Teaching Cognitive Science and the Arts I

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Part 1: Visual Art

Introduction: The chief challenge of planning a course on cognitive science and aesthetics is the audience. In principle, such a course could appeal to students from diverse majors, ranging from art, literature or philosophy to psychology, computer science, and pre-medicine. The problems of presenting information to such a diverse group are obvious. Material covering recent developments in cognitive neuroscience is likely to be difficult for arts and humanities students; and conversely, students with better preparation for studying cognitive science may know too little about art to recognize reductionist or narrowly focused approaches to the perception of paintings.
Despite this challenge, there is ever-increasing material in the field that should prove fascinating to discuss. Cognitive science, the intersection of such fields as psychology, robotics, neuroscience, linguistics, philosophy, and artificial intelligence, is revolutionizing our understanding of ourselves by providing new accounts of human rationality and consciousness, perceptions, emotions, and desires, with great consequences for our understanding of the creation, interpretation, and appreciation of artworks in all mediums. For example, new scientific studies of the mind and brain are taken by some people to disprove Freud's most fundamental hypotheses, undermining psychoanalysis as a theory of art. New work in perceptual psychology might falsify key tenets of Goodman's aesthetic theory, such as his notorious denial that representation is based on resemblance.

To ignore this burgeoning field would be a disservice to students. Ideally, there should be a two-way street between new research on the mind/brain and theories of the arts. Cognitive science may even help "legitimate" studies of the arts as central to any adequate account of the human mind. Dominic Lopes claims that psychologists and neuroscientists have only recently begun to take the study of art very seriously: "In the view of these writers, human cognition and perception is at its most sophisticated in the cognition and perception of art works, so understanding the art-perceiving mind is a key to understanding human cognition" (Lopes 1999).

My essay will attempt to sketch a course on cognitive science and the visual arts. (A subsequent essay will take up similar options for a course on cognitive science and other arts, such as literature, film, and music-

temporal or narrative arts, which raise different sorts of questions with different connections to cognitive science.) My proposed trip through this material raises questions at the meta-level: What is possible in this field? Where does research stand? What are its biggest gaps? I would provide background in traditional aesthetics, then study explanations that are roughly "top-down" vs. "bottom-up", or psychological vs. neuroscientific. The proposed course is one I have not yet taught. Others in aesthetics are pursuing related plans, so let me briefly mention two.

For example, Mark Rollins is already teaching a course on "Art and the Mind-Brain" at Washington University. His syllabus covers an impressive range of topics (representation, expression, aesthetic experience, and art's history), in each case linking fairly standard material for a course on analytic aesthetics with recent scientific research. Second, Jennifer McMahon proposes to do a course at the University of Adelaide entitled "Aesthetics and Cognition in Beauty," combining recent research finding on principles of form construction, etc., with readings about beauty from Hutcheson, Kant, Sircello, Mothersill, and others.

A Possible Course Syllabus

In teaching a course on cognitive science and the visual arts, I would begin by covering material from E.H. Gombrich and Nelson Goodman's *Art and Illusion* and *Languages of Art,* respectively. I might select some key sections of Goodman's discussion of representation and resemblance and several chapters from Gombrich for inclusion in a xeroxed course-pack. I would introduce students to Gombrich's general view of art as a successive series of visual experiments aimed at improved realism in the depiction of our world, reviewing his model of art's history as a series of experiments of "making and matching." I would discuss contributions made by artists like Giotto and Constable. Next, I would cover Goodman's approach to art as a symbol system, emphasizing the psychological evidence he drew from to argue the conventional nature of realism in art. Students could be asked to pursue topics either contrasting these two thinkers or researching criticisms of their views.

I would then move on to address a combination of more recent material from three sources: Semir Zeki's book *Inner Vision: An Exploration of Art and the Brain*, Robert Solso's *Cognition and the Visual Arts*, and two special issues on Art and the Brain from *The Journal of Consciousness Studies*.

Zeki's book represents what I call the "bottom-up" approach to art. As a neuroscientist, Zeki seeks to explain aspects of art creation and appreciation in relation to the most primitive components of the human visual apparatus, such as color perception, face recognition, and form and motion perception. Zeki's book is beautifully illustrated and covers a range of examples, with helpful information about vision and the brain. It shows a prominent neuroscience researcher who takes the study of art very seriously-Zeki goes so far as to write that "artists are in some sense

neurologists" (p. 10). The book is also "Goodmanian" in spirit, in that Zeki emphasizes the reason we see is to acquire knowledge about the world-and that art is part of this naturally grounded epistemic process.

On the other hand, there are significant limitations with Zeki's book. Despite his professions of humility about venturing into terrain where he is no expert, Zeki's aim is ambitious: "to develop outlines of a theory of aesthetics that is biologically based" (1). He makes sweeping claims (for example, that "just as vision is modular, so is aesthetics" (59)). But the resulting theory of aesthetics is fuzzy at best. Zeki is dismissive of Kant's aesthetics and purports to draw on Hegel and Plato, often mentioning either Ideas or the Ideal, but not going much beyond that. He focuses primarily on very recent art, admitting that, "it is harder to address more complex older works involving higher-level activities through narration and/or representation" (1). The actual positions Zeki takes about art are often oddly flat. He sees artists as conducting experiments that in effect isolate parts of the visual system: "Painters experiment with what pleases their brains" (3). Since we can now study the visual system in a direct scientific manner, Zeki implies that some of these painters' experiments have either been superceded or proven wrong; e.g., he claims that the Fauvists' experiments with color "naturally failed" because we humans simply do have a realistically grounded color perception system. The connection between visual brain functioning and the evaluation of artworks is repeatedly stretched: Zeki thinks that someone with prosopagnosia (damaged facial recognition ability), for example, would probably "not be able to appreciate" portraits by Bronzino (but do any of us "recognize" the faces pictured there?).

A key purpose of reading Zeki would be to consider whether his claims present interesting challenges or updates of Gombrich's and Goodman's views. Putting the question this way might prompt students to begin formulating a view about the contributions, limitations, and challenges of visual neuroscience studies about aesthetics. For instance, there is no social or cultural dimension in Zeki's book, since he presumes a biologically grounded visual system. Questions might be pursued about whether his work suffers irrecoverably from its failure to consider non-Western art.

Turning to Solso's book, we find a more "top-down" approach, which could be noted to show students how a psychologist raises interpretive issues differently from a vision scientist. Solso does discuss some "elemental" aspects of visual perception, such as perception of line, form, color, and perspective. But he tends to employ a more global focus, as when he discusses how light and shade function together with viewer's cultural knowledge (for example, in perceiving the light symbolism in images of the Christ child by de la Tour). Again, he reports on studies of how the eye movements in viewing a painting vary among different groups, or according to instructions given viewers before the experiment. (Examples include medical vs. art students' eye movements in viewing Rembrandt's *The Anatomy Lesson* and Manet's *Olympia*.) Like Zeki's book, Solso's is replete with illustrations, helping make it clear and approachable for students from many backgrounds. There is some overlap

with Zeki, but many differences, including Solso's explanation of "InfoPro," a complex processing strategy for interpreting pictures. Solso applies this to explain form recognition in a range of examples such as Max Ernst's *The Elephant Celebes*. He also addresses topics Zeki does not consider, such as the perception of mood and feeling, with examples like Norman Rockwell's *Thanksgiving,* Edward Hopper's *Nighthawks,* and Andrew Wyeth's *Christina's World.* This section of Solso's book would allow for some interesting comparisons with Goodman's account of expression in art , and could be used for a distinct unit on the nature of expression, if desired.

After discussing the Solso and Zeki books-or possibly as an alternative-I would use selections from the two issues of JCS on Art and the Brain. Here the primary text would be Ramachandran and Hirstein's "The Science of Art: A Neurological Theory of Aesthetic Experience", from the first issue (1999). The authors describe what they call the eight 'laws of artistic experience': a set of heuristics that artists either consciously or unconsciously deploy to optimally titillate the visual areas of the brain. These include, for example, the "Peak Shift Effect," described as "use of 'supernormal' stimuli to excite form areas in the brain more strongly than natural stimuli." Or, according to another principle of "Perceptual Grouping and Binding," "different extrastriate visual areas may have evolved specifically to extract correlations in different domains…into unitary clusters - objects… facilitated and reinforced by direct connections from these areas to limbic structures." I cannot resist commenting that this article, which might seem to improve upon Zeki by including images from classical Indian art and hence for once introducing non-western art into the dialogue, is irredeemably "bad" on gender--its series of semi-erotic nude drawings are accompanied by a commentary that unselfconsciously equates the erotic interests of a "normal" (=heterosexual male) viewer with innate and universal principles of visual perception allegedly grounded in "our" biological purposes. Happily perhaps for purposes of teaching, this volume of JCS also includes a wide variety of short and often pungent responses to the lead article from authors in many fields, ranging from psychology and virtual reality to art history.

The more recent JCS issue, Art and the Brain II, has some further thoughts from Ramachandran and Hirstein, along with a new piece by Gombrich. Other interesting articles here are Amy Ione's "Connecting the Cerebral Cortex with the Artist's Eyes, Mind and Culture", and Jennifer McMahon's "Perceptual Principles as the Basis For Genuine Judgments of Beauty". A final plus is the inclusion of the papers from the Cognitive Science Conference, "Perception, Consciousness, and Art," held in Brussels in May, 1999.

It would, of course, be possible to do a course using just one of the texts mentioned above. Trying to do them all, in combination with Gombrich and Goodman, might prove impractical. Any of these books could be supplemented by materials placed on reserve or in a coursepack. Some students will need a more general background about cognitive science. A

useful resource would be the *MIT Encyclopedia of Cognitive Science,* available to universities on the web via subscription, and updated regularly. Blackwell has several good recent introductions, including their Companion to Cognitive Science. Students may need to be oriented to main approaches within the field of cognitive science. Although there is a strong emphasis on computation (Dawson's *Understanding Cognitive Science* from Blackwell is a good case in point), Jerry Fodor's recent *The Mind Doesn't Work that Way* offers a refreshing and profound challenge to the idea that computationalism can account for everything.
Various texts and anthologies could be used to provide a broader range of essays on vision research. *The Artful Eye*, edited by Richard Gregory et al. (1995), includes a variety of articles from researchers like Glyn Humphries and V.S Ramachandran, summarizing work that might bear on our understanding of art, in articles that are clear and intelligible. Similarly useful is Ilona Roth and Vicki Bruce's *Perception and Representation* (1995), which covers topics like form construction, object recognition, and recognition of faces; with helpful comparisons among competing theories in the field (from David Marr, Irving Biederman, Glyn Humphries, et al.). This too would be a good resource for students who are starting out with the study of perception and cognitive science. I also recommend Volume 2 of the Invitation to Cognitive Science series, titled *Visual Cognition and Action,* edited by Daniel N. Osherson, et al.

Finally, all students might find it useful in tracking the most recent research to visit relevant websites, many maintained by top scientists from prominent vision research laboratories. Several are recommended in the bibliography below; Dan Simons' site, based at Harvard for example, offers an intriguing variety of demonstrations of vision research experiments including some that can be "taken" on-line in self-tests. Checking these sites periodically should enable professor and students alike to stay at least minimally on top of developments in this very exciting and constantly-evolving field.

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