In 2006, Nobel-laureate neurobiologist Eric Kandel published an invaluable history of modern cognitive science, *In Search of Memory*, in which he sought to 'interweave two stories', a very personal one from childhood memory of the trauma of the Vienna Anschluss, and one which develops from that into an account of a distinguished scientific career in America—among leading figures and discoveries from the fields of psychology, cognitive science, neuroscience and molecular biology, whose most recent 'merger' into a 'new science of mind' (xii), he held, is now set to meet the challenge of 'biology’s loftiest goal': 'understanding the biological nature of the human mind'. Restating that goal even more boldly six years later as 'the central challenge of science in the twenty-first century' (xiv), *The Age of Insight* attempts part of that project through a very ambitious effort at a 'neuroaesthetics’, which, by focusing on specific areas of depictive visual art, seeks to 'engage with art' (xv) in new ways, thereby sketching an even broader union of contemporary science and the humanities.

Even more than the previous book, the speculative *Age of Insight* reads as two accounts, requiring more effort at interweaving. Also beginning in Vienna, but historically rather than personally, its first account looks back to that city as a true birthplace of the modern, at least from its ‘inward turn’ around 1900 through World War I, while the longer account looks forward with an exposition of so-called ‘neuroaesthetics’. Kandel hopes to have us understand ‘neuroaesthetics’ as a resumption of that great preceding Viennese tradition, in which modern medicine, psychology and art mixed in revolutionary practices of what he broadly terms ‘insight’: that is, in their varying ways, seeing through surfaces into hidden depths. In the science of the 19th Century Vienna School of Medicine (which, he argues, inspired all the rest), insight took the form of explanation in terms of the first systematic, scientific anatomy; in the novels of Arthur Schnitzler and visual arts of Gustav Klimt and others, the form of imagining people in revealing new ways; whereas Freud’s psychoanalysis was a bit of both. Each approach focused on aspects of our bodies, while today’s ‘neuroaesthetics’ attempts explanations more narrowly in terms of our brains. To emphasize historical continuity, besides arguing that neuroscience has theoretical roots in the Viennese tradition, *Age of Insight* illustrates it through

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1 Eric Kandel, *In Search of Memory: The Emergence of a New Science of Mind* (New York: W. W. Norton, 2007), pp. xi-xii. (After the next, Roman-numbered page references are to *Age of Insight.*)
examples drawn from figurative—notably portrait—works by the painters Klimt, Egon Schiele and Oskar Kokoschka, whose ‘insights’, like the others’, into ‘sex, aggression and death’ (123), do not usually make pretty pictures.

I

This cultural and intellectual history may be of interest to philosophers of art at a time when Klimt and the others are increasingly popular. More likely of interest than its ‘Vienna 1900’ aesthetic, however, is the book’s alleged aesthetics—that is, a case for ‘neuro-aesthetics’, presented through many well-diagrammed pages—although, as will be argued, it does little for the logic of already well-known reductionist arguments there. However, what may prove most valuable for philosophers of art is neither main thesis, but the most tenuous aspect of the book: Kandel’s effort to connect them. A central thread of that runs through his account of the cognitive psychology of the post-WWII decades, which, he argues, links the earlier Viennese insights into the unconscious to the tougher neuroscience of our last two decades, with which it now interweaves. Surprisingly, that argument includes a valuable appreciation of the work of E.H. Gombrich related to what, following him, Kandel terms 'the beholder’s share'. Putting aside the book’s ambitious historical theses, that will be the focus here.

To be sure, Kandel’s mentions of Gombrich may appear gratuitous, as they are usually self-consciously yoked to references to his early Viennese collaborator, Ernst Kris, an art-historian, psychoanalyst protégé of Freud: Kandel is at pains to trace complex, dendritic-like nets of personal contact and influence among his Viennese—especially across the sciences and arts. Thus we are told that Freud (who knew Schnitzler) was ‘in every sense a product of’ (44) Karl von Rokitansky’s Vienna School of Medicine, and so forth. In these terms, Vienna-born Gombrich’s classic 1960 Art and Illusion can carry the Viennese story into the narrative of postwar cognitive psychology, just before it joined with cognitive neuroscience, where a former student of Rokitansky’s School, Stephen Kuffler (‘a contemporary of Ernst Kris and Ernst Gombrich’ [238]), takes up some threads, passing them on to the Nobel work of David Hubel and Torsten Wiesel, thence through the 1960s into contemporary brain research, which confronts the new century’s ‘central challenge of science’.

But the Vienna motive alone would not account for Kandel’s sixty pages of references to the great art historian Gombrich (511), across twenty of the book’s chapters. That emphasis is a welcome departure from the attitude of a fellow neuroscientist he approvingly cites, V. S. Ramachandran, who favors a ‘new name for this discipline’, what ‘Semir Zeki calls neuroaesthetics—just to annoy the philosophers', who, according to Ramachandran, 'haven’t really made a lot of progress' regarding 'aesthetic ability or creativity' over their 'three millennia domain' there. It is not only philosophers such researchers seek to annoy, since Ramachandran

2 Including Margaret Livingstone, ‘a student of Hubel and an intellectual grandchild of Stephen Kuffler’ (292).

holds that brain science can explain what art historians and critics have failed to, notably the success of modern art. Yet, as Kandel relates, first among Ramachandran’s ‘principles’ is ‘peak shift’ (445) regarding ‘supranormal stimuli’. Thus, ‘if a rat is rewarded for discriminating a rectangle from a square, it will respond even more vigorously to a rectangle that is longer and skinnier that the prototype.’ The same holds for natural stimuli such as shape and marking of parent gulls’ beaks, which elicit ‘fixed action patterns’ of feeding nestlings, well known from the Nobel work of Niko Tinbergen and Konrad Lorenz by the early 1950s.

Ramachandran holds that it was left to neuroscience to point out that this principle also explains nonrealistic forms that characterize much figurative art, including caricature, and that thereby how ‘artists through trial and error, through intuition, through genius have discovered the figural primitives of our perceptual grammar.’ Striking here is neglect or ignorance of Gombrich’s *Art and Illusion* forty years earlier, which centrally argued that effective visual depiction relies on ‘not the nature of the physical world but the nature of our reactions to it’, that is, on ‘the mechanisms of certain effects.’ Thus, Gombrich held, it is a psychological problem, requiring ‘discoveries not of likenesses but of equivalences’, some rooted in the ‘biologically conditioned inborn release mechanisms of the lower species’—for example (citing Tinbergen and Lorenz), that ‘whenever anything remotely facelike enters our field of vision, we are alerted and respond’—thus a matter of, by trial and error, the ‘forging of master keys for opening the mysterious locks of our senses to which only nature herself originally held the key.’

Further regarding Ramachandran’s acquaintance with such ‘progress’, the style of a second of his ‘neuroaesthetic’ principles is typical:

[A] nude seen behind a diaphanous veil is much more alluring . . . than a full-colour Playboy photo . . . Why? . . . Our brains evolved in highly camouflaged environments. Imagine you are chasing your mate through dense fog. Then you want every stage in the process — every partial glimpse of her — to be pleasing enough to prompt further visual search — so you don’t give up the search prematurely in frustration. In other words, the wiring of your visual centres to your emotional centres ensures that the very act of searching for the solution is pleasing, just as struggling with a jigsaw puzzle is pleasing long before the final ‘AHA’ . . . . It’s about generating as many "AHAs" as possible in your brain.

That may be put beside a central principle of William Hogarth’s aesthetics of 1753, which Gombrich was fond of quoting:

This love of pursuit, merely as pursuit, is implanted in our natures, and design’d, no doubt, for necessary, and useful purposes. Animals have it evidently by instinct. The hound dislikes the game it so eagerly pursues; and even cats will risk the losing of their prey to chase it over

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5 Ramachandran, ‘The Artful Brain’.


7 Ibid., pp. 341-5, 103, 359.

8 Ramachandran, ‘The Artful Brain’.
again. It is a pleasing labour of the mind to solve the most difficult problems; allegories and riddles, trifling as they are, afford the mind amusement: and with what delight does it follow the well-connected thread of a play, or novel, which ever increases as the plot thickens, and ends most pleased when that is most distinctly unravelled! The eye has this sort of enjoyment in ... a wanton kind of chase, and from the pleasure that gives the mind, intitles it to the name of beautiful.\(^9\)

In short, there is more than one thing to wince at in Kandel’s reference to ‘the Kris-Gombrich-Ramachandran theory’ (446).

II

Not only is *Age of Insight* opposite to Ramachandran in attitude, Kandel’s recognition of Gombrich’s contributions to perceptual psychology itself plays a major role there. As Gombrich admitted, the theses of *Art and Illusion* proved difficult for many to grasp, including philosophers, including philosophers, who have tended to approach it through their concerns with metaphysics and epistemology, not through his concerns with image history. In welcome remedy to that, Kandel begins with Gombrich’s pre-war work with Kris on caricature, and readers of *Art and Illusion* might do well to begin with its penultimate chapter, 'The Experiment of Caricature', where Gombrich again argues that his topic, convincing depiction, never rests on the likeness of elements so much as on the identity of responses to certain relationships ... not the imitation of individual features so much as on configurations of [perceptual] clues'.\(^10\)

Perhaps neuroscience’s emphasis on perceptual effects could shift philosophers and cognitive psychologists from considering depictions as they still do, as derivative from so-called ‘real world’ things, to which they may to some extent correspond (usually by projection). First, Gombrich argued, with the 19th C. comic draughtsman Rodolphe Töppfer, that no model is even required. As Töppfer showed, physiognomically expressive success 'could be learned by a recluse who never sets eyes on any human being', since 'any drawing of a human face' has 'character and expression', to find which all one need do is ‘vary his scrawl systematically’ (339f) and log the results. More relevant, as Kandel observes, is Gombrich’s psychological ‘projection’: you make some marks and see how well you can project something into them. Initially, there is no telling: it is, as Gombrich stressed, hit and miss. What works for you, you store, while also (as with all skills) picking up dodges from others—some traditional ‘schemata’ (to use Gombrich’s word)—with which you can improvise. As these collections are consolidated and improved, naturalisms can arise, along with corresponding challenges and rejections, since image-making has many functions, some inconsistent with naturalism.

All this is owing to Gombrich’s point, that convincing representation requires psychological probing of the evolutionary vagaries of human perception. Effective depiction is therefore a matter of finding minimal cues ('clues', as he called them), given that environmental


perception, itself, is based on scanty samples in ‘infinitely’ ambiguous natural situations. Without strong prejudices set by evolution, there would be no place to begin; but without ability to revise them it would be all over quickly, as for insects beating against window panes on the sound evolutionary assumption that what they can see through they can fly through. Yet depictive physiognomics provides just the beginning of Gombrich’s refutation of the imitation of appearances view. It is, as he wrote, ‘only a special case’ of depictive success generally. Even as we respond to a tangle of lines as if it were a face, he remarked, ‘we respond to a white blob on the black silhouette of a jug as if it were a highlight’ (345). But not just as if it were—and it is here, in the construal of Gombrich’s psychological arguments, that readers need carefully to watch Age of Insight’s interpretation of him.

III

Things begin to go wrong when we find what sort of cognitive psychology Kandel means: pre-war Gestalt theory, which he treats as (in contemporary terms) the ‘bottom-up’ part of Gombrich’s theory. Yet, while Gombrich made use of some Gestalt ideas, he was consistently critical of them, whereas an early ‘cue’ perceptual-hypothesis theorist, Egon Brunswik (a Viennese Kandel misses), was closer to his basic approach. Post Kris and Vienna is the British Gombrich, Sir Ernst. It was his wartime BBC radio monitoring experiences and, later, the perceptual psychology of J.J. Gibson to which, he stated, he owed ‘most of all’ (339f). Also the post-war perceptual psychology on which Gombrich most depended is that of visual cues, such as the blob of white, which, opposite to the holism of Gestalt, takes a modular approach. There is a central strategic reason for this. As an art-historian, Gombrich’s explicit project in Art and Illusion was to explain why there is a history to visual designers’ making of increasingly effective depictions. Crucial to his explanation is that ‘the elements of … visual experience could be taken to pieces and put together again’—elements such as foreshortening for depth, tonal modeling for bulk, highlight for texture, and a host of other cues he discusses. Unless these effects were separable, they could never have been discovered. Even perspective, usually considered as a unit, consists, as recent perceptual psychology shows, in a ‘concomitance’ of occlusion, foreshortening, size diminution and other gradients, horizon intersection and other effects, each with a variety of long and ongoing histories of discovery and independent use in many cultures, as a major theme in the history of images. If we call such ‘elements’ and ‘pieces’ modules, without implying uniformity or interchangeability, we may call Gombrich’s approach ‘modular’.

A second, most important, point is that, unless depictive design worked with such distinct modules, it could not deploy them separately or in different combinations—inventively, or as we

11 Gombrich, Art and Illusion, p. ix, where he mentions Brunswik’s famous joint work with E.C. Tolman, which Gombrich states he did not know when writing his book decades later.

12 Gombrich, Art and Illusion, p. 329. For other cues, such as highlight, see p. 360.

say, ‘creatively’. As with caricature, Gombrich argued this through common examples. 'To see them in isolation’, he suggested consulting commercial design’s use of scant perceptual cues in posters—and, we might add, simple graphics, including cartoons, road signs, ideogram logos and so forth. These provide many clear examples for understanding that effective depiction, far from being somehow derived from actual views, is a construct from a palette of cues we use for seeing views in the first place.

Indeed, Gombrich’s treatment of Cubism took an important, if hesitant, step beyond the merely modular, when he saw in it even ‘the introduction of contrary clues which will resist all attempts to apply the test of consistency’ (282). It has been noted that, personally, Gombrich fell short here, even with Klee and Cubism, but especially in his comments on non-figurative art, by not fully appreciating how the next step in freedom is use of such devices to construct the ever more autonomous objects of modern art. But that was no fault of his theory.

IV

Although Kandel does not use the term, his approach also stands easily under the heading ‘modular’—and at a profound level. As his earlier In Search Memory expounded it, modern vision theory begins with the founder of neurobiology, Kuffler. His pioneering discoveries of 'the deconstruction of the visual image' at the retinal level (238), carried forward in the Hubel-Wiesel Nobel work on the receptive fields of the visual cortex as reconstructed in the visual brain, is a notable instance of Kandel’s basis for the whole ‘new theory of mind’ (xiiif). This theory’s principles are essentially modular: 'each mental function in the brain . . . is carried out by specialized neural circuits in different regions', which are 'made up of the same elementary . . . nerve cells', using 'specific molecules to generate signals', 'molecules [that] have been conserved . . . through millions of years of evolution'. Indeed, that earlier book stressed that the defining ideas of modern biology are modular, since the 'extraordinary conservation' of these modules at every level, which made biological—including mental—evolution possible, also makes its biological understanding possible, since we can observe, even experiment on, its simple, separable elements as they occur in us and in much simpler organisms. Thus, had Golgi’s holistic ‘reticular’ (net) theory of nervous systems been more correct than Ramón y Cajal’s modular ‘neuron’ theory, their complexity would have prevented not only science of sentient life but its very evolution.

Such, too, is the avowed basis of Kandel’s modular, or what he terms ‘radically reductionist approach' (203), to depiction and art in the later book, many pages and diagrams of which are devoted to recent research on his main theme of attempting ‘to correlate mental functions with various brain regions' (291), its vocabulary bristling with the terms ‘localized’, ‘distinct’, ‘discrete’, ‘meticulously specialized’, ‘specific regions’, ‘segregated’, ‘selective’ and

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14 Gombrich, Art and Illusion, p. 284.

15 Kandel, In Search of Memory, xii-xiii.
the like. Rather than discussing whether Kandel’s ‘reductionism’ here is of the philosophical
token-token or type-type ontological or even methodological kinds, it seems more interesting to
take him literally at his own word, ‘reductionist’, but in the clear and specific biological sense
forcefully argued in *In Search of Memory*. His own discoveries, he remarked there,
reinforced an important biological principle: evolution does not require new, specialized
molecules to produce a new adaptive mechanism . . . . Thus the biochemical actions
underlying memory did not arise specifically to support memory. Rather, neurons simply
recruited an efficient signaling system employed for other purposes in other cells and used it
to produce the changes in synaptic strength required for memory storage. 17

'Evolution', he continued, citing another Nobel biologist, François Jacob, 'is a tinkerer. It uses the
same collection of genes time and again in slightly different ways' (235). Two crucial aspects of
reductionism here are ‘use’ and ‘new’, regarding a tinkering process of recruiting then
reassigning existing modules for novel purposes, to make genuinely novel organic systems, even
kinds of creatures.

This way of thinking seems well applicable to depiction, since not only Jacob’s ‘tinkerer’
metaphor, but also the ground of Kandel’s own terms, 'employs', 'uses', 'recruiting'—all
metaphorical regarding nature—is literally art in the most general sense, including that of
making effective images. If we may quote Jacob directly, just as a tinkerer 'uses whatever he
finds around him . . . to make some kind of workable object [and so gives it] unexpected
functions to produce a new object’, so depictive-image makers use aspects of nature, including
our natural modules of environmental vision, for a multiplicity of biologically unexpected
functions. That is the way of all technologies. Besides, individually, we are all inveterate
improvisers, with our artifacts as with our natural structures. It is to be expected that we
manipulate our nervous systems for our own purposes, not nature’s, so hardly news that we do so
by exploiting our natural perceptual sensitivities to visual cues.

In short, we use our brains, for our own purposes—if not always our own good. Thus,
just as Ice Age people exploited selected physical characteristics of natural materials in novel
ways, giving them, literally, purposes, so they used some of their own natural, including visual,
responses, finding out by trial and error (as Gombrich stressed) what works and what does not on
human viewers, and in what situations. A number of these devices have served ever since, but
just as charcoal and ochre have been supplemented with other materials, image-makers have
greatly expanded their palettes of perceptual effects. Simply taken as artifacts—before
considering them as works of fine art—two important points about visual representations and
other images proceed from this. These will be treated in the next two sections.

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16 Were, for example, a more holistic approach accepted—such as the ‘holonomic’ idea of a great Vienna-born
neuroscientist Kandel misses, Karl Pribram—such mapping of discrete elements would be more difficult to sustain.

17 Kandel, *In Search of Memory*, pp. 234f. The next two quotations are from p. 235.
First is that designers can not only ‘recruit’ and ‘use’ natural spatial cues in isolation, in opposition, but also in mixtures with diverse elements such as language, for many dimensions of meaning not available in nature. How well does Kandel’s application of his ‘reductionism’ to art represent this? A sketchy inter-chapter, ‘The Emergence of Twentieth-Century Painting’, makes no use of it. There, despite allegedly concerning ‘the deconstruction of form’, his treatment of a French painting contemporary with his Klimts, a late Cézanne Mt Sainte-Victoire, is typical. Cézanne, he writes, 'experimented with reducing the spatial depth in his paintings', citing the stock view that, with him, 'perspective in the old sense is dead' (215f). Yet, even in the book’s pale color print, depth is partially evoked by use of standard cues of overlap-occlusion, height in field, with gradient diminutions (including converging lines and optical clarity), warm ochres to cool blues—unsurprising, since Cézanne’s own words continuing the now clichéd ‘le cylindre, la sphère, le cone’ cited by Kandel were ‘le tout mise en perspective’: ‘everything placed in perspective, so that each side of an object, of a plane, leads to a central point’ (point central).

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18Montagne Sainte-Victoire (1904/06), Kunsthau Zürich.

Missing from Kandel’s account is Cézanne’s orchestration of these materials, gradually to build the distance to the mountain, including the mass of air before it, which includes his typical figure-ground tension along the line defining the mountain’s right contour and a forward push by the dark central middle-ground. To do this he set his cues in controlled oppositions, to create tensions, making us earn our grasp of the picture. While these cues derive from environmental seeing, that is not entirely how they work there. Only if we choose to stay with such a picture, possibly coming back to it over several viewings—to do the work—which includes actively using parts of our brains that neuroscience investigates, does something grand emerge. Such are reasons why it hangs in a museum, where people not particularly interested in seeing the mountain itself come repeatedly to see it.

At least that chapter allows that image-makers can deliberately back off from using perspective cues; yet, more disappointing is Kandel’s explanation of why that is possible. Despite various discussions of ‘creativity’, little sense of the freedom of even tinkerers is reflected in his approval of the idea that depictive images ‘are allowed to breach the possibilities of reality’, including such ‘transgressions of standard physics’ as ‘impossible shadows, colors, reflections or contours’, because, luckily, ‘our visual brain uses a simple, reduced physics to understand the world’ (278). Given that ‘deviations from true physics do not matter to the viewer’, image-makers can ‘present cues more economically’, fitting ‘the message of the piece rather than the requirements of the physical world’ (quoting Patrick Cavanagh) (ibid.). Thus, thanks to our brains not being so good at science, artists, Kandel explains, can ‘take dramatic liberties’ and their works ‘are allowed to breach the possibilities of reality’, since we will simply fail to notice inconsistencies, ‘distortions’ and so forth (ibid.). (It is left open whether this explains as well our accepting logos, emoticons, or cartoons of talking mice wearing white gloves.) That much of the information available in visible light, as anything else, goes by us is not news. Looking is ‘lossy’. But the fact that vision theorists should think that not this, but any theory, is needed to explain why image-makers get by with use of their materials reveals the persisting grip of ‘imitation of appearances’ ideas. Thus, unlike with biology, Kandel’s modular approach to this subject turns out to be superficial.

That is confirmed by Kandel’s own explanation, in a chapter on ‘top-down processing’, of how viewing a picture ‘differs in important ways from . . . ‘everyday perception’’ (313). He agrees with other cited authors that a depiction must begin from what is ‘untrue’ (314), but that we can 'compensate' for that by making unconscious 'corrections to our perception of it’ (ibid.), thanks again to a slackness in our perception. Notably, our 'tolerance of flat representations' would be due to the fact that probably 'we do not experience the visual world as truly 3D' after all (316). If such a ‘nothing new’ approach were applied to tinkering, a fan’s being converted from Jacob’s ‘old car wheel’ would reveal that car wheels had actually been fans all along. Applied to biological science, it would fail to explain how traits selected from one context can be exported to a different one where some of their properties are exploited, as they are combined with those of other traits, thereby producing new kinds. However, to cite Jacob again, the immense variation of the biological world is essentially due to 'using differently the same
structural information', since 'novelties come from previously unseen association of old material. To create is to recombine.'

VI

The second point about depictions is that, while 'uses' is metaphorical in Kandel’s natural evolutionary contexts, its literal application to such design artifacts as visual representations has a significance overlooked by him. It should not fall below notice of any ‘science of mind’ that something’s seeming on purpose or accidental makes a big difference to the perceptual experience of it. We normally try to understand pictures and the like—simply because they are artifacts—in terms not only of what materials are used but also why: literally, what they are doing there. Accordingly, our visual activities with such images and their parts are interrogative in terms of purposes—notably purposes regarding our own perception: ‘What’s that supposed to be?’ is always a relevant question. Wondering what an abrupt, dark blue horizontal is doing to the right side of the mountain in the Cézanne is not wondering whether birds were flying by. Of course this will be mixed with ‘recruited’ object-recognition capacities: as in biology, mixture is the point of modularity. Yet, because we look at such artifacts differently from how we look at nature, they will ‘look different’ to us. In general, for any correlated neural activity or structure identified by neuroscience, there will always be pertinent questions about how and why an image-maker has chosen to appeal to it, or not, questions no more answerable in terms of science than that Prussian blue line’s presence is, in terms of it ferric-ferrocyanide paint chemistry.

Neither is function represented by Kandel’s rare references to cases where 'by laying bare their artistic techniques' viewers are made consciously aware of them (330), nor by a chapter on 'The Biology of the Beholder’s Share', even though that includes comments on 'attempts to understand what the artist is trying to convey' about subject-matter—notably, people, including 'inner life' (403). Here the account of the 'biological underpinnings' of our 'ability to read and respond' to others’ mental states, as illustrated by Georges de la Tour’s well-known Louvre The Cheat with the Ace of Diamonds 1635 card-game painting [below], is entirely in terms of how they work in actual life—that is, via (maybe) mirror-neurons, up a hierarchy to ‘theory-of-mind’'s neural network of cortical sites. While interesting and important facts, these add little to our understanding of the painting, since no-one had doubted that it calls on our everyday recognitional abilities with its narrative components—indeed, typically regarding its genre, viewers enjoy exercising and showing off social shrewdness of observation.

By contrast, Gombrich’s ‘beholder’s share’ was not intended to be the lion’s, and even that includes understanding what is beheld—an artifact: that is, in terms of various of its aspects being there on purpose, for purposes—such as why in the Louvre version, as opposed to the earlier (Cheat with the Ace of Clubs) Kimbell version in Houston [below], the middle figures are compressed and shifted left, which beholders attempt to work out—and by which, crucially, painters learn. Kandel quotes Uta Frith’s comment regarding this work, 'Although we cannot see states of mind, we can attribute them, guided by the painter’s intentions, with logic and

20 François Jacob, 'Evolution and Tinkering', pp. 1164, 1163.
precision’ (407), yet passes over our perception of those intentions. When Frith remarks, 'therefore, the painter means us to think that [the depicted card victim] does not know what is going on’ (408), ‘neuroaesthetics’ says nothing of the crucial additional levels of intentionality implied—how we understand the painter to understand, regarding us—which make the painting a representation thereby definitively extending the cognitive complexity of the human ‘social brain’.

VII

Focusing on the theme of modularity in *Age of Insight* in connection with Gombrich, we have only touched on the broader claims of the book, associated with Kandel’s central principle that 'different mental functions are localized to different regions of the brain' (38). This principle, even when combined with 'all mental functions are derived from the brain', implies neither that 'mind is a series of functions carried out by the brain’ (206)—nor even, more modestly, that all mental functions can be localized to distinct brain regions, whereby ontological reductionism is encouraged. Absent any such a priori principle, and thereby free of the extravagances of a unified program, we may ask what neuroscience—even a ‘new theory of mind’—as exposited in this book, might offer our understanding of visual representation and thereby its fine arts. Of course it is always an open question what information regarding some aspect of the world might inform our understanding of such matters—noting that information relevant to aesthetic and artistic matters no more need be called ‘aesthetic’ than information relevant to ethical or legal decisions need be called ‘ethical’ or ‘legal’.

As noted above, neuroscience’s basically modular approach via specialized brain regions, down to individual cells, indirectly confirms Gombrich’s refutation of the standard ‘imitation of appearances’ ideas of the nature and history of depictive naturalism. However, insofar as Gombrich needed science for his argument, that was already available in perceptual psychology prior to the Hubel-Wiesel neural studies, of which he made no subsequent use. Nor did we need Töpffer to tell us of our particular hair-trigger settings for facial recognition; less would we need to know, as Kandel reports, that this is due to large 'distributed', rather than holistic, neural organizations in the fusiform and temporal parts of our brains, where sites for detecting something as a face are distinct from higher level ones for recognizing particular faces, and that both are sensitive to selected areas of the stimulus—although these are interesting facts. Yet perhaps, even rhetorically, science might help counter the deeply ingrained idea that understanding a depiction consists in noticing a resemblance or likeness between appearances rather than in recognizing something.

Still, further discoveries in brain science may increase confidence regarding what we already think we experience, or direct us to new perceptions, regarding aesthetics. For example, the idea of tactile values in visual art, which might seem whimsical to some, appears to receive support from brain-imagining science. By demonstrating that sensory and motor neurons in primates need not be distinct, mirror-neuron discoveries may not only support ideas about empathy in depictions, as Kandel suggests, but also about our perception of process-facture in
works, which is often considered to be a matter of indirect inference rather than experience. Broad background may help, too. A central organizational effort of *Age of Insight* is to link closely perceptual and emotional matters, with the thesis that, via its anatomical approach, brain science may find connections among the affective or motivational realms of feelings and emotions, motor activities and sense perception that previous cognitive psychology could not investigate. Even more broadly, cognitive neuroscience could be understood as a hardware response to a previously dominant software functionalism of the earlier computer age. In that connection, and relevant to the book’s topic, certain synaesthetic effects might be convincingly explained in terms of resonances between specialized brain areas that happen to be physically adjacent, lending force and direction to another intermittently discussed but insufficiently developed issue in general aesthetics.

That remains to be seen. However, *Age of Insight* provides no general reasons to suppose that findings in cognitive neuroscience are likely to have interesting applications to our understanding of depiction, aspects of art or aesthetic experience. Even Kandel’s particular, highly selected examples fail to establish clear linkages. For example, he writes, ‘What ultimately makes an image like Klimt’s *Judith* so irresistible and dynamic is its complexity, the way it activates a number of distinct and often conflicting emotional signals in the brain and combines them to produce a staggeringly complex and fascinating swirl of emotions’—the signals being released are of dopamine, endorphin, norepinephrine, serotonin and acetylcholine (436). Yet it is unclear whether that is intended to distinguish the painting from actual encounters we have with people, which can also be emotionally complex, or, if it is, what would make that an aspect of an aesthetic or even artistic experience. Here, biology can provide information, but it is left to art criticism, even aesthetics, to show how that might be relevant.

This is a familiar situation, basic to biology, where, as François Jacob pointed out, ‘each system at a given level uses as ingredients some systems of the simpler level, but some only. At each new level, new properties may appear which impose new constraints on the system’.21 It would be ironic if, by denial of the reality of such ‘new levels’ for depiction, aesthetic matters, and notably for art, the ‘neuroaesthetics’ argued in *The Age of Insight* fails to be aesthetics at all through its shortcomings as biology.

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Georges de la Tour, *Cheat with the Ace of Clubs* 1630-4 (Kimbell)

Georges de la Tour, *Cheat with the A of Diamonds* 1635 (Louvre)