

Visual Perception as Patterning: Cavendish against Hobbes on Sensation

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Abstract

Many of Margaret Cavendish's criticisms of Thomas Hobbes in the *Philosophical Letters* (1664) relate to the disorder and damage that she holds would result if Hobbesian pressure were the cause of visual perception. In this paper, I argue that her "two men" thought experiment in *Letter IV* is aimed at a different goal: to show the explanatory potency of her account. First, I connect Cavendish's view of visual perception as "patterning" to the "two men" thought experiment in *Letter IV*. Second, I provide a potential reply on Hobbes's behalf that appeals to physiological differences between perceivers' sense organs, drawing upon Hobbes's optics in *De homine*. Third, I argue that such a reply would misunderstand Cavendish's objective of showing the limited explanatory resources available in understanding visual perception as pressing when compared to her view of visual perception as patterning.

1. Introduction

In Margaret Cavendish's view, her *Philosophical Letters* are the "building" (1664, preface; hereafter *Letters*) that rests upon the foundation already laid in her *Philosophical and Physical Opinions* (first edition 1655; second edition 1663; hereafter *Opinions*). In the *Letters* she criticizes Descartes, Hobbes, More, van Helmont, and others by arguing for the superiority of her philosophical system in its ability to explain various phenomena and to avoid the objections she highlights.

Many of Cavendish's criticisms of Hobbes in the *Letters* relate to the disorder and damage that she holds would result if pressure, as Hobbes claims, were the cause of visual perception and of cognitive activities such as the forming of conceptions. Pressure cannot be responsible for visual perception since it would more likely "annoy and obscure" than "inform" (1664, 20). If pressure were the cause of visual perception, the sentient organs would be "pressed to death" and parts of the body like the eye would be "pressed into the centre of the brain," and the result would be a constant "war between the animal senses and the objects" (1664, 60). These

criticisms relate to Cavendish's general desire to account for the order and regularity of natural phenomena in terms of bodies' self-motion and perception by sensitive and rational matter.¹

Beyond the disorder and damage that would result were Hobbes's view correct, Cavendish's assault in the *Letters* incorporates an additional worry for the perception-as-pressure model: Hobbes lacks the explanatory resources needed to accommodate everyday instances of differences in visual perception, such as between two individuals perceiving one another at a distance such that they perceive one another at differing degrees of clarity. To make this claim, in *Letter IV* Cavendish provides a thought experiment about two such individuals and argues that "if perception were made by pressure [as Hobbes holds], there would not be any such mistakes" in visual perception (1664, 20).

Scholarly discussions of Cavendish's natural philosophy have focused on her desire to account for order and regularity. In this paper, I argue that her "two men" thought experiment in *Letter IV* is aimed at a different goal: to show the explanatory potency of her account and the corresponding lack of explanatory resources in Hobbesian natural philosophy. Cavendish holds that Hobbes is simply unable to explain the regular occurrence of differing levels of "perfection" in visual perception. Since Hobbes would seem to see the strengths of his natural philosophy as the twin aspects of 1) simple assumptions (we need only assume bodies in motion pressing upon each other) and 2) explanatory breadth (given these simple assumptions we can explain all

¹ For discussion, see Duncan (2012, 397-399). Cavendish rejects both atomism and mechanism due to considerations of the orderliness of nature (Detlefsen 2006, 207ff; James 1999, 222). Detlefsen (2007) also connects Cavendish's claims about order with the freedom of nature. Much of the scholarly focus on Cavendish's view has been on the role of order and regularity as *explanandum*, but in the "two men" thought experiment that I discuss from the *Letters* (1664, 18-20), as well as in Cavendish's account of regularity in the *Opinions* (1663) that I discuss in section 4.2, order and regularity play the role of *explanans* when Cavendish appeals to the regularity of the motions in each of the senses. On the role of order as an assumption for Cavendish, see Boyle (2015, esp. 439).

perceptual and cognitive phenomena), Cavendish's criticism in *Letter IV* is damaging. In a word, she argues that, in his inability to account for an everyday commonplace like small differences in perception, Hobbes's assumptions are too simplistic.

My argument proceeds in three stages. First, I discuss Cavendish's view of visual perception as "patterning," and I show the consequences that this view has for the "two men" thought experiment in *Letter IV*. Second, I show that on a first reading of the thought experiment it seems that Hobbes could easily account for differences in visual perception between two individuals by appealing to physiological differences between the sense organs of each perceiver; indeed, by discussing Hobbes's explanation of degraded perception in old age in *De homine*, I show that within his optics Hobbes appears to have these resources available to him. Cavendish may have viewed such a reply made on Hobbes's behalf favorably in the 1650s, especially since she includes a chapter explaining "blindness" similarly in the first edition of *Opinions* (1655).

However, this chapter on blindness is removed by the time of the 1663 edition of *Opinions*. By the 1660s Cavendish explains visual perception, and errors of it, by appealing to "patterning" self-motions as well as by appealing to ways in which the rational matter and sensitive matter can influence one another. Sometimes this influence causes mistakes in visual perception, for example, making us think that we see "Hobgoblins" or smell unusual scents (1663, 277). I focus on the 1663 edition of *Opinions* because of its closeness in Cavendish's career to the *Letters* (1664).² Third, I argue that offering such a reply on Hobbes's behalf, where differences in sense

² Additionally, Cavendish describes the 1663 edition as having "corrected" the 1655 edition. Walters (2013) has cogently argued that the 1663 edition of *Opinions* should be considered the more authoritative edition. My goal in the present paper is to understand the two men thought experiment with primary attention to the 1663 edition of *Opinions*. In addition to the aspect of closeness in time to the *Letters*, Cavendish herself identifies *Opinions* as the "ground" of her criticisms in *Letter IV* (1664, 18). In the final section, I draw upon Part VI of her later *Ground of Natural Philosophy* (1668), which she then also calls the "second edition" of *Opinions*. There in

organs would explain minor differences in the clarity of visual perception between two perceivers, would misunderstand Cavendish's objective of showing the limited explanatory resources available in understanding visual perception as pressing – Cavendish's claim is that pressure is too simplistic an *explanans* to account for the everyday occurrence of minor differences in visual perception.³

2. Cavendish on sensitive and visual perception

Cavendish is a materialist like Hobbes. However, Cavendish rejects Hobbes's view that motion "cannot be generated except by [a body] moved and contiguous" (OL I.110).⁴ Instead, for Cavendish all motion is self-motion, often resulting from bodies perceiving and accommodating other bodies by means of such self-motion but other times occurring without any external body occasioning it, as in the case of the self-motions responsible for dreams (more on dreams below). Thus, there is no transfer of motion in situations where body-body contact appears to occur.

Given her reliance upon self-motion as responsible for sensitive perception in general, and visual perception in particular, Cavendish agrees with some of the Hobbesian account of visual perception while rejecting other parts of it. In *De corpore* XXV, Hobbes defines sense as

Chapter XIII she explains the defects of sense organs in terms of a lack of knowledge proper to the kind of body parts they are (1668, 85-86).

³ In what follows, I use 'visual perception' to refer to perception by humans and 'sensitive perception' to refer to the more general sort of perception that Cavendish holds occurs throughout all sensitive matter.

⁴ This principle related to the generation of motion is essential to Hobbes's explanation of sensation. Hobbes explicitly cites it in *De corpore* XXV (OL I.318). The Molesworth edition of Hobbes's *Latin Works* and the 1655 edition (1655, 224) incorrectly record this citation as to *De corpore* VIII.9. Schumann (Hobbes 1999, 268) corrects the citation to *De corpore* IX.9. I cite Hobbes (2005) as EW and Hobbes (1839-45) as OL, followed by volume and page. Adams (2016) discusses Hobbes's explanation of sensation in *De corpore* XXV and its connection to first philosophy and geometry.

“[...] a phantasm made by means of a reaction from an endeavour to [the] outside, which is generated by an internal endeavour from the object, and there remains for some time” (OL I.319).⁵ Thus according to Hobbes there are both external motions and internal motions involved in explaining visual perception. An instance of Hobbesian visual perception begins in motions from an object, which continue through various media, and ends in the resistance against those motions by the internal endeavour from the parts of the sentient body. Cavendish agrees with Hobbes that motion is responsible for visual perception, but since she holds that all motion is self-motion she denies that motion from external objects is transmitted to parts of the sentient body.

When these internal self-motions are occasioned by the presence of an external body then *visual perception* occurs. However, sometimes these internal self-motions can occur even in the absence of any external occasion, leading to dreams or illusions. She notes later in the *Ground of Natural Philosophy* (hereafter *Ground*) that internal self-motions constitutive of visual perception move “according to the outward Object” but when we are asleep these self-motions “move by rote” (1668, 90). Since she identifies the “sense of seeing” with these internal self-motions, she argues that even without sense organs like the eye being present the “sense of seeing is not lost”:

...It is true, by Experience we find, that without an Eye we cannot see Outward objects as they are without us, yet we see those Objects as they are without us in our Sleep, when our Eyes be shut: Thus the Sense of Seeing is not lost, although the Eyes were out, and the Optick Nerves stop'd up (1663, 294-295).

⁵ The definition leaves open the worry that pressing inanimate bodies will be endowed with sense. Hobbes blocks this worry by claiming that for sense to occur there must be memory whereby we are able to make a judgment (OL I.320-321, EW I.393; for discussion, see Duncan 2012).

Considering what happens during sleep, or after the removal of the eyes, is designed to force one to identify the cause of visual perception (this also applies for the other senses as well) as strictly internal. Since indistinguishable self-motions can be present when occasioned by an external body (an instance of visual perception) or without any such occasion (an instance of dreaming), they must be *self*-motions. On this point, Cavendish argues that “the Interior motions may move the Brain with the Variety of every Sense, without the Exterior Passages or Objects...” (1663, 297). As a result, we cannot hold that it is “Outward objects that make the sense, but the Animate matter, which is Self-motion, which the Sense and Knowledge, and the Different motions therein, and therefrom, make the Differences thereof...” (1663, 298).

Cavendish is led to this claim that in dreaming something indistinguishable to visual perception occurs, even in the absence of the eye, because she holds that all motion is self-motion.⁶ However, more generally Cavendish can hold such a view because, although she rejects Hobbes’s account of perception, she embraces his understanding of cause as “entire cause” (*causa integra*) (cf. Eileen O’Neill’s discussion in Cavendish 1666/2001, xxxiii; Michaelian 2009, 40). Hobbes defines an entire cause in *De corpore* IX.3: “But a cause simply, or an entire cause, is the aggregate of all the accidents both of the agents how many soever they be, and of the patient, put together; which when they are all supposed to be present, it cannot be understood but that the effect is produced at the same instant...” (EW I.121-122).⁷ With this understanding of *causa integra*, for Cavendish the internal self-motions of patterning and figuring are both necessary and sufficient causes for human visual perception or for self-motions that are

⁶ On this issue of dreams being indistinguishable to us from visual perception, in *Opinions* Cavendish argues that when the motions responsible for dreaming are “as strong and industrious” as when we are awake we may sometimes “see, here [sic], taste, smell, touch, as strong as if we were awake” (1655, 113).

⁷ Leijenhorst (1996) connects Hobbes’s use of *causa integra* to Suarez.

indistinguishable from human visual perception, like dreaming.⁸ Another way of putting this point is that since causes are always necessary for their effects on the *causa integra* view, external bodies cannot be the cause of patterning since patterning can occur without any such external objects being present (cf. Michaelian 2009, 40, fn. 23 for discussion).

In place of the Hobbesian principle that motion “cannot be generated except by [a body] moved and contiguous” (OL I.110), Cavendish holds a form of vitalism according to which matter exists in three “degrees”: inanimate, sensitive, and rational. She describes these degrees of matter in *Opinions* (1663): “As for the Infinite Degrees of Matter, there be but two which are Principle, as, Animate and Unanimate, and the Degrees of Animate are but Sensitive and Rational, and the Degrees of Unanimate Matter is but Dense, Rare, Light and Heavy” (1663, 8). These degrees of matter do not exist in isolation from one another as parts of the “Only Matter”; rather, they are mixed together throughout nature so that “no particle in nature can be conceived or imagined, which is not composed of animate matter, as well as of inanimate...” (1666, 158).

In adopting a form of vitalism whereby “the Only and Infinite Matter is Living and Knowing” (1663, 13), Cavendish need not provide a mechanism on account of which phenomena such as visual perceiving are made mechanically intelligible.⁹ On Cavendish’s view, visual perception occurs by means of a capacity where the sensitive matter patterns after the

⁸ I limit this claim to humans since Cavendish demurs on whether patterning and figuring motions are responsible for sensitive perception more generally: “Neither can I certainly affirm, that all perception consists in patterning out exterior objects; for although the perception of our human senses is made that way, yet nature’s actions being so various, I dare not conclude from thence, that all the perceptions of the infinitely various parts and figures of nature are all made after the same manner” (Cavendish 1666, 140).

⁹ Unlike Hobbes, whose aim was to make perceiving and cognition mechanically intelligible (Adams 2014).

motions of air, and the air itself self-moves as it copies after the self-motions of the objects being perceived:

...*the Motions of Outward objects Move and Figure the Air*, being a Rare and Soft Agil Substance, to its own Likeness, and so long as those Figures or Motions last, those Figures and Motions are Sensible to the Senses, for *the Senses Move according to the Motions of the Objects in the Air*, and for the most part, the Reason Moves according to the Senses” (1663, 301-302; emphasis added).

When she asserts that the “Motions of Outward objects Move and Figure the Air,” we must understand the motion of the air as one of self-motion and imitation. Elsewhere in *Opinions*, Cavendish compares the motions of “soft or porous” air in response to “solid bodies” moving to what happens when creatures “...print themselves in Snow...” (1663, 218-219). She holds that “...as we move from Place to Place, new Figures are made [in the porous bodies such as air]” (1663, 219). Since air is more porous and soft, it is more imitative and thus takes on the “print” of more solid bodies. I suggest that Cavendish understands these motions, which air acquires, as self-motions which appear and disappear easily. For example, she notes that “...when the Air is Thin and Serene, the Print Dissolves as soon as the Figure Removes” (Ibid.). Even though air is involved in this account of visual perception in *Opinions* (1663), it must be emphasized that air’s self-motion would serve only as a medium for our visual perception of *objects*, and air is not mentioned elsewhere in Cavendish’s explanations of visual perception.¹⁰

¹⁰ For example, air plays no role in the example from the *Letters* (1664, 20) to be discussed below. Also, in *Observations* (1666) air plays no role in chapters XXXV and XXXVI; instead, Cavendish refers to perception “of exterior objects” (e.g., 1666, 150; cf. 1668, 55). Although air plays a role only in the discussion of visual perception in *Opinions* (1663), it is possible to accommodate the involvement of air into the accounts that we find in *Observations* and *Ground*. Here two points are relevant. First, as discussed already, Cavendish holds that “no particle in nature can be conceived or imagined, which is not composed of animate matter, as well as of inanimate...” (1666, 158). As a result, even though it is “soft” or “porous,” air will be composed of both animate and inanimate matter, and the animate parts are capable of self-motion. Second, the analogy between speech and perception that Cavendish makes in *Opinions* (1663, 299),

For Hobbes, Cavendish’s account of visual perception as the sensitive matter patterning after the self-motion of the air leaves a gap unexplained, a gap that Hobbes would claim makes the view *inconceivable*. Since the subject of philosophy for Hobbes is “every body of which we can conceive any generation” (EW I.10), patterning understood as self-motion would be inconceivable because we are unable to imagine one body patterning after the motion of another body without some body-body contact. In other words, Hobbes holds that attempting to understand patterning, or any type of motion for that matter, as *self*-motion requires one to try to imagine an ungenerated generation – something that is inconceivable.¹¹ Unlike Hobbes’s appeal to pressure, which for Hobbes fills the gap in Cavendish’s account, Cavendish posits that sensitive matter has the ability to pattern motions outside of it.¹² Once the sensitive matter in a perceiver has patterned the motions of the air around an object, the rational matter (called “Reason” in the quote above) patterns the motions of the sensitive matter.

discussed below in Section 4, might help illuminate how we could understand the role of air in visual perception. Perception between an object and a perceiver requires the motions of the thing being perceived to be communicated, but without any sort of body-body transmission. Air’s ability to self-move in imitation of an object’s motions – what she calls being a “print” in *Opinions* (1663, 218-219) – could enable this communication. Thus, just like when someone speaks to a group of people there “are made Multitudes of Copies” of her words (1663, 300), we might also expect Cavendish to hold that many copies of an object could be made in the air, like a print in snow, and these copies would then enable our visual perception of it.

¹¹ Conceivability as a constraint for philosophizing is operative when Hobbes introduces what Jesseph (2006) calls the “persistence principle” in *De corpore* VIII.19: “Whatsoever is at rest, will always be at rest, unless there be some other body besides it which, by endeavouring to get in its place by motion, suffers it no longer to remain at rest” (EW I.115). Any attempt to conceive self-motion, that is, to imagine a body self-moving, for Hobbes would be an exercise in self-deceit (Jesseph 2006, 134). Adams (2014) discusses conceivability more generally in Hobbes’s project.

¹² In works following *Opinions* (1663) and *Letters* (1664), Cavendish adds self-knowledge to her account of perception (more on self-knowledge below). She claims, for example, that “self-knowledge is the fundamental cause of perception” (1666, 176). See Michaelian (2009, 32-33, fn. 7).

This key difference between Cavendish and Hobbes – patterning instead of pressure by body-body contact – figures in Cavendish’s thought experiment in *Letter IV* of the *Letters* (1664). Cavendish begins *Letter IV* by highlighting *Leviathan I* as her target, where she quotes Hobbes: “That the cause of Sense or Sensitive perception is the external body of Object, which presses the Organ proper to each Sense” (1664, 18). She appeals to *Opinions* as the “ground” of her objection against Hobbes, repeating the view already discussed that “...Perception is but the effect of the Sensitive and rational Motions” (1664, 18). She next raises a particular worry for the pressure account related to bodies that may lie between two perceiving individuals:

Two men may see or hear each other at a distance, and yet *there may be other bodies between them, that do not move to those perceptions*, so that no pressure can be made, for all pressures are by some constraint and force; wherefore, according to my Opinion, the Sensitive and Rational free motions, do pattern out each others object, as Figure and Voice in each others Eye and Ear; for Life and Knowledge, which I name Rational and Sensitive Matter, are in every Creature... (1664, 18-19; emphasis added).

Like Hobbes, Cavendish is a plenist.¹³ In this thought experiment she assumes Hobbes’s view of pressure as moving bodies between these perceivers for a *reductio ad absurdum*. Given the pressure view, the worry is that if Hobbes were correct, at certain distances the bodies located between two perceivers may not move. Were such a scenario possible and yet visual perception still occurred, pressure could not be responsible for visual perception.

This objection related to the possibility that *bodies lying between perceivers may not move* even though visual perception occurs is not devastating since Hobbes could reply that we should understand the strength of the pressure responsible for visual perception between two perceivers in degrees. The closer two perceivers are to one another (or one perceiver to any

¹³ Several passages in the *Letters* suggest that Cavendish is a plenist (1668, 290, 301-302, and 423).

perceived object), the stronger the pressure would be and, as a result, the more the bodies between them would be pressed and the more vivid the visual perception would be. Hobbes would deny that there are bodies that would communicate absolutely no motion, since he claims in *De corpore* XXII.9 that “in a full medium all endeavour proceeds as far as the medium itself reacheth; that is to say, if the medium be infinite, the endeavour will proceed infinitely” (EW I.341).

Nevertheless, Hobbes could admit that certain bodies transmit pressure better than others, so some bodies would be more likely to deaden the pressure than others. For example, both Kepler and Descartes identify certain parts of the interior of the eye as black in color so that they deaden light rays passing into the eye (Kepler 1964, 160; Kepler 1604, 176; Descartes 2001, 95; Descartes 1972, 53-55) and by doing so these parts of the eye contribute to distinct vision. Like Kepler and Descartes, Hobbes notes in *A Minute or First Draught of the Optiques* (1983, 81-82) that the pupil and ciliary processes are black. Although Hobbes does not explicitly claim that the reason why these parts are black is to deaden reflecting rays, he could accommodate the Keplerian-Cartesian explanation into his pressure-as-perception account by positing that dark-colored bodies like these parts of the eye deaden pressure and thus contribute positively to distinct vision, which for Hobbes occurs along the optic axis.

This reply to Cavendish’s first worry in *Letter IV* has affinity with how Hobbes understands the motions that are constitutive of perceiving, imagining, dreaming, and remembering in terms of the degree of their intensity. For example, in *Leviathan II* Hobbes identifies imagination as “nothing but *decaying sense*” (Hobbes 1994, 8; emphasis original). As the motion responsible for sense continues to decay, it becomes “fading, old, and past,” and this is what we call “memory” (Hobbes 1994, 9). A view that understood the pressure between

perceivers in degrees could hold that there needs to be a threshold of pressure reached for visual perception to occur: if there were bodies that did not move easily between two perceivers then a sufficient degree of pressure could not be transmitted and continued to a perceiver. As a result, these two individuals may not perceive one another at all.¹⁴

Cavendish's second objection in *Letter IV* continues with the same example of two men perceiving one another at a distance. She argues that "...if the sensitive and rational motions be irregular in those parts [of the sensitive organs], between which the perception is made, as for example, in the two fore-mentioned men, that see and hear each other, then they neither both see nor hear each other perfectly" (1664, 19-20). Here Cavendish is taking what she thinks is an everyday example drawn from experience: in a two-perceiver situation, person A may perceive person B more clearly than B perceives A. Another similar example would involve two individuals perceiving the same object at differing levels of clarity, though Cavendish does not mention this possibility: individual A may perceive some object C more or less perfectly than another individual B standing next to him or her.

Cavendish claims that her account of visual perception as patterning can explain this everyday occurrence better than Hobbes's account. It is commonplace that "one [individual] may see the other better and more perfectly"; however, Cavendish argues that "if perception were made by pressure, there would not be any such mistakes" (1664, 20). Cavendish's criticism of the pressure view seems to rely upon seeing Hobbesian visual perception as passive for perceivers. On the pressure account, the information, as it were, acquired by perceiving human perceivers is impressed upon sense organs by the motions from bodies outside of the perceiver,

¹⁴ Hobbes provides an example of our inability to see a single grain of sand that is "removed to such a distance as not to be any longer seen, though by its action it still work upon the organs of sight" (*De corpore* XXII.9, EW I.342).

which information continues into the body of the perceiving individuals by pressure of one part of the body upon another.

Cavendish's idea is that if pressure alone were sufficient to explain visual perception, and perceivers (and their sense organs) played a passive role during it, then we should expect uniform levels of clarity in visual perception. Two persons perceiving each other, or perhaps two individuals perceiving the same object, should both perceive with the same level of clarity since *only the pressure from without* would determine how clearly an object is perceived (and since she seems to consider Hobbesian visual perception as passive, this pressure would be equal for both perceivers). Since we do, in fact, experience differences in the clarity of visual perception on a regular basis, Cavendish holds that we should clearly see the deficiency of Hobbes's perception-as-pressure account.

This second criticism of the Hobbesian perception-as-pressure account is potentially more damaging than the first criticism encountered in *Letter IV* (already discussed), for if it were correct it would undercut the explanatory breadth of Hobbes's account by showing that his assumptions about the nature of visual perception were too simplistic. Unlike Cavendish's other criticisms of Hobbes in the *Letters*, which relate to the general disorder and disunity of the world that would result were his account correct, what she calls a "perpetual dance ... which would produce a very Restless Life" (1663, *Another Epistle to the Reader*), this criticism instead points to a phenomenon that Cavendish argues Hobbes is unable to explain. In the next section, I will provide a response on Hobbes's behalf that draws upon his optical work in *De homine* and then in the following section re-characterize Cavendish's objection in light of this Hobbesian response as relating to a different *explanandum* than the order and regularity present in the world (see fn.

1), namely, why there are different levels of clarity in visual perception in typically-functioning human perceivers.

3. A Hobbesian reply to Cavendish's criticism in *Letter IV*

A reply on Hobbes's behalf to Cavendish's second criticism would appeal to physiological differences in the sense organs between the two individuals in her thought experiment.

According to this reply, we can account for person A perceiving person B less perfectly than B perceives A because of some defect in A's sense organs. Likewise, if we focused on the parallel example of two individuals perceiving the same object, we could explain why individual B perceives the basketball more perfectly than individual A because of either some defect of her sense organs or because of some disturbance in the media between the ball and A not present in the media between B and the ball. The perception-as-pressure account would understand differences in the clarity of visual perception by A and B to be due to a disruption in the pressure from the perceived object to the perceivers, whether a disruption by the receiving sense organ or something in the media. In this section, I first discuss this reply on Hobbes's behalf by drawing upon his explanation of the "confusion of vision by the fault of the eye" in *De homine* 2.4. Next I show that this explanation may have been amenable to Cavendish in her first edition of the *Opinions* (1655), but it would not have been acceptable to her by the time of her second edition of that work (1663) and likewise not in her *Letters* (1664).

After Hobbes discusses the optic axis, the visual line "in which alone is vision distinct" (OL II.11), he treats instances where vision in the optic axis is "confused." Hobbes focuses first on cases in which vision is "confused from the smallness of an object" (*De homine* 2.3, OL II.11). He argues that whenever we perceive very small objects, or large objects that are very far

away, our vision is confused because the pupil is unable to be contracted sufficiently to allow only the rays from those small objects to enter and thus prevent oblique rays, such as the oblique ray from object A that strikes the pupil at C and after passing through E and reflects along the line E-F (see Figure 1 below). Such rays enter and confuse our vision, as Hobbes demonstrates with a constructed diagram of an eye, because “pupil C is not able to be contracted in order to shut out all of the oblique rays” (OL II.11).

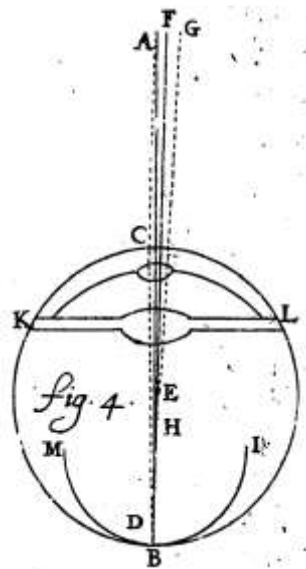


Figure 1 (from 1658 edition of *De homine*)

In the following article (*De homine* 2.4), Hobbes examines instances when vision is confused “from the fault of the eye” (*a vitio oculorum*; OL II.12). Hobbes retains the diagram from the previous article, but now he supposes two additional conditions related to the size and shape of the parts of the eye. First, he considers what would result from having a retina of a smaller shape than the retina considered in *De homine* 2.3; he compares the original retina with a smaller retina described by M-B-I on Figure 1. He argues that “the confusion at each point of the object to this point will be greater” with retina M-B-I because “the center of the retina will be nearer to the lowest part B” around point H.

Confusion will be greater because of the way that rays would refract inside an eye with a smaller retina like M-B-I. As already mentioned, for the eye considered in *De homine* 2.3, when the ray from A strikes the pupil obliquely at C it reflects away from the retina along line E-F. When this happens, our vision is confused, and we perceive object A as located in the wrong location: “point A will appear at the line E-F” (OL I.11). However, when the eye with retina M-B-I is considered, Hobbes argues that, after the ray from object A strikes the retina at B, it will pass through the center of the retina at point H, rather than at point E. As a result, it will continue along line H-G, causing object A to appear along line H-G.

The smaller spherical shape of retina M-B-I thus causes greater confusion of vision when we perceive objects, such as object A, by means of oblique rays. The reason for this is that the apparent location is *farther* from the actual location of object A than the apparent location would be with the originally-considered, larger retina. In other words, if the size of the retina were smaller, our perception of objects by means of oblique rays, which is already confused, would be even more confused; we would perceive objects such as A along H-G which is farther away from perceiving them as being along E-F, and thus more confused.

The second condition, or fault, of the eye leading to confused vision that Hobbes considers results from a change in the crystalline humour. He considers what consequences there would be from this humour being smaller or larger in size, or being farther from or closer to the retina. In each of these dispositions of the crystalline humour, “the confusion will always be greater” (OL II.12) than its typical arrangement. Vision would be more confused with these changes because the refractions that would result would be greater and thus cause point A to be seen along a line that is further to the left or right of the optic axis than A would otherwise appear.

These demonstrations related to the two conditions of the parts of the eye, made upon the basis of the behavior of refracting and reflecting lines, allow Hobbes to explain conditions that result in confused vision. For example, a corollary that he draws from these explanations explains that one reason why confused vision occurs in old age, or why it occurs with those who are “dim-sighted,” is that the retina is contracted, becoming smaller like the retina described by M-B-I in Figure 1 (OL II.12-13). He notes that eyeglasses, or “a perforated plate with a small aperture, or a small pipe brought into contact with the eye” provide a remedy for those with such a “fault” in vision because they filter out the oblique rays that would otherwise confuse vision.

This foray into the optics of *De homine* has had the goal of showing a possible reply to Cavendish that Hobbes could have offered. Cavendish claims in *Letter IV* that in the case of two individuals perceiving one another, “one may see the other better and more perfectly” but “if perception were made by pressure, there would not be any such mistakes” (1664, 20). However, in *De homine 2* we find a potential answer to this objection. If one of the two individuals in Cavendish’s thought experiment were “dim-sighted,” to use Hobbes’s term, then the dim-sighted individual would see the other less perfectly than the other saw him. Granting Cavendish’s assumptions in the thought experiment, we could say that the pressure being transmitted by media between A and B would be equal, but that the reception of that pressure by the dim-sighted individual A would be hindered, thus causing him to have a less perfect perception of B than B has of A.

Cavendish may have found this Hobbes-inspired reply satisfying around the time of her work in the 1650s. Indeed, in Chapter 162 of the first edition of *Opinions* (1655), she explains blindness similarly by outlining the seven “defects” that cause it. By “blindness” she does not

mean the total loss of sight but instead she means the *obscuring* of vision, as is evident from one example that she provides of it as perceiving objects in a location other than their actual location:

A second defect may be in the ball of the eye; for according to the compasse of the concave, or convex thereof, the objects are presented nearer, or at a further distance, or longer or shorter, or broader, or narrower (1655, 121).

Cavendish claims that the curvature of the ball of the eye will influence the location at which we perceive objects in our visual field, a claim similar to the way in which the size of the sphere of the retina M-B-I would impact the apparent location of perceived objects for Hobbes. However, this explanation of “blindness” that she provides in Chapter 162 of the 1655 edition is not present in the later 1663 edition, and neither are the other six explanations that she offers in that earlier work.

In the 1655 edition there appears to be a tension between two views about the nature of visual perception. On the one hand, Cavendish claims that “...the sense of seeing is not lost, although the eyes were out, and the optick nerves stopped up” (1655, 118; retained in 1663, 294-295, discussed in section 2 above). This view appears to diminish the role of the sensory organs in explaining visual perception. On the other hand, as seen above in the quotation, Cavendish aims to explain “blindness,” understood as obscured vision, not by appeal to differences in patterning self-motions, as would be expected from the later “two men” thought experiment in the *Letters* (1664), but by appeal to features of the sense organs like the curvature of the “ball of the eye.” Other physical features she considers in Chapter 162 of the 1655 edition include what would be the result if the optick nerve “be full of slime” or if the “eyes move too quick, or too slow” (1655, 122).

Given the tension between these two views, it seems that in 1655 Cavendish could explain differences in the visual perceptions of the two individuals either by appeal to

physiological differences by appealing to the roundness of eye balls, the size of pupils, and so on, or by appeal to differences in patterning self-motions. However, by the 1663 edition of *Opinions* this tension disappears because she removes the explanations of blindness, and she abandons explaining differences in visual perception between individuals by reference to physiological differences in the parts of the eye. She is similarly unconcerned with offering such explanations in *Observations upon Experimental Philosophy* (1666).¹⁵

Although in 1655 Cavendish may have been persuaded by the potential Hobbesian reply to the “two men” thought experiment criticism offered above, by the time of her second edition of the *Opinions* (1663) and the *Letters* (1664) she would not have accepted an explanation of differences in visual perception by appeal to physical characteristics of the sense organs.

Cavendish’s removal of the explanations blindness is evidence for this claim; the main difficulty for the Hobbesian account of perception by the time of the publications of the 1660s is that it relies upon *pressure*. As I discuss in the following section, in the 1660s Cavendish holds that pressure is explanatorily impotent when it comes to accounting for differences in visual perception like those present in the “two men” thought experiment.

4. Reconsidering the “Two Men” Thought Experiment

4.1 Sensory Organs and Explaining Defects in Hearing and Seeing

The discussion regarding Cavendish’s removal of the chapter on “blindness” between the 1655 and 1663 editions of *Opinions* should not be taken to imply that in the later works she saw the

¹⁵ Cavendish’s interest in blindness in *Observations* concerns what blind individuals could know about color by touch (1666, 82-83, 87) and the sort of motions that occur in the “optic sensorium” even in the absence of being able to use the optic sense in case of blindness (1666, 154).

structure of sense organs as entirely *irrelevant* to visual perception. Instead, I will show in this section that this removal should be seen as part of her greater emphasis upon self-motion and patterning in the 1663 edition. The primary issue behind her criticism of Hobbes in *Letter IV* is not whether defects in sense organs are sufficient to explain differences in perceptions between the two individuals; instead, the issue is whether the perception-as-pressure model is sufficiently explanatorily potent. The thought experiment is designed to show that the Hobbesian model is not explanatorily potent.

Although Cavendish removes her chapter on blindness from 1663 edition, she does hold that parts of the body are sometimes relevant to explaining certain aspects of perception in later works. She uses communication by speech between human individuals as a model for thinking about how the senses work. She begins making this connection by noting that

...some may think it strange, that One Word should strike or enter into Several Ears at One Time, but surely it is not more strange that One Word should strike ...many Several Ears than that One Object shall enter into many Several Eyes at One Time... (1663, 299).

The connection between hearing a spoken word and two perceivers seeing the same object is meant to be straightforward. The self-motions of the senses constitute visual perception by imitating the motions of the objects, and in the same way the self-motions of other parts of the body imitate the motions responsible for the communication of words from one speaker to another.

Speech and perception both depend upon the production – by patterning – of many copies of self-motions. Cavendish explains how there is a multitude of such copies made when communication by words occurs: “when as a Man Speaks to an other man, [words] are made many times over Several ways; as for Example, a Man before he Speaks, Thinks of those Words

he should speak, then those are made in the Mind of the Speaker, by the Rational matter and motions...” (1663, 299-300). Cavendish continues by noting that these words, as motions, are then copied in the mouth of the speaker, in the speaker’s ears when he hears himself speak, and finally in the listener’s ears when he hears and in his mind. If the speaker is communicating to a group of individuals, then from the words he speaks “are made Multitudes of Copies” (1663, 300).

Communication by words occurs not by some transmission of motion from one body to another, but by the sensitive matter of one body imitating the self-motion of another by patterning. This model of patterning present in verbal communication also explains how perception works. However, and here we find the relevance of the sensory organs even in Cavendish’s works of the 1660s, if multiple copies of sounds or figures perceived are present, one might worry that “more would enter the Ear [or Eye] than was needful, and so would make a Confusion” (1663, 301). The apparent worry is that multiple copies would be copied simultaneously by an eye or an ear and result in confused perception or hearing. Cavendish responds to this worry by asserting that properly functioning sense organs will imitate only what is necessary: “I answer, that [such a confusion] cannot easily be, *unless the Ear be Defective, the like for the Eye*, as so for the other Senses” (1663, 301; emphasis added). So in some instances defective visual perception or hearing can be explained by a fault of the sense organs, but the fault in such organs would be a fault in patterning; for example, they may pattern too many motions and cause confusion.

Cavendish discusses the special role for sense organs, such as the eye in perception, later in *Observations* (1666). She considers the following question: “But some may ask, If a man be so blind that he cannot make use of his optic sense; what is become of the sensitive motions in

that same part of his body, to wit, the optic sensorium?” (1666, 154). She argues that even in the absence of a functioning eye, these motions in the optic sensorium will continue, but they will be altered or changed, allowing a blind individual to “guess by touch.” But such a guess by touch of how an object would appear if seen will be imperfect since “we cannot perfectly know it, except we saw it, by reason the perception of sight belongs only to the optic sense” (1666, 154).

If Cavendish holds that the sense organs are relevant to explaining visual perception, and to accounting for why visual perception can be more or less perfect, why would she reject the Hobbesian reply to the “two men” thought experiment offered in the preceding section?

Although she removes the explanations of blindness from the 1663 edition of *Opinions*, she nevertheless appeals to sense organs as explanatorily relevant in that same edition, as already discussed, and in the later *Observations* (1666). In the remainder of this section, I will argue that the reason why the Hobbesian reply offered above in section 3 would fail in Cavendish’s view is that it would still rely upon understanding the motion responsible for perception as *pressure*. Cavendish agrees with Hobbes that visual perception must be understood in terms of motion, but she articulates rational and sensitive self-motion as capable of more diverse forms of motion than simplistic Hobbesian pressure. Pressure is too blunt an *explanans* to do the work needed in explaining differences, sometimes subtle differences, in perception.

4.2 Pressure as the Target of the Two Men Thought Experiment

Given Cavendish’s interest in explaining some instances of imperfect perception or hearing by appealing to the sense organs in both the works from the 1650s and 1660s, as already discussed, it is worth attending to her mention of sense organs in the thought experiment from *Letter IV*.

She notes about these two men that

...if one's motions be perfect, but the other's irregular and erroneous, then one sees and hears better than the other; or if the Sensitive and Rational Motions move more regularly and make perfecter patterns in the Eye than in the Ear, then they see better than they hear; and if more perfectly in the Ear than in the Eye, they hear better than they see: And so it may be said of each man singly, for one man may see the other better and more perfectly, then the other may see him; and this man may hear the other better and more perfectly, then the other may hear him; whereas, if perception were made by pressure, there would not be any such mistakes. (1664, 20)

I have included the complete quotation from the thought experiment in *Letter IV* of the *Letters* because it shows the ways that Cavendish thinks that her account of self-motion can handle slight differences between situations that she holds Hobbes cannot. Against Hobbes, Cavendish claims that “if perception were made by pressure, there would not be any such mistakes” in perception (1664, 20).

Although Cavendish's criticism that “besides the hard pressure of objects...would rather annoy and obscure, then inform” (1664, 20) is distinct from the criticism I am examining (it is related to the criticism that disorder that would result from perception-as-pressure), it does reveal how she thinks of Hobbesian pressure. It seems that on Cavendish's view the pressure to which Hobbes appeals is a unilateral, forceful motion that could not account for subtle differences in perception between individuals like those considered in the “two men” thought experiment. In the face of the force of the pressure from external objects, the perceiver is passive.

In contrast to Hobbesian pressure, in *Opinions* Cavendish portrays the rational and sensitive motions as much more complex in nature, capable of representing better because they are capable of more diverse forms of motion, as well as *active* in patterning out the self-motions that they witness. Thus to explain an instance of imperfect perception, Cavendish may appeal to a deficit in patterning by a sense organ or to the motions of the sensitive or rational matter as they imitate one another. In *Opinions* Part VI, chapter XVI, she describes the rational and

sensitive matter as “the highest Extract” and as the “Quintessence of Nature (1663, 275). The rational animate matter has “no incumbrances” when it moves, and it “can Divide and Unite, Dilatate and Contract itself Infinite Several ways in its own Substance and motions” (1663, 275). The sensitive animate matter moves “after another manner” because it is linked with the inanimate matter: “...it Divides and Composes, Dilatates and Contracts with the Inanimate matter” (1663, 275). In contrast to Hobbesian pressure, Cavendish holds that these self-motions are capable of a greater degree of differences than pressure and thus are more explanatorily potent.

In addition to positing motions that are more complex than simple Hobbesian pressure, in the extended quotation above from the “two men” thought experiment Cavendish appeals to the *regularity* of a perceiver’s rational and sensitive motions. She holds that “if the Sensitive and Rational Motions move more regularly and make perfecter patterns in the Eye than in the Ear, then they see better than they hear” (1664, 20). The regularity of the sensitive or rational motions of a creature can explain why its perceptions have a particular quality, but the way that the regularity of the rational and sensitive motions are coordinated with one another also impacts the clarity of perception. She argues in *Opinions* that in the typically-functioning creature there will be a “sympathetical agreement, and Natural Unity between the Rational and Sensitive matter and motions” (1663, 75), but imperfect perception will result where such an “agreement” is lacking.¹⁶

¹⁶ This understanding typical function as sympathetical agreement might seem to run contrary to the earlier discussion of the two men thought experiment as designed to show how Cavendish can better account for *differences* in clarity of perception among *typical* perceivers. This tension appears to arise within the text of the *Letters* where Cavendish views irregular motions as “those motions which move not after the ordinary, common or usual way or manner” (*Letters*, 360) or as “not always moving after their usual and accustomed way” (*Letters*, 538). I suggest that Cavendish understands typical function as a continuum, and that typically-functioning perceivers, like the individuals in the two men thought experiment, may nevertheless make small errors. This view is supported by a distinction that Cavendish makes in *Ground* between “small

This agreement that Cavendish describes occurs for “safety and defense” of creatures, so that when a creature is attacked by another creature “all the Powers, Faculties... strive to defend themselves from Hurt or Dissolution; the Rational advises, the sensitive acts...” (1663, 75). The ability of the rational matter to “advise” should be understood as having an influence whereby the sensitive matter is more likely to imitate (pattern) the motions of the rational matter than the rational matter is to imitate the sensitive.¹⁷ In other words, this influence of the rational matter upon the sensitive matter occurs not by means of a transfer of motion by pressure but rather by the rational matter causing the sensitive to move like a hand can cause a ball to self-move. As Cavendish will argue later in the *Observations*, the ball does not “move by the hand’s motion, but by its own,” for the hand is “only an occasion that the ...ball moves thus and thus” (1666, 139-140).

Sometimes the rational matter and sensitive matter break from this sympathetical agreement and instead act at odds with one another. When such a disturbance occurs, the internal self-motions are disrupted and the functions of the creature, such as visual perception, are negatively affected. In *Opinions* Part VI, chapter XVIII, Cavendish describes this sympathetical agreement in terms of the regularity of motions and its disruption in terms of their irregularity. When the motions of the sensitive and rational matter are both regular they agree, but sometimes

Errors” and “high Irregularities.” This distinction suggests that she would view the two men thought experiment as a common-place small error in need of being explained: “when one man mistakes another, that is some small Error, both of the Sense and Reason. Also, when one man cannot readily remember another man, with whom he had formerly been acquainted, it is an Error; and such small Errors, the Sense and Reason do soon rectifie: but in causes of high Irregularities, as in Madness, Sickness, and the like, there is a great Bustle amongst the Parts of a Human Creature” (1668, 82-83).

¹⁷ Cavendish will similarly argue in *Observations* that rational perception is superior to sensitive perception because rational perception is “so active and subtle, as it is the best informer and reformer of all sensitive perception” (1666, 47). For discussion, see Boyle (2015, 445-446).

the “Rational motions are Regular, and the Sensitive Irregular” (1663, 277) and there is a disruption. Likewise, the sensitive motions may be regular while the rational motions are irregular, causing disruption of the internal motions.

Similar to the way in which the rational matter can influence the sensitive matter by “advising” it, through their self-motions the rational and sensitive matter can influence one another to be irregular: “oftentimes the Irregularity of the Rational motions, causes the Irregularity of the Sensitive, and oftentimes the Irregularity of the Sensitive motions, causes the Irregularity of the Rational” (1663, 277). Indeed, in Part VI, chapter XVII Cavendish holds that the “Rational motions in the Mind have great Power over the Sensitive motions in the Body” (1663, 276). She describes this influence as the ability of the rational motions to “persuade” or “command” the sensitive motions (also “inform” and “reform”; cf. fn. 17).

The influence that the rational motions have over the sensitive is understood as the greater inclination of the sensitive motions to pattern after the rational motions. As an example, Cavendish considers when “the Rational motions are so much Irregular, as to be Tumultuous, so as to cause Fearfull Imaginations...which cause the Sensitive motions to move Irregularly and Tumultuously” (1663, 277). This irregularity of the rational motions “causes the Sensitive motions to Print in the Sensitive passages Irregular Objects” such as “Hobgoblins, Spirits, and Devils” or to hear strange noises, smell unusual scents, and feel unusual touches (1663, 277). Such a violence of the rational motions when mimicked by the sensitive motions can impart unusual strength and intensity to the sensitive motions, which Cavendish takes to explain why “Mad men in the Mad fits, have many times more Strength” than they do otherwise (1663, 278).

In summary, Cavendish’s criticism in *Letter IV* of Hobbesian perception-as-pressure as unable to account for “any such mistakes” in perception (1664, 20) reflects her views about the

diverse kinds of motions that are responsible for visual perception. The diverse motions of which the sensitive and rational matter are capable – motions of *dividing* and *composing*, as well as of *dilating* and *contracting* – provide the potential for finer detail and greater explanatory potency than the overly simplistic perception-as-pressure model where perceivers are passive. With such diverse motions in her account, Cavendish can explain more subtle differences between perceivers than Hobbes can with pressure. In addition to being able to appeal to these types of motions, Cavendish can also appeal to differences in the regularity of the sensitive and rational motions, and to the influence of one upon the other.

Cavendish later develops her account of visual perception in Part VI of the *Ground* (1668). There she appeals to the self-knowledge that parts of human bodies have regarding how they are to act (Boyle 2015, 441-442). In Chapter IX, Cavendish compares the knowledge that body parts have to the knowledge that individual humans have: “...as one Human Creature doth not know what another Human Creature knows but by Confederacy; so, no Part of the Body, or Mind of a Man, knows each Part’s perceptive knowledg[e], but by Confederacy” (1668, 81-82). As in her earlier accounts discussed already, she appeals to regularity to understand the coordination between reason and sense: “sometimes, the Human Sense is regular, and the Human Reason irregular; and sometimes the Reason regular, and the Sense irregular” (1668, 82). When such difference occurs, she holds that “the Regular Parts endeavour to reform the Irregular” (Ibid.). Sometimes the errors introduced are “small,” but other times “high Irregularities” occur (cf. fn. 16).

This account of properly-functioning parts knowing what they should do, as possessing self-knowledge, in *Ground* allows Cavendish to explain being blind, for example, by identifying the eyes themselves as “natural fools.” She argues that with such a “defect” “those Parts have no

knowledg[e] of such Properties that belong to such Parts” (1668, 85). Blindness thus is caused by a failure of the eyes insofar as they no longer know what to do as eyes. In the case of such defects, she identifies old age as a decay in the self-knowledge of body parts: “sometimes the Sensitive Body decays, before the Rational Mind; and sometimes the Rational Mind, before the Sensitive Body” (1668, 86). These later developments in her view in the *Ground* allow her to accommodate more subtle failures of visual perception, such as in the two men thought experiment, with even greater explanatory resources than in her previous work, and they represent a third stage in her development of her account of visual perception beyond what was evident around the time she composed the *Letters*. The earlier discussion of the transition from the 1655 edition of *Opinions* to the 1663 edition showed Cavendish removing from her account the physiological characteristics of the eyes in her explanation of blindness and appealing to patterning self-motions. Her later development of these ideas in the *Ground* incorporates her view of matter as intelligent and draws upon the idea of self-knowledge, which can be possessed more or less by parts of the human body, as essential to explaining defects in visual perception.

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