



Reflection & Refraction

Reflection

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Nicole Oresme

(1320-1382)

- *On Seeing the Stars* (De Visione Stellarum)
- Main question of the work: “Are the stars really where they seem to be?” (Burton 2007)
- Early work of philosophical optics; focus on atmospheric refraction; important mathematical discussion
- Numerous interesting contributions, e.g. ‘lux’/‘lumen’, and four modes of seeing: straight, reflective, refractive, mixed. (Note, ‘straight’ seeing is an abstraction.)

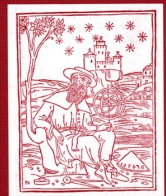
MEDIEVAL AND EARLY MODERN SCIENCE

Nicole Oresme's
De visione stellarum
(*On Seeing the Stars*)

*A Critical Edition of Oresme's Treatise
on Optics and Atmospheric Refraction, with
an Introduction, Commentary, and
English Translation*

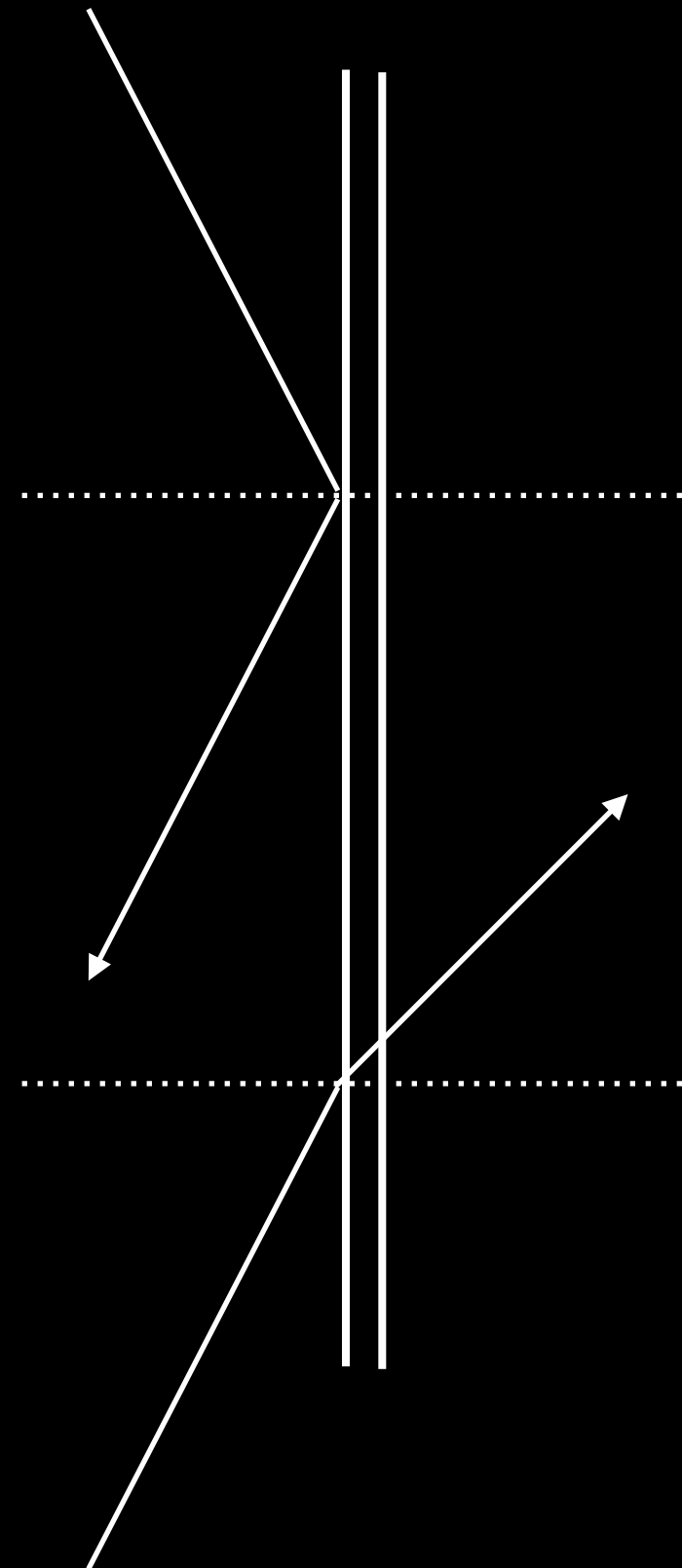
DAN BURTON

BRILL



‘Optical scepticism’

- Following Alhacen and others, Oresme assumes the following familiar ‘image assumption’: *Seeing something in a mirror implies seeing a mirror image.*
- But he thinks this has striking consequences for vision.
- “I hold absolutely the same opinion concerning refraction and reflection, for if the object is not seen but the image [is] when vision is reflected, so also in the same way, [the object is not seen but the image is] when refraction occurs.”
- “It immediately follows that we never see the sun, the moon, a planet, or any star at all, but only [their] images—except when they are over the zenith.”



Reductio ad Absurdum

- Fact: we do see the sun. I take Oresme's argument to be a *reductio ad absurdum*. But of what?
- The argument may seem to settle a central dispute in philosophical catoptrics.
If seeing something in a mirror implies seeing a mirror image, then absurdity follows. Therefore, seeing something in a mirror does not imply seeing a mirror image
- However, we need not treat the argument this way.
Instead, we may take Oresme's argument as forcing us to be clearer about the nature of reflection and refraction

Formalising the argument

- | | |
|--|--|
| 1. If S sees O by reflection, then S really only sees an image of O
(‘Oresmic image assumption’) | 1. $P \rightarrow Q$ |
| 2. If (If S sees O by reflection, then S really only sees an image of O), then
(If S sees O by refraction, then S really only sees an image of O)
(‘Parity’) | 2. $(P \rightarrow Q) \rightarrow (R \rightarrow Q)$ |
| 3. If S sees O by refraction, then S really only sees an image of O
(inference from 1,2) | 3. $R \rightarrow Q$ |
| 4. If S sees O, then (S sees O by refraction) or (S sees O by reflection)
(‘Anti-abstractionism’) | 4. $S \rightarrow (P \vee R)$ |
| 5. If S sees O, then S really only sees an image of O (inference from 1,3,4) | 5. $S \rightarrow Q$ |
| 6. If (If S sees O, then S really only sees an image of O), then Optical
Scepticism is true (‘Optical Scepticism’) | 6. $(S \rightarrow Q) \rightarrow T$ |
| 7. Optical Scepticism is true (conclusion from 5,6) | 7. T |

A fallacy?

- It is tempting to think that the argument shows that one of the key debates in philosophical catoptrics is decided:
We do not see a mirror image when we look in the mirror, but just our own face
- We can even give a diagnosis of the error: the ‘mirror images’ we find in textbooks of geometrical optics are part of a *model* of the optical properties of mirrors. The mirror image models in which direction we have to look to see the object reflected in the mirror
- But you cannot infer that, because there’s an image in our *model* of the mirror, there’s an image on or behind the mirror

The new *imagophilia*

- I think that all this is correct.
- Instead of offering Lewis Carroll styled access to a world of mirror images, mirrors provide for a special way of seeing the ordinary world around us (a left-right reversed way, if you like)
- However, there seems to be something *phenomenologically* astute about the image assumption.

“That shiny surface, *over there*, presents you with the appearance of your face, *over here*! (Like, that painted portrait on over there shows how your grandmother looked.)”

A better account

- We can take the earlier criticism to heart while also holding on to the image assumption, as soon as we give up the assumption (implicit in Oresme's argument) that we cannot see both object and image

- Here's what I think is a better account of mirror perception:

In a mirror you see (a) object and (b) mirror image, and the distinctive phenomenology of mirror perception is (in part) that of a conscious experience of both

- What this requires is a conception of images that doesn't make all images 'rival' objects of vision. But that's readily available.

Minimalism about images

- An image represents the look of an object or scene. Philosophers have been too specific about images. A focus on paintings or photographs has lead to the idea that images must be opaque things. But that doesn't follow: you need not be coloured to represent the look of an object.
 - **Look:** a complex universal that can be instantiated by three-dimensional object and determines the phenomenal character the object has for vision, e.g. the complex of redness, roundness and size of a tomato
 - **Possession:** An object possesses a property iff the object is a way determined by the property. A tomato possesses redness if and only if is red
 - **Presentation:** An object presents a property iff perceiving the object can acquaint one with the property. For example, a red tomato not only possesses redness, but it also can acquaint you with redness

Minimalism about images

- Not all cases of possession are cases of presentation. You typically cannot see what it is for a creature to carry influenza A when you're presented with a bird who carries the virus
- Not all cases of presentation are cases of possession. Your passport photo presents the way you looked (on a specific occasion), but the photograph doesn't itself look that way. The paper rectangle is an image: it presents a look it doesn't possess (i.e. it represents that look)
- This implies that we can make sense of a 'pure image', i.e. something that is just an image of something and no more. Such a thing has only one quality: presenting the look of something else. (Mike Martin suggests perfect holograms are like that.)

Images and the stars

- On the minimal conception of images, mirroring surfaces are images: they have the right quality: they present the looks of the scene around them, without themselves looking that way.
- Mirror images are not pure images, because they have a nature that is more complex (they can be hard, made of silver, cold, etc.)
- Crucially, a mirror image in this way doesn't exclude other objects of sight. The claim that you see a mirror image of your face doesn't contradict the claim that you see your face.
- So we need not reject the assumption that we see mirror images to uphold the claim that we can see the moon and the stars.

Blocking the argument

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|---|--|
| 1. If S sees O by reflection, then S sees an image of O ('Minimalist image assumption') | 1. $P \rightarrow Q$ |
| 2. If (If S sees O by reflection, then S sees an image of O), then (If S sees O by refraction, then S sees an image of O) ('Parity*') | 2. $(P \rightarrow Q) \rightarrow (R \rightarrow Q)$ |
| 3. If S sees O by refraction, then S sees an image of O (inference from 1,2) | 3. $R \rightarrow Q$ |
| 4. If S sees O, then (S sees O by refraction) or (S sees O by reflection) ('Anti-abstractionism') | 4. $S \rightarrow (P \vee R)$ |
| 5. If S sees O, then S sees an image of O (inference from 1,3,4) | 5. $S \rightarrow Q$ |
| 6. If (If S sees O, then S really only sees an image of O), then Optical Scepticism is true ('Optical Scepticism') | 6. $(S \rightarrow Q) \rightarrow T$ |
| 7. ? | 7. ? |

But it's wrong!

- But this gets something wrong still. Surely, we don't see an image when we see through a refractive medium! (Or is this just a persistent illusion?)

“When myopic subjects wear eyeglasses, they do not see the optical properties of their eyeglasses in addition to the objective properties of their environment. What they do see are the visual properties that were not visible to them without wearing eyeglasses. Refractive lenses don't have any intrinsic phenomenological properties; they only change perceptual experiences by changing what portion of reality is accessible to the perceiver.” (Mizrahi)

But it's wrong!

- Mizrahi's observation suggests the following argument:
 1. When we see through a refractive medium, we do not see the medium.
 2. If we always see an image when we see through a refractive medium, then when we see through a refractive medium, we do see the medium.
 3. Hence, we do not always see an image when we see through a refractive medium.

Against Parity

- Those sympathetic to the image assumption really need to reject Parity: the idea that reflection and refraction are on a par
- What made parity attractive was a fundamental truth in geometrical optics: reflection and refraction are both ways for light rays to change direction, and not qualitatively different
- But I have already noted that we cannot simply infer from facts about the model used to facts about the reality modelled. The idea that reflection and refraction are qualitatively on a par may well be an artefact of the model

Phenomenology of reflection

- Given that the minimalist conception of an image is a phenomenological one, we should ask: are reflection and refraction *phenomenologically* on a par? This really becomes a question about reflective seeing and refractive seeing.
- The answer is: Refractive and reflective seeing are phenomenologically not on a par.
- We can observe the difference clearest with a basic case of reflection: highlights







- Reflective seeing: we see the visual aspect the surface presents us with (and clearly doesn't possess) as somehow on the surface.
- Refractive seeing: we do not see anything as on or in the medium (the distinctive phenomenology involves not seeing the medium)

Phenomenology of mirrors

- As with the highlight, you see the visual aspect the mirror presents you with (and clearly doesn't possess) as on the surface of the mirror
- But unlike the highlight, you do not see this visual aspect as a visible in its own right; you recognise it for what it is: the appearance of something else
- This is how the phenomenology of reflection is an integral part of the phenomenology of mirror perception

Question begging?

- I claimed that in reflection we see a visual aspect on a surface, while it is also manifestly not possessed by that surface. Isn't this just to say that in reflection we see an image?
- If it was just that, then the difference between reflection and refraction would be that in the one case we see an image whereas in the other case we do not. Yet that was the claim my phenomenological distinction was meant to support. You can't support a claim with itself!

Question begging?

- But this would be to overlook that not all images have this 'on' phenomenology. A free-standing hologram can be seen as image, but we would not see anything on anything here. Pure images lack a bearer. The 'on' phenomenology is not necessary for imagery.
- Further, as shadows and highlights show, it's at least not obviously sufficient. Shadows are not images, and specular highlights are at least not always images, and if they are images, are hard to see as images.

Conclusion

- There is a distinctive phenomenology to reflection. It is an integral part of the phenomenology of mirror perception. But another integral part is the phenomenology of the image.
- As I have suggested, none of this is in conflict with the sensible thought that we can see the ordinary objects and people around us when we look in an appropriately placed mirror.
- Oresme's argument fails, but it fails instructively.

