Patrick Maynard

WHAT DRAWING DRAWS ON: THE RELEVANCE OF CURRENT VISION RESEARCH

Abstract

Fifty years ago Ernst Gombrich's *Art and Illusion* revolutionized philosophical and scientific study of visual representation by thoughtful application of research from the modern vision sciences. Since then those sciences – recently including neuroscience – have greatly developed, and it is now common to atrempt direct translation of their findings to depiction, even treating its perception as a branch of visual perception.

Unfortunately, rather than advancing Gombrich's project, many of these applications – often reductive in nature – involve elementary logical fallacies. These fallacies are mostly due to overlooking Gombrich's main idea, that image makers – like other technologists – use natural principles for their own purposes, and that their first purpose is to make artifacts, which are perceived as such. With better context, it should be possible to find more constructive directions for recent cognitive research, related to drawing.

This essay, at the fiftieth anniversary of E.H. Gombrich's *Art and Illusion*, is about drawing and uses. It is not about the important topic of the uses of drawing – "the functions of images" – which Gombrich consistently emphasized as an art historian, against the historicist tendencies of his time[1]. Rather, it treats one of his great book's theoretical themes: of how drawing and related activities "draw upon", use, our mental capacities for their production and understanding.

As a philosophical essay, it must also be about the uses that drawing theory itself makes of the developing sciences of these capacities. With a research boldness he explictly called for, and at the risk of seeming "eclectic", the art historian drew on the new experimental vision sciences of his time, even subtitling his

[1] I discuss uses of drawing and its devices in Maynard 2005. A number of its themes and arguments recur here.

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book with the term "psychology"[2]. In the half century since, cognitive psychology, together with fast developing computer studies and, lately, neurosciences, has not only expanded those sciences but returned Gombrich's compliment by addressing depiction, mainly as drawing. Unfortunately, that has come with the danger of going to opposite extremes. If earlier theories tried excessively to explain by social and historical generalities, too often recent cognitive scientists address depiction reductively, as transferred from our universal biological equipment for environmental perception. At *issue* in both is the autonomy of drawing and other image-making practices, first from cultural forces, now from biological reduction of one of the few defining characteristics of our modern species' emergence. At *stake* is the autonomy of its philosophical study. This paper's main thesis is that, following Gombrich's example, drawing theory needs to use vision research for its own purposes, rather than following it, just as – indeed, because – drawing actively uses our cognitive structures for its own purposes, rather than being a product of them. This, I argue, would involve a change of direction for current theoretical work. Argue, how? Wittgenstein remarked that «the work of the philosopher consists in assembling reminders for a particular purpose»[3]. Using only generally accepted principles of perception theory, logic and empirical observations that all can test for themselves, the paper seeks to redirect prevailing use of cognitive research toward progress in our understanding of drawing and related activities. The first step is to identify the "particular purpose": a central one of understanding mental content in this nonlinguistic form of expression.

The problem of mental content

The serious situation that I see in current conceptions of drawing and other visual, notably pictorial, practices is their inability to account for mental content. That this is nothing new was succinctly stated by Michael Podro, in his last lectures and publications, as follows.

> In the mid-eighteenth century it was thought, by Diderot, Lessing, and Herder, that there was an inherent limitation to the art of painting because it presented its subject matter only for visual scrutiny; *it was external* – it confronted the mind as opposed to offering, like poetry, something in which the mind could participate [...]. This is a rough and abbreviated outline of their misgivings: the problem for the defenders of

[2] See his 1957 University of London inaugural lecrure (the year afrer the Mellon lectures on which the book is based), "Art and Scholarship", reprinted in Gombrich 1963: 118. Prefaces to printings of the fully titled *Art and Illusion: A Study in the Psychology of Pictorial Representation* (Gombrich 1960) list the psychological research he relied on, with increasing emphasis on rhe work of J.J. Gibson. That carries research through the 1960s, followed by his series of papers amounting to a second book. Gombrich also made crucial use of the ethology studies of Nikko Tinbergen and Konrad Lorenz.

[3] Ludwig Wittgenstein, *Philosophical Investigations*, I.127.

painting was to show how it could – like language – become *internal*, open to the mind's participation, part of the mind's thought and feeling.

This problem, Podro stated,

> reappears in the twentieth century, initially by the concentration on the skills of representation; Ernst Gombrich focused [...] on this because it could be treated as a rational process to explain developments in visual representation, replacing [...] metaphysical explanations. A second convergent route [...] was from philosophers who treated depiction as a matter of [...] how the visual array offered by the picture could elicit recognitions as of the visible world. An assumption of such philosophers [...] has been that a description of what has been depicted [...] constitutes the reptesentational content of the painting; they restrict the tepresentational content of a painting to what could be said about the object itself seen face to face, the rest being attributable to style. The implicit argument is that we can only pick out representational content by reference to possible or at least plausible aspects of the real world[4].

It is worse in the present century, just after what the US government named the "Decade of the Brain"[5], complicated by cognitive and cognitive-neurosciences of increasing general research influence, backed by vigorously-marketed, fast-developing imaging technologies (including "virtual reality"), at a time when there are few defenders who even remember, much less argue, that such works can have mental content, "internal" to the minds that receive them.

The present situation is simple: following the perceptual sciences, all such approaches treat representational pictures as external "objects for visual scrutiny", "stimuli", like the natural environment around us, and attempt to understand them as grasped, by sight, through similar means, as "aspects of the real world", just under reduced conditions – though also including "paradoxical" or "cue conflict" visual information to the effect that they are pictures, which new technologies would suppress[6]. This accords pictures of mountains the same mental content as mountains: none. To be sure, mountains in pictures by Hokusai, Cézanne, Ansel Adams appear differently – even in characteristically Hokusai, Cézanne, Adams ways – but mountains appear differently under different conditions, too. Therefore we make any mental content from, not in, these like-apprehended "stimuli", pictures. By contrast, although we have to hear, look at (read), feel (for the blind) verbal descriptions of mountains – whether in poetry or not – the descriptions we thereby access come to us already in the

[4] Podro 2006, 2008.

[5] «To enhance public awareness of the benefits to be derived from brain research» via «appropriate programs, ceremonies, and activities.» See http://www.loc.gov/loc/brain/.

[6] The favored "pictures are paradoxes" example is their being apparently both two and three dimensional: see for example Gregory 1970: 11. For more recent interpretations of such "cue conflict", see Cutting 1997.

mind's coin of thought, as "internal" to it: in words and like symbols. Thus our modern *paragone*.

Although this approach begins in Western Renaissance theory, it has been greatly encouraged by the fast development of photographic technologies that supply the most numerous images ever. Partly due to its nature, but mainly to its predominant uses, photography has further spirited our conceptions of visual representation away from mental content, in the direction of substitutes for sight. Evidence for this is recurrent ambivalence about the status of photography as fine art, based not so much on aesthetic scruples as on unease about its ability to bear mental content. Regarding even photography, this dominant "visual scrutiny" conception of pictures is at times resisted, notably by symbolic or "semiotic" approaches, which attempt to construe them as language-like. But, long on rhetoric, short on science, these efforts seem now overwhelmed by perceptual research and universally effective technologies that demonstrate how easily cues and mechanisms for visual effects are transferred from nature to pictorial cases with like results[7]. Meanwhile, contemporary image-production technology, driven by economic marketing, pushes toward increasingly immersive, vivid transfers of visual effects. The inconsistency of this conception with many valued kinds of images, including great works of art, diagrams, comics and much else, has not deterred it.

Lines of logic

If there is a strong tendency of vision sciences to take its insights in the wrong direction for understanding graphic representations, perhaps an understanding of drawing can help set a better course. To be sure, these sciences have had important successes, absent such guidance. Their most significant achievement has been to discredit the existence of anything called "appearances" that could be imitated, as on older conceptions. An outstanding characteristic of modern perceptual studies is modularity. They have shown sense perception to be a matter of deft, active construction of narrow information filtrations by discrete systems, with much interpolation based on assumptions of nature's uniformities. For their part (thus Podro's reference to Gombrich), image technologies exhibit objective kinds of "advance" by their ability to exploit these natural partialities through even more limited means[8]. Consider, for example, the perceptual "persistence of vision" phenomenon – then the technical persistence of Edison (or, rather, Dickson) – which enabled motion pictures to work. Understanding the visual phenomenon and constructing the mechanism were possible only by methods of isolation and analysis. Another significant case is linear perspective, which

[7] There is now evidence of chimpanzees and dogs recognizing things in pictures and similar displays.

[8] I have in several places argued this interpretation of Gombrich's *Art and Illusion* and subsequent writings on the topic, e.g. in Maynard 2005.

had been seized upon by semioticians as a prime language-like, culturally relative "symbolic form" or code long passed off as natural. Empirical research on perspective as instead a concomitance of discrete features (including gradients of foreshortening and diminution, along with occlusion and horizon-ratio) show that their several contributions to vivid depiction derive from exploitation of biologically universal mechanisms[9].

Due to these research advances, cognitive scientists and philosophers are now further encouraged to think of pictorial perception theory as a minor branch of vision theory, regarding ingenuities of technique that extend the biological audacities of sight.

However, the logical weakness of this interpretation is as striking as is the implausibility of its no-content conclusion, that pictorial perception is "just seeing", but under reduced, perhaps paradoxical, conditions: its representational arts akin to landscape, room, flower arrangement – as the setting before vision of selected subjects in lighting, space and other perceptual conditions (with deferred promises of accommodation for "distortions", perhaps "attributable to style"). Let us make explicit the unstated reasoning behind this: because pictorial representation draws upon the resources of environmental vision, and because its now dominant naturalistic techniques heavily exploit them, pictorial representation consists in that, can be understood in those terms[10].

This is fallacious. In general, it does not follow from *a*'s involving or employing *b*, that *a* consists in *b*, or that theory of the *b* yields theory of *a*. That running is an important part of many sports does not entail "reductive running": that these sports can be understood as varieties of running. Running sciences cannot even tell us how running is used in a given sport: for pursuit or evasion, to cover ground, reach a goal, build momentum, for least time etc. Similarly, we cannot comprehend our visual activities as called upon by pictorial and like representational practices, in the varying parts they play, without first grasping what representation is. Vision sciences cannot do this for us. Little wonder the inability of perceptual approaches even to recognize mental content, without which such works could not exist, not only as major arts but as illustration or satire: that is, as things mainly of the mind, not of visual processing. That seems left to philosophy: but how well is it leading?

[9] See Cutting 1997, 2005. It needs adding that many philosophers and psychologists still cling to "appearances" global conceptions of pictorial representation, according to which they are basically 2D perspective projections of 3D scenes, departures from which are to be understood in terms of distortions. This is because many pictures (notably photographs) are made by such projection – an invalid form of reasoning now to be considered.

[10] This fallacy is nor confined to empirical vision research or philosophy following it. The influential, anti-semiotic, approach of philosopher Richard Wollheim is based on his reasoning: «Our strongest intuition» is «that pictorial representation is a perceptual, more narrowly a visual, phenomenon. Imperil the visual status of representation and the visual status of the pictorial arts is in jeopardy» (Wollheim 1998: 217). But retaining the visual status of such representation does not require defining it, as he does, in terms of a previously identifiable kind of visual experience (called "seeing-in").

To answer that, let us observe the appeal of the reductive fallacy in action, with philosophy's use of some recent, intriguing neuroscience findings. Research indicates that our visual pathways are divided between anatomically (possibly evolutionarily) distinct streams, for the different computational tasks of perceptual experience (the ventral stream) and action (the dorsal)[11]. Localized traumas show loss of abilities in one to be consistent with working levels in the other – e.g. visual agnosias, up to "blind sight", that feature motor abilities absent conscious experience, and, with certain optic ataxias, visual experience absent ability to guide actions by them. Normal experiences may reflect this. Speaking of sports, our quick, deft actions must be at least initiated before we are conscious of situations. Conversely, we have good capacity to separate visual experience from "egocentric" motor actions. Researchers use pictorial experience to demonstrate this. Despite a common association of pictures with windows, the slightest testing convinces us that, unlike with actual windows, we can perceive the relative sizes and spatial relations of depicted figures on pictorial surfaces in a purely "object-centered" way – that is, without scaling them to our actual environments – and with no tendency to act with regard to them. For example, we place objects in pictures – say, on tv screens – in depth relationship to one another without relating them to objects in the surrounding room.

The ventral pathway of conscious experience thus seems to underlie the sort of "psychic distance" aesthetic theories long postulated. As a leading researcher remarks, «watching television convincingly mimics our experience of the world. What it cannot mimic is the visual information we need to act on the world»[12], which would require placing them in an egocentric framework. Given the current sway of cognitive neuroscience in philosophy, these findings are reshaping research, interpreted as showing one-track use of normal perception's "duplex" stream to be «constitutive of pictorial perception», «depicted objects not [being] represented by dorsal perception», as a recent paper urges[13]. A philosophical study of vision states that «a picture gives you no information of location relative to yourself. Suppose you are looking at a picture of two men shaking hands. *Where* are they? As far as what you can tell by seeing in the picture, the question has no answer»[14].

However not all experience of the sort is pictorial, while only some pictorial experience is exemplified by television. Normal visual experience includes seeing reflections in water, heavenly bodies, things through distance optics, without clearly or at all relating them to egocentric locations or possibilities of action.

[11] See Goodale and Milner 2004.

[12] Goodale and Milner 2004, caption to fig. 6.1.

[13] Nanay 2008.

[14] Matthen 2005: 315. This idea also appears in arguments about photography: see Kendall Walton's citations in response to Gregory Currie and Nöel Carroll in Walton 2008: 128-130.

Conversely, and contrary to the increasingly accepted idea that «a picture gives you no information of location relative to yourself», much of the world's pictorial work, including many canons (such as the philosophers' beloved "School of Athens"), appears as continuous with one's own actual space, on walls, ceilings, floors, also on pottery, fabric and other work, with strong "egocentric", action-space orientation and meaning, including approaching, pointing, touching, verbally naming. There is strong evidence for this already in prehistoric cave painting, in Greek floor mosaic, Roman wall decoration, even contemporary restaurant decot – and in the work of the street artist Banksy. It is a strong motive throughout all traditions, worldwide and from prehistory onward. Continuity with architectural space was also a main aim in the development of linear perspective, which, ironically, strongly influenced modern vision theory. In short, depiction appears to be a kind of fiction and fiction cannot be defined in terms of visual perception. This example illustrates the two themes of this paper. First, the fact that representational practice can exploit so global a matter as ventral-stream independence, or deny it, underscores the point that it uses visual structures for its own purposes, rather than reducing to them. Second, there is the methodological point that theory of representation should employ aspects of vision theory, but only as guided by its own purposes – notably in understanding mental content.

Both suggest that we use our heads.

Modularity and mixing

To address the issue of content positively, let us apply these morals to a broader situation. Modern vision science freed us from the ancient imitation of appearances idea by showing that "there is more to seeing than meets the eye". This "more" comes from a "less": less, because, contrary to phenomenal experience, perception, working with limited resources, uses brief samplings by a variety of discrete systems keyed to specific situations. Indeed that modularity is what made modern experimental vision sciences possible, given that the workings and contributions of different modules can be isolated in their effects, now even in their brain structures, for humans and other creatures, for discovery and study. These sciences also show that this active construction works against a background of interpolation and extrapolation, such as the "filling in" of blind spots, based on presumed regularities in the environment – an example of perception as hypothetical projection. These sciences delight in showing how illusions exploit weaknesses in these assumptions[15]. Thus Gombrich was right

[15] R.L. Gregory is an especially influential innovator of this method, consistently arguing that vision is a matter of bold predictive hypothesis. His website, with papers and interactive experiments: http://www.richardgregory.org/. For brief, effective illustrations of related matters, see Ramachandran and Ramachandran 2008, and other articles there. Ramachandran applications, however, tend to be reductive. For more extended treatment see Hoffman 1998.

not only to suppose that artists, rather than imitating appearances, discover ways of tapping discrete idiosyncrasies of human vision to produce effects, but that perceptual experience tends to smooth over the gaps – producing the conscious impression of that unitary entity, "appearances", which so long stood in the way of understanding of pictures.

Alas, vision sciences at this point overlook their positive resources. They note that, in accord with the general principle of perceptual modules, arts and practices can make different selections and combinations, exploiting the filling-in or blending tendency to make the result seem continuous, complete. But they are less observant of the next two, crucial, points: that the natural modules adopted by art need not be used as in nature, and that arts can blend other materials into these combinations – exploiting the same "filling-in" activities of mind's "mind the gap" activities. Here, it may be helpful to consider visual representation as technology. It is the essence of technology to use natural materials and processes (as explained by the appropriate sciences) in non-natural ways, for our ends. To understand and extend technologies we develop sciences, however natural sciences explain what aspects of the natural world technologies use, not what technologies are. Engineering does not reduce to physics or chemistry.

The three listed modular and mixing mental capacities render pictorial perception, as Podro observes, different from environmental, which it exploits for its own purposes. Notably, they allow perception to grasp mental content by means described by vision science's own principles. The first means, much emphasized by psychology, is drawing's well-known "sketch" ability to suggest much by few indications. Cases abounding, consider how a few strokes suffice to evoke face-recognition, there being particular neural groups in the brain responding to such pattetns. Second is the simple point that effects particular to perception of certain things may be turned to other advantages in drawings. This may seem to verge on triviality, since every use of a sense is of something biologically derived, including reading and writing. However, unlike writing, drawing's graphic or diagrammatic uses are normally a function according to which differences among particular variables are reflected in differences along some visible aspect of the drawing. Accordingly, even as with depiction, effective diagram drawing method attends to natural idiosyncrasies of perception. For example, pie charts are circular diagrams divided into sectors from the center, arc lengths corresponding to compared quantities. It is found that they are better for comparing sectors to their wholes than to other sectors or across different charts, also best up to about half a circle, while bar charts tend to be less misleading for larger percentages. That would be due, just as in depiction, to our natural abilities visually to estimate angle-sectors and lengths, and sensitivity of shape perception to orientation, but with charts and diagrams these visual abilities are turned to comprehension of situations not visually perceptible. Our ability to understand functional correlations among entities shades off into less determinate

analogies, even to visual similes and metaphors, opening onto great resources of content, which we can scarcely touch on here.

An implication of this is that a mark in a drawing may work both depictively and analogically, providing examples of the great, third use of perception modules in graphics. Consider two widely spaced examples. A well-known one is depiction that presents a subject such as a god or pharaoh by means of larger figures, according to importance. There, while numerous natural recognition systems – for object edges, depth, face-recognition etc. – are translated fairly directly to pictorial context, they are combined with diagrammatic functions not thus translated. Interesting are the smooth transitions we make regarding variations of image size as signifying comparative sizes of people, their limbs, structures; also degrees of importance; but not depth or distance, for which other natural cues of overlap, height in visual field and degrees of foreshortening are recruited from nature vision – applications of our first principle. For a second example, compare recent high-tech examples such as neuro-science imaging of the sort we have been considering. False-color fMRI technology developed from that based in chemical analysis, which issued largely in numerical data. With late 1970s advances in computing it was turned toward visual image diagnosis of tissue structures, joining the existing radiological tradition – that is, presenting information in forms directly accessible to natural visual recognition powers, rather than in more specific numeric displays. And, in a further shift, color was introduced, since vision is more sensitive to its differences than to grayscale, while the number of colors available in the apparatus is powers greater than intensity levels on oscilloscopes[16]. In both familiar examples "diagrammatic" functions are smoothly blended into dominantly depictive visual-recognition transfer situations. The god or pharaoh is not only "symbolized" as dominant – but *looks* so, without looking gigantic or distorted – while the tissues, appearing distinctly, seem distinct but not polychrome. All is visual, although only some entail direct transfer of visual effects from nature to like effects and meanings on surfaces.

Working from the other direction, diagrammatic drawings are frequently inflected by more pictorial features. For example, topological maps of rail lines or rivers usually make geographical concessions. More complex mixtures of far more various factors are much the point of representations in a great variety of kinds and purposes. But before considering these, our slight diagrammatic considerations raise a couple of questions.

The phrase "depictive (or pictorial) perception" has two terms, each of which perhaps concedes too much. Common usage distinguishes the depictive or pictorial from the diagrammatic – an inclination I believe can be theoretically defended[17]. But just for present purposes, it may suffice to distinguish them

[16] For ctitical histories of these developments see, for example, Kelves 1998, and Joyce 2008.

[17] For an account of visual depiction, see Walton 1990, also as used in Maynard 2005.

according to visual devices involving transfer of modular effects directly from natural to representational contexts and those that do not. For example, placement higher in a picture tends to make something seem further off, because placement higher in visual fields normally indicates distance, whereas being taller on a graph does not mean (for a population) looking at all. But that we thereby distinguish two kind of representations, "diagrams" and "pictures", does not mean that the former do not contain the pictorial or the latter the diagrammatic. (Compare: that we distinguish dramatic and narrative elements in prose means neither that they are unmixed in works of prose nor that they should be.) It is not easy to find clearly unmixed cases of the pictorial and diagrammatic in millennia of works in European medieval and other highly developed visual cultures. Accordingly, the case would have to be argued that "depiction" implies absence of diagrammatic functions. To treat depiction "as a matter of ... how the visual array offered by the picture could elicit recognitions as of the visible world" is therefore presumptuous, worse when the blending of other factors is considered, as below.

Thanks to the breadth of drawing, diagrams present another challenge, better than do painting and photography. That concerns the term "perception". We are less likely to speak of "diagram perception" than of "diagram understanding", for, while effective diagrams may be fully visual, constrained by our visual capacities, we still consider them to be entities for the understanding, not of the sense that receives them: that is, in terms of uptake, not intake. The question arises, when vision sciences study "pictorial perception", what is the topic? If it is merely the means by which (significantly) pictures are taken in, this leaves open the issue of what it is that is taken in, notably whether it has mental content, ideas, "internal" to the mind – as diagrams do[18]. However, to give the mental-content aspect of graphic arts over to this factor would still be to give away too much, also to encourage a dualism within depiction. We need to see how even the working of vision research's beloved perceptual modules themselves carry mental content. Let us now address this directly, from within the "uptake" visual experience of directly derived visual experiential effects.

Drawings as artifacts

I have argued that theory of representation – including drawing – needs to make selective use of sciences' discoveries, for its own purposes. A promising case is the perception of artifacts. Again, drawing is particularly useful, given that photography has given pause concerning its producing artifacts, that is, things made by people rather than nature. As Kant remarked, if we spot some lumber

[18] By addressing visual representation from the standpoint of sense perception, theory has failed to treat representation and consequently has made little contribution to more important matters of content, for example the capacity of various drawing systems to encode kinds of information. If this is forgivable in empirical studies, it seems not in philosophy.

in a bog we take it differently from its surroundings, because we understand it to be an artifact, «a work of people»[19]. It will stand out as such, perhaps as much as a root mistaken for a snake – not for its shape but for its category. Kant observes, «its producing cause had an end in view to which the object owes its form». His term "end" is ambiguous, since "artifact" has two meanings in terms of ends or purposes, even intentions. First, we experience aspects of a board, including shape, as being *for* purposes. Such is also true of the living parts of the bog; but, unlike them, we experience the artifact as being these ways *on* purpose.

Attempting to characterize depictions in terms of the "object-centered" vision previously discussed, philosopher Mohan Matthen, earlier quoted, also writes, "Depictive experience offers you an epistemic, but not a motor, affordance", or set of characteristics fitted to doing something[20]. Speaking of affordances, cognitive researchers such as primatologist Michael Tomasello hold that comprehending functional aspects or affordances of artifacts intentionally, by age nine months, is a basic feature of human cognitive development, on which much depends. A child watches an adult using an artifact, identifying

> the user's goal, what she is using the artifact "for." By engaging in this imitative learning, the child joins the other person in affirming what "we" use this object "for": we use hammers for hammering and pencils for writing. [The child then] comes to see some cultural objects and artifacts as having, in addition to their natural sensory-motor affordances, another set of ... intentional affordances based on her understanding of the intentional relations that other persons have with that object or artifact[21].

Affordances are "for", and there is emphasis on another "for" in this intentional affordance story, a social one. Apart from issues of having produced the artifacts intentionally are Tomasello's of their being intended for use for a social group. To experience something as an artifact is to experience in terms of a group with shared perception. (This applies to artifacts from other cultures and times – much to the benefit of museums.)[22] Accordingly, children must also learn to identify accidents, mistakes, incompletions regarding ends. They also playfully "decouple"

[19] Immanuel Kant, *Critique of Judgment*, §43: «Wenn man bei Durchsuchung eines Moorbruches, wie es bisweilen geschehen ist, ein Stück behauenes Holz antrifft, so sagt man nicht, es ist ein Product der Natur, sondern der Kunst; die hervorbringende Ursache desselben hat sich einen Zweck gedacht, dem dieses seine Form zu danken hat». J.C. Meredith (1911) translation.

[20] Matthen 2005: 315.

[21] Tomasello 1999: 84, 91. Tomasello has qualified some of his claims for human uniqueness among primates in later publications, but not for this one.

[22] David Attenborough voiced this author's feeling of recognizing intentional affordances, on handling a nearly two-million year old hand-ax: «Your first reaction is [...] it fits without any compromise into the palm of the hand and in a position where there is a sharp edge running from my forefinger to my wrist [...]. What is more, it has a bulge on it so that I can get a firm grip. That's the sensation I have that links me with the man who [...] laboriously chipped it [...]to leave this [...] sharp edge» (BBC Radio 4 "A History of the World in 100 Objects", Neil MacGregor host: episode 1 [17 Jan. 2010]).

intentional affordances, in pretence, mischievously using objects in wrong ways. Pictures are among these.

Another of our scientific sources had considered "action agnosias", "unknowings". Radical failure to grasp these kinds of purposes would count as a disability in a person, a kind of "associative agnosia", like not being able to recognize objects, faces, by sight or touch, or to integrate movements into actions – a quite serious "unknowing", since the natural/artifactual distinction is basic. Consider relative agnosic inabilities to perceive as, *for* purpose:

a. affordances of things (i) for self, (ii) others, (iii) different creatures;
b. fixed (e.g. organic) affordances (i) for self, (ii) others, (iii) different creatures;
c. (Tomasello's theme) intentional (fixed) affordances (i) for one's group, (ii) others ("for us", "for them");

and as, *on* purpose:

d. made or done by agents,
e. for purposes (other than just doing it).

We are limited in all these abilities, exercising them more or less and at various levels. But congenital failures with any would count as cognitive disabilities (*a*, *b*, *c* (i) being severe forms of retardation).

Since pictures are understood as artifacts, all that applies to them[23]. Compare this with Matthen's description of a picture, typical of contemporary theory: «Of course, you know where the *picture* is [...] right in front of you, where it can be grabbed or pushed [...]. You can pick it up, adjust the way it hangs on the wall, [...] clean it – clearly you know where it is relative to you»[24]. Here a "picture" is taken only as a body in space, for mechanical action, not recognized as an artifact with intentional affordances of use, like any other familiar artifact in the room. Such theoretical "artifact-agnosia" is necessary, to block application of one of the most basic psychological principles, which undermines the "visual scrutiny" project, as is expressed by one cognitive researcher: «There is nothing special about picture perception as compared to the perception of natural scenes»[25]. The principle is that cognitive context can strongly affect perceptual experience. Certainly contexts of purpose do, as a bump being interpreted as a

[23] Confirmed by difficulties modern audiences have with fast-changing "experimental" pictures, also those from a variety of cultures and subcultures. Audiences are often at first uncertain about what aspects of these works are "for" – that is, why they are there – and so cannot disringuish accidents, misrakes, lack of skill, incompletions – or tell whether they are being kidded. That is, they may not at first sufficiently grasp the intentional affordances of such works, but in time usually do. Different as such works are, they usually have the trait of being *for display* – thus there are galleries, museums etc. We perceive them with expectations that some aspects of them are affordances for being perceived.

[24] *Ibidem*.

[25] Cutting 1997: 33.

kick or shove illustrates. Artifact, function, on purpose contexts being fundamental, like living/inanimate, they strongly shape perceptual experience of pictures. Therefore there is something special about the experience of picture perception, distinguishing it from that of nature. Confirmation of that may be found in an overdue acknowledgement of photographic arts. We look at such photographs with very different expectations than we do most, with more searching attention to relationships among the shapes and patterns they define, the connections and groupings we seek only partly guided by efforts to identify natural scenes. The better the photographer the more demanding this vision, as it seeks more levels of reasons why, its reward being in finding more meaning.

"Visual array" treatments of pictures dominant in philosophy and perceptual psychology ignore these basic facts about perception. Overlooking that depictions are familiar artifacts and used as such, they neglect the great differences between looking at things and looking at depictions of them. Notably, they hide the fact that we look at depictions, not real scenes, for their depictive "for" affordances, and in terms of "on purpose": why they were put or left there, what they are *doing* there – including whether they should be there. Accordingly, although the visual experiences may be significantly similar – the pictorial exploiting aspects of the natural – they are profoundly different. As drawing makes clearer than photography, any perceptual cue borrowed from nature – such as occlusion, gradient change, foreshortening, horizon ratio, shading, highlight – though it work similarly in a picture, also works very differently, since it is experienced as being there on purpose, for purposes – even where that purpose is to work an effect as in nature. However questions why there is or is not a shaded shape at a certain place in a drawing, which guide our visual activities, not just our comments, would make no sense regarding an actual scene[26].

This applies not only to the means by which entities are shown in depictions, but also to represented entities themselves. Of, say, a shadow, "what is that doing there?" has very different meanings in the two cases. Again, photography, rather than providing a paradigm of depiction, produces exceptions to prove the rule: familiar doubts about photographs' artifactuality spring from unclarity about whether such "why?" queries about the shapes in them, and the entities these reveal, are different from those about their subjects themselves. Drawing also makes clearer that the visual affordances we thus seek are for the work's contents, which may be nonvisual, not just in order to be perceived.

Visual displays

It is remarkable that the dominant "visual scrutiny" account of depictions should be thus undermined by common knowledge combined with simple

[26] Visual design – notably architectural, landscape, city – provides interesting exceptions to this, deserving detailed study as such. That an aspect of this is to make certain features of things more salient to view opens topics of ornament, bodily attire and so forth.

principles from vision theory itself. This is without semiotic recourse to codes, even "conventions", since, as with artifacts generally, normal usage shows us, within a social group, what their characteristics are "for". No linguistic or "symbolic" analogy is thereby invoked. Further, absent theoretical arguments to the contrary, there is no reason to suppose that this kind of mental content presupposes possession of language[27]. It is also interesting that "visual scrutiny" should fail at the first indication of intentional or mental content – that, simply by treating graphic works as artifacts, we understand some of their features to be accidental but many to be on purpose, in order to do something. Yet, since the same could be said of any artifact, this leaves us well short of understanding the mental content that particularly matters to us in such works, of how they could be "open to the mind's participation", express thought, yet still work visually.

An initial step would be to notice within artifacts another level of cognitive content. Only some artifacts' affordances are for cognitive acts of perceiving or conceiving. Such is what pictures but not what (principally) cups, cars, clothes, are for[28]. There seem to be two minimal requirements for such mental content. Cups etc. reflect intentions of use of their physical affordances for specific tasks. But they do not reflect intentions of use for cognitive tasks of imagining or conceiving things in specific ways, as do visual representations and descriptions. Opposite to that would be natural situations such as cloud forms, which may provide physical affordances for cognitive acts of conceiving the things we "see" in them, but we cannot ask what parts of the cloud are "for". Crafted features of depictions however facilitate not just seeing them, but also conceiving the things and situations they represent, in very specific ways: "ways of seeing", cognitive content. In terms of artifact intentional affordances, that simple statement suggests two levels of mental content.

The first is perceptual: among artifacts, pictures and the like – for example, drawings of all sorts – are visual "displays", that is, things we know to be made for visual appreciation of certain kinds. In all our dealings with them we keep in mind that they are made in order to be perceptible, whatever else they are for. In Tomasello's words, that is our «understanding of the intentional relations that other persons have with» them, as artifacts. This opens a large topic, which can hardly be touched on here. As is well known, in nature and in art there is more to display than just being perceptible; there is also being made so. Display is perceptual salience for purpose, which, in the case of humans and higher animals, is also on purpose. Understanding human and animal doings in terms of display involves seeing how they are fitted by intention to that purpose, whatever other

[27] Tomasello's approach to language and the symbolic reverses this idea, basing them on community formed by intentional affordances combined with joint attention: see Tomasello 1999: ch. 4.

[28] The qualification has two reasons. First, since artifacts have multiple functions, they have multiple sets of affordances for them. Second, many artifacts have design features; they are partly formed for perceptual and social meaning, a subject of much study.

purposes are served. A sign declaring, «high visibility clothing must be worn in this area», is a display, but the clothing it calls for may not be. We do not make a display unless we also provide indications that what we make perceivable is done so with that intention. This is another level of mentality in what is visible that is applicable to all pictures, even the nonrepresentational. Hence, looking at a drawing of the most technical or cursory sort, we are alert to indications of what has been put there to be seen. That is the kind of artifact it is.

Sustaining seeing

It is also in the nature of displays that purposiveness ramifies, since we often look for further motivation. Such is true of relevant aspects of depictions: as Podro observes, «we seek the intention of a drawn line», understand it not only as intentionally visible, but thus in order to serve its function for viewers of, say, defining a contour. Therefore, with the general category of visual display artifacts, absent principles specific to art, we are well into the relevant mental content possible in drawing, painting and so forth. This point would develop greatly if we had space further to specify *depictive* content, thereby providing a fuller dimension of mental content. Short of that, let us only invoke a psychological principle earlier cited, that vision is a hypothetical, predictive matter. Confirmation, development, revision are essential to hypothetical methods, including perception. Applied to pictures that we count as works of art, as Podro remarks, they "address us, and they do so in part through creating uncertainty; our engagement with them involves a continuous adjustment as we scan them for suggestions on how to proceed and for confirmation or disconfirmation of our response."[29] This is not because they are puzzles but because they encourage and reward more sustained, often repeated and joint looking, which is why they are displayed in public places. Podro's point is that a purpose of such back and forth attention is to resolve developing issues about what, for example, we depictively recognize in a picture and the picture's means for making it recognizable. Furthermore, in continuity with perception generally, this is not a matter of spotting, but rather of integration toward a «synoptic view: our sense of the subject emerging within the painting», as «the viewer waits upon the suggestions the painting will offer within the framework of other recognitions» – an active process. This, backed by assumption of purpose, becomes part of content.

Gesture

So far drawing, long a "handmade handmaid" to other arts, has been used to consider wider matters. What of drawing itself, notably as art? Something needs

[29] Podro 1998: vii.

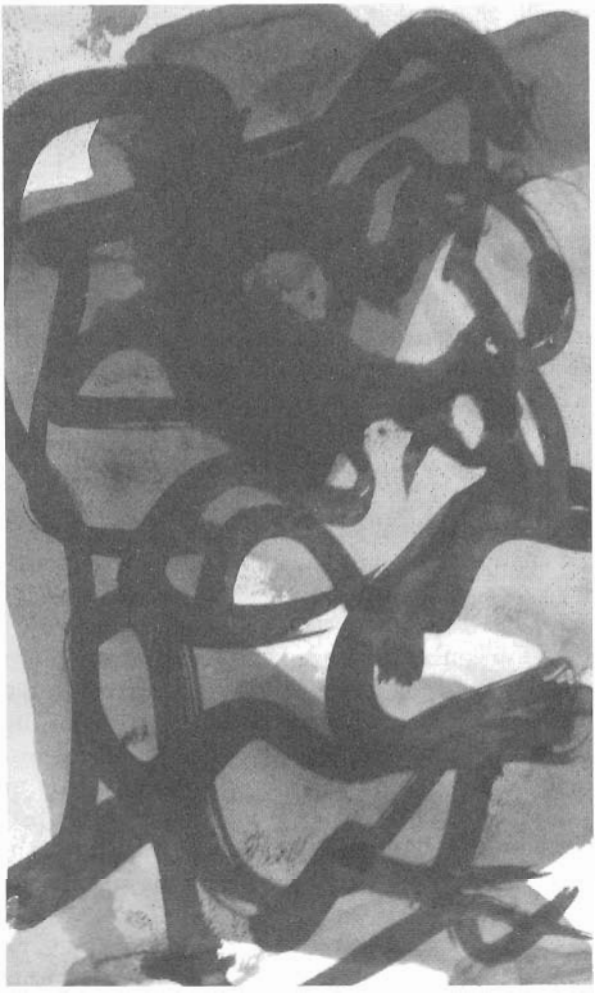
to be sketched about whether drawing theory, using current vision research, can help us better understand those characteristics most typical of *drawing*, in terms of mental content.

"Drawing" often suggests at least three things: design, immediacy and intimacy, physical gesture. As already noted, the design element has obvious implications for content. Let us briefly consider the other two by focusing on the current rise of drawing as fine or gallery art, in addition to general usage. If immediacy, informality, expressiveness are cliché associations to drawing, they have good basis. Historically drawing, a means to making other things, has been done with relatively cheap and dispensable materials, typically of little physical bulk and by rapid procedures: "works on paper". That fits its common association with line marking on largely unmarked (reserved) surfaces. Drawing recedes as layers begin, usually atop, effacing it. With layering – painting – the marking actions cover their tracks, allowing revision and accumulating more material, with more investment of effort. Thus drawing's multiple associations with the direct, immediate, informal. Also the self-expressive, for two reasons. First, drafters, with less investment of time, effort and material typically work more freely. Next, we have come to have an interest in formative actions, easier to see in the result[30]. Indeed "display" might appear a paradoxical term to use with drawing, since, as just stated, that term implies self-consciously inviting others' attention. But of course display need not be public display; the social "for us" includes us singly, not just in groups. Besides, the most informal, transitory drawings are still displays, at least to the working drafter, guided by perceiving what has been produced, in order to continue and refer back to it. These considerations lead to the next tentative suggestions.

Let us view these factors in the current prominence of drawing arts. Regarding materials, only in recent decades have uv-3 plastics and archival matting been developed and understood, along with drawing surfaces such as white mylar, to promote confidence among galleries, collectors and artists regarding display permanence. Associated are more affordable market prices. Also, with the artworld's easing of borders between artforms, the modern *arti del disegno* provide a nexus for crossings. This is noticeable among contemporary sculptors, who typically think by drawing rather than paint. In addition, we may conjecture that, in this time of overpowering public display in marketing media, combined with political and economic disillusionment, there is increased interest in private, meditative workings of experience. For this, meanwhile, digitalization's shift of art photography to large scale displays, for walls[31], has moved spontaneous, small-image photography from central position, perhaps rather as had electronics the quiet, meditative sound of the guitar. Maybe recent work in vision sciences can be used to carry us beyond cliché in understanding drawing's particular appeal here.

[30] Thus Saul Steinberg: «Even in Picasso it is the clumsy we like [...]. The hesitations over the parts in the drawing where one sees emotions and reasoning» (Steinberg 2009).

[31] One current aesthetic for this is Fried 2008.



Mark Wiener, no title, ink and graphite on moleskine, 2010.

The English term "drawing" also suggests physical process. This combines with the distinct idea of design by ascribing purpose, not just sequence to the formative aspect, as action. According to the mixing principle, where that is developed, drawing's capacity for mental content might increase significantly, combining with the sense of purposefulness our strong awareness of intentional meaning in motor actions. It is often observed that in drawings we experience marks as traces of motor actions. Besides traditions of calligraphy, the extensive successful modern art "experiment" of gestural nonfigurative drawing has dem-

onstrated the significance of that, independent of representation. An important result has been confirmation that shapes and relations themselves have independent visual meaning for perception. Here at least two kinds of cognitive science might be of assistance. One relates to synaesthetic phenomena within perceivers, the other to empathetic perception among them.

Gestural drawing is well known for visual perception's engaging awareness of touch and motor action. We not only experience shapes – for example, 1D marks on 2D surfaces (sometimes with notional 3D fullness) – we experience them as having been produced in time by deliberate actions: that is how they look to us. Recent synaesthesia-related brain-imaging studies suggest neural interactions of different senses, as well as sense-action, modes. There are different possible routes for such research as related to drawing. For example, there has been focus on the Broca-area's dual functionality for hand action and speaking as a site for transition from gestural expression to spoken language. Where motor-actions show in traces, links to oral-motor and other neural structures may obtain.

Next, Tomasello's intentional affordances idea had us consider drawings in terms of what their aspects are for – for an intended social group. I argued that current vision science and philosophy tend to suffer from "artifact agnosia" regarding our topic, while other science points a better way. Neuroscience of action recognition could be part of that. Recognizing, too, that «successful social interaction depends on an ability to understand others' actions in relation to intentions»[32], it investigates action in terms of motor patterns. Current "embodied cognition" theory, supported by mirror-neuron findings, also postulates social perception by means of mapping others' motor patterns towards goals in terms of observers' own bodies and motor patterns. Should such hypotheses become well established, and also related to marks as traces of guided actions, the "intimacy" aspect of naïve ideas about drawing might be theoretically developed.

But now, by haste, its closing risks undermining the essay. If, early in his own project, Gombrich encouraged us to be "wild", he never meant "careless"[33]. Besides being sketchily speculative, the last suggestions have been too general. The care that needs to be taken in our studies includes the kind Gombrich gave, typical of good science: attention to individual cases – great art, art or not art – always shown to be interesting in themselves, not only as illustrations of theses. Worse, these speculations run the risk of contradicting the theme of the essay, making it appear as though we await new vision-science advances to carry on our investigations. However, much of the interesting work remains to be done with countless case studies of artists' autonomous uses of well-known

[32] For a simple example see Bosbach, Cole, Prinz & Knoblich 2005. Prinz is an exponent of the "common coding" theory, closely linking perception and action neural representations.

[33] "Scholarship, as I see it, can only profit from such wild questions being asked..." (Gombrich 1963: 118).

perceptual principles[34]. I hope that much of that will be directed to our understanding of drawing's capacity for mental content, as particularly «*internal*, open to the mind's participation, part of the mind's thought and feeling».

[34] Besides artists' tool-kit freedom being enabled by perception's modularity, it is important to stress that artists also exploit these "tools"' different biological weights: e.g., face-recognition response is powerful, occlusion is the strongest depth cue (J. Cutting), cast shadow trumps perspective geometry (Casati 2007), and so forth.

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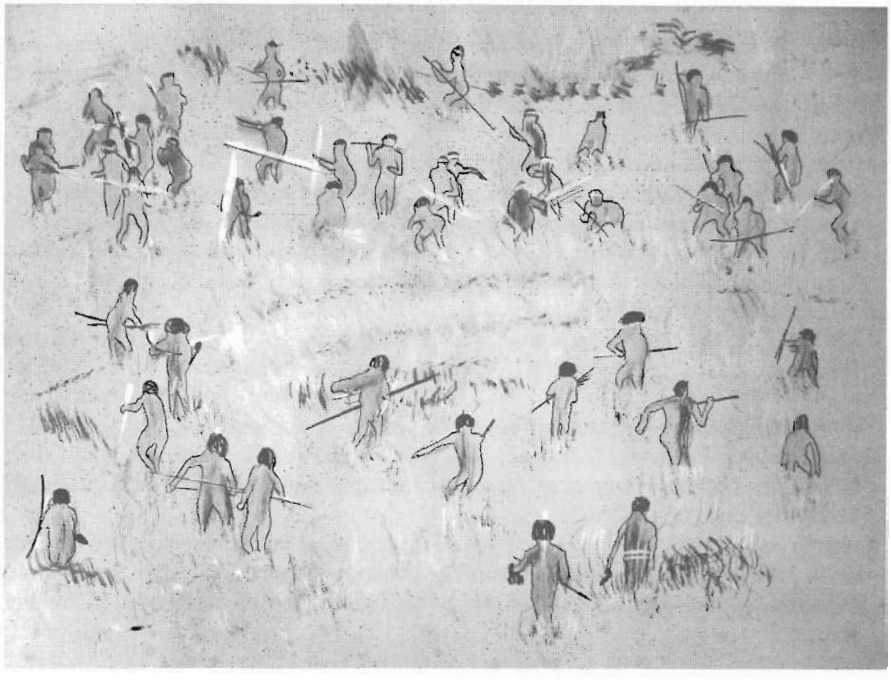

John M. Kennedy, Grassland Threat, *ink on paper, 1971.*