

René Descartes and the Geometrization Problem

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Given contemporary theories of perception, René Descartes' understanding of the relationship between sensation and the intellect can be difficult to grasp. Descartes offered some novel and—based on our current biological models of perception—highly accurate insights into how perception physically works. Consequently, unpacking Descartes' revolutionary relationship between natural geometry, sensation, and the intellect can still illuminate the mechanics of sensory perception. But his theories are prone to contrary, yet equally valid, interpretations. Nancy Maull, for example, makes a compelling argument that his natural geometry makes primary qualities accessible to the intellect alone and secondary qualities to the sensations. Alison Simmons, on the other hand, critiques Maull's approach, arguing that it creates a deep bifurcation in Descartes' theory by attributing primary qualities of sense perception to the intellect and secondary qualities to the sensations. Ironically, both are correct, tapping into accurate interpretations of Descartes. While this may seem implausible, given their seemingly irreconcilable positions, I will demonstrate that the ambiguity that fuels these disparate interpretations is actually central to Descartes' own writing. He was not consistent and not

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as careful about key distinctions as he could have been, thus allowing for multiple interpretations that are equally valid.

Nancy Maull

In “Cartesian Optics and the Geometrization of Nature,” Nancy Maull recounts the history Descartes found himself responding to, and highlights Galileo as the pivotal figure. Galileo had recently rejected Plato’s skepticism that physical bodies could be understood through purely mathematical terms and Aristotle’s belief that essences constituted scientific knowledge. For these two Greek philosophers, the geometrization problem—or the problem of how geometry applies to nature—did not exist (255-56). Galileo generated this difficulty when he envisioned a world with quantifiable bodies, thinking nature could and should be understood through mathematics (256). But explaining nature through geometry was difficult: one does not explicitly see the world as a set of lines and angles (253). As preliminary contributions to the solution, Galileo idealized and simplified the world to make room for a geometrical understanding (256). Physics seemed to him the best candidate to explain the senses within this idealized and simplified world. But Galileo never could explain what sensory or intellectual grasp of the world we possess to make this sort of geometrization viable and informative. He defaulted to God as the best explanation for how we access mathematical primary qualities (257). Descartes thus took up the work of Galileo and tried to solve this problem without explicitly drawing on God as the efficient solution.

Descartes embraced the task of explaining both “how a mathematical theory of nature is to be applied to particular physical situations” and “how the correct version of that physical theory is to be discovered,” and he thought geometry was the key, being the only pure and true description of physical bodies (257). His obsession with geometry led him to believe that these a priori principles revealed higher-level laws, yet he was cognizant that a priori reasoning alone could not explain all of the physical world. Our limited minds can’t always trace these higher-level laws to the physical world, we need lower-level laws to explain “actual physical circumstances” (258). For Descartes, sensory perception provided the information we need to identify these “lower level physical laws” (258). Thus, while God might easily derive lower-level laws through a priori reasoning, humans find sensory perception essential for collecting the data necessary to know them (258).

However, while Descartes’ account depended upon sensory perception, he recognized that it isn’t the most reliable instrument. Particularly,

Descartes thought perceptions that locate secondary qualities—colors, tastes, odors, sounds, etc.—“in bodies” were false (258). In this regard, Descartes went strongly against the current of Kepler’s theory that bodies have secondary qualities and “are not merely perceived that way” (258). Like Galileo, Descartes pushed against this resemblance theory and tried to understand the perception of color through extension and motion, or via mechanistic means. For Descartes, secondary qualities merely “produce sensations in us” (259). Similar to the way words convey things that are not akin to the sounds or visual appearance of the words themselves, these secondary qualities can “make us feel the sensation of light” (260). For Descartes, perception of secondary qualities does not give us direct access to how the world is. He gave two examples to further detail this principle. Sound is not resembled in any way by its motion through the air, and the “sensation of being tickled resembles nothing in the feather” (260). Thus, for Descartes, we are often wrong when determining the cause of something, like a soldier who mistakes a pain for a battle wound when it is just a “twisted belt buckle” (261).

However, Descartes made this account more nuanced with his later example of engraved images. These images maintain the same color uniformly, but the engravings on them give us figures and outlines that “represent to us forests, towns, men, and even battles and storms” (261). Unlike the previous examples, this one seems to demonstrate that perception can resemble some sense of how the object really is. To make sense of this apparent contradiction, Maull argues that Descartes offered the example to indicate an important distinction between primary and secondary qualities. Color and other secondary qualities do not represent something “in a physical object, since physical objects are mere extension” (262). But figure and other primary qualities do “resemble to a degree” this extension (262). The fundamental distinction between the two is that in primary qualities alone we use an algorithm, or a “natural geometrical calculation” of “kinesthetic responses” (262). This algorithm, or natural geometry, is what gives the soul knowledge of “the distance, position, size, and shape of a body” (263).

Maull explains how the geometric function works in our perception. The soul cannot simply know the linear distance from one eye to an object. However, with a second eye, the soul can know the distance between the two eyes along with the angle of each eye and can, thereby, determine the length of the other two sides of the triangle, giving knowledge of distance. Thus, via triangulation, the soul engages in some intellectual process—though it is subconscious—that renders knowledge of extension in size, position, shape, and distance (264).

Crucially, intellectual geometrization of this kind is not involved in Descartes' perception of secondary qualities. For these qualities, Descartes gave a separate, yet, elaborate understanding of extension and motion. For Descartes, corpuscles—or particles—can move linearly or spin. It is the spin and linear speed of particles from the object in question that hits the retina and the retina sends a message depending on “the ratios of rectilinear to rotary motion” that determines the color of the object in question (265). Different optic nerves receive different ratios and then certain “movements in the nerve fibers” transmit the messages to the brain (265). This is a remarkable anticipation of modern atomic theory and neuroscience. Notably, for Descartes, while the soul gains its awareness through these transmissions, it is not aware of the transmissions themselves (265). How the soul gains this awareness lies at the core of the mind-body problem—a subject requiring far more elaboration than can be offered in this paper. Bracketing this problem, Descartes' depiction of perceiving secondary qualities proffers the soul “no direct access to physical objects” (265). Thus, Descartes' argument here is that “vision is an activity, not of the body, but of the soul” (265).

Therefore, Descartes argued that our soul never errors in having sensations, but in confusing them for “realities existing outside the mind” (266). The sensations are good for everyday life, but not for scientific understanding of how the external world really is (266). Furthermore, we naturally and unknowingly judge in such a way as to assume that our judgments are sensations (267). For instance, we confuse “the mere sensation of red” with the judgment that “the rose is red” (266). We strongly believe that these judgments are clear and distinct, but only the sensations are uncontroversial (267). For Descartes, “certainty, like the possibility of error, can only belong to the understanding, never to the senses” (267). But through “additional, improved judgment” we can correct the error that our quick and hasty judgments of sensations produce (267).

Herein lies the significant distinction between secondary and primary qualities that Maull highlights in Descartes. Secondary qualities are pure sensation and are, thus, uncontroversial, but don't represent how the external world really is. Primary qualities are the subject of judgment and, therefore, offer the only possibility of understanding the external world with any certainty. Under her account, Descartes drew a deep distinction between the two qualities and the status given to them, placing primary qualities in the higher category of understanding.

Alison Simmons

Alison Simmons presents a contending interpretation in “Descartes on the Cognitive Structure of Sensory Experience.” She argues the dichotomy between the intellect and senses has been overblown, disagreeing with the traditional approach that other scholars use to read Descartes’ treatment of primary and secondary qualities. Simmons shows that some—Nancy Maull, in particular—overread the two qualities as having a distinction in intellectual involvement that Descartes does not mean to convey (550).

She argues that Descartes has a “unified cognitive account of sensory experience according to which the senses and intellect operate together to produce a fundamentally imagistic representation of the world in both its primary and secondary quality aspects” (550). This unification is central to the relation between the senses and intellect generally for Descartes (550). She admits that he can be confusing to read. At times, he argued that the senses impede intellect’s operation and intellect impedes the functioning of the senses, seeming to convey that they are different cognitive functions (551). However, at other times, he depicted the senses as involving the intellect (551). This is what Simmons thinks is being forgotten in accounts such as Maull’s. Simmons argues that the intellect operates in a similar manner for “our sensory experience of both primary and secondary qualities: it alters the sensory image without in any way intellectualizing it” (551).

She begins her argument by outlining three grades of sense perception for Descartes: physiological, the mind, and purely psychological (553). The first grade, or physiological, consists of the stimulation and mechanical process that delivers sense perception to the pineal gland (553). When the mind connects to the corporeal organs, the effects that immediately follow are considered the second grade. For Descartes, this grade is best understood as sensation (553). The third grade consists of judgments that alter the sensations, this grade is best understood as the intellect (553).

Simmons argues that most commentators—particularly Maull—have created a deep bifurcation between secondary and primary qualities, the first being solely relegated to the second grade, sensation, and the latter to the third grade, intellect (555). She notes that many commentators take this approach because Descartes did not seem to include primary qualities when he described the second grade sensory perception, but he did explicitly include them when discussing third grade sensory perception (556). She argues that these commentators have misread Descartes and that he actually treated both primary and secondary qualities as a joint part of both the second and third grades of sensory perception.

She first demonstrates the misreading of the second grade by referencing times that Descartes seemed to include primary qualities into sensation. She highlights that he used the “psycho-physiological mechanisms at work between the first and second grades of sensory perception . . . to explain our sensory perception of all the visible qualities, including ‘color, light, position, distance, size, and shape’ (AT VI 130), that is both primary and secondary qualities” (557). She takes this to mean that for Descartes, the second grade is not “devoid of size, shape, and position” but that it is “devoid of formal size, shape, and position” (557). Instead of formal primary qualities, second grade perception has “objective” primary qualities, in other words, they “represent” the primary qualities (557). This seems to match Descartes’ description of the “sensations of color patches, not sensations of color points” (557). Color seems to carry with it some representation of spatiality in the sensation, even though it does not carry with it the explicit spatiality conveyed in the third grade sensory perception (558).

To further solidify her argument, she offers the example of looking at her computer and then turning her head to see a tree out the window (558). The change in muscles in the neck and the neural transmissions those send give the perception that the tree is to the left of herself “despite its appearing in the center of [her] visual field” (558). In the *Dioptrics*, Descartes described this as happening “‘without [her] having any cognition or thought’ of the position of [her] eyes or head (AT VI 135)” (558). Because this is done without any thought or judgment, this sense of position must be accomplished in the second grade of perception (558).

She then argues that the geometrization Maull discusses is problematic. First, in the *Treatise on Man*, it is not a judgment, but rather, “incorporated into the first grade of sensory perception” because it is cast “in purely physiological terms” (560). Second, there seems to be a good reason to think that some of the primary qualities are posited in the second grade because we need shape and distance to calculate the size (560). She then considers objections that attempt to bypass the second grade and bring first grade sensory perception to the third grade, as Maull does (560). These, she argues, misrepresent Descartes, for the “relation between brain [third grade] and mind [second grade] in sensory perception is first and foremost causal not cognitive” (561). The brain doesn’t directly examine the corporeal image (561). She argues that ultimately, Descartes thought that the judgments are based on the sensations, not the “corporeal images themselves” (562).

Later, Simmons argues that judgments in the third grade incorporate both sensory content and intellectual content (567). These rely on second grade sensory perception (567). Simmons problematizes the traditional

interpretation by arguing that there is no difference in the treatment of secondary and primary qualities in the intellect (570). She first distinguishes between two types of judgment in the third grade: projective, when we “judge that there is something in the world that ‘resembles’ or ‘conforms to’ our sensations”; and constructive, those that “help to construct the phenomenological representation of particular qualities in the first place” (553-54). Within projective judgments, there doesn’t appear to be any intellectual primacy given to either quality, for “in the third grade of sensory perception, projective judgments about primary qualities are no more intellectual or rational than projective judgments about secondary qualities” (570). Thus, if there is a greater status given to one, it would appear in constructive judgments.

She argues that while natural geometry may seem to be purely intellectual, other constructive judgments “are better described as involving the habitual association of sensory or pictorial cues than as involving any sort of rational, geometrical calculation” (571). This is represented in Descartes’ thoughts about distance, “fuzzy bright images are judged to represent nearby objects; fuzzy dim images are judged to represent more distant objects” (572). This perception is largely dependent on an imagistic representation. Through second grade perception, we are able to acquire primary qualities (572). After proving this, she finishes by arguing that natural geometry is also imagistic. She argues that for Descartes, we don’t actually engage in the natural geometry described by Maull, rather “we could rationally reconstruct” our spatial reasoning “through genuine geometrical reasoning” (573). We have the ability to abstract to this understanding of spatiality, not that we naturally use this reasoning (573). Furthermore, geometrization is not as purely intellectual as it initially seems. We might be able to describe it all through “clear and distinct ideas, but the representation of the world is still in the form of a sensory image” (574). Thus the world seems to have this structure, but doesn’t have to be understood that way (574).

The Two Reconciled

Both Simmons and Maull interpret Descartes accurately. While this reconciliation between the two views may seem paradoxical at first, since Simmons adamantly deconstructs the view presented by Maull, Descartes was perhaps not as consistent as either of them are trying to craft him to be. There are good explanations for these discrepancies in Descartes work. But first, we must appreciate how both Maull and Simmons are tapping into solid representations of that work.

Alison Simmons repeatedly references reasons that one might believe in the bifurcation view. Descartes has statements that seem to both explicitly support such a view and radically disavow her theory of equal status between primary and secondary qualities. For example, he declares, "I calculate the size, shape, distance of the stick: although this is usually attributed to the senses (which is why I here refer it to the third grade of sensing) it is clear that it depends solely upon the intellect" (AT VII 437-38). This quote, along with others she references, seems to assign primary qualities solely to the intellect, or the third grade. In this quote particularly, he appears to explicitly reject the role of senses in primary qualities. While Simmons frequently suggests that Descartes could have simply forgotten to include primary or secondary qualities in the lists he attaches to sensation and the intellect (for he did include them at other times), statements like the one above seem to unquestionably endorse the deep bifurcation other scholars have attributed to him.

Despite statements from Descartes to the contrary, Simmons is correct that both secondary and primary qualities should be both in second and third grade sense perception. Color does seem to offer the grounds to derive a sense of size and figure. And much of what Descartes said draws from imagistic ways to obtain primary qualities. But her argument against Maull's interpretation of natural geometry seems more suspect. Maull draws from a lot of passages that seem to explicitly endorse a view that distance can be purely intellectually derived. Simmons' argument that this is just one possible way to describe the world doesn't seem to fully do justice to the elaboration Descartes gave on how the intellect obtains distance information purely from knowing the triangulation of the object with the two eyes. Thus, it does seem that while Simmons has broken down the barrier between intellect and sensations' access to primary and secondary qualities for Descartes, she hasn't fully demonstrated that there are no purely intellectually obtained primary qualities, such as distance. This is the way I propose to reconcile the two views. Maull doesn't indicate a certain affinity towards maintaining the distinction between intellect's acquisition of primary qualities and sensations' acquisition of secondary qualities in any category except distance perception. She might have an affinity towards figure and size, but both seem to rely too much upon the imagistic conception to maintain the division in light of Simmons' argument.

I argue that the two scholars might have come to different interpretations of Descartes for one of two reasons: Descartes changed his position over time, or he wasn't as careful as he should have been in at least one of the writings, the *Dioptrics*. The first seems less likely than the latter. While the *Dioptrics* did precede the later works that Simmons

more frequently referenced—*Treatise on Man* and *Meditations*—both scholars found equally disjointed thoughts from the same works. They both drew heavily from the *Dioptrics* and found seemingly contradictory statements. Thus, it seems that Descartes might not have been as careful on this issue as he was concerning others. Perhaps the two derived meaning from thoughts that Descartes either did not have the time to fully develop in a consistent manner, or Descartes might not have had the desire to explicitly blend or separate secondary and primary qualities in both the intellect and sensation. But this might be reading too much into the intent of Descartes himself. A third option, and the one that I personally opt for, is that Descartes likely gained a greater finesse for the details in his latter works than in his former. Maull predominantly draws from Descartes' *Dioptrics* while Simmons draws more equally from Descartes' other writings, such as *Treatise on Man* and *Meditations*. Thus, Simmons might be representing the more mature and careful account of Descartes, while Maull represents a less definite yet interesting version of Descartes, at the time he is focused on solving the geometrization problem of Galileo.

Conclusion

Both Maull and Simmons seem to be tapping into valid, yet seemingly contradictory depictions of Descartes' theory of sense perception. There are multiple possible explanations for such radically different theories, but the most likely one seems to be the development of Descartes' theory over time and the precision he later acquired. This seems to best capture why Descartes himself said seemingly contradictory things. Because of this, Simmons' theory might be the most accurate to Descartes' later years and while Maull's interpretation might not be what Descartes intended, his earlier writings definitely seem to merit the interpretation she offers.

Works Cited

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