes of image-stimuli are important to the following discussion. The first are those heavily constrained by human phylogeny (e.g., the detection and recognition of faces); the second class of image-stimuli arise from accumulated constraints embodied in culture (e.g., the graphic letters in an alphabet).

The difference between these two kinds of stimuli is illustrated by the images in Fig. 1 (Pritchard 1961). In each row of the figure, the left-most image is the one projected and fixed with respect to the retina, while the images to the right are the images that subjects report seeing as the initial image disappears or reappears.

Essential to interpreting the figure is the fact that the “HB” monogram and the female profile share basic, biologically constrained, properties such as the sharp changes of luminance at the borders between black and white. Differential responsivity at points of high luminance variations is present at birth (Bronson 1990; Haith and Goodman 1982). In our current terms, the fragments into which the woman’s profile breaks up are predominantly *natural, phylogenetic objects*. What appears to be innate recognition of the mothers face turns out to be recognition of a pattern of luminance (Pascalis et al. 1995). The one specifically cultural element in the fragments (the hair band) is secondary.

Precisely the opposite is true of the HB monogram which is a quintessential cultural object, the meaning of which depends upon knowledge of the alphabet. Differential luminance is of course present, but in every case the way the constituents of the HB monogram disintegrate and reappear are all reported as written alphanumeric symbols, not points of highest luminescence contrast. (See the bottom line of Fig. 1). This response pattern cannot be attributed to phylogenetic history. Rather, each of the fragments is organized as meaningful cultural unit (to literate persons).

To explain the fragmentation patterns of the HB monogram, Pritchard, following Hebb (1949), suggested that, as a result of the massive experience of using graphic symbols, the human brain has formed “cell assemblies,” what currently might be termed “cortical firmware,” to facilitate the maintenance and activation of their internal organization. Following this interpretation of research on the components of the visual image we can conclude that *one* component is highly specified by factors

Fig. 1 The shapes into which the profile of a female head and the monogram HB disintegrate when they are fixed with respect to the movement of the retina (adapted from Pritchard 1961)



arising from the phylogenetic development of human beings. A *second* component conforms to individuals' culturally organized experience. However, both sources (or conditions) of experience are not sufficient to give a coherent image of the object before one's eyes. A *third component* is required in the *active reconciliation*, or *filling-in*, by human beings who make sense of their experience over the course of moment-to-moment experience. The active reconciliation of information arising at two slightly different points in time is made necessary by the operation of saccadic eye movements (Botzung et al. 2008). This "resolving activity" is necessary for a whole image of the world to arise, and for thought and action to be possible. Hence the three constituent parts of what we consider to be an image: 1) a set of biological conditions stemming from human phylogenetic development; 2) a set of cultural conditions and its historical-social development; 3) the individual, cognitive resolution of both conditions that, moment-to-moment, resolve to produce an image.

This excursion into apparently obscure research on the physiology of perception warrants, in our view, the conclusion that it is incorrect to think of imagination as a process occurring only in the absence of the imagined object. Instead, it seems *necessary* for human cognition that individuals constantly engage in a process of image formation. Image formation is the "connecting bridge" between two states of experience: one conditioned by the phylogenetic history of the human species, the other by the cultural-historical environment and history of experience. What this bridging process entails—and what the results of the fixed image experiment indicate—is that human beings are *by nature* always engaged in a process of image formation; of imagination. They are constantly engaged in this image formation process because, in fact, they are situated between nature and culture; both act as constraints, as principles that make thought possible, on the condition that a third term—the individual's "resolving activity," or "gap-filling"—is involved.

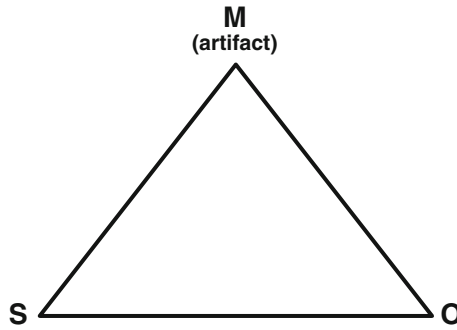
Culture, Mediation and Artifacts

As a means of generalizing the results of studies of fixed images on the retina to culturally more diverse and socially more significant human experiences, we have found it useful to follow the lead provided by Vygotsky, who represents human thought as a triangular relation between subject, object, and cultural medium (Vygotsky 1978). We have already noted that Vygotsky interprets ontogeny as the emergent outcome of phylogeny and cultural history. The underlying structural schema he used to represent this interpretation—the triangle—motivates our search for a theory of imagination as a biologically required, culturally-mediated, temporally-variable process—and not as a frozen function. Again we turn to, and then seek to elaborate upon, Vygotsky's ideas.

Within psychology, Vygotsky is well known for representing the cultural mediation of human experience using a triangle (Fig. 2).¹ The base of the triangle

¹ We note here that the use of the triangle metaphor is ubiquitous in philosophy and contemporary psychological discourse. For descriptions of the many ways in which this general approach can be used see Zittoun et al. (2007). Our goal in this paper is not to invoke a general discussion, within the Vygotskian tradition of thought, about the triangle. We find it a useful metaphor, however, for discussing the conditions and process of imagination.

Fig. 2 The basic mediational triangle, in which subject and object are seen as not only “directly” connected, but simultaneously “indirectly” connected through a medium constituted of artifacts (culture)



represents an unmediated, direct connection between person and world. For the purposes of this discussion, the base of the triangle represents the individual's phylogenetically constrained relation to the environment. The path through the vertex represents the mediation of this relation through culture. When the two pathways are simultaneously in operation, a qualitative re-structuring of the relation of individuals to the world and to themselves is produced (engendering what Vygotsky referred to as “the cultural habit of behavior;” Vygotsky 1929, 420–421.² Indeed, this is one of the main arguments of Vygotsky's representation of behavior: neither route is privileged; all three must be taken into consideration (theoretically and methodologically) in order to account for the structure of behavior and the nature of psychological processes, such as the process of imagination. Indeed, the triangle is a useful analytic device for thinking about the saccadic movements of the eye at a moment-to-moment micro scale. The continuous movement of the eye *generates* a continuous difference, or gap, in the physiological information received by the brain (i.e., the relation of subject to object). This continuous gap-generation opens up a space for a culturally-mediated relation to the object to operate in parallel to the phylogenetically constrained relation.

Although useful for representing the minimal set of relations and constraints of thought and action (or, in this case, imagination), a solid triangle is not as successful at modeling the idea that thought occurs *over time*, perpetually in the process of *change*.³ Nor is it particularly good at indicating that there are multiple *scales of time* that are simultaneously relevant. To partially remedy this problem for the purposes of the present analysis, Fig. 3 adds a temporal dimension. The open-ended vertex in Fig. 3

² The position of the subject – S, in Fig. 2 – is usefully thought of in Peircian terms as an interpretant, an “interpretation in the sense of a product of an interpretive process or a content in which an interpretive relation culminates, though this product or content may itself be an act, a state of agitation, a conduct, etc. Such is what is summed up in saying that the sign stands for the object to the interpretant.” (Wikipedia, accessed November 6, 2010).

³ In recent decades, the triangle metaphor has been expanded explicitly to include the social world in the form of social rules, community, and the division of human labor (Engeström 1987). This “expanded triangle” is a powerful intellectual tool with which to study processes of human change and development. However, these representations fail to capture that aspect of cultural mediation which brings imagination and creativity clearly into view as essential aspects of human thought—time. Engeström and others who use these graphic representations are aware of the need to include *time* in their basic unit of analysis; our point here is only that the representation of time via a timeless geometric figure somewhat restricts thinking about the processes of focal interest to us here.

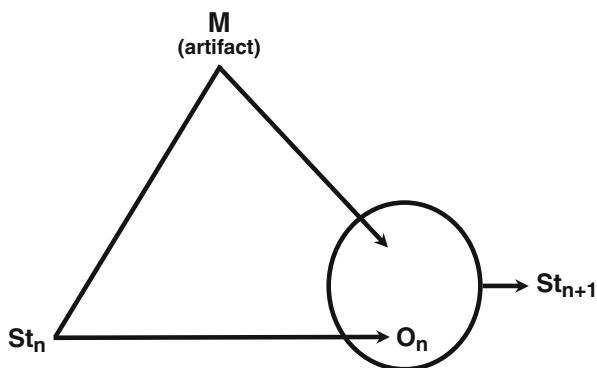


Fig. 3 A dynamic representation of the basic mediational triangle that includes time in the unit of analysis. The fact of non-correspondence between mediated and unmediated (indirect and direct) subject-object relations is represented by the oval at the right, indicating the need for active cognitive resolution of the discrepancies by the subject, the process referred to in the text as *voobrazhenie*

seeks to emphasize the necessary future-oriented nature of imagination as a culturally-mediated psychological function. The coming-together of direct and mediated relations at the right of the triangle is replaced by a gap were phylogeny, culture, and ontogeny are momentarily reconciled so as to produce an image. This image is a condition of thought and action, for it provides the subject with a stable-enough image of the world into which thought or action has meaning. This way of diagramming the process of imagination foregrounds the question of how a subject, at a future moment in time (t_{n+1}), reconciles the differences between “direct” and mediated sources of knowledge, bringing into being a single and stable image of the world. We wish to emphasize that the analytic device of the triangle—here used to think about imagination as a process that unfolds at a very micro, moment-to-moment scale—can be generalized to broader conditions of imagination, as our paper will show later.

To make explicit the link between this representation of mediated thought and our discussion of imagination, consider that the gap indicates a process of resolving sources of information about the world that are heterogeneous. This “resolving activity” is akin to the process we concluded must exist from fixed-image experiments described earlier. In this regard, we think of a process occurring at time n that results in a new image at time $n + 1$ as analogous to the resolving process that occurs in the process of a saccadic eye movement. In each case, a gap is generated so that an image may emerge from resolving differences in the sources of information.

We wish to draw attention to several aspects of the “gap” where the mediational triangle is not fully connected as a way of better specifying what the process of image formation entails.

1. This gap represents a set of *differences* in experience that exist at a “next moment in time.” These differences arise as a *result* of the fact that experience is conditioned by the intermingling of phylogenetically-constrained *and* culturally-mediated relations of the subject to the object. Each of these relations has its own heterogeneous temporal dynamics, as a consequence of which discoordination between them is a constant, necessary reality. The biological constraints on thought and action are spatially and temporally difference from those of culture or

- individual development. Although the “object” in the diagram is the only vertex that is open, we are not suggesting that only objects change through time. In order to broach a discussion of how the individual and environment change over time, however, we will need (later in this paper) to discuss the related concept of creativity. Figure 3 is intended only to depict the idea that imagination is a process that resolves gaps generated by continuous constraint of past experience, cultural history, and phylogeny on the individual so that he or she may produce an image of the world *into which* they can act and think in the present.
- The differences between the two relations that constitute the gap must be resolved *cognitively* by the individual. By “resolved” we do not claim that all of the differences between the two relations are eliminated, but that the work of imagination sufficiently “fills in” the difference to make possible a single image of the world into which they can act.⁴ Hence images are not the same as representations, since images do not re-present a sensed world. Images do not, as it were, have an epistemic status. Imagination produces stable and single images of the world, but the decisive feature of images is not that they are real or veridical. It is that they are stable-enough, and singular-enough, for the individual to *think or act at all*. This means, among other things, that imagination is a diverse, indeterminate process. While it is constrained by history and biology in ways that are shared, it nevertheless refers to a single individual at a moment in time. Minds are partially and diversely made by imagination, the process of filling in the gaps.
 - The way that time is represented in Fig. 3 implies that culturally mediated thought and must be *future-oriented*—any “doing in the present” (at time n) needs to reduce uncertainty about the future (time $n+1$) as a condition of coordinated action. At the same time, it indicates that the resulting product is partially an illusion, an *imagined* state of stability about the future. An imagined state of the world does not mean that such a state is a true or false representation of the world. It is a condition of coordination or thought and action with the world. If we are correct, resolving non-correspondences between phylogenetic and cultural constraints on experience requires reducing the uncertainties about the future *so that* one can act think or act in the present. To imagine is to imagine a future in which thought and action can be meaningful, which is to say that, by drawing on the past, the imagination is able to work out a future so as to think or act in the present. This process of prolepsis, discussed at greater length by Cole (1996), is an ineluctable part of the process of culturally-mediated cognition.

We hope that each of these points can be clarified by drawing upon different, intuitively inviting, examples of the image formation process we are seeking to specify.

Gaining Intuition into Imagination as a Process

Our discussion thus far has been largely theoretical, descending to what is considered empirically verifiable data only in the experimental evidence concerning

⁴ Bartlett (1982), in his classic monograph, *Thinking*, refers to thought as a process of gap filling.

the phenomenon of the fixed visual image experiment. Each of the following sections is intended to fill in the theoretical picture of imagination as an active process of resolving temporally and spatially dis-coordinated sources of experience that, as Vygotsky claims, is fundamental to the creation of culture and the constitution of human thought. Rather than using experimental data, we take the unorthodox path of drawing on a set of examples, using the fixed image as a thought experiment and the open, dynamic mediational triangle as a tool. Our goal is to provide the reader with a personal experience of the phenomenon we are seeking to describe by which to judge the validity of our claims.

Imagination as Into Image Making: The Perspective of the Blind Deaf

Alexander Suvorov, a blind-deaf Russian psychologist, has provided a striking insight into the process of imagination as a culturally mediated process (Suvorov 1983). Suvorov was one of a large group of blind-deaf children who underwent a long period of socialization in a school that used signed Russian, in which letters of the alphabet were spelled on student's hand. His mentors at this school were members of the Vygotskian cultural-historical psychological tradition. After he obtained his Ph.D, Suvorov conducted basic psychological research for several years. He then returned to work on improving the systems of upbringing disabled children in organizations and schools. Seeking to summarize the lessons learned about culture and human thought, Suvorov provided a way of thinking about the experience of the blind-deaf that invites consideration of the process revealed by fixed image experiments and, more generally, of imagination as a process.

In a key article, Suvorov argued that *voobrazhenie*, which means “imagination” in Russian, is a basic cognitive act of all human beings. When this article was translated into English, and based on the translator (Cole, also co-author this paper), it was suggested that *voobrazhenie* appeared, in Suvorov's theory, to be analogous to the function of *representation* as it was used by Anglophone cognitive theorists. But on its face, *representation* fails to capture the major insight of the term *imagination* as it is used in Russian psychology. Understanding this difference of interpretations begins by recognizing that the word *voobrazhenie* can be decomposed into three parts—*vo*, a prefix that means “into;” *obraz (zh)*, “image,” and *enie*, a suffix that indicates “doing” or “making.” Altogether, *voobrazhenie* refers to the “process of making an image,” or more literally and aliteratively, “into-image-making.”

In writing about his notion of *voobrazhenie* as the foundation of cognition, Suvorov evokes the metaphor of “rising up from the world and returning to it again.” This metaphor can be employed in at least two ways. On the one hand, it provides a description of the entire cycle of saccadic eye movements that “rise up from the object and return to it again.” Separation and subsequent fusion, repeated constantly (like the phylogenetic mechanism of human vision) captures, claims Suvorov, the most intimate and pervasive mechanism of human cognition.

One the other hand, this metaphor can be taken as a literal description of the predicament of the young blind deaf child. The blind-deaf lack two critical sensory mechanisms (sight and hearing) that are necessary to perceive the world *at a distance*—a distance that is both spatial and temporal. Distance is intimately related to human experience in the sense that one cannot see without perspective. Having no

space to “see ahead” removes the critical conditions necessary for “gap filling” because there is too little of a gap to fill. From the perspective of the blind-deaf, the world is *too close*. They are denied the ability to separate themselves so that they can adjust to what is about to impinge upon them. As the fixed image experiment reminds us, under conditions of total contact or a lack of contact between person and world, into-image-making is impossible. Only with the acquisition of culture / language and associated mediational means does it become possible for the blind-deaf to separate themselves from the world. In doing so they create a gap in order to be able to reflect upon the world and to “think ahead” (where ahead is simultaneously a spatial and a temporal metaphor) in order to control the world and themselves more effectively.

Engaging in Into-Image Making 1: New Yorker Cover

It is possible for readers to experience into-image-making by analyzing the *The New Yorker* magazine cover reproduced in Fig. 4. For the purposes of this essay we have chosen an image that, while quite complex compared to an HB monogram, illustrates the pervasive presence of the three parts of the image and for which access to the process of image formation is readily accessible introspectively.

Spend a minute or two examining the image in Fig. 4. We have shown this image to several colleagues and friends and, in every case, each reports a complex process of image formation that has different starting points and different ending points for different people (we include only a few of many such pathways to a “final meaning” we observed).

To begin with, we found that people were quite articulate in formulating the courses of their interpretive processes. Many informants first saw this image as a

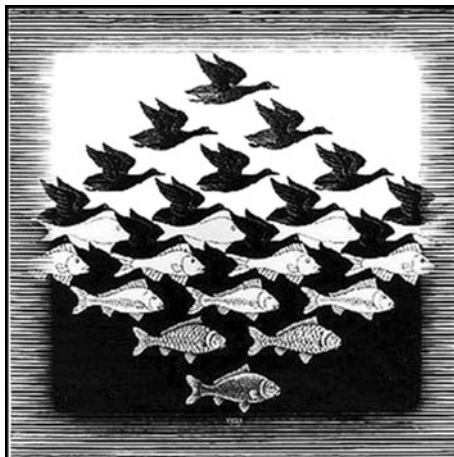
Fig. 4 The cover of *The New Yorker*, July 5, 2010



variation on Escher's *Sky and Water I* (Fig. 5) and some stopped at this point, perhaps puzzled by the fact that the top-most bird is different from the others, a pelican (Pelaprat). Others (Cole, for example), starting from the same point, wondered at the liquid dripping from the pelican, and put the magazine aside. Others who started with the Escher image experienced an "aha!" moment when the oddity of something dripping from the pelican was black, like the pelican—the liquid is dripping from an *oil soaked* pelican, emblematic of the oil spill in the Gulf of Mexico which had begun a month before these observations were made. Still others (Cole's wife), "reading top to bottom," immediately associated the pelican with the oil spill, then noticed the likeness to the Escher painting, thought "how clever" and stopped there. When Pelaprat, who became "trapped" in the Escher image was told that image was a representation of the oil spill, he reported an immediate reorganization of his perception of the sub-images below; he now "saw" the elements of the Escher-like drawing as emblematic of the sea life affected by the oil spill and even extended to more local perceptual discoveries, noting that the bottom-most creature is a turtle, and that the background which creates the image of a turtle is also an image in itself—of two plumes of oil rising into the water. At the opposite extreme, some informants living far from the United States (e.g., South Africa) did not extend the image to the broader social and cultural knowledge about a disastrous oil spill. Indeed, these informants, owing to a different set of cultural conditions, failed to make a more generalized image. These observations suggest that the generation of a whole image such as "oil spill" or "ecological disaster" has the potential to reorganize perception of elements previously unseen, creating more and more complex images. But such "expansion by incorporation" does not occur if the relevant cultural information is not available.

In addition to illuminating a number of specific, culturally mediated "into image making" paths, this drawing also illustrates the simultaneous operation of phylogenetic, cultural-historical formations, and personal knowledge. One is likely to see first the division of sharply defined, phylogenetically constrained, gradients of luminescence and color (blue, brown) that map onto the cultural categories of sky and ocean, perhaps jarring loose a gap that we can represent in the form of the

Fig. 5 M.C. Escher's *Sky and Water I*, 1938



question, Why is the ocean brown? The shapes of the birds and fish and turtle, although supported by clear phylogenetic mechanisms, are more saturated with cultural knowledge which is likely to be brought into play as the shapes slowly morph. Yet higher levels of cultural knowledge are required to appreciate the interpretive significance of the fact that this picture is on the cover the *New Yorker*, with all of its arcane cultural practices.

Engaging in Into-Image Making 2: Montage

Analysis of the image of an oil disaster revealed various pathways through which the process of imagination travels. Almost always, the initial image making process is partial. In the continuing process of imagining, the meaning of the cover may vary from complete inability to make sense of any special meaning uniting the various components in the image, to seeing only a copy of Escher, or to discovering a turtle deep in the ocean whose “alter image” is oil spewing from below. Parts can be there with no whole uniting them, and an apparent whole—“it’s the oil spill!”—can be accompanied by failing to see the turtle or the spewing oil.

The process present in the case of the *New Yorker* cover may be fruitfully considered as a special case of the most famous example of image formation as a process of “gap filling”—the principle of montage, made famous by Sergei Eisenstein. The epigraph by John Livingston Lowes to Eisenstein’s essay on “Word and Image” reads as follows:

Every word has been permeated, as every image has been transmuted, through the imaginative intensity of one compelling creative act. “Consider it well,” says Abt Vogler of the musician’s analogous miracle:

Consider it well; each tone of our scale in itself is nought; It is said everywhere in the world—loud, soft and all is said: Give it me to use! I mix it with two in my thought: And there! Ye have heard and seen: consider and bow your head!

Give Coleridge one vivid word from an old narrative; let him mix it with two in his thought; and then (translating terms of music into terms of words) “out of three sounds he [will] frame, not a fourth sound, but a star.”

In explicating his theory of montage, Eisenstein invoked precisely this idea in more formal language: “Representation A and representation B must be so selected from all the possible features within the theme that is being developed [so that their juxtaposition] shall evoke in the perception and feelings of the spectator the most complete image of the theme itself.” (Eisenstein 1942, 69).

As an illustration of the montage process at work, we turn to work on the psychological mechanisms underlying the interpretation of comic book stories (McCloud 1994). (At this point the reader is strongly urged to spend a moment interpreting the two images in Fig. 6). The two image comic strip panel Fig. 6 is taken from Scott McCloud’s *Understanding Comics: The Invisible Art*. It is one of a multitude of comic panels, each of which demonstrates how, to use McCloud’s phrase, “meaning is made in the gutter.” What is true for comics, as Eisenstein’s comment regarding the process of montage in art, is true for life. It also fits rather

Fig. 6 From *Understanding Comics: The Invisible Art*, by Scott McCloud, for whom “meaning is made in the gutter” between the panels. This figure illustrates the “cognitive-cultural resolution” activity we call “into image making.”



precisely the model of the fixed image on the retina, although now under circumstances where the individual images being juxtaposed, and the conditions of juxtaposition, are immensely more complex than and HB.

The meaning of the event, or concept, articulated by these two panels—murder, the way it unfolds over time (“reading” left to right), and the horror of it—is not literally “represented” by either of the two panels on its own. In the first panel, nobody has been killed, yet we “see” that the action is about to happen; in the second, we are only left with a scream echoing across a city landscape. The event of the murder itself is *imagined* or, more precisely, the mind automatically reconciles the difference between the two panels so that they the two parts are combined into a new whole, at which point the meaning becomes clear. The event/concept of murder emerges as the image “into which” the person is moving by resolving the differences between the juxtaposed panels (As Eisenstein would insist, this juxtaposition is itself critical; on their own, each panel would structure an entirely different process of “into image making”).

Social Proprioception

The last analysis of into-image-making we offer here is about a phenomenon drawn from contemporary social life: “social proprioception.” We choose this form of imagining because it expands two general themes that have been central to this paper—the process of imagination as “gap filling,” and the importance of the temporal dimension of thought and action to understanding the centrality of imagination in cognition. The expansion of this line of thought moves in two directions. First, “social proprioception” involves a form of imagination that underlines the ways in which global, digital forms of material culture re-mediate the psychological relationship between one’s sense of self and an expanded social sphere. In this regard, we want to show how an analysis of imagination

can be applied at a very different scale of social life, temporality, and spatiality. Second, “social proprioception” involves a very critical form of gap-filling that draws the self out in relation to others.

The term “social proprioception” was coined by Clive Thompson (2007) to describe a feeling of the self in relation to others that emerges from interactions on micro-blogging services such as Twitter.⁵ *Proprioception* is a physiological term ordinarily associated with the sense of the relative position of one’s body in its proximal, physical environment. Thompson finds this to be an apt metaphor for describing the feeling that arises in connection with new digital media practices. He describes *social* proprioception as the sense whereby geographically separated individuals in constant contact through Twitter begin to feel their self within a proximal *social* environment. He provides the following everyday example:

When I see that my friend Misha is “waiting at Genius Bar to send my MacBook to the shop,” that’s not much information. But when I get such granular updates every day for a month, I know a lot more about her. And when my four closest friends and worldmates [*sic*] send me dozens of updates a week for 5 months, I begin to develop an almost telepathic awareness of the people most important to me.

It’s like proprioception, your body’s ability to know where your limbs are. That subliminal sense of orientation is crucial for coordination... Twitter and other constant-contact media create social proprioception. They give a group of people a sense of itself, making possible weird, fascinating feats of coordination.

Implicit in Thompson’s example is the necessity of imagination as a process mediated by cultural and biological constraints. Why is this so? In order to develop a “sense” of oneself in relation to others through Twitter, one has to engage constantly in the process of making an image of the world, and of the people in that world. Thompson’s example foregrounds the space-time expansion of the psychological image that results from receiving a stream of granular updates from specific others. By the same token, it alerts us to a kind of “temporal trade off” between the rapid and wide distribution of myriad tweets and the slower, but more durable and long-lasting, conventions of everyday face to face discourse. In another respect, however, the image of the world generated by constant-contact media produces the space in which the self can emerge in a social environment.

Indeed, the claim that social proprioception refers to an expanding sense of self is best understood, we believe, as the social expansion of one’s image of the world. Constant contact with others through Twitter makes one’s social context more proximal. At the same time, however, it extends the *reach* of our social action. The

⁵ Twitter operates on the simple model that each individual can broadcast short, instant messages (*tweets*) to whoever is subscribed to that individual’s Twitter “feed.” Individuals may also subscribe to other individuals’ twitter feeds. The result is an horizontal, uneven network of broadcast relations; but the model itself its extremely simple. A limit of 140 characters is imposed on all tweets. Over the course of a day, an individual subscribed to twitter feeds of others can expect to be regularly, instantly notified of new tweets from specific people they know. The service is increasingly integrated in mobile devices, making it “always on, always available.” In short, tweets are constant, immediate, available, grab the attention and require little effort to read and respond.

double movement of proximity and reach alters the kind and degree of social life in which one is engaged. It is what Suvorov refers to as “rising from the world and returning to it again.” Vygotsky indicated that this kind of expansion arises in collective, social life when he wrote that imagination is “the means by which a person’s experience is broadened, because he can imagine what he has not seen [and] can conceptualize something from another person’s narration and description of what he himself has never directly experienced” (2004, p. 17). Twitter is a cultural artifact which organizes imagination processes that draw the self out, as a self, into a social world. The psychological images formed through these imagination processes are drawn from prior experiences of the world but, again, are not “of” the world. They are images that condition thought and action vis-a-vis *others*. As a result, tweeting makes it possible for a group of persons to get a sense of itself, “making possible weird, fascinating feats of coordination.”

An instructive example of social proprioception through Twitter-enabled imagination was illustrated with enormous international political force in June 2009, when Twitter users in Iran broadcast the course of populist demonstrations (called the “Green Revolution”) against the country’s government after suspected tampering in the Presidential election. In response to the protests, the Iranian regime clamped down on internet infrastructures. Twitter, however, remained a means of communication between the protesters inside Iran and those outside Iran. As it turns out, Andrew Sullivan—a former editor of *The New Republic* and author of one of the most frequently updated political blogs on the internet—had been in contact with many Iranian bloggers in the months leading up to the disputed June election results. Sullivan describes his experience collecting and retransmitting tweets, the perfect location for a mediator of such activity, in the week after the beginning of the “revolution:”

With internet speed deliberately slowed to a crawl by the Iranian authorities, brevity and simplicity were essential. To communicate, [Green Revolution partisans in Iran] tweeted. Within hours of the farcical election result, I tracked down a bunch of live Twitter feeds and started to edit and rebroadcast them as a stream of human consciousness on the verge of revolution.

The effect was far more powerful than I had expected. A mix of fact and feeling, rumor and message, here was day one: “It’s worth taking the risk, we’re going. I won’t be able to update until I’m back. Again thanks for your kind support and wish us luck.” “People were holding signs saying, ‘We are not sheep.’” “State TV right now: rally is illegal and police will use iron fist against law breakers.” “Tens of thousands of protesters are chanting ‘No fear, no fear.’” (Sullivan 2009)

The constant contact between Sullivan, the protesters, and gradually the international news media had a two-fold effect. First, Sullivan claimed, as did many others, that he *felt* the event happening in real-time to people with whom he felt a deep empathy. These feelings—which in our view can be understood as an “expanded” sense of self—fomented in large part because it was possible to imagine some form of “being there.” “It was like reading a million little telegram messages being beamed out like an SOS to the world,” wrote Sullivan; “within seconds I could transcribe and broadcast them to hundreds of thousands more.” Second, the constant-contact between people inside and outside Iran began to produce a common image of the world. Indeed, it was this

“common image” that was often referred to in the press, on blogs, and on television as the strange effect of a Twitter-mediated experience. Here is how Sullivan describes the effect of this common world feeling:

As I did so [re-broadcasting tweets on his blog], it was impossible not to feel connected to the people on the streets, especially the younger generation, with their blogs and tweets and Facebook messages—all instantly familiar to westerners in a way that would have been unthinkable a decade or so ago. This new medium ripped the veil off “the other” and we began to see them as ourselves.

Concluding Comments

At a minimum, we hope to have convinced the reader that imagination is constitutive of human thought, and should *neither* be understood as a specialized mental faculty *nor* as the creation of unreal fantasies. The contents of the imagination, though taken from the world, are not entirely “of” the world. Similarly, the contents of the imagination, though resolved within the individual, are not entirely “of” the individual. And yet, or perhaps because of this, the process of imagination is crucial to constituting the world and thereby the mind and experience of the individual. Normal mental processes are not reducible to either culture, biology, or individual experience. There are fundamental “gaps” that must be resolved for individuals to think or act in relation to the world. Resolving these gaps through image making constitutes the self and the world in the same process. It is inherent to the structure of human cognition and action.

We hope to have demonstrated that the relevant “gaps” are of many kinds and depend on the medium in which an individual is situated. For fixed images, the conditions have been simplified to highlight the cultural and biological sources of gap filling (imagination). The case of the blind deaf provides a metaphor that links imagination to the process of mediation in which both the “separation” and “coming together” aspects of the image formation process are highlighted. We combined these two sets of observations to motivate introducing a temporal aspect into the basic Vygotskian, triangular, representation of mediation, revealing in a new manner the way in which the mediated and “immediate” contributions to image formation are not perfectly aligned, requiring active resolving. The remaining examples illustrated additional kinds of gaps, conceptual and temporal, produced from different mixing of the biological, cultural and individual. In the case of the processes arriving at a generalized image of an oil spill, we experience the contingency of the paths of conceptual change that are possible. Some viewers grasp a generalized image, but the manner in which they do so is revealing. Failures to grasp a conceptual generalization were precipitated by “prematurely” stopping at a different level of structuration. The claim here was not that one imagination is more correct than another. Rather, we pointed to the contingency and diversity of imagination in underlying other psychological processes (here, perception). The link to montage similarly illustrated that a wide variety of cultural meanings can be constituted by juxtaposing even just two images. Finally, social proprioception illustrates how the spatial / temporal affordances

of tweeting, combined with a sufficient penetration of the technology into a society and a high enough level of literacy may bring into being new, expanded, yet proximal social worlds that shift the bounds of self and other.

With this material before us, we wish to return to the epigraph from Vygotsky at the head of this essay which we repeat here for convenience of discussion: “All that is the work of the human hand, the whole world of culture, is distinguished from the natural world because it is a product of human imagination and creativity based on imagination.” There is much at stake in understanding this oft-repeated quote. A major importance, perhaps, is the delineation of new areas of research when we understand how imagination and creative are two distinct, yet inter-penetrating, processes. From a cultural-historical point of view, studies of activity, pedagogy, art, or learning all imply some forms of imagination and creativity, and it is conceptually useful to understand how each are distinct and related. But clearly understanding this passage also has broad implications for the study of psychology, as we’ll hope to persuade the reader of below.

This passage by Vygotsky implies that creativity begins with a process of imagination from which something new emerges and becomes “the work of the human hand.” This suggests to us that Vygotsky is re-visiting the idea that the “thought is completed in the word” as it makes the transition from sense to meaning. The work of the human hand (like the word carried through an audible medium) produces the world of culture in which thought can circulate and organize our lives. Psychological processes of imagination thus externalize or introduce something ineluctably new into the world, however it may be perceived as “new.” If it is perceived as new the products of imagination become creative when they enter cultural world of interaction.

However, we cannot jump too quickly to the notion that “first there is imagination and then there is creativity” because in the opening lines of the same essay, Vygotsky writes:

Any human act that gives rise to something new is referred to as a creative act, regardless of whether what is created is a physical object or some mental or emotional construct that lives within the person who created it and is known only to him. (p. 7).

Viewed only from the point of view novelty, it seems difficult to distinguish imagination from creativity. To focus on the *products* of imagination or creativity, in this regard, makes it difficult to understand the complex interrelations of the two processes. Both processes involve the production of novelty through the combination and recombination of aspects of prior experience. Both develop something “new” (although exactly how, why, or what novelty entails remains at issue), yet both combine pre-existing forms such that one encounters discussion of the processes as “creative imagination.” Some criteria of “novelty” is often taken to be a primary criteria in the psychological literature when discussing imagination or creativity. But our reading suggests that this may over-emphasize a term that ends up confusing two distinct and related processes.

The merging of imagination and creativity occurs elsewhere in Vygotsky’s discussion. He writes, for example, that imagination is central to human thought as a means of dealing with variations and uncertainty in the natural and cultural environment.

“If the brain’s activity were limited merely to retaining previous experience, a human being would be a creature who could adapt primarily to familiar, stable conditions of the environment. All new or unexpected changes in the environment not encountered in his previous experience would fail to induce the appropriate adaptive reactions in humans (p. 9).

Consequently, in order to cope with a constantly changing environment where new experiences abound, the brain constantly

“combines and creatively reworks elements of this past experience and uses them to generate new propositions and new behavior... . It is precisely human creative activity that makes the human being a creature oriented toward the future, creating the future and thus altering his own present (p. 9).

While these statements are perfectly interpretable we prefer to maintain a distinction between processes occurring in the brain on a temporal scale of microseconds and those occurring in the environment of which the brain and body are a part. Imagination and creativity do combine, in many ways, but they are nonetheless differently mediated and differently experienced parts of human cognition and action. Again, the criteria of “novelty” blurs attempts to define a clear distinction and relation between them. Vygotsky’s quotes above point, however, to the way forward: imagination and creativity are different kinds of developmental, adaptive processes. They must be understood as part and parcel of how an individual thinks and acts in culturally-mediated environments.

Thus, when we keep in mind the temporalities of cultural mediation that we emphasized in the open triangle in Fig. 3 which highlight the non-correspondence, in time and content, of “direct” (phylogenetic) and “indirect” (culturally mediated) thought / action, we begin to see similarities among, and differences between, imagination and creativity. The processes differ in that imagination is primarily an intra-psychological process, ending when a resolution between the mediated and direct sources of experience is made. It is at this point that creative processes begin—insofar as the individual embodies in some form the products of imagination—on a socio-historical scale and logic of temporality. At this moment an image, now embodied, enters the world of social relations. Csikszentmihalyi (1988, 34) has described the ensuing possibilities well:

What we call creative is never the result of individual action alone; it is the product of three main shaping forces: a set of social institutions, or field, that selects from the variations produced by individuals those that are worth preserving; a stable cultural domain that will preserve and transmit the selected new ideas or forms to the following generations; and finally the individual, who brings about some change in the domain, a change that the field will consider to be creative. [...] Creativity is a phenomenon that results from interaction between these three systems. Without a culturally defined domain of action in which innovation is possible, the person cannot even get started. And without a group of peers to evaluate and confirm the adaptiveness of the innovation, it is impossible to differentiate what is creative from what is simply statistically improbable or bizarre.

What is crucial here is that creativity and imagination, though both involved in the production of novelty, cannot be understood by the criteria of their products. What is primary and irreducible to creativity is *social and cultural change* in the world of reciprocity, norms, laws, knowledge, and institutions—that is, in a “culturally defined domain of action in which innovation is possible.” Imagination, for its part, references not simply the criteria of novelty in an “image,” but the *development of an individual* into a social, cultural form of life. The example of the blind-deaf shows that imagination is the process which makes it possible for an individual to emerge as such and, thereby, for the world to come into view. What distinguishes creativity from imagination are the temporalities (micro-fragments of experience, cultural time, etc.) and forms of development (ontogenesis vs. cultural-historical change) that are involved in each.

Consider the cyclical, mutually-dependent nature of the interpenetration of creativity and imagination. Images embodied in art, writing, and speech are taken up, valorized as creative, reproduced across various social forms, and then re-appropriated by the individual. Individuals who are appropriating images are constantly “making sense” of the meanings embodied in our cultural environments. To the extent that this form of “making” is more than a play on words, it reminds us that we are discussing a reciprocal process of organism-environment exchanges so that what is produced by the imagination at one time may become a source of imagination at a later time. In the meantime, however, the image has been transformed by its social and cultural existence; that is, by the activities of others who have appropriated and re-embodied a set of images of the world which make possible thought and action. The interpenetration of these two processes seems to us to be the cause of inconsistencies when scholars discuss imagination and creativity, particularly when the criteria for creativity or imagination is “novelty.” Precision is aided if we keep in mind the predominantly individual-temporal-spatial of imagination in contrast with the socio-historical aspect of creativity, a distinction that leads us to think of each process in terms of change, constraints, conditions, and gaps, as opposed to products of each process alone.

To understand the inter-penetration of these processes, then, means to recognize that both are involved in, and constitutive of, broader developmental processes. To remediate mind through culture already draws individuals into social forms of thought and living, because the constraints on mind are partially cultural in nature. Vygotsky argued this early in his career when he wrote on the psychology of art: “art is the social within us, and even if its action is performed by a single individual, it does not mean that its essence is individual.” (Vygotsky 1925/1971, 249). As with art, so with other cultural artifacts. The necessity of imagination in human beings is not only a necessity to think and act socially; it is a requirement to develop, expand, and order one’s life within a set of cultural meanings and social relations with others. The mind draws the individual into the social world by image making. Embodying images in material culture does entail embodying one’s “self” in culture, although the degree to which the personality of individual remains tied to embodied images is highly variable. The degree to which this happens in different contexts depends on, as Csikszentmihalyi, the “three main shaping forces” of creativity. But here again we may note that cultural-historical development—the domain proper of creative processes—is impossible unless it is

actively changed by the imaginations of individuals. Whether in the case of Twitter, New Yorker images, or montage, the introduction of something “new” in the world is a mediating moment of broader processes of cultural, social, and individual development.

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