they nevertheless accept fundamental reductionist claims. Holists would agree that to suggest that no “correct” knowledge can be gleaned without perfectly elaborated context is to deny that we can, in the vision science analogy, understand or predict any dimension of response to natural scenes using reductionist models. This is demonstrably not the case (David & Gallant 2005; David et al. 2004).

For example, measurement of reduced properties of naturalistic stimuli can grant novel and unexpected insights — with respect to vision and to art. The basic statistical properties of natural scenes such as spatial frequency spectrum characteristics have been shown to be regular, and this regularity influences mammalian vision via evolutionary demands for efficient neural coding (Field 1987; 1994). Regularity exists despite the common impression that natural scenes are limitlessly diverse — indeed, this naïve view went mostly unchallenged until the 1980s. However, we now know that natural scene regularities shape systems including retinal and cortical coding, object segmentation, and attention, and so forth (see Geisler 2008).

Experiencing reduced aspects of art while retaining a degree of naturalism is likewise essential to scientific understanding of this unique and defining human trait. By measuring low-level statistical properties in samples of world artwork from many cultures and time periods, we find that art also has regularities. In particular, nearly all paintings, like natural scenes, show scale invariant (1/f) spatial statistics (Graham & Field 2007; 2008; Redies et al. 2007) — again, despite apparent heterogeneity. This means artist output is constrained by evolved aspects of the visual system: images lacking such regularities (e.g., very blurry images, or random, white noise images) are difficult for the system to process, because of its evolved coding strategies. Such images are in a way imperceptible. No artist or movement would last long making only, for example, white noise images, because they would be indistinguishable — even though there are far more possible white noise images than there are particles in the universe (Graham & Field 2009). Thus, certain types of art are a priori unlikely to be made or appreciated. Such fundamental knowledge is revealed without reference to historical context, but does derive from the study of basic, shared properties in natural exemplars and — crucially — from consideration of their relation to the brain.

Moreover, if we defer to historical context — to the exclusion of reductionist empiricism — we can come to mistaken conclusions. Consider Jackson Pollock: we know from historical documentation that Pollock’s paintings were created using drip techniques that employed significant randomness. Indeed, what made his art so avant-garde — even compared to earlier automatist art — was precisely this randomness (Chave 1999). Though Pollock retained a degree of deliberate design, the randomness of his art is today seen as essential to the appreciation of his work, as B&R note. Thus, taking the stance of historical philosophism, we might conclude that such paintings prove our visual system can appreciate random patterns so long as we comprehend the appropriate context.

However, when we examine Pollock independently of “causal data” and historical context, and instead test his work with respect to basic properties relevant to human vision, we see that in fact Pollock’s paintings are not truly — or even approximately — random. They show robust scale invariant spatial statistics, which are mostly indistinguishable from those of natural scenes, representational art, and nonrepresentational art (Graham & Field 2008). Pollock thus shares fundamental properties with other art styles, which are in turn shaped by visual coding. We can even suppose that if they were truly random, his paintings would not have been appreciated — neither in his time nor ours. This gives us a rather different perspective on the appreciation of Pollock’s work.

B&R’s arguments can be challenged on their own philosophical terms as well: for example, which experts are we to trust with regard to “correct” context, and when do we declare such stories unassailable? Rigid contextualism invariably leads to revisionism: because the “relevant facts” change with greater perspective — consider that Pollock was dismissed as an unserious showboat in his time by serious critics and artists — we often cannot appreciate context until we have created mythology, which is surely anathema to B&R’s demand for historical accuracy.

B&R’s strain of utopian philosophy is of little relevance in the empirical sciences. Yet accounting for naturalism is surely warranted — in the scientific study of art, as in vision science. The solution in both fields is to integrate holistic and reductionist approaches.

Memories of Art

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Abstract: Although the art-historical context of a work of art is important to our appreciation of it, it is our knowledge of that history that plays causal roles in producing the experience itself. This knowledge is in the form of memories, both semantic memories about the historical circumstances, but also episodic memories concerning our personal connections with an artwork. We also create representations of minds in order to understand the emotions that artworks express.

Bullot & Reber (B&R) have brought several important features of art under the umbrella of their approach, most notably the history of art itself. Their framework has several resources for capturing the appreciation of art and is expandable to take in further aspects as they are understood. In this response, I will make several suggestions toward the improvement and expansion of the theory.

It is odd to think of the viewer as somehow recovering the history of an object from the object itself, as the authors do, except in certain specialized senses. We frequently have knowledge about the art-historical context of a work prior to exposure to it. It is this knowledge that plays important roles in our appreciation of art, rather than the historical events themselves. The history taught to students of art, for example, plays vital causal roles in how they go on to create and perceive artworks. Certain aspects of art’s history are exaggerated to make them entertaining and memorable. Many of the most famous stories of artistic creation are at the very least embellished, or even spun from whole cloth, but their purpose is motivational, not merely instructional.

Theory requires both the actual historical context and the remembered historical context. We need to know what the artists of a certain movement thought the history of art was, in order to understand their work. We also need to understand how this knowledge comes into play in creating and understanding art. How exactly is the history of art encoded in the memories of those who know it? How are the right portions of that memory brought up in a given context? How do these memories participate in the creation, augmentation, and continuation of aesthetic experience? We also need to speak of the history of art itself. When mistakes are made about the history of art, we need to have a concept of the actual history in order to make sense of that. We also need it in order to make sense of one account being more correct than another.

Not all of our memories of the history of art are neutrally stored as impersonal semantic memories. Some of them are memories of personal experiences involving the artwork and are stored among our episodic memories. There is need for caution here; several fallacies lurk. In the right context, a blurry memory from having heard a piece of music long ago can be mistaken for an aesthetic
response to it, or both memory and response can happen in a tangled mélange. Worse, someone might mistake a positive association with an artwork for a positive aesthetic response to it. A man likes a certain song merely because it was playing when he first danced with his future wife. The positive role of memory here is that it allows us to progressively enrich and mature our aesthetic experience of a work. Lovers of art revisit their favorite works, slowly altering and augmenting their understanding of them each time. We know that memories evolve over time rather than remaining frozen, like videotapes. This evolution can make eyewitness testimony unreliable, but it is welcomed by the art appreciator. Without memory of some sort, our aesthetic taste cannot mature. We cannot move beyond the songs we liked as children. Just as artists move on to new styles, their viewers move with them, partly by having the same sets of experiences with the old style, which prepared them to receive the new style. The accumulation and continued use of art-historical knowledge is a vital part of living a life enhanced by art. In other places, B&R describe something closer to procedural memory, for example where they speak about listeners implicitly learning how to perceive higher-level properties of music, such as the relationship between a theme and its variations, through repeated listening.

Another vital knowledge resource we bring to artworks is our empathic ability, but empathy in a deeper sense than B&R describe. We not only understand intentions behind artworks, but we also create full-blown simulations of human minds in order to understand them. Music expresses emotions, of course, but whose? Perhaps those of a hypothetical persona (Levinson 1996b; Robinson 2005); someone who underwent a series of emotional experiences expressed by the music. We don’t merely understand isolated mental states; we employ representations of an entire mind (Hirstein 2010).

The most obvious and strong aesthetic experiences do seem to involve fluency, but this practice is deviated from so frequently that fluency alone is not enough of the story, as B&R seem to recognize. There are several interesting ways in which fluency and disfluency have been combined in single artworks. The blues, for example, can establish a background that is perceived fluently, because it is familiar, repetitive, and so forth, on top of which the instrumentalists, especially the lead guitarist, are free to experiment with disfluencies (within careful limits). Visual art can use pattern to produce fluent intake, which can then form a background for more original motifs. Fluent processing keeps us in routine mode, but no artist wants her viewer receiving her work like this. Artworks entice us to think, to emote, to remember, and the better ones do all three.

In describing the peak shift effect, Ramachandran and I (1999) were pointing to features of the perception of art that cannot be accounted for by an understanding of art history, but which can be accounted for by an understanding of how the brain reacts to artworks. The peak shift effect can help us understand why a given form produced a stronger aesthetic reaction in a case where no amount of knowledge of the history of art could have predicted that, because the explanation required specific knowledge of the human perceptual/cognitive system. Or, to make the point stronger, the explanation might require knowledge of features of the perceptual system that had not previously made themselves evident in the history of art, so that the use of historical knowledge to predict them would be all but impossible.

**Abstract:** The target article presents a thought-provoking approach to the relation of neuroscience and art. However, at least two issues pose potential difficulties. The first concerns whether “art appreciation” is a coherent topic for scientific study. The second concerns the degree to which processing fluency can explain aesthetic feeling or may simply be one component of a more complex account.

“Art appreciation” involves at least four distinct sets of concerns. Two are aesthetic. First, there is actual aesthetic response—a person’s feeling of aesthetic pleasure in a work. Note that this can change. Thus it is not confined to basic exposure. Second, there is normative aesthetic evaluation—the judgment that a work merits an honorific such as “beautiful” or “sublime.” Neither of these entails the other. I may find something aesthetically pleasing but judge it to be kitsch. Conversely, I may recognize that something is aesthetically accomplished but be unmoved by it.

The third and fourth concerns are more institutional. The third is whether something is socially treated as art. The fourth is whether a work should be categorized as art. Both are independent of aesthetic feeling and aesthetic judgment. For example, a work may be understood as normatively artistic if it introduces new stylistic techniques, even if those techniques are used somewhat ineffectively (as in one common view of Edouard Dujardin’s interior monologue; see for example Beja 1992, pp. 66–67).

The point of this analysis is twofold. First, it clarifies why art appreciation is “psycho-historical.” What we call “art appreciation” involves concerns that are emotional and responsive, hence psychological. It also involves institutional issues that are historical. What is actually taken to be art is a function of history. Moreover, what should be taken as art is in part a function of a given work’s relation to previous works (e.g., the way it adds technical devices to those available), hence history. In consequence, an account of art appreciation will need to involve both historical and psychological elements. But that risks making the “psycho-historical” claims banal. Art appreciation may be “psycho-historical” only in the sense that part of art appreciation is psychological and part is historical.

The second point of the preceding analysis is related—and it brings us to the second large issue raised by Bullot and Reber’s (B&R’s) article, that of explanation. It is important to be clear about the different components of art appreciation, explaining them separately as they are separate components. Of these, aesthetic response is perhaps the most relevant to neuroscience. As Thaut explains, “Theorists in experimental aesthetics” have proposed that aesthetic pleasure increases with complexity “until activation becomes too complex” (2005, p. 22). Apparently going against this trend, B&R discuss aesthetic response in terms of processing fluency. However, if pleasure is a function of processing fluency, there is no clear reason why we continue to pay attention to works that frustrate fluency—or why we do not simply get our aesthetic pleasure from quotidian, readily processed objects initially. Nor is it clear why we tire of works, given that processing fluency should increase in, for example, “over-listening” to music. Aesthetic pleasure points to reward system involvement. Some music research suggests that reward response may involve successful pattern isolation (see, for example, Vuust & Kringlebach 2010, pp. 256 and 266 on “anticipation/prediction” and reward and p. 263 on “violation of expectancies”); on reconciling “anticipation/prediction” and “violation of expectancies,” see Hogan, forthcoming). This should not simply be a matter of processing fluency. Response should be affected by habituation (see LeDoux 1996, p. 138). Hence we might expect the most aesthetically pleasing work to involve some degree of predictability combined with some unpredictability, perhaps including components of each sort. The predictability might then constrain the unpredictability within some specifiable period of sustained attention. Unpredictability need not involve disfluency per se. Indeed, it seems more likely that the reverse is true, more fluent of an artwork we may infer partially formed possible outcomes but remains uncertain about the final result, hence exhibiting complex fluency. For