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Looking at images and reasoning about their content: The case of shadow depiction

The depiction of cast shadows is an interesting laboratory for solutions to representational problems, and in this they provide interesting material for the study of visual cognition. For instance, shadows in paintings have been alleged as examples of perceptual double dissociations: some perceptually acceptable shadows are physically impossible, and conversely some physically correct shadows are perceptually impossible. Here I discuss a larger set of cases that involve more topical *inferences*: shadows of invisible objects, of objects that should not cast shadows, of objects whose presence is only implied and not shown in the painting, cast by lights that are not visible. Interestingly, some shadows can be used to ascertain the original properties of a painting. In all these cases the viewer is moving from some visible features of pictorial content to features that are not displayed in the picture.

Introduction

The complex and multi-faceted contribution of Gombrich to our understanding of pictures, in particular those pictures that count as works of art, with a sympathetic eye for the psychological side of the issue, can hardly be summarized in a thesis or in a set of theses. This in itself will be no excuse for my own cherry-picking attitude towards the corpus of Gombrich's writings. I have, however, a sufficiently circumscribed target here--shadow depiction and the inferential landscape that depicted shadows make possible--and I would like to pursue it in some detail. My hope is that by analyzing some subtleties of the depiction of shadows in art light will be cast on the viability of the larger program.

Gombrich's contribution can be conveniently assessed in terms of its subsequent developments. Two main trends have emerged, one of which, quite ambitious, was and still is a powerful attractor in framing an account of pictures; the other, possibly less conspicuous, surely less investigated trend, is interestingly promising. Let us very quickly clear the ground with a fast run through the literature on depiction. Consider the first set of post-Gombrich developments. Gombrich talked of 'illusion' in relation to pictures. We can consider 'illusion' as an umbrella term for a class of features that are intuitively ascribed to pictures. Common sense has it that something in our experience of representational pictures is similar to the experience of being in front of the depicted object. We can at the same time accept that we are very rarely fooled by pictures. Complete illusion--taking the picture for its subject--is out of the question here, even as a regulative ideal¹. Pictures that were completely illusory would have a very odd place in our communicative and artistic practices. Most representational pictures do not aspire to being completely illusory in that sense. (Things may change because of technological development; exceedingly effective virtual reality can become commonplace.) Short of requesting complete illusions, accounts of pictoriality have tried to do justice to the intuition that something goes on in picture perception that closely matches what goes on in perceiving the subject a picture is supposed to represent. Some accounts (distal, 'Albertian' accounts) revolve around various notions of an object's appearance, and take pictures as either being proxies for, or as copying these appearances². However, it is not clear what it is for a

1P. Maynard, *Drawing distinctions: the varieties of graphic expression*. Ithaca, 2005.

2C. Peacocke, 'Depiction', *The Philosophical Review*, 96, 1987, pp. 383-410; J.J.

Gibson, 'The information available in pictures', *Viewpoints* 47(4), 1971, pp. 73-95.

picture to copy an appearance in the first place. Similarity accounts have fallen under the set of Goodman's objections³. Similarity is symmetric; depiction isn't. Pictures resemble other pictures more than they resemble their referents. And anything resembles anything else, but a picture does not depict *any* thing. Chastised proximal (recognition) accounts⁴ suggest that when one looks at a picture as of a P one's very same recognitional apparatus is mobilized that is triggered by a visual encounter with a P. No imitation of appearances is involved here, no similarity between a picture and the represented object; the only similarity, if any, is between the visual experience of the picture and some relevant aspects of the experience engendered in the visual encounter with the object the picture represents. However, when the details of the psychological story told by recognitional accounts are spelled out, problems arise. If the structure of the internal representations that subserve recognition is itself iconic, the recognitional account suffers from a nasty missing explanation argument⁵. Hence any psychological account of pictures must either be structural or give up the thesis that the internal representations that underscore picture perception be themselves iconic.

At this point it is clear that we are at some remove from commonsense, intuitive theories of pictures. The beautiful question facing us from now on is whether picture perception constituted or not a psychological natural kind. Either way, the key properties of picture perception are open to empirical investigation, and indeed we may be surprised by what we will come to know about them; arguably, intuitions about pictoriality will lose relevance.

Another, completely different class of accounts of pictures claim that depiction can be characterized in purely structural terms. Pictures have a certain structure or multiplicity, that is a spatial structure, that differentiates them from other representational items, such as uttered sentences or diagrams. It is hard, though, to

3N. Goodman, *Languages of Art: An Approach to a Theory of Symbols*, Indianapolis: 1968.

4 D. Lopes, *Understanding Pictures*. Oxford 1996; F. Schier, *Deeper Into Pictures*, Cambridge, 1986.

5 J. Kulvicki, *On Images: Their Structure and Content*. Oxford, 2006.

specify the structure at issue. To take a recent example, Fodor⁶ proposes that if P is a picture of X, then parts of P are pictures of parts of X. However this account does not distinguish pictures from diagrams.⁷ Goodman's own proposal had it that pictures are syntactically and semantically dense (they are analog) and relatively replete (whereby "more properties are relevant to the identity of a picture than are relevant to the identity of a diagram")⁸. This ambitious characterization entailed that the result of tearing a picture and scrambling pieces is still a picture⁹. Kulvicki tried to block such counterexamples to structural accounts by requesting that the picture making process would be recursively iterable without (much) loss of information about the picture's content--what he calls 'transparency'. If you take a photograph of a photograph of P (from an appropriate viewpoint), then you have something that is or comes close to being a photograph of P itself. More generally, something is a picture if, on top of being syntactically sensitive (whereby pictures are syntactically more sensitive than written letters), of having relative repleteness, and semantic richness (whereby photographs are richer than icons, that have all the same content), it is transparent. This account blocks the scrambling counterexample, and felicitously incorporate audio recordings into the class of pictures. But it is too restrictive relative to commonsense classifications as it leaves out radar images or sonograms. An interesting and little explored consequence of transparency is that being a picture becomes sensitive to using a certain representational vehicle. Consider a device whereby a laser scans the occluding boundaries of a 3d object, and outputs a silhouette of the object on a sheet of paper. The sheet with the silhouette is not a picture because transparency is violated: if the laser scans the sheet of paper, then it outputs a silhouette of the sheet of paper. But suppose the device outputs a cutout silhouette instead of the sheet of paper. This is a picture as the transparency clause is fulfilled; it can be further scanned, and another cutout will be output. The printed silhouette is not a picture; the cutout silhouette is.

We have seen that theories of depiction both of the structural and of the 'illusion' strand are blocked by various problems and counterexamples. One has to pay

6 J. Fodor, *LOT 2: The Language of Thought Revisited*, Oxford, 2008, p. 173.

7 Fodor's interest is not in distinguishing pictures from diagrams, but both from language-like items.

8 See again Kulvicki quoted above.

9 R. Wollheim, 'Nelson Goodman's Languages of Art', *The Journal of Philosophy*, 62, 16, 1970, p. 531.

attention to the dialectic involved in using counterexamples. It can be decided that the costs of admitting the cutout silhouette in the class of pictures and excluding the printed silhouette class are acceptable if compared with the advantages of having radar recordings in the same class as photographs. More generally, being forced to give up commonsense ideas about depiction could be a sign of attained maturity of the topic. I surmise that the two unequal developments stem from an unresolved tension between Gombrich's attempt to strike a balance between an intuitive notion of a picture, and a notion that is more friendly to psychological aspects. Indeed, it may turn out that a psychological account of picture perception will be quite counterintuitive. The tools in what has been called the Gombrichian "toolbox"¹⁰ --those uncovered by artists in centuries of tireless experimentation, and by psychologist when concocting ingenuous illusions--need not be accessible to the intuitions of the untutored.

We presented a dilemma. In order to avoid missing explanations and circularity, psychological accounts of pictures must either be structural or give up the thesis that the internal representations that underscore picture perception be themselves iconic. If we reject structural accounts, that is if we are on the 'illusion' side of our decision tree about depiction, we ought to give up the idea that the internal representations are pictorial.¹¹ This is what we shall assume at a starting point in what follows. The structural account is considered as imposing a strong constraint on the psychological, Gombrichian account.

Gombrich's Programme: Artists' Toolboxes

Let us say something about the path. In systematizing part of Gombrich's ideas, Patrick Maynard writes: "...convincing depiction is largely a matter of building a toolbox of effective devices, - dodges- passed on, studied, borrowed, stolen, or

¹⁰ Maynard, *Drawing distinctions*.

¹¹ As neurophysiologist Neil Burgess once told me, it is nice to have maps in the brain, except that you should now explain who can use them.

invented, though occasionally systematized”¹². Gombrich himself eloquently stated that

“The history of art... may be described as the forging of master keys for opening the mysterious locks of our sense to which only nature herself originally held the key... Like the burglar who tries to break a safe, the artist has no direct access to the inner mechanisms”¹³. “The question is not whether nature 'really looks' like these pictorial devices but whether pictures with such features suggest a reading in terms of natural objects”¹⁴.

A toolbox account of depiction is thus the thesis that artists have arranged certain physical properties of their productions so as to compel the viewer of those productions to *visually* imagine a certain situation and to *imagine that she is seeing* that situation. Triggering of recognitional abilities is certainly an useful ingredient of this imaginative relationship with pictures. But it is not enough--for instance, if we exclude triggering of motor responses we block the possibility of explaining the perspectivalty of pictures. So let us be inclusive and accept that any tool that enables visual imagination and imagination of seeing is to be found in the toolbox.

It is no minor feat of Gombrich's project that at the same time it assumed and showed the impressive continuity between *beaux arts* and demotic art at all levels, from the productions of children to that of visual designers, to banal endeavors by practitioners and amateurs. Nothing in the image production activity is alien to the scholar of art.¹⁵ Thus opening the field to the investigation of all sort of contributions unravels a vast body of knowledge that artists could choose to deploy at their will. But what is the point of the deployment? What are those tools good for?

There are three points worth emphasizing. First, “convincing depiction ” is a metacognitive, pragmatic term. It is a quality of the representational vehicle that is borrowed from a quality of the experience of the viewer. We have been sufficiently

12 Maynard, *Drawing Distinctions*, p. 98.

13 *Art and Illusion*, p. 359.

14 *Art and Illusion*, p. 360.

15 A point forcefully made about reception by David Freedberg in his *The Power of Images*, Chicago, 1989.

guarded against the risks of collapsing convincing depiction on illusion. But we need some substantive account of convincing depiction--and one that preserves the idea that *depiction* is at stake. Second, the toolbox account predicts that some depictions are convincing but not correct, if compared to some geometric or physical standards. Third, it also makes the dual prediction that some depictions are correct according to some standards, but still remain unconvincing. (Never mind, of course, the many correct and convincing depictions, and the even more numerous wrong and unconvincing depictions.¹⁶)

These predictions call for the study of some particular tools in the box. The representation of shadows appears to be an interesting candidate because shadows have a rich informational structure, a relatively straightforward geometry, and are very salient in the visual scene. At the same time the logic of mental shadow computations is quite idiosyncratic and deflects from the norms of geometry and physics. Let us introduce some pictorial representations of shadows. In *Shadows* Gombrich lists some *functions* of shadows by investigating paintings mostly in the collections of the National Gallery¹⁷. I have tried to enlarge the classification¹⁸, and there is still quite a lot of work ahead. But already at this point out of the large number of examples of depicted shadows some regularity emerges. At times shadows have been depicted almost for their own sake, for the pleasure of documenting an interesting visual phenomenon. One beautiful example is the shadow of the suspended candle in Crivelli's, *Madonna della Candeletta* (Brera). Photographic art has pursued this approach--many beautiful aspects of the visual world have been registered accordingly.

16 As an example, line drawings provide one key to convincing depiction and the dual set of predictions.

17 E.H. Gombrich, *Shadows. The Depiction of Cast Shadows in Western Art*. London 1995.

18 R. Casati, Poster for the conference Shadows - From Art to Neuroscience, Rovereto—MART, 2003; R. Casati, 'Methodological Issues in The Study of the Depiction of Cast Shadows', *Journal of Aesthetics and Art Criticism*, 62, 2, 2004, pp. 163-174.

In the spirit of the Toolbox account, shadows have been mostly used to add vividness to pictures; their images have helped the viewer to visually represent a scene in such a way that she can imagine to be visually representing it; they have helped bestowing on a depiction the character of convincing depiction. Most interesting of all for our purposes are those depictions that are convincing in spite of not being of photorealistic quality and not even geometrically accurate.

I would start from a case I recently observed; whose interest lies in the fact that it provides a striking example of an actual double dissociation between convincing power and correctness. The two pictures in question are the *Nativity* of Filippo Lippi in Spoleto (1466-69) and the *Nativity* of his collaborator at Prato, Fra' Diamante (1465-70, now at Louvre). Lippi present us with very convincing shadows of poles protruding from the ruins of a building. The shadows are parallel on the image, indicating a source of light (the sun) that is placed somewhere on the top left area of the represented space. However these shadows are impossible, as they are projected on surfaces that form an angle incompatible with the uniqueness of the light source. The fresco is convincing but incorrect. Fra Diamante's work, on the other hand, is correct but unconvincing. He represents a very similar situation, in which shadows are cast from poles protruding from two surfaces that form an angle. The shadows appear to *converge*. Much as this can disturb the viewer, the convergence is consistent with the presence of a single light source and the relative positions of beams and walls.

It is important to notice that much as the metacognitive predicates 'convincing' and 'unconvincing' are the result of some automatic processing of the visual scene, the normative predicates 'correct' and 'incorrect' require some reasoning. Someone has to spend time observing the painting, pay attention to details, and reason about the geometry, order to find out that shadows in the Lippi fresco are not normatively correct, whereas shadows in the Fra' Diamante painting are correct.

We can enlarge the picture a bit. If we look into general informational properties of shadows, we can see that many of those properties are not exploited by the visual system¹⁹. The visual system is blind to potentially useful information. Call this the

19R. Casati, 'The shadow knows: a primer on the informational structure of cast

Cherry-Picking Principle. The fact that information is Cherry-Picked depends on many causes; we can only blame the random paths of selection that made us cherish some type of information when other, ideally more useful types were neglected. As an example, the size of sun's images projected to the ground through foliage can tell you about the distance of leaves and branches from the ground. The beauty of this mathematical property of foliage in the sun apparently was shunned by evolution. Nobody seems to be able to immediately perceive the height of a tree upon inspection of the shadows of foliage on the ground.

Conversely, if we look into what the visual system considers as useful informational means, we discover that it is not only blind to many physical and other constraints, but that it positively speaks in favor of violations of these constraints. Call this the Goodenough Principle. In a picture, patches of color that appear to be uniformly darker than their surroundings and are somewhat made to correspond to objects in the scene count as shadows even though they may be fantastically inaccurate from the physico-geometrical side.²⁰

Cherry-Picking and Goodenough show that there are interesting idiosyncrasies of the visual system; it does not behave in an ideal way, but according to some internal logics. Contrary to psychologist Patrick Cavanagh's hypothesis²¹, this logic is not that of a “simplified physics”, as in some cases the putative laws that are followed by the represented shadows are more complex of the actual laws of physics.²² For a shadow to bend around a corner, as happens in Conrad Witz's *Adoration of the Magi* (1444, Musée d'Art et d'Histoire, Geneva), light rays must be deviated in physically impossible ways around corners. Witz's example is particularly telling because of his association with naturalism. The *Adoration* is depicted on the interior panel of a triptych one of whose exterior wings, representing the *Miraculous Draught of Fish*, is

shadows', *Perception*, 33, 11, 2004, pp. 1385-1396.

20 The fact that light is unconsciously assumed to come from 11 hours to the vertical (and not from 12 hours, the zenith) (Mamassian...) is another case in point.

21 P. Cavanagh, The artist as neuroscientist. *Nature*, 434, 2005, 301-307.

22 The copycat effect provides another example. A copycat shadow can be inaccurate and convincing, where the correct shadows can be unconvincing. No simplified physics could account for the impossible position of the shadows in the convincing but inaccurate picture. See R., Casati 'The copycat solution to the shadow correspondence problem', *Perception*, 37, 4, 2007, pp. 495-503.

alleged to be one of the first representations of a real landscape--Lake Lemman, with mount Le Môle on the background²³.

Once we have set aside more anecdotal cases, we can see the liberating force of the Goodenough Principle. The visual perceptually possible does not coincide with the physically possible. Painters have taken advantage of this fact in order to depict characters--historical or fictional--whose behavior defies the laws of physics.

Famously, Panofsky²⁴, used an example from *The Vision of the Magi* (1445-1448, Berlin, Gemäldegalerie) of Rogier van der Weyden to make the point that we can draw inferences about the subject matter of the painting based on our knowledge of the laws of physics. We would rule out the literal interpretation of a baby falling from the sky or projected into the air and settle for some supernatural event; a flying baby, or a flying divinity.

The *visual* perceptually possible is certainly more heavily constrained by (some) physics than are other types of possibility. I can tell a tale about the jealousy number three feels for his fellow number four, but I cannot depict this tale (I may depict numerals, not numbers, but this would be another tale yet.) But to what extent visual possibility requires physical possibility? Numbers cannot be depicted because they do not have a visual appearance. (Is this because they do not interact with light? Can there be visual appearances that do not depend somehow on interaction with light and on light transmission? These are further questions.)

Possible worlds exist in which colors are instantiated by different types of properties than the ones we find in our environment. These worlds would be perceptually close to ours but physically remote. They could still be depictable. Indeed, many pictures show how a visual world could be made that defies the lights of physics and still be conceptually acceptable. Of course, much has to be said about the sense of “conceptually acceptable”. In a weak sense we may want to operationalize conceptual acceptability based on the triggering of sufficiently rich recognitional and interpretive abilities. No visual stimulus is probably such as to elicit no recognition at all: color concepts will be always activated when looking at a visual display. But richer, more structured concepts may not.

23 K. Clark, *Landscape into art*. London, 1949, p.19.

24 E. Panofsky, *Studies in Iconology*, New York, 1939, p. 10.

Shadows in paintings are in many cases instances of this discrepancy between the conceptually acceptable and the physically acceptable. However, it is not only recognitional factors that play a hand in the game, but inferential factors at large. The following sections thus deal with inferences concerning the spatial and material layout of represented space. There are more complex inferences one may want to study, related for instance to recognition of characters. In what follows I offer a fragment of a taxonomy.

Inferences based on pictorial shadows

Shadows of allegedly invisible or diaphanous objects

We start from shadows of characters that ought not to cast a shadow. Indeed, there is a conceptual problem here. Some paintings represent souls or angels that, being diaphanous or immaterial, ought not to cast shadows. However, if light is not blocked by those characters, they ought to be completely transparent, hence (virtually) invisible. If the characters were not totally but only somewhat transparent, they ought to cast weaker but in any event non-full shadows. A classical example²⁵ is the Lippi representation of Dante's Purgatory (V Canto). Dante and Vergil cast shadows and this betrays them :

*Now had I left those spirits, and pursued
The steps of my Conductor, when beheld
Pointing the finger at me one exclaim'd:
"See how it seems as if the light not shone
From the left hand of him beneath, and he,
As living, seems to be led on." Mine eyes
I at that sound reverting, saw them gaze
Through wonder first at me, and then at me
And the light broken underneath, by turns. [...]*

When they perceiv'd that through my body I

25 Discussed in R. Casati, *The Shadow Club*. New York, 2002.

*Gave way not for the rays to pass, their song
Straight to a long and hoarse exclaim they chang'd.*²⁶

Another paradigm example is Lorenzo Lotto's *Annunciation* of 1528 (Painted for the Church of Santa Maria dei Mercanti, Recanati, now at the Villa Volaredo Mels museum). The angel casts a shadow (that incidentally is not consistent with the one cast by the candle on the wall.)

We find here an instance of the depiction of worlds that are physically different from ours but still conceptually accessible. Not only they are inhabited by immaterial characters, but these can cast shadows although, as they are “immaterial”, they should let light pass through.

This suggests in turn an intriguing cognitive hypothesis: that shadows are conceptually close to objects in the sense that they do not appear to be the result of a process. No matter the way they are produced, we can recognize them as shadows. Even if we recognize that immaterial objects ought not to produce them, we still accept them as shadows.

Shadows that indicate the presence of objects that are not visible in the painting

There are some masterly examples of this category. One, described in Gombrich's *Shadows*, is *Golgotha: Consummatum est* painted by Jean-Léon Gérôme in 1867 (Paris, Musée d'Orsay), in which the three crosses--the *topos* of the painting--are visible only via the shadows they cast. We know everything of the story, nothing is left to say, and the depiction of the material, wooden crosses would distract from the contemplation of an empty landscape. Another, earlier example (a precursor?) is the *Vue de Marseille* of Emile Loubon (1853; Musée des Beaux Arts de Marseille). Barely readable, the shadows of two cowboys riding their horses are visible on the right in the foreground. This is a tale of power. The masters, unseen by us but whose presence is made manifest by their shadows, control the activities of the little servant.

²⁶ Dante Alighieri, *The Divine Comedy*. Translated by Robin Kirkpatrick. London, 2006.

Even if you cannot see us, we keep an eye on you. The masters are all the more present as they are mysterious. In both examples, shadows that are so introduced are by default intended as key elements of the composition.

The “small crowd” hypothesis

An interesting conceptual problem arises here as well. Consider what happens when one takes a casual picture of a crowd on a sunny day. One part of the crowd is framed in the picture. Some characters are inevitably outside the “core” part, and in appropriate lighting conditions they would cast a shadow which is visible in the photograph. If you are a painter who depicts a crowd you may not be willing to incorporate those shadows of unframed characters. The “small crowd” hypothesis is indeed a simple prediction we can make about crowded paintings. Building from this we can reason that the “small crowd” effect of ancient paintings is just an inferential artifact.

Because of the “small crowd” assumption, shadows from unseen character that are not provided with narrative justification will be interestingly informative. We will see now a couple of reasoning threads.

Shadows that may induce wrong inferences about unseen objects

The Bellotto 1758-1761 painting *Kaiserliches Lustschloss Schönbrunn* represents the shadow of an architectural detail, a portion of the wing of Schönbrunn castle. The shadow of an urn is visible, and we would expect by symmetry to find also the shadow of a sister urn. The second urn is indeed present. However it is not visible in the painting. Its shadow is not visible too. It looks as if shadows have been added later, only looking at what is visible in the painting and not checking the real scene. We are reminded of the fact that painted shadows are not photographed shadows²⁷.

Shadows that can be used to infer the original properties of a painting

27 R. Casati, *The Shadow Club*. New York, 2002.

In Masaccio's Pisa Polyptich shadows of non-displayed characters have been used by art historians to infer the size of the original, now incomplete panel. Their reasoning can only work under the assumption that no shadow can be cast from a character who is not represented in the painting. "Most art historians assumed that the central panel and the two side panels were three paintings separated by gilded colonettes. But in 1966 the Harvard art historian John Shearman concluded that the Madonna that Berenson found was probably the central part of a single painting that had been broken into three pieces, perhaps to render it more marketable. He had noticed two very faint shadows falling from left to right along the stairs in front of the Madonna--cast, he surmised, by figures standing to the left."²⁸

Shadow-based inferential procedures are used in restoration techniques. Postulating consistent shadows helped the reconstitution of the frescoes in the Casa di Augusto in Rome--whose pieces were found scattered on the floor (Gianna Musatti, personal communication).

Shadow of the painter himself: "forcing" pictorial content

In his *Shadows* Gombrich published a "*Self-Portrait of the Author in the Setting Sun*, a photograph he took around 1990. It displays a shadow of Gombrich himself taking a picture. He calls it "self-portrait", innocently as if it were. As if it was perfectly normal, first, to consider a photograph of a shadow of a person a portrait of that person, and second, to dub "self-portrait" an image in which it is impossible to recognize the sitter. In the case at hand, any person carrying a cane would have projected a similar shadow.

Indeed, the impossibility of recognizing the sitter draws our attention to the importance of *labeling* pictures as portraits of a given person in order for us to take them as portraits of that person; and in particular of stating that a certain portrait is a self portrait in order for the viewer to take it as a self portrait. It is an interesting fact about self-portraits that their content alone cannot in general be used to tell them from portraits that are not self-portraits. In general we need supplementary, non pictorial information to ascertain whether the painter and the sitter are the same

28 D. Preston, 'The Madonna Puzzle', *The New Yorker*, Dec. 2000, pp. 79-85; J. Shearman, 'Masaccio's Pisa Altarpiece: an Alternative Reconstruction', *The Burlington Magazine*, 108, September 1966, pp. 449-55.

person (typically, labels do this). There are, though, cases in which a *prima facie* classification of the portrait as a self-portrait is made possible by visual inspection of the content. M.C. Escher's *Hand with Reflecting Sphere* (1935) belongs in this category. In it, a hand holds a sphere which reflects the hand itself and the person to whom the hand is attached. We are *prima facie* entitled to infer that this is a self-portrait (Casati 1990).

Of course, pictures are always underdetermined, whence the *prima facie* proviso. The litograph could have been created by someone who pretended to be Escher. It could represent a hand carrying not a mirror, but a painted sphere representing someone who is very similar to Escher. Or it could represent a reflecting sphere which reflects a mannequin in whose eye is placed a periscope allowing the artist to take this very picture. But *prima facie* we are entitled to infer that this is a self-portrait.

Analogously, Gombrich's photo can *prima facie* be taken as a self portrait. It is of some importance that the sitter himself be not visible, as this fact forces the inference that the photo can only be taken from the viewpoint of the sitter. That very shadow is *prima facie* the shadow of the person who took the photograph, hence it is *prima facie* a self-portrait. There are countless alternate interpretations of the picture: the shadow could be that of a mannequin hiding a remotely operated camera, etc. But the *prima facie* interpretation stands.

Other shadow-based inferences

Some paintings represent shadows from sources of lights that ought to be visible but aren't. In Piero's *Flagellation* (1455-60 ca., Urbino, Galleria Nazionale delle Marche) the beams cast shadows in the ceiling from a source (possibly two) situated somewhere atop the face of the Christ. But no such source is visible. We are entitled to infer the presence of a supernatural source of light.

Conclusions

The augmentation of the Gombrichian Toolbox took us on a path that moved away from purely perceptual and imaginative effects or uses of images, without requesting us to access the vast empires of semantic and episodic memory that are the preserves of the art historian and of the connoisseur in general. The precise limits of background knowledge are of course hard to trace. For instance, a whole set of

inferences would require technical knowledge of astronomy. A number of impossible Moons and eclipses are suspended in the skies of many a painting. But many intriguing inferences can be triggered by simple careful observation. One needs not be an iconographer in order to be able to appreciate that Dante's shadow is inconsistent with that of most other characters in Lippi's depiction.

I'd like to conclude on two programmatic points. The first is a plea for this strange, humble activity, that is simple, untutored but patient and good-willed observation of a painting, or of an image more generally. A large panoply of interesting phenomena await for a description, located as they are between automatic recognition and the subtleties of erudite contemplation. No longer the immediate power of pictures; not yet the use of pictures for intellectual activities that do not engage predominately their pictorial aspect. The second is a request to study the mechanisms that underpin patient observation that require the exercise of attention. To echo what a reviewer said of Levinson's theory of musical experience, we have little yet in terms of an account of how working memory is used in the act of looking at images; and even less of an account of how plans for managing the viewer's memory are represented in the intentions of she who produces an image. Saying that the Toolbox is likely to be larger than was thought so far is not yet saying which tools belong in it.

