to the work of art may serve as a causal input to cognitive systems responsible for artistic appreciation. But those systems are already extended, having come literally to physically incorporate cultural resources themselves not contained within the boundary of the individual cognizer.

This is not to say that, as in cases in which the reliance on cognitive tools stops short of expertise, when artistic appreciation is more casual, uncertain, or passing in nature, it does not draw on extended cognitive systems in each of the three modes that B&R identify. My chief question for them is whether they view this introduction of the extended mind thesis as one they find useful for further articulation of their psycho-historical approach.

Authors' Response

A psycho-historical research program for the integrative science of art

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Abstract: Critics of the target article objected to our account of art appreciators' sensitivity to art-historical contexts and functions, the relations among the modes of artistic appreciation, and the weaknesses of aesthetic science. To rebut these objections and justify our program, we argue that the current neglect of sensitivity to art-historical contexts persists as a result of a pervasive aesthetic–artistic confound; we further specify our claim that basic exposure and the design stance are necessary conditions of artistic understanding; and we explain why many experimental studies do not belong to a psycho-historical science of art.

We thank the commentators for the unique opportunity to respond to commentaries and defend, revise, and extend our proposal. The commentators concur that it is timely to combine psychological and historical theories of art to overcome the controversies that divide the "two cultures" (Slingerland & Collard 2011; Snow 1959). We will argue that the outcome of this unprecedented collective effort is the outline of a novel psycho-historical research program for an *integrative science of the arts* (hereafter *science of art*). Our program provides a problem-solving strategy and both core and auxiliary hypotheses for research on the arts across different disciplines.

At the center of our program for the science of art is an acknowledgement of the need for a core of psycho-historical principles. Psycho-historical principles are empirical hypotheses that describe and explain interactions that tie historical individuals or categories with the mentality of cognitive agents. Despite the fact that commentators identify contentious issues, many support the core of the psycho-historical program. Importantly, no commentator has argued against the benefit of combining psychological and historical theories of art. This support for the program connects scholars working in fields as varied as art history, literary studies, cognitive archaeology, neuroscience, philosophy, and psychology.

In this Response, we roughly follow the sections of the target article (Table R1). We address commentaries on the foundations of the integrative science of art (sect. R1); the nature of art-historical works and contexts (sect. R2); the modes and mechanisms of art appreciation (sect. R3); psycho-historical empirical research (sect. R4); and the proposed extensions of the framework (sect. R5).

R1. The science of art and aesthetics

Following Shimamura and Palmer (2012), we will use *aesthetic science* to refer to the field that encompasses empirical aesthetics (Berlyne 1971; Fechner 1876), neuroaesthetics (Ramachandran 2011; Skov & Vartanian 2009; Zeki 1999), and the non-historicist part of philosophical aesthetics. Aesthetic science has promoted universalist explanations of aesthetic responses. This science is traditionally aimed at investigating so-called "hedonic" responses (Shimamura 2012, p. 4) and universal preferences for properties traditionally described as "aesthetic," such as attractiveness, balance, beauty, or harmony. In contrast to aesthetic science, our program seeks to develop a *science of art* understood as a rigorous theory of the arts that integrates empirical contributions from the biological, cognitive, and social sciences along with history and the humanities. Beyond empirical and neurobiological aesthetics, researchers in experimental philosophy (Knobe & Nichols 2008) and a variety of fields in social sciences may contribute to empirical research in the science of art as we conceived it.

Chatterjee, **Fitch & Westphal-Fitch**, **Graham**, **Leder**, **McManus**, and **Vartanian & Kaufman**, along with others in empirical aesthetics or neuroaesthetics, identify *aesthetic science* with the *science of art*. In contrast, the psycho-historical program entails that contemporary aesthetic science qualifies neither as an integrative science of art *qua* art nor as a science of artistic appreciation. At least two reasons support this claim. First, aesthetic science does not account for the historical origin of artistic categories and artistic functions. Second, it does not explain artists' and other appreciators' sensitivity to art-historical contexts and categories (premise 2, sect. 1.2 of the target article). Our assessment concords with positions defended by Bloom (1996a; 2010); Carroll (2000a; 2001); Davies (1991b; 2006b; 2012); **Gelman, Meyer**, & **Noles (Gelman et al.)**; **Gilmore**; **Hogan**; **Levinson**; **Parsons & Carlson**; and **Silvia**.

The psycho-historical program hypothesizes that the artistic domain ("the artistic") is not identical to the aesthetic domain ("the aesthetic"), though they may sometimes overlap. This distinction between the aesthetic and the artistic is defended by several contributions to philosophy of art (Carroll 2001; Danto 1981; 2003; Davies 2006b; 2012). Furthermore, the distinction is in the spirit of those works in anthropology, economy, history, or sociology that attribute functions to works of art that reach beyond the aesthetic because these functions pertain to economic, political, religious, ritual, and symbolic realms.

Table R1. A psycho-historical research program for the science of art

No.	Topics	Commentaries
R1.	The science of art and aesthetics	Chatterjee; Fitch & Westphal-Fitch; Gelman, Meyer, & Noles; Gilmore; Graham; Hogan; Leder; Levinson; McManus; Parsons & Carlson; Silvia; Vartanian & Kaufman
R1.1	Misled by the aesthetic–artistic confound	Gilmore; Leder; Silvia; Vartanian & Kaufman
R1.2	Sensitive to historical conceptions of the arts	Gilmore; De Smedt & De Cruz; Fitch and Westphal-Fitch; Hogan; Leder; Levinson; Thompson & Antliff
R2.	Art-historical works and contexts	
R2.1	Singular art histories amenable to scientific explanation	Chatterjee; Davies; Gelman, Meyer, & Noles; Graham; Newman; Thompson & Antliff
R2.2	Embodied or extended cognitive systems	Gibbs; Hirstein; Leder; Malafouris; Rollins; Wilson
R2.3	Traces of intentions or inheritors of functions	Davies; De Smedt & De Cruz; Fitch & Westphal-Fitch; Levinson; Parsons & Carlson; Rollins; Ross; Tullmann
R3.	Art appreciation	Hogan; Tullmann
R3.1	Basic exposure	Hirstein; Rollins; Ross; Schellekens; Thompson & Antliff; Tullmann
R3.2	Artistic design stance	De Smedt & De Cruz; Fitch & Westphal-Fitch; Gelman, Meyer, & Noles; Ross; Schellekens; Thompson & Antliff
R3.3	Artistic understanding	Gilmore; Leder
R3.4	Mental and brain processes	Freeman & Allen; Hogan; Silvia; Takahashi & Ejima; Thompson & Antliff
R4.	Psycho-historical empirical research	
R4.1	Dependent variables	Gilmore; Ross
R4.2	Independent variables	Chatterjee; Gilmore; Leder; Silvia; Vartanian & Kaufman
R4.3	Misled by ahistorical universalism	McManus; Graham
R5.	Expanding the psycho-historical program	Freeman & Allen; Gelman, Meyer, & Noles; Gibbs; Hogan; Kozbelt & Ostrofsky; Malafouris; Newman; Wilson
R6.	Conclusion	

R1.1. Misled by the aesthetic–artistic confound

Theories that neglect the distinction between the aesthetic and the artistic stem from what we propose to term the *aesthetic–artistic confound*, which is a theoretical assertion that identifies the aesthetic domain with the artistic domain, or at least significantly obscures their differences. Views that promote the aesthetic–artistic confound are expressed in numerous contributions to philosophical aesthetics (Beardsley 1958/1981; 1983; Kant 1793/2000; Stolnitz 1960) and aesthetic science (Dissanayake 1992; Jacobsen 2006; Leder et al. 2004; Locher 2012; Ramachandran 2011; Skov & Vartanian 2009); see also **Leder** and **Vartanian & Kaufman**. Even one of us (Reber) could not free himself from the seductive appeal of this confound (Reber 2008; 2012).

A philosophical view derived from the aesthetic–artistic confound is the *aesthetic theory of art* (Osborne 1981; Tolhurst 1984), which asserts that the chief function of art is to induce aesthetic experience (for a critique of this theory, see Carroll 1986; 2001).

The prevalence of this confound in psychology is illustrated by the fact that the journal of the *International Association for Empirical Aesthetics* is titled *Empirical Studies of the Arts*. Likewise, many researchers take for granted that *neuroaesthetics* is an adequate term to denote research on the neural bases of art appreciation, or that the term *aesthetic science* is acceptable to describe the scientific study of art (Shimamura 2012).

Silvia was puzzled by the fact that "aesthetic science has an ambivalent relationship with art itself." However, this "ambivalent relationship" is only puzzling if one takes for granted the seductive but misleading aesthetic–artistic confound. Likewise, Currie (2004), **Gilmore**, Hyman (2006; 2010), and Noë (2011) have criticized aesthetic science on the contextualist ground that this science neglects the arts and their singular histories. Their criticisms echo earlier assessments (Dickie 1964; Munro 1951, pp. 178–80). Such disputes would not arise if researchers could agree on how to demarcate the science of art from aesthetic science.

R1.2. Sensitive to historical conceptions of the arts

The psycho-historical research program defends a contextualist foundation for the science of art, which is currently missing in aesthetic science. In response to our critique of aesthetic science, **Chatterjee** claims that "artistic meaning" can "be ahistorical." In our opinion, asserting that artistic meaning can be ahistorical is problematic because it invites or legitimizes disregarding of the art appreciator's sensitivity to art-historical contexts (see **Gilmore**; **Hogan**; **Levinson**). In contrast to ahistorical views, our aim is to argue that the science of art needs to take into account art-historical phenomena studied in social sciences and the humanities – such as art-historical categories and cultural learning (Richerson & Boyd 2005; Sterelny 2012) – to avoid the pitfalls of radical forms of anti-contextualism.

Consider the varieties of art-historical categories. Agents involved in art-historical contexts and scholars studying these contexts develop different conceptions of the arts (Shiner 2003; Tatarkiewicz 1971). For example, *techne* in Greek (τέχνη, technique), *ars* in Latin, the concept of *liberal arts*, or the *romantic concept of art* are distinct

categories. We agree with **Fitch & Westphal-Fitch**'s and **Leder**'s claim that these different historical categories should not be identified with the modern concept of *fine arts* (Shiner 2003). Art-historical categories like *techne* or *liberal arts* refer to distinct *historical kinds* (Hacking 1995; 1999; 2002; Millikan 1999; 2000). Art-historical names like *Yirrkala bark petitions 1963* (Museum of Australian Democracy) or *Edvard Munch* refer to distinct *historical individuals* (Danto 1966; Strawson 1959). Such historical kinds and individuals are generated by singular causal processes that can often be discovered by means of historical inquiry (see R3.2; and **De Smedt & De Cruz** for a discussion of problematic cases). The psycho-historical program is based on the thought that one of the core tasks of a science of art is to account for the appreciator's sensitivity to such art-historical kinds and individuals. Because the psycho-historical program stresses the variety of art-historical contexts, kinds, and individuals, we disagree with Fitch & Westphal-Fitch's and **Thompson & Antliff**'s claim that our program is irreversibly tied to Western fine arts (see also R3.2).

R2. Art-historical contexts

R2.1. Singular art histories amenable to scientific explanation

Bloom (2010), **Gelman et al.**, and **Newman** agree with our core hypothesis that the cognition of historical individuals and kinds is essential to art appreciation. As illustrated in Figure 1 of the target article and as argued by Newman, art appreciators are often exquisitely sensitive to the fact that works of art are causal extensions of the individual agents who produced them. Such a sensitivity to unique artistic histories is demonstrated by phenomena associated with appreciators' interest in authenticity (Newman & Bloom 2012) and with contagion (Newman et al. 2011). Does art appreciators' interest in the uniqueness of art-historical agency raise a problem for the science of art?

We disagree with **Chatterjee**'s claim that scrutinizing layered historical meanings of an individual artwork is "too fine-grained a level of analysis to be resolved by the lens of scientific experimental methods." Humans routinely rely on the tracking of historical individuals over time to serve the identification of such individuals (Gutheil et al. 2008) and the scientific explanations of their behavior (consider the need to track individual organisms in ecology; see, e.g., Block et al. 2005). Furthermore, there is scientific work on the mental mechanisms engaged in tracking and identifying historical individuals, such as visual tracking (Kahneman et al. 1992; Pylyshyn & Storm 1988), multimodal tracking (Bullot 2009b; Bullot & Droulez 2008), memory systems for self-knowledge (Conway 1990; 2005), face recognition for identification (Gobbini & Haxby 2007), and other mechanisms that track agents' identities (Bullot 2006; Bullot & Rysiew 2007; Gutheil et al. 2008; Rips et al. 2006). Regarding art, the empirical research indicating appreciators' sensitivity to artistic historical individuals by Hood and Bloom (2008), Newman and Bloom (2012), and Gelman et al. (Gelman & Bloom 2000; Gelman et al. 1994; Gelman & Ebeling 1998; Gutheil et al. 2008) qualify as experimental research on the sensitivity to "layered historical meanings" (Chatterjee) of an art-historical individual. Lastly, though it rarely uses experimental methods and may often lead to historical fallacies (Fischer 1971), research in the historical social sciences and humanities that attempts to explain historical events can be based on rigorous evidence-based reasoning (McCullagh 1984; Shafer 1969/1974; White 1965; Wigmore 1913) and source assessment (Gottschalk 1950/1969; Howell & Prevenier 2001).

In contrast to **Chatterjee**'s skepticism about a science of the sensitivity to historical individuals and unique events, we think that such sensitivity can be explained by theories that combine models of cognitive mechanisms with models of particular historical contexts. How can this integration be achieved? As indicated in Figures 1 and 2 of the target article, the psycho-historical program proposes to apprehend art-historical contexts, artists, works, and the mechanisms of appreciation as *hierarchical* and *nearly decomposable complex systems* – in the senses expounded by Bechtel (2008; Bechtel & Richardson 1993) and Simon (1969/1996). Our program seeks to identify some relations of hierarchical dependence (or *loci* of control) between these complex systems. For example, we hypothesize that the artist's work depends on both an originative art-historical context and a particular sequence of the artist's actions; or that the appreciator's artistic understanding depends both on basic exposure and the design stance.

Graham claims that our "radical" contextualist approach to complex systems is a "variant of holism" that dismisses "the viewpoint of the opposing side" understood as either universalism or reductionism. However, this interpretation misses the fact that the psycho-historical program can incorporate universalistic hypotheses and be locally reductionist. The multilevel and multicomponent structure of complex systems encourages pluralistic analyses of causal structures at different levels of organization (Mitchell 2009). Such complex systems analysis can aim at identifying hierarchies of modular mechanisms whose workings are explained by means of reference to interactions between parts and subparts. This kind of view is remote from the holism criticized by Graham.

This hierarchical analysis of a nearly decomposable complex system can also be used in reply to an objection raised by **Thompson & Antliff**, who admit the lack of interaction between the psychology of art and art history but maintain that "it is not clear that such interaction will replace a status quo that is polarized." According to the psycho-historical program, the psychology of art and art history often have *interdependent* (rather than independent) explanatory objectives because they study the same complex systems. Thus, in principle, an *integrative explanation* that combines psychological and historical descriptions of an artistic complex system will be preferable to explanations that are not integrated.

R2.2. Embodied or extended cognitive systems

Gibbs, **Malafouris**, **Rollins**, and **Wilson** offer commentaries from the standpoint of externalist and embodied theories of cognition and art (see also Brinck 2007; Manzotti 2011; Tribble & Sutton 2011). How does the psycho-historical framework relate to externalist theories of the mind (Clark 2008; Menary 2010; Putnam 1975; Wilson 2004) and theories of embodied cognition (Barsalou 1999; 2008; Gibbs 2006)?

1. We are not aware of works in the externalist tradition that integrate the psychological and historical approaches in the way our program does. For example, when they refer to history, advocates of semantic externalism like Kripke (1980) and Putnam (1981) rely on philosophical conceptions of causal and social history that engage with neither particular models of psychological mechanisms nor actual works by historians. Likewise, the works singled out by **Wilson** on the extended mind thesis (Clark & Chalmers 1998; Wilson & Clark 2009) or Sutton's "historical cognitive science" derived from active externalism (Sutton 2000; 2006; 2008; 2010) have not examined the psycho-historical hypotheses that we propose about art appreciation.

2. Several core hypotheses of the psycho-historical program seem neutral with respect to the alternatives between externalism and internalism. For example, the relevance and truth of our hypotheses on the artistic design stance and artistic understanding do not seem to directly depend on the truth of the externalist theses defended by **Wilson** and **Malafouris**.

3. **Malafouris** claims that our framework is "internalist." But such a claim misses the fact that the psycho-historical framework defends an *historical externalism* that is interpretable as "externalist" in at least two important senses specified in philosophy. First, the framework posits that modes and episodes of art appreciation are relations of *epistemic tracking* in the sense expounded by externalist theories in epistemology (Azzouni 2004; Goldman 1967; 1999; Kornblith 2001; Liebenberg 1990). On this account, a mental episode is an act of artistic appreciation because it tracks (is sensitive to) objective art-historical kinds and individuals (see sect. R1). Furthermore, our program argues that the *classification* of a token mental event as an episode of *artistic* appreciation depends on the identification of determinative relations between the mental episode (e.g., perceptual state, emotion) and historical categories and functions of arts and crafts (e.g., *didjeridu*, *sfumato*, or *serialism*; see sect. R1). Thus, this account is also externalist in a *taxonomical* sense (Wilson 2004, pp. 81–82).

4. Certain auxiliary hypotheses of the psycho-historical program can be developed in the direction of an embodied approach as suggested by **Gibbs** or an approach based on perceptual strategies as proposed by **Rollins**. Embodied cognition (Gibbs) and the theory of perceptual strategies (Rollins 2003a; 2003b; 2004; 2011) provide interesting hypotheses on the appreciator's simulation of the artist's actions during the creation of the artwork (**Hirstein**; Rollins). For example, some implicit processes might bypass explicit forms of the design stance if traces afforded by the artwork enable tracking of the artist's actions by means of basic exposure alone. However, such implicit processes may explain only part of the process of artistic understanding because causal information from the artwork alone is often insufficient, as **Levinson** and **Ross** rightly argue (see sect. R2.3).

5. Our historical externalism is also reflected in our critique of the internalism of contemporary researchers in aesthetic science. The latter seem tempted to argue that episodes of artistic appreciation can be individualized independently of the relations of brain states to art-historical categories and contexts. In contrast to the externalist/contextualist approach, they may refer to knowledge stored in memory about the art-historical work and context (**Hirstein**). For example, although Leder et al.'s (2004) proposal is one of the most advanced models in the psychological approach, this model follows the traditional internalist methodology that dominates aesthetic science, and it lacks the contextualist and externalist characteristics of the psycho-historical framework. We concede to **Leder** that Leder et al. (2004) "postulated a stage of cognitive mastering, in which interpretation and assigning meaning are crucial." However, Leder et al.'s model does not account for the determinative dependence of art-historical understanding on the appreciator's sensitivity to objective historical individuals, kinds, and contexts. Consequently, the model can account for neither the genealogy of context-specific artistic functions (Parsons & Carlson 2008) nor the appreciators' sensitivity to such functions. For example, although the model could be integrated into the right part of Figure 1 (modes of art appreciation) in the target article, it circumvents the fundamental reference to the art-historical context depicted by the left part of Figure 1.

R2.3. Traces of intentions and inheritors of functions

We agree with **Levinson** that the concept of "causal-historical *traces* left in artworks" – used by Bullot (2009a, pp. 96–97); see also Leyton (1992), Shafer (1969/1974), and Smail (2008) on historical traces – is adequate for analyzing each particular artwork as a causal extension of its maker and originative context (**Newman**). We used the concept of causal traces in prior versions of the manuscript. However, one reviewer's objections about its generality led us to use the term "carrier of causal information."

Levinson argues that we adopt the misleading hypothesis that "causal history can be reliably inferred from what [we] call the causal-historical *information* carried by artworks." Levinson's concern about information would be warranted if we had linked causal information to necessarily true information-driven belief, akin perhaps to Dretske's (1981; 1994) theory of information-driven belief. Yet, this is not the case. We simply use *causal information* to refer to carriers of causal information *qua* appreciator-independent causal *traces*, which are also referred to as *cues*, *indices*, or *marks* in the literature. In fact, we agree with Levinson that causal information carried by the work is not a sufficient source for artistic understanding, and we do not assume that "retrieval is a simple matter" (**Ross**). Nor do we think that traces "transparently indicate" the artist's generative actions (Levinson). Artistic traces may be ascertained by means of multiple defeasible methods and sources that can be incorporated into the design stance. Relatedly, we agree with Levinson that beliefs, feelings, and explanations that result from the adoption of the artistic design stance are not immune to *errors* and *misunderstandings* (sect. 3.3.1), as implied in our connection between the design stance and inference to the best explanation (sect. 3.2).

The psycho-historical framework proposes hypotheses about the work as a causal trace of the artist's agency (sect. 2; **Newman**) and the genealogy of artifact functions (Parsons & Carlson 2008; Preston 1998). **Davies** thinks that we "identify artists' intentions as the primary data that appreciators attempt to retrieve from the art-creative

context in the process of comprehending artworks." But his point overlooks the fact that we acknowledge that works in the arts have a variety of complex *unintended functions* (**Parsons & Carlson**; **Ross**). Nevertheless, we concede to Davies that original intentions were mentioned too often without analysis of their complications. In that respect, Davies usefully lists seven complications faced by any appreciator who wishes to reliably attribute and interpret artistic agency. These complications refer to intentions that are (1) unconscious; (2) failed (see also Ross); (3) facilitated by social status and authority or (4) other factors in art-historical contexts; (5) categorial, as proposed by Levinson (1996b, p. 188–89) and Rollins (2004); (6) contradictorily assessed by actual intentionalism (Carroll 2000b) and hypothetical intentionalism (Levinson 2010); or (7) fancifully disconnected from actual historical intentions (sect. 3.1, R3.1).

Davies' typology of artistic intentions helpfully charts the rugged terrain that appreciators need to explore to track artists' conscious and unconscious agency (Davies 1982;1996; 2006a). Davies' analysis can be expanded by the psycho-historical program. For example, unconscious intentions may not be directly known by the means of introspection (Carruthers 2009; Wilson 2002). However, if causally efficient, our framework suggests that these intentions could be known indirectly if they leave causal traces in the artist's behavior and work (R2.3). For appreciators can adopt the design stance to retrieve information about these unconscious causes and keep track of the artist's action over time. Appreciation driven by the design stance and essentialist assumptions (**Gelman et al.**; **Newman**) might lead appreciators to posit unconscious drives – as in psycho-analytical interpretations of artistic creation (e.g., Breton 1924/1988, p. 316) – that seek to explain manifest artistic behavior and unconscious agency. Given appreciators' propensity to overattribute intentionality and mentality (Bering 2006; Heider & Simmel 1944), this interpretative process might lead to illusions and artistic misunderstanding (sect. 3.3; **Gilmore**; **Levinson**; **Newman**).

We agree with **Rollins** that the design stance may be "construed in terms of positing hypothetical intentions, *based on beliefs about the actual historical context* in which the work was produced;" see also **Tullmann**. From the standpoint of normative artistic understanding (**Gilmore**; **Ross**), the psycho-historical program implies that accounts of virtual artistic intentions have to be integrated with information from the art-historical context to obtain relevance and plausibility. If such information is not available (see **De Smedt & De Cruz**; **Fitch & Westphal-Fitch**), virtual etiologies or thought experiments (Gendler 2010) may be the only way to achieve a form of understanding that might be richer than basic exposure (sect. R3.2).

Parsons & Carlson elaborate on the difference between artistic intentions and proper functions. According to their account (Parsons & Carlson 2008), the *proper function* of an artwork does not essentially depend on artistic intentions; it "must be analyzed in terms of artwork's causal histories." Specifically, "an artwork has F as its proper function just in case it belongs to a type that has achieved selective success in the marketplace due to performing F" (Parsons & Carlson). In many cases, the artist never envisioned the proper function the artwork gained over time.

Parsons & Carlson's clarification is important because it strengthens artistic contextualism. However, we also focused on intentions as a means of stressing potential commonalities between Bloom's psychological and intentionalist account of artifact categorization (Bloom 1996a; 1998) and Parsons and Carlson's purely philosophical theory of proper functions. Furthermore, despite our endorsement of Parsons and Carlson's proper functions, we are interested in a more encompassing analysis of artistic functions because artworks may have ephemeral, albeit reproduced, effects that might correspond to artistic functions without qualifying as proper functions. For example, and in contrast to **Fitch & Westphal-Fitch**'s charge of elitism, the psycho-historical approach can vindicate the appreciation and understanding of *art brut* ("low art" or "outsider art") by self-taught or naïve art makers whose work has never been institutionalized (Dubuffet 1986). According to Parsons & Carlson, these works cannot be conferred proper artistic functions because they are not socially sanctioned or known as art. According to a more encompassing psycho-historical view, however, works of *art brut* nonetheless have artistic functions of a private type in which the self-taught *art brut* artist performs the functional roles of both artist and audience.

R3. Artistic appreciation

Hogan wonders "whether 'art appreciation' is a coherent topic for scientific study." **Tullmann** argues that the concept of *artistic appreciation* is "inadequately defined in the psycho-historical account." What makes an appreciation an act of *artistic* appreciation? Tullmann develops a discussion where she often substitutes the term "aesthetic" for the term "artistic" in a way that does not clearly distinguish between the aesthetic and the artistic (sect. R1.1). The psycho-historical framework, however, specifies *the artistic* in contrast to *the aesthetic* as a domain defined by actual art-historical kinds and functions (sect. R1.2) and not by phenomenal contents detached from historical kinds and historical categories (R2.2). Consequently, on our account, artistic appreciation can only occur if a work is appreciated as a token of an art-historical kind or function. For example, when the American authorities interpreted a sculpture by Brancusi as a "piece of yellow-colored metal" and not as an artwork (Heinich 1996a; Rowell 1999), although they might have responded to it aesthetically, they did not identify or evaluate it artistically. A working definition of "*artistic* appreciation" has to refer to responses that are sensitive to the fact that the examined work is an artifact belonging to some art-historical or craft-historical kind and context.

R3.1 Basic exposure

Tullmann asks whether basic exposure to the artwork is necessary in order to appreciate the work. Others questioned whether it is necessary for eliciting the design stance (**Rollins; Ross**) and subsequently causal "reverse engineering" (**Thompson & Antliff**) or artistic understanding (**Schellekens**). What about an artwork seen in the past (see also **Hirstein**)? Does a friend's testimony about a novel count as basic exposure?

Any exposure to information about the artwork, including poor reproductions or testimonies by friends, could count as rudimentary types of basic exposure. Could one appreciate a work as made by an agent in a particular context if we were unable to access any sorts of information about it? One could not. Thus, minimal basic exposure is a *necessary condition* for any mode of appreciation, and therefore for eliciting the design stance.

In many cases, however, minimal exposure would not be adequate in terms of searching for and finding the accurate causal information about the art-historical context. For example, poor reproductions, indistinct memories, or unreliable testimonies may misguide the artistic design stance, triggering searches for information that lack relevance. In contrast, veridical and rich external representations of artworks – for example, high-resolution visual, audio, and audiovisual depictions, "compliant notational systems" (Goodman 1968), or reliable testimonies (Lackey & Sosa 2006) – and veridical internal representations of artworks (e.g., episodic memories; see **Hirstein**) will facilitate the appreciator's search for accurate causal information when adopting the design stance. Consequently, the availability of veridical representations should facilitate appreciation of the work based on artistic understanding.

Rollins, **Ross**, **Schellekens**, and **Tullmann** criticized the hypothesis of a strictly unidirectional causal relation linking basic exposure to design stance and the latter to artistic understanding. As discussed in the target article, the arrows in Figures 1 and 2 refer to necessary conditions, not temporal order. For example, when a reader knows that she is going to read a novel, she presumably does infer a categorial intention (Levinson 1996; Rollins 2004), eliciting the design stance before basic exposure occurs. Nevertheless, the search for causal information typical for the design stance can only start with basic exposure to information about the artwork, for example by reading a novel. The actual process of appreciation is best captured as a recursive process including feedback loops. A reader may anticipate that she will read a novel and prepares to adopt the design stance. When reading the novel (basic exposure), she looks for relevant causal information that fosters artistic understanding, and artistic understanding subsequently informs further reading. For the sake of simplicity, the psycho-historical framework as depicted in Figure 1 in the target article is unidirectional, refers to the artwork as artifact and its reproductions, and does not consider the reception history. A fuller psycho-historical theory would be recursive, referring to memories (**Hirstein**) and the mechanisms of collective and individual agency that control the reception history of the work.

R3.2 Artistic design stance

Hypotheses about the design stance and essentialism made by developmental psychologists (Bloom 2004; 2010; Gelman 2003) belong to the core of the psycho-historical program (see also **Gelman et al.**). This choice is justified by the fact that these theories – which have been neglected by research in aesthetic science – take into account both philosophical and historical issues that are central to the psycho-historical program.

De Smedt & De Cruz observed that if knowing the art-historical context were necessary for artistic understanding, much early art could not be understood because historical information about earliest artworks from the Pleistocene is missing. We agree that this issue is important. The possibility of insurmountable difficulties or errors in the understanding of some artworks is compatible with our framework (sect. 3.3.1, R2.3). In their interpretation of the design stance, De Smedt & De Cruz propose that "some of the designer's intentions can be gathered non-inferentially through direct experience with prehistoric artworks." Their proposal suggests that causal information in the artwork itself may sometimes suffice to understand the designer's intentions. Although this suggestion is in the spirit of the psycho-historical framework, it faces the challenges raised by **Davies**, **Levinson**, **Ross**, and **Gilmore**. As Levinson and Ross pointed out, it seems unlikely one can transparently track the past from the perception of artwork traces without the support of independently justified beliefs about the art-historical context (sect. R2.3).

Similarly, **Fitch & Westphal-Fitch** claim that it is "often impossible to reconstruct the agent behind an artwork, or the context in which it was produced" and think that our framework "would confine the study of aesthetics to those works for which historical information is available, mainly post-eighteenth century Western 'high art.'" We disagree because our psycho-historical program can be deployed to study folk art and art from non-Western cultures. There has been growing academic interest in the history of oral cultures (Prins 1991), decorative arts and crafts (Craig et al. 1999; Dutton 1993; Green 2007; Vlach 1990), popular music and dance (Bohlman 1988; Buckland 2006; Connell & Gibson 2003), and folk tales (Ògúnjìmí & Na'allah 2005; Rölleke 1991; Yassif 1999; Zipes 2006) in both Western and non-Western cultures. This suggests that Fitch & Westphal-Fitch's claim that "we cannot know the maker of these works" is too strong. Furthermore, even if some of such artworks were unintelligible to a particular audience, the audience of the artist's time and culture – and not just the elites – would have had some form of understanding based on their knowledge of their originative art-historical context, such as the religious, ritual, and political functions of the work (Boyer & Wertsch 2009; Rappaport 1999).

Several commentators (**Fitch & Westphal-Fitch**; **Schellekens**; **Thompson & Antliff**) questioned the degree to which the art-historic context, and therefore the design stance, plays a role for art appreciation. Schellekens asked: "can we really assume that all artworks require us to take contextual information into account in exactly the same way?" Fitch and Westphal-Fitch assigned a minor role to the design stance and emphasized the role of the biological roots of artistic appreciation. We do not object to the hypothesis that there are biological roots of aesthetic preferences and biases, such as preference for symmetry (Jacobsen et al. 2006; Reber 2002; Rhodes 2006), that may explain ornamental functions. Our point is that if eliciting aesthetic preferences pertains to the functions and meanings of a work of art, the appreciator's understanding of these functions is dependent on an examination of the relevant art-historical context and kinds.

R3.3 Artistic understanding

We agree with **Gilmore**'s claim that "understanding and evaluation need to be disentangled and their relations of dependence identified," and that "artistic understanding

is a *precondition* of artistic evaluation, even if the two approaches proceed simultaneously." Commentators differ, however, in the assessment of whether the normative mode of understanding is a necessary ingredient of the psycho-historical framework.

Leder noted that the core of this problem lies in the "unnecessarily normative pretense that art is only truly appreciated in the *artistic understanding* mode." **Gilmore** provides a direct response to Leder. We agree with Gilmore that "a normative conception is required to distinguish the appreciation of art *qua* art from appreciation of it from artistically irrelevant points of view. According to a normative account of appreciation, an artistic evaluation can be distinguished from a mere liking or preferring by being answerable to reasons" (Gilmore; see sect. R1). Leder's opposition to the normative mode originates from the concern that it could widen the gap between the "two cultures" by making the empirical study of the arts more difficult, if not impossible, because of the singular nature of artworks. As discussed in section R2.1, however, scholars can conduct rigorous psycho-historical research on the sensitivity to historical individuals and kinds. Empirical research based on the psycho-historical program is possible (see R4), albeit challenging (**Ross**).

R3.4 Mental and brain processes

In agreement with **Silvia**, we think that the psycho-historical program can be integrated with appraisal theories of emotion (Ellsworth & Scherer 2003; Lambie & Marcel 2002; Lazarus 1991; Silvia 2005a). Mechanisms enabling appraisal of the relationship of the appreciator to art-historical contexts are likely to determine the nature of the appreciator's sensitivity and affective responses to expressive contents (Robinson 2005) or artistic intentions (Rollins 2004; Silvia 2005c). Furthermore, the appraisal of the art-historical context may enable the experience of emotions informed by artistic understanding (sect. 3.3.2).

Likewise, to contribute to a science of art *qua* art, research in neuroscience needs to present models of the brain mechanisms determining the appreciator's sensitivity to the art-historical context. We agree with **Takahashi & Ejima**'s claim that findings on "contextual information processing in the human brain" could enable "empirical experimentation" on the sensitivity to art-historical context. For example, recent hierarchical models of functional organization of the prefrontal cortex (Botvinick 2008) may serve as a framework for developing models of the neural mechanisms implicated in contextual reasoning triggered by the design stance and associated with artistic understanding.

Hogan, **Silvia**, and **Thompson & Antliff** comment on problems regarding fluency and expectation. On Reber's (2012) account, fluency, though influenced by it, differs from expectation because fluency is a phenomenal experience, whereas expectation and prediction are symbolic processes. In addition, surprising fluency is positive, not fluency per se. **Rollins** remarks that there "is no reason to think that false beliefs inevitably cause dysfluency." Reber and Unkelbach (2010) provide a Bayesian analysis of why false beliefs are more likely to cause disfluency than accurate beliefs. Transgressions (**Freeman & Allen**) may be another example of inducement of disfluency leading to alienation effects.

Silvia wrote that the appraisal approach to emotion "is probably more fertile than the processing fluency approach" in research about art appreciation. Although we agree with Silvia's suggestion that the appraisal approach to emotion can be integrated into the psycho-historical program, we do not view the appraisal and fluency approaches as mutually exclusive. Artists manipulate a multitude of mental and brain processes to generate artifacts and categories with art-historical functions. Such processes range from *basic processes* in vision (Zeki 1999), audition (Bullot & Égré 2010; Thompson 2008), or processing fluency (Reber 2012) to *context-sensitive processes* of theory-based reasoning (Murphy & Medin 1985) and emotions (Hogan 2011; Silvia 2005b). In regard to the making of art-historical functions, such processes complement each other.

R4. Psycho-historical empirical research

In this section, we address the commentators' objections to our analysis of the methodological implications of the psycho-historical program for empirical research (sect. 4). We reassess the choice of what scientists in aesthetic science traditionally measure (dependent variables; sect. R4.1) and of the factors they attempt to manipulate in their experiments (independent variables; sect. R4.2). We also illustrate how several commentators remain committed to ahistorical universalism (sect. R4.3).

R4.1 Dependent variables

1. We agree with **Gilmore's** and **Ross**' claim that measuring *liking* for studying appreciation of art *qua* art is misguided. For the choice of liking as a dependent variable tends to neglect the connections between art-appreciative processes and art-historical categories and functions, and thus amounts to committing a far-reaching aesthetic–artistic confound; see also Gilmore (2000; 2011). For example, measuring how much undergraduate students like artworks cannot directly provide clear information about the modes and mechanisms controlling appreciators' sensitivity to art-historical functions. Even asking experts in a category of art whether they like an artwork is pointless if it remains unclear how modulation of liking is controlled by processes sensitive to historical kinds such as the design stance or artistic understanding. Furthermore, many art-historical functions of artifacts, if not all of them (Carroll 2002; Goodman 1968), derive from pictorial or semantic content that demand an interpretation rather than stimuli that trigger pleasure or liking. Therefore, an appreciator's liking is unlikely to indicate the appreciator's sensitivity to categories and functions in an art-historical context. Assessing judgments of liking, quality, or interest without a concomitant assessment of artistic understanding is likely to be irrelevant to the study of art.

Given the prevalent use of liking as a dependent variable, we think with the benefit of hindsight that the criteria used in our target article for identifying studies meeting the criteria of the psycho-historical framework were too lenient.

2. Very few studies on the influence of semantic context (sect. R4.2) measured dependent variables that probed sensitivity to art-historical contexts, such as meaningfulness (Russell 2003), or understanding (Leder et al. 2006).

3. How can the same dependent measure become relevant or irrelevant for measuring art appreciation? Studies by Takahashi (1995) and Smith et al. (2006) illustrate this point. Both used

semantic differential scales as dependent variable. Whereas ratings in Takahashi's study measured the dependence between participants' categorical appreciation and artists' drawing intentions, Smith et al. (2006) have not explained how ratings in their study were sensitive to categories from an art-historical context.

R4.2 Independent variables

Chatterjee, **Leder**, and **Vartanian & Kaufman** directed our attention to studies that they interpret as consistent with our psycho-historical program. Leder argued that our target article "omitted a large corpus of existing research" that would develop psycho-historical hypotheses. The studies can be classified into two categories: (1) inquiries that manipulate the *semantic context* and (2) inquiries that examine the effects of *expertise* (Lindell & Mueller 2011).

1. Most of the studies that manipulate semantic context assess the effects of titles or descriptions on liking of an artwork without connecting this judgment to the cognition of art-historical contexts (Millis 2001; Specht 2010; Temme 1992). However, even if we ignore the problem of liking as a dependent variable and turn to independent variables, many studies that manipulated semantic context did not manipulate art-historical information. For example, they presented metaphorical titles (Millis 2001) and left open the way in which titles related to the art-historical context (Belke et al. 2006; Franklin et al. 1993; Leder et al. 2006).

In another manipulation of semantic context, Kirk et al. (2009b) presented abstract paintings with the labels *gallery* or *computer*, indicating that the paintings belonged to a reputed art museum or were generated by the experimenter with a computer program. Behavioral and brain imaging data indicated higher hedonic value for paintings labeled *gallery*. The study is similar to the thought experiment with Warhol's *Brillo Boxes* analyzed in the target article. However, this study lacks the controls required to determine that the observed effects reflect manipulation of the art-historical categories, and not, for example, effects of monetary appraisal because abstract paintings in a reputed museum presumably cost more than paintings purportedly created by the experimenter (see Plassmann et al. 2008, on effects of monetary value of wine on hedonic value). Future studies would have to ensure that art-historical categories are not confounded with other, less relevant variables.

2. Because experts possess more knowledge about art-historical categories and functions than non-experts, comparing the two groups should provide a means for probing appreciators' sensitivity to art-historical contexts. Does this entail that existing studies of expertise have already implemented a psycho-historical research program? We do not think so. Apart from the fact that most expertise studies assessed hedonic measures (Hekkert & van Wieringen 1990; Kirk et al. 2009a) that may be irrelevant to the art-historical context (sect. R4.1), they pose at least two methodological problems:

First, experts may like some artworks more than others not because of relevant artistic understanding but because they know which artworks have to be liked more if one is to count as an expert and connoisseur (Bourdieu 1979/1987).

Second, experts may like and remember artworks better (see Kirk et al. 2009a for a study on architects) not because they have become experts, but they may have become experts because they have liked and remembered artworks better from the outset. Experimental manipulation of historical knowledge may prove helpful to adjudicate this alternative (Kruger et al. 2004; Silvia 2005c; see sect. 4.1). In a study by Wiesmann and Ishai (2010), participants who were provided with more expert knowledge about cubism than the control group were better able to recognize the objects depicted by cubist paintings. This study meets the criteria of the psycho-historical framework because it provides the participants with art-historical knowledge and measures the recognition of objects in cubistic artworks, a dependent variable that might be more relevant to assessing sensitivity to an art-historical category than judgments of liking. By means of its manipulation of knowledge and use of non-evaluative variables, this study circumvents the problem that experts may provide responses that have to do with adherence to norms of a social class (Bourdieu 1979/1987), and that an observed outcome may be the cause instead of the effect of expertise.

3. In conclusion, did we omit a large corpus of existing research on art appreciators' sensitivity to art-historical contexts in the target article? From the standpoint of a lenient criterion and a focus on independent variables alone (as we did in the target article), we concede that the target article overlooked a few studies that may meet the criteria of a psycho-historical framework (Russell 2003; Smith et al. 2006; Specht 2010; Temme 1992; Wiesmann & Ishai 2010). These studies manipulate the appreciators' knowledge about the art-historical context in a way similar to the studies taken as examples in the target article (Kruger et al. 2004; Silvia 2005c). In contrast to Takahashi (1995), however, none of these studies manipulated the art-historical context directly.

Let us reiterate, however, that the aim of the target article was to propose an integrative research program and not to review advances in aesthetic science. The psycho-historical program entails that researchers in aesthetic science need to adopt stricter criteria for defining the science of art and overcoming the aesthetic–artistic confound (sect. R1.1; **Gilmore**; **Ross**). From the standpoint of strict criteria, where both the manipulation of the art-historical context and the dependent measure satisfy the criteria of the psycho-historical program, only the studies by Takahashi (1995), Russell (2003), Wiesmann and Ishai (2010), and Newman and Bloom (2012) may qualify as psycho-historical. Therefore, regardless of whether we rely on lenient or strict criteria, we did not omit a large corpus of research.

R4.3 Misled by ahistorical universalism

The methodological commentaries by **McManus** and **Graham** illustrate the pervasiveness of the ahistorical universalism we criticize – see also **Chatterjee** (discussed in R2.1), **Leder** (addressed in R2.2), Locher (2012), and Martindale (1990).

To vindicate his study *a posteriori*, **McManus** argues that Mondrian is an "anti-historical" and "anti-narrative" artist. McManus's commentary provides the kind of information about Mondrian's art-historical context that one would have expected to see discussed in his original article (McManus et al. 1993; cited in sect. 4.2).

McManus' outline seems to justify the thesis that Mondrian could be appreciated without any knowledge of the modernist art-historical context. However, both his thesis and his reliance on Krauss (1979) can be challenged. Arguing that grids in modernist art have a "bivalent" structure and history, Krauss' (1979) analysis responds to historical debates on the context of artistic modernity initiated by Greenberg (1961), Fried (1967/1998), and T. J. Clark (1973; 1982; 2001). Krauss is therefore thoroughly *contextualist* in her attempt to disclose the varied historical and psychological functions of grids in modernist art. Although debatable, her interpretation allows multiple interpretations of Mondrian's grids and does not endorse an aesthetic–artistic confound. In contrast, McManus' thesis that Mondrian's paintings "may encapsulate some universal principle of compositional order which can be detected by subjects" (McManus et al. 1993) suggests the ahistorical view that appreciators have an innate or universal preference for specific types of organizations in grids, regardless of the art-historical context. This kind of statement implies an endorsement of the aesthetic–artistic confound and a neglect of the appreciator's sensitivity to Mondrian's *modernist* art-historical context.

Another example of the assumption of ahistorical universalism is found in **Graham**'s commentary. In contrast to **Gilmore**, **Silvia**, and the psycho-historical program, Graham criticizes holistic methodologies from an ahistorical standpoint. We disagree with Graham's claim that the psycho-historical program entails methodological holism (see sect. R2.1). We think that the research on the non-randomness of Pollock's work he cited is irrelevant to the science of art because it assumes the validity of an ahistorical analysis of artworks. That said, we concede that "measurement of reduced properties of naturalistic stimuli can grant novel and unexpected insights – with respect to vision and to art" (Graham). Again, the point of our argument is that such research needs to offer models of the sensitivity to art-historical individuals, kinds, and contexts in order to contribute to a science of art *qua* art (see sect. R1; Gilmore; **Takahashi & Ejima**). This point is missing in Graham's discussion of artistic randomness.

R5. Expanding the psycho-historical program

Several commentators proposed to extend the psycho-historical program in a variety of ways. Beyond the justified thought that future psycho-historical research should inquire further into examples from art education (**Freeman & Allen**), they proposed to expand or adapt psycho-historical frameworks for explaining the way we keep track of the individual history or biography of agents and objects (**Gelman et al.**; **Hogan)** and states like mood (**Hogan**), extended cognitive systems (**Wilson**), embodied cognition (**Gibbs, Malafouris**), contagion (**Newman**), and art production (**Kozbelt & Ostrofsky**).

Gelman et al. offer important extensions, refinements, and correctives of our account of the relationship of the design stance to essentialism. Their commentary adds a wealth of fascinating evidence to demonstrate the interdependence between essentialist and historical thinking. We agree that "many of the points" we make "are not limited to cognition about art, art-historical contexts, or the design stance of an artist, but rather are relevant to more general cognition about objects, their historical paths, and the intentions of their creators." Bloom's and Gelman's research on psychological essentialism (Bloom 1996a; 1996b; 2010; Gelman 2003; Gelman & Bloom; 2000; 2007; Gelman et al. 1994; Gelman & Wellman 1991; Newman & Bloom 2012; Newman et al. 2011) offers core hypotheses for developing the psycho-historical program for the sciences of the sensitivity to historical individuals and kinds.

Embodiment (**Gibbs**; **Malafouris**), extended cognition (**Wilson**), and contagion (**Newman**) are extensions that could add new mechanisms for implicit processing to the theory-based reasoning underlying the design stance and artistic understanding proposed in the psycho-historical framework.

Kozbelt & Ostrofsky have provided us with the opportunity to mention art production because we originally envisioned a broad psycho-historical framework for a science of art that could integrate production and appreciation (Bullot 2009a). Like the psycho-historical framework for art appreciation, an analogous framework for art production not only extends the scope of empirical research by including variables that measure artistic understanding, but also examines the extent to which the creator of the artwork takes the appreciator's perspective.

The fact that the psycho-historical program proposes significant novel hypotheses about the modes of appreciation and can nonetheless integrate a wide range of proposed extensions demonstrates the power of this program for generating hypotheses on art appreciation and production.

R6. Conclusion

We ended our target article with the hope that our psycho-historical framework would help bridge the gap between the psychological and historical approaches, and hence lead to an integrated science of art appreciation. However, similar antagonisms between a psychological approach and the humanities plague many other academic domains, such as anthropology, education, sociology, or the science of religion. Thus, we end this response with the dream that the psycho-historical program will inspire scholars across disciplines to discover how scientific research in psychology and neuroscience can be fruitfully integrated with historical approaches from the humanities.

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[The letters "a" and "r" before author's initials stand for target article and response references, respectively]

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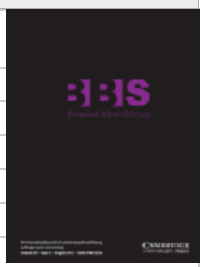

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