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Descartes on certainty in deduction

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ABSTRACT

This article examines how deduction preserves certainty and how much certainty it can preserve according to Descartes's *Rules for the Direction of the Mind.* I argue that the certainty of a deduction is a matter of four conditions for Descartes. First, certainty depends on whether the conjunction of simple propositions is composed with necessity or contingency. Second, a deduction approaches the certainty of an intuition depending on how many "acts of conceiving" it requires and—third—the complexity or difficulty of the acts of thinking, which is determined by the content of the thoughts and on external factors. Fourth, certainty depends on the intellectual aptitude of the person using the deduction. A deduction lacks certainty when it relies on memory such that it is not apprehended with immediacy. However, the mental capacity and speed of a mind can be increased by training the special mental faculties of perspicacity and discernment. Increasing one's intellectual aptitude allows for more steps of a deduction to be inferred in fewer acts of conceiving, thereby helping preserve the certainty of a deduction.

1. Introduction

Descartes writes in his *Rules for the Direction of the Mind* that if someone seriously wishes to investigate the truth of things, they should "consider simply how to increase the natural light of his reason" (AT X 361; CSM I 10).[1] The way to increase one's natural light of reason involves the practice of recognizing the "simple natures" one can "intuit" with certainty and deducing further knowledge from those simple concepts (AT X 381-7; CSM I 21–4). An intuition is an immediately self-evident conception of a clear and attentive mind which leaves no room for doubt (AT X 370; CSM I 15). A deduction is "the inference of something as following necessarily from some other propositions which are known with certainty" (AT X 369; CSM I 15). Though it may at first appear familiar, Descartes's conception of deduction has little to do with formal validity—as readers today might instinctively assume—and more to do with certainty.[2]

My goal in this paper is to clarify what makes deduction preserve certainty in Descartes's *Rules*. On the one hand, when deduction is understood as a completed process, it is seemingly as certain as intuition and "comes under the heading of true intuition" (AT X 389; CSM I 26). Yet, Descartes also claims that deduction is less certain than intuition (AT X 368; CSM I 14) and deduction includes what we would today consider to be experimental induction in which the steps of a deduction are only contingently connected. This makes Descartes's conception of deduction quite different from our own. These seemingly conflicting claims have led to disagreement about how to understand Descartes's account of the certainty of deduction in the *Rules*.[3] I examine here *how* deduction preserves certainty and *how much* certainty deduction can preserve. Descartes's use of the term "deduction" persists in his later works, especially the scientific works, so gaining clarity about the nature of deduction and certainty in the *Rules* is valuable for understanding Descartes's science.[4]

I argue that the certainty of a deduction for Descartes is a matter of four conditions. First, certainty depends on whether the conjunctions of simple propositions within the steps of a deduction are composed with necessity or contingency. Complex deductions are more likely to stray

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[1] References to Descartes use the following abbreviations: AT = Descartes (1996), which is *Oeuvres de Descartes* edited by Adam and Tannery. CSM = Descartes (1984), which is *The Philosophical Writings of Descartes*, translated by Cottingham, Stoothoff, and Murdoch. The reference "AT X 361; CSM I 10," for example, refers to AT volume 10 page 361 and the corresponding English translation in CSM volume 1 page 10.

[2] Normore (1993), Owen (1999).

[3] See Beck (1952), Wong (1982), Gaukroger (1989), Normore (1993), Owen (1999), Rogers and Nelson (2015).

[4] Garber (1978: 119), Clarke (1982), Alanen (2003: 12–22), Doyle (2009: 3–4), Dika 2020. Descartes's conception of intuition in inference is also a live option in recent literature. See Dogramaci, 2013 and Paul (2022) for overview of recent Cartesian or Cartesian-inspired views of inference.

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from certainty, which leads to the next two conditions: a deduction approaches the certainty of an intuition depending on how many "acts of conceiving" it requires and—third— the complexity or difficulty of the acts of thinking, which is determined by the content of the thoughts and on external factors. Fourth, certainty depends on the intellectual aptitude of the person performing the deduction relative to that particular deduction. A deduction lacks certainty on the fourth condition when it relies on memory such that it is not apprehended with immediacy. However, the mental capacity and speed of a mind can be increased by training the special mental faculties of perspicacity and discernment. Increasing one's intellectual aptitude allows for more steps of a deduction to be deduced in fewer acts of conceiving, thereby helping preserve the certainty of a deduction. The upshot is an account of Descartes on certainty in deduction in the *Rules* that improves upon previous leading accounts, namely, those of Wong (1982), Owen (1999), and Rogers and Nelson (2015), whose views I assess in section 3. A key contribution of this article, improving upon Owen (1999), is that a deduced conclusion can retain the certainty of intuitions without retaining the self-evidence of intuitions.[5]

2. Intuition

Intuition and deduction are the only ways to arrive at knowledge for Descartes (CSM I 14; AT X 368). My goal in these first two sections is to give an account of what intuition and deduction are in *Rules* and how they relate to each other. This section shows that intuitions include acts of conceiving simple conceptions or propositions, compounds of simples, and the linking rules for combining simples. Compounds of simple conceptions are intuited when a necessary connection between the simples is intuited.

Intuition is the conception of a clear and attentive mind which leaves no room for doubt (AT X 368; CSM I 14). It is an intellectual perception or grasping that "proceeds solely from the light of reason" (AT X 368; CSM I 14). Intuition is the "simplest" operation and "quite basic"; it cannot be taught (AT X 372; CSM I 16). Clarke describes intuition as the most basic and unanalyzable act of intellectual understanding (1982: 60, 65). In Rule Eleven, Descartes writes that there are two requirements for a proposition to be a mental intuition: (1) the proposition must be clear and distinct and (2) it must be understood all at once (AT X 407; CSM I 37). In Rule Three, we are told that an intuition is self-evident and certain (AT X 368; CSM I 14); it is an act of immediately recognizing that a proposition is self-evident. For example, on Descartes's view it is self-evident that (1) I exist, (2) I am thinking, (3) a triangle is bounded by just three lines, and (4) a sphere is bounded by a single surface (AT X 368; CSM I 14).[6]

Descartes thinks simple conceptions and compounds of simple conceptions can be intuited. *Simple conceptions* are ideas whereas *simple entities* are corporeal.[7] Simple conceptions are "only those things which we know so clearly and distinctly that they cannot be divided by the mind into others which are more distinctly known" (AT X 418; CSM I 44). The content of simple conceptions is either purely intellectual, purely corporeal, or common to both intellect and body.[8] Simple conceptions that have corporeal properties as their content include the simple conceptions of shape, extension, and motion. Purely intellectual simple conceptions include ideas of knowledge, doubt, ignorance, and action of the will (volition); these are known by a "sort of innate light" (AT X 419; CSM I 44). *Common* simple conceptions are ideas such as existence, duration, and unity, which are both intellectual and corporeal (AT X 419; CSM I 45). For instance, both ideas and bodies have in common that they exist.

Common "notions" and privations also count as common simple conceptions. Common notions are "links which connect other simple natures together" (AT X 419; CSM I 45). An example of a common notion is, "Things that are the same as a third thing are the same as each other" (AT X 419; CSM I 45). A common notion is self-evident and exemplifies the sort of self-evidence that is the basis for all the rational inferences we make.[9] Examples of privations corresponding to common simple conceptions are "nothingness" or "rest." Descartes writes, "This way of conceiving things will be helpful later on in enabling us to say that all the rest of what we know is put together out of these simple natures" (AT X 420; CSM I 45). Simple natures are all self-evident and never contain any falsity. On the other hand, a composite can be made up of a simple conception that we perceive and something unknown to us (AT X 420-1; CSM I 45). Although composition can allow falsity to creep in, Descartes is clear that composition itself is not the reason for falsity: "… there can be no falsity in the mere intuition of things, be they simple or conjoined" (AT X 432; CSM I 53). The conjoining of simples can produce a self-evident and certain intuition.[10]

Falsity can creep into a composition depending on *how* the simples are conjoined. On Descartes's view, the conjunction of simple concepts is either necessary or contingent. A conjunction is contingent when the relation between the two simples allows the two to be conceived distinctly apart from one another. For example, "a body is animate" is a contingent conjunction because a body can be conceived distinctly even when it is *not* animate. A body can be at rest—it is not necessarily in motion. Falsity comes in through contingent conjunctions, which are put together by the intellect through impulse or conjecture (AT X 399, 423; CSM I 32, 47).

On the other hand, a conjunction is necessary "when one of them is something implied (albeit confusedly) in the concept of the other so that we cannot conceive either of them distinctly if we judge them to be separate from each other" (AT X 421; CSM I 45–6). The connection between simple conception x and simple conception y is necessary when either x or y cannot be conceived distinctly as separate from the other.[11]

[5] I limit my discussion to Descartes's conception of deduction in the *Rules for the Direction of the Mind*. A problem I do not address in this paper is how Descartes's account changes over his lifetime, including whether it changes within the *Rules* itself, given that Descartes composed *Rules* over a period of about ten years. Jean-Paul Weber's (1964) *La constitution du texte des Regulae* argues that the *Rules* is a set of fragments with questionable consistency. See Garber (1992: Ch 2) for more on how the *Rules* itself may represent shifts in Descartes's thinking over time. For a view opposed to Weber (1964), see Doyle (2009).I also do not discuss Descartes's role in the history of deduction, namely, how his view differs from conceptions of certainty in deduction prior to Descartes (such as is found in Ramus or the Scholastics), during Descartes's lifetime (such as in Franco Burgersdijk), or after Descartes (such as in the Port Royal Logic or in Leibniz). Contextualizing Descartes's account is a significantly larger project than I can undertake here. For more on the contextual relevance of Descartes's conception of deduction in the history of philosophy, see Owen (1999) and especially Capozzi and Roncaglia (2009).

[6] For more on how "I exist" is self-evident according to the *Rules* see Paul (2022: 6–10).

[7] As an example of a simple entity, Descartes says, "If, for example, we consider some body which has extension and shape, we shall indeed admit, with respect to the thing itself, it is one single and simple entity. For, viewed in that way, it cannot be said to be a composite made up of corporeal nature, extension and shape, since these constituents have never existed in isolation from each other. Yet with respect to our intellect we call it a composite made up of these three natures …" (AT X 418; CSM I 44).

[8] Descartes says, "those things which are said to be simple *with respect to our intellect*" are intellectual, corporeal, or common to both (AT X 419; CSM 1 44, emphasis added).

[9] The mind "finds certain common notions from which it constructs various proofs and, for as long as it attends to them, it is completely convinced of their truth" (AT VIIIA 9; CSM I 197). Descartes provides more examples of common notions in *Principles* I.49, such as 'nothing comes from nothing.'

[10] For more on simples, see O'Neil, B. E., 1972.

[11] Calvin Normore takes necessity to be the sole condition for certainty in the *Rules*. He writes that if an inference from x to y has necessity, then it retains certainty (1993).

At the root of perceiving necessary connections between simple natures are common notions which link simple natures together. The self-evidence of common notions "is the basis for all the rational inferences we make" (AT X 419; CSM I 45). Beyond common notions, some necessary connections between simple conceptions depend on the specific features of the simple. For example, shape implies the concept of extension (AT X 421; CSM I 46). In apparent contrast to common notions, necessary connections that depend on features of simple conceptions are not always self-evident: "there are many instances of things which are necessarily conjoined, even though most people count them as contingent, failing to notice the relation between them" (AT X 421; CSM I 46). Necessary connections, which includes common notions, link simples together with certainty.[12]

All of our certain knowledge comes from compounding simples: "the whole of human knowledge [*scientia*] consists uniquely in our achieving a distinct perception of how all these simple natures contribute to the composition of other things" (AT X 427; CSM I 49). That is, knowledge comes from using necessary connections to compose compound conceptions from simple conceptions that are intuited. Composition can come about through deduction and of the three ways to compound simple conceptions (impulse, conjecture, and deduction) deduction is "the sole means of compounding things in a way that enables us to be certain of their truth" (AT X 424; CSM I 48). Thus, deduction, the subject of the next section, allows us to make inferences based on intuitions in a way that can retain their certainty and thereby expand knowledge.[13]

3. Deduction

Deduction is "the pure inference of one thing from another" (AT X 365; CSM I 12) or "the inference of something as following necessarily from some other propositions which are known with certainty" (AT X 369; CSM I 15). However, deduction is also described by Descartes as *beginning* with a conclusion and then tracing a path from the conclusion down to its simplest parts:

> We shall follow this method exactly if we first reduce complicated and obscure propositions step by step to simpler ones, and then, starting with the intuition of the simplest ones of all, try to ascend through the same steps to a knowledge of all the rest. (AT X 379; CSM I 20).[14]

One condition for a deduction to produce certain knowledge is that each inferential step, starting from the simples, must be a necessary connection—such as when the proposition "nothing which lacks extension can have shape" utilizes the necessary connection between shape and extension (AT X 425; CSM I 48). After reducing to the simplest propositions, deduction then uses intuitions and necessary connections (including common notions) to infer propositions that result "from a comparison between two or more things" (AT X 440; CSM I 57). Descartes's project is "not to inspect the isolated nature of things, but to compare them with each other so that some may be known on the basis of others" (AT X 381; CSM I 21). He even says that all knowledge—aside from simple intuitions—results "from a comparison between two or more things" (AT X 440; CSM I 57). Descartes provides some basic examples of this. Here is one:

> The self-evidence and certainty of intuition is required not only for apprehending single propositions, but also for any train of reasoning whatever. Take for example, the inference that 2 plus 2 equals 3 plus 1: not only must we intuitively perceive that 2 plus 2 makes 4, and that 3 plus 1 makes 4, but also that the original proposition follows necessarily from the other two. (AT X 369; CSM I 14–5)

In this example, the common notion is, "Things that are the same as a third thing are the same as each other." In this case, 2 plus 2 and 3 plus 1 are compared by their similarity of both equaling 4. In general, the simple conceptions of self-evident intuitions are combined or compared through necessary connections to derive further propositions which may retain the certainty of the initial intuitions due, in part, to the certainty of the necessary connections.

However, there are two ways that we can view a deduction. We can view it as a movement or as a completed process (AT X 407-8; CSM I 37). When conceived as a movement, deduction is distinguished from intuition: "we are distinguishing mental intuition from certain deduction on the grounds that we are aware of a movement or a sort of sequence in the latter but not in the former" (AT X 370; CSM I 15). When there is mental "movement" in the deduction, then it does not count as an intuition.

When deduction is viewed as a completed process, a simple and transparent deduction seems to be an intuition (AT X 407-8; CSM I 37). As a completed process, the intuition(s) and the propositions involved in the inference coalesce into a single operation of "intuiting one thing and passing on at once to another" (AT X 408; CSM I 38).[15] That is, in order for a deduction to count as an intuition, the deduction must be evident (AT X 389; CSM I 26) and *immediate*: "those propositions which are immediately inferred from first principles can be said to be known in one respect through intuition, and in another respect through deduction" (AT X 370; CSM I 15). A deduction is immediate if it is apprehended in one act of inference (AT X 383-4; CSM I 22–3).[16] As a completed process, evident deduction goes under the heading of true intuition since such an inference is performed by means of intuition (AT X 389, 407-8; CSM I 26, 37). The conclusion retains certainty by being "inferred from true and known principles through a continuous and uninterrupted movement of thought in which each individual proposition is clearly intuited" (AT X 369; CSM I 15). Descartes apparently thinks that a deduction loses certainty when memory plays a role because memory is bodily and separate from the "purely spiritual" power by which we gain knowledge (AT X 414; CSM I 41-2).[17] In sum, a deduction, qua completed process, can be as certain as an intuition if it is immediate and is understood as the result of one simple movement of the mind. The proposition '2 plus 2 equals 3 plus 1' will have the certainty of an intuition if the intuitions of the conjoined simples and the inference are apprehended immediately in a single operation of mental comprehension.

When a deduction involves a movement of the mind and thereby is "complex and involved," Descartes calls it "enumeration" or "induction," which is akin to induction in our sense (AT X 408; CSM I 37). An enumeration is "an inference drawn from many disconnected facts" (AT X 407; CSM I 37). Because enumeration is an inference of a proposition from many disconnected propositions, insofar as the mind is not able to grasp all those propositions at once, the inference does not qualify as an intuition and so it produces less certainty than an intuition (AT X 389; CSM I 26). Descartes's procedure for analyzing a magnet is an example of an enumeration (AT X427; CSM I 49). He writes of the scientist,

[12] Thanks to an anonymous referee for pointing out the non-identity of common notions and necessary connections between simple natures.

[13] For a recent and helpful account on intuition in Descartes, see Paul (2022).

[14] See Garber (1992: 31–44) for more on this process.

[15] More precisely, a completed process is when the intuition and the "enumeration"—which I explain below—"seem to coalesce."

[16] Contrast this with Gaukroger's claim that deduction and intuition are distinguished by whether three or more propositions are being related: "The difference between intuition and deduction lies in the fact that whether the latter consists in grasping the relations between a number of propositions, intuition (*intuitus*) consists in grasping one proposition or in grasping a necessary connection between two propositions, and it is equated with clear and distinct perception" (Gaukroger, 1989, p. 50).

[17] Descartes thinks deduction qua movement cannot be as certain as intuition. I say more about memory below.

> First he carefully gathers together all the available observations concerning the stone in question; then he tries to deduce from this what sort of mixture of simple natures is necessary for producing all the effects which the magnet is found to have. Once he has discovered this mixture, he is in a position to make the bold claim that he has grasped the true nature of the magnet, so far as it is humanly possible to discover it on the basis of given observations. (AT X 427; CSM I 49–50)

The conclusion of this enumeration is only as certain as the experimental evidence available and the scientist's mental power to infer what can be known on the basis of that evidence. An enumeration has full certainty when it infers with necessity in a single operation a conclusion from a collection of intuitions. However, many enumerations will be "deficient and hence liable to error" (AT X 389; CSM I 26). If our chain of inference makes any omissions or if any simple conception is not distinguished from something else, then the certainty of the conclusion is lost (AT X 389-90; CSM I 26). Enumeration is therefore a species of deduction that infers propositions that may or may not have full certainty.[18] The inclusion of enumeration as a species of deduction helps make sense of the distinction between deduction and intuition: all intuitions are immediately self-evident whereas a deduction *can* be immediately self-evident but need not be, such as in the case of enumeration. Rule Three supports this: "immediate self-evidence is not required for deduction" (AT X 370; CSM I 15). A deduction may involve a movement or diachronic sequence (AT X 370; CSM I 15). As I discuss in the next section, when a deduction is not immediately self-evident, it must rely on memory. With enough rehearsal, and if a deduction is simple enough, its totality can seem to be intuited (AT X 408-9; CSM I 38). Descartes is not always clear on how he is using the term deduction. Going forward, I will be speaking of deduction as Descartes does, as a term that includes both deduction qua process or movement and as the result of a process.

So far, we have seen that a deduction begins by reducing propositions to simples which are self-evident intuitions. Necessary connections can then be used to intuit relations between simples and infer the next steps in the deduction. The next steps in the deduction can either be simple, and thereby self-evident, or composite. We have seen that simples can be compounded with known necessity or with contingency (the latter is related to induction or enumeration). Conjunction with known necessity renders the composition certain. Descartes provides a rule to avoid error when compounding simples through deduction: "it is within our power to avoid this error, *viz.* by never conjoining things unless we intuit that the conjunction of one with the other is wholly necessary" (AT X 424-5; CSM I 48). Taking our earlier example, we can intuit that nothing which lacks extension can have a shape because extension and shape are necessarily connected; you cannot have shape without extension. Simples in the premises can also be present in later steps: "This common idea is carried over from one subject to the other solely by means of a simple comparison, which enables us to state that the thing we are seeking is in this or that respect similar to, or identical with, or equal to, some given thing" (AT X 439; CSM I 57). So, compositions of simples can be compiled using self-evident necessary connections (such as common notions), which retain the certainty of intuitions. A certainty-preserving composition will conjoin simples only when we intuit that their composition is necessary. There are thus two conditions, so far, that a deduction must meet to preserve certainty: the composition of simple conceptions must be connected with known necessity, and the inference must occur immediately in one act of mind.

David Wong focuses on the second of these conditions in maintaining that the certainty of a conclusion is a matter of how many acts of intuition are involved in a deduction (1982: 13–4). On his view, the more acts of intuition there are in a single deduction, the more one can doubt whether each step was performed correctly. However, Wong also holds that "only deductions short enough to be grasped within a single act of intuition—the cogito—are ones of which we are certain at the time we are performing them" (13). Longer deductions are too long to be grasped within a single act of intuition—and the problem is not memory, but the mind's limited ability to hold before itself longer and longer proofs in a single act of intuition (14). My account differs from Wong's by maintaining that longer deductions *can* be known with certainty, as I argue below. Additionally, I maintain that memory is an important limiting factor in whether a deduction preserves certainty.

In a view similar to Wong's, David Owen holds that deductive conclusions are less certain than intuitions because deductions are less simple based on how many operations a mind performs. He writes,

> We noted earlier that Descartes says of intuition '[b]ecause it is simpler, it is more certain than deduction'. Part of what Descartes means here by simplicity is the self-evidence characteristic of intuitive truths. Simpler truths are more likely to be self-evident than complex ones. But more importantly, intuition is a phenomenologically simpler operation of the mind. (1999: 20)

For Owen, intuitions are *simpler operations* of the mind and involve no steps, so intuition is less complex than deduction and more certain (1999: 20). But deductions can be more or less complex. If a deduction can be held in the mind all at once in a single thought, then it will be comparable to an intuition (1999: 22). Rogers and Nelson have recently criticized Owen's account:

> Owen stresses that Descartes' logic, unlike both the Scholastic syllogistic and contemporary logic, is based on content rather than form. Descartes had very little interest in formal rules allowing the transformation from one sentence form to another; he was instead interested in how the truths of particular ideas are related to one another, and this required him to consider the *content* of those ideas. Yet despite his acknowledgement of this feature of Descartes' logic, Owen's account does not emphasize the *content* of deductions, i.e., the actual ideas that are intuited and deduced. Owen explains the certainty of deductions only by appeal to the *form* (as it were) of our cognition of them; deductions acquire certainty to the extent that they share the characteristic phenomenology of intuitions. (2016: 116)

The claim here is that Owen assigns certainty to deduction based on the phenomenological "form" of deductions, i.e., when the phenomenological form shares the simplicity of intuitions. Rogers and Nelson find Owen's claims that a deduction is more certain depending on how phenomenologically simple it is to be "unsatisfying" because they say this is an appeal to "form"—which goes against Descartes's view—rather than content (2016: 116-7).

There is a way in which Rogers and Nelson's criticism is on the right track though not fully developed in their chapter. Owen seems to describe the certainty of a deduced conclusion in terms of the *self-evidence* that is characteristic of intuitions. Thus, the simplicity or "phenomenological form" of a deduction that determines its certainty is, in part, what Owen calls "self-evidence," as we just saw in the Owen quote: "Part of what Descartes means here by simplicity is the self-evidence characteristic of intuitive truths" (1999: 20). Given that Owen claims the simplicity of a deduction determines how certain its conclusion is, Owen is claiming that the certainty of a deduction is in part determined by its self-evidence.

However, this part of Owen's account appears to conflict with Descartes's claim that the conclusions of longer deductions are "not self-evident" but are nevertheless "known with certainty" (AT X 369; CSM I 15). So, pace Owen, the certainty of a deduction does not share the "phenomenological form"—to use Rogers & Nelson's framing—of an

[18] Enumeration is an important concept in the *Rules* and fully unpacking it is beyond the scope of this paper. See especially Rules 5 and 13. Dika (2020: 2.4) draws attention to five ways that enumeration could be understood. See also Beck (1952: 111-33), Clarke (1982: 67–70), and Garber (1992: Ch 2).

intuition if that form is understood as including the self-evidence of intuition. Nevertheless, a deduction can be *certain* when the simples that make up its conclusion are necessarily conjoined and inferred in one act (AT X 421-2; CSM I 46). On my account, a deduction retains the simplicity of intuition when it is performed in one act of inference, and not necessarily because it retains the self-evidence of intuition.

In contrast to my view, Rogers and Nelson (2015) hold that a conclusion is "a composite" of the initial intuition along with "other confused elements" (129). They think compositeness is what explains why deductive conclusions are more complex than simple intuitions—and they think this better explains how intuition is "phenomenologically simpler" than deduction, as Owen had put it. Being a composite is what allows uncertainty to creep into the conclusion on their view: "Of course we cannot know Z [the conclusion] in the highest degree, because it is a confusion, i.e., a composition, of several natures" (129, insert added). And so, "the doubt and certainty of long deductions comes from the composite nature of the conclusions of such deductions" (117). On this view, certainty cannot be completely preserved in any deduction of a composition (123).

I think Rogers and Nelson's view goes wrong by claiming that composition is responsible for deductions losing certainty. My account presents a way for even a long chain of inferences with composite propositions to retain the full certainty of intuitions. In his later work, *Principles,* Descartes says that "I think, therefore I am"—a composite proposition—is "the most certain of all" (AT VIIIA 7; CSM I 195).[19] In the *Rules*, Descartes claims there can be necessary connections between parts of a deduction that are far apart in a chain of inference. For instance, he writes that there is a necessary connection between the parts of "I am, therefore God exists" and "I understand, therefore I have a mind distinct from my body" (AT X 421-2; CSM I 46). So, it does not look like compositeness *per se* makes a conclusion less certain, even in long deductions. On my view, Wong, Owen, and Rogers and Nelson do not get Descartes's account fully correct.

4. Preserving certainty in deduction

So, what exactly is it that can make a conclusion of a deduction less certain? And is there more we can say about the underlying mechanisms that determine the basis of certainty? I examine in this section how a deduction becomes less certain depending on how many "acts of conceiving" the deduction requires, the complexity or difficulty of its inferences, and the mental power of the mind using the deduction.

Recall that a requirement for a proposition to be an intuition is that it be understood all at once, and not bit by bit (AT X 407-8; CSM I 37). So, if memory is required to understand a deduction, the deduction will not necessarily preserve the certainty of an intuition:

> … conclusions which embrace more than we can grasp in a single intuition depend for their certainty on memory, and since memory is weak and unstable, it must be refreshed and strengthened through this continuous and repeated movement of thought … it is necessary that I run over them again and again in my mind until I can pass from the first to the last so quickly that memory is left with practically no role to play [*ut sere nullas memorise partes relinquendo*], and I seem to be intuiting the whole thing at once. (AT X 408-9; CSM I 38)

The goal of intuiting the premises and necessary connections between the steps in the deduction again and again is to give memory "practically no role to play" and thus "the sluggishness of our intelligence is redressed, and its capacity in some way enlarged" (AT X 388; CSM I 25). It appears that memory does have some role even in *immediate* deduction: "deduction in a sense gets its certainty from memory" (AT X 370; CSM I 15). One must have clear memory of each part of the chain of a deduction for a deduction to preserve certainty. But memory is inherently unreliable and often not powerful enough to simultaneously intuit a whole deduction at once. The simultaneous intuiting of the steps of a deduction "is needed to make good any weakness of memory" (AT X 387-8; CSM I 25). When the chain of a deduction is long enough, it is not possible to eliminate memory fully. According to Rule Eleven, it is useful to reflect on the relations of simple propositions to something derived from them "and to form a distinct and, as far as possible, simultaneous conception of several of them. For in this way our knowledge becomes much more certain, and our mental capacity is enormously increased" (AT X 407; CSM I 37). This quote supports my claim that simultaneously conceiving multiple propositions and the steps between them helps raise the certainty of a derived proposition because it lowers a mind's dependence on memory, which is "weak and unstable" (AT X 408; CSM I 38).[20]

Descartes gives us more explanation for why a mind might need to depend on memory in a deduction:

> … given only the first and second magnitudes, I can easily find the third and fourth, etc.: the reason is that the discovery is made by means of particular and distinct *acts of conceiving*. But if only the first and the third are given, it will not be so easy for me to discern the intermediate magnitude, for this can be done only by means of an *act of conceiving* which simultaneously involves two of the acts just mentioned. If only the first and the fourth magnitudes are given, it is even more difficult to intuit the two intermediate ones, for in this case three *acts of conceiving* are simultaneously involved. (AT X 409–10; CSM I 38-9; emphasis added)

Descartes is here saying that the certainty of a deduction depends in part on how many acts of conceiving are taking place simultaneously. The more acts of conceiving that are needed, the more difficult it is to simultaneously intuit the necessary connections between the steps of a deduction.

The certainty of a deduction is not merely determined by how many premises or how many steps a deduction has. A deduction might be more complex or involved, i.e., have subject matter and connections between steps that are more difficult for an intellect to perceive (AT X 408; CSM I 37). The difficulty of individual inferential steps, or being unfamiliar with a subject matter, or being particularly distracted are cases in which the acts of conceiving are more difficult for internal or external reasons. Such factors as these and related factors, e.g., being in a specific mood, distracted, intoxicated, etc., are factors that influence whether the steps of a deduction are intuited simultaneously and hence how much certainty the deduction has.[21] So, the certainty of a deduction is determined not merely by how many acts of conceiving it requires, but also by how complex or difficult each inference is. The simplicity of the acts of conceiving involved in a deduction will help determine both whether memory use is necessary and whether a deduction has the certainty of an intuition.[22]

Recall that simple conceptions are the clearest and most distinct ideas we can have (AT X 418; CSM I 44). When multiple acts of conceiving are required to derive the step of a deduction, or a step is complex or difficult, then the likelihood of the inference having the certainty of an intuition goes down (AT X 389; CSM I 26). When a deduction does not take place all at once, it involves a kind of movement of our mind, which means that, because it is not understood all at once, memory is involved and hence it is distinct from intuition—it might qualify as enumeration. When a deduction *does* take place all at once, it

[19] See Paul (2022: 10) for discussion of how the *cogito* can be both an intuition and a deduction.

[20] For recent discussion of Descartes on memory, see Parvizian (2021).

[21] Thanks to an anonymous referee for pressing me on the complexity of inferential steps and the role of external influences.

[22] Beck notes that "certainty is a psychological fact rather than a logical fact" (1952: 125). Owen says that although certainty is psychologically based, it is not merely psychological for Descartes (1999: 19).

is not perceived as distinct from an intuition (AT X 407-8; CSM I 37). Descartes writes, "For if we have deduced one fact from another immediately, then provided the inference is evident, it already comes under the heading of true intuition" (AT X 389; CSM I 26).

In sum, my account differs from Owen (1999)—the account most similar to mine—because I argue the certainty of a deduction does not depend on the self-evidence of later steps in the deduction. If a deduction uses necessary inferences and common notions as linking principles, then the certainty of a deduction is determined in part by (1) the number of acts of conceiving and (2) how complex or difficult those acts are, where (1) and (2) determine (3) whether the conceiving can happen simultaneously in a single operation of "intuiting one thing and passing on at once to another" (AT X 408; CSM I 38). These variables are responsible for whether memory plays a role and how closely a deduction approaches the certainty of intuition. I argue in the next section that the certainty of a deduction also depends on the mental power of an individual mind.

5. Mental power, perspicacity, and discernment

Descartes points out frequently that the certainty of a deduction will depend, in part, on the mental power of each individual. He also claims that our mental powers can be improved. For example, he says that some people are "born with a much greater aptitude" for intuiting simple facts than others, "but our minds can become much better equipped for it through method and practice" (AT X 402; CSM I 34). My claim that the certainty of a deduction relies, in part, on the mental power of a mind has been implicit in my account above. A deduction will approach the certainty of an intuition insofar as it is understood all at once and distinctly. For a mind to understand a deduction all at once, it must have the mental power to intuit the steps of the deduction and the necessary connections between the steps in one act. Descartes suggests in Rule Seven that our ability to encompass many propositions in a single intuition depends on our "intellectual capacity" (AT X 389; CSM I 26). This seems to be why Descartes points out that our "mental capacity can be enormously increased" (AT X 407; CSM I 37). The mental power of a mind is one factor in determining how many simple intuitions or acts of conceiving—including complex or difficult inferences—can be performed simultaneously.[23] A more powerful mind will have greater certainty in longer deductions, all else being equal, because it can infer more steps of a deduction simultaneously. A less powerful mind will intuit fewer acts of conceiving simultaneously. The number of things I can simultaneously intuit varies depending on other factors, such as the difficulty of the deduction, the subject matter, my mood, whether I am intoxicated, how distracted I am, etc. These factors, along with the mental power of a mind, determines how many acts of intuiting can be performed simultaneously. All else being equal, a less powerful mind will take time to process the multiple acts of intuiting and so be more dependent on memory.

There are mental virtues that can be cultivated as a means of raising one's powers of deduction. Descartes's method in *Rules* is supposed to develop one's deductive capacities: "we are searching for ways of making ourselves more skillful at deducing some truths on the basis of others" (AT X 405; CSM I 36). To this end, he points out two mental virtues: (1) perspicacity, and (2) discernment. Perspicacity is the ability to make perfect distinctions between things, however minute and delicate. Discernment is the ability to recognize the proper ordering and connections of propositions based on their simplicity (AT X 400, 404; CSM I 33, 35). Descartes provides specific advice for how to increase these special faculties.

Perspicacity is the distinct intuition of particular things. Someone with a developed "special mental faculty" of perspicacity never lets "their thinking be distracted by many different objects at the same time, but always devote[s] their whole attention to the simplest and easiest of matters" (AT X 401; CSM I 33). This devotion allows someone to become better able to identify the simples:

> We should, as I said, attend carefully to the simple natures which can be intuited in this way, for these are the ones which in each series we term simple in the highest degree. As for all the other natures, we can apprehend them only by deducing them from those which are simple in the highest degree, either immediately and directly, or by means of two or three or more separate inferences … we must seek a means of developing our intelligence in such a way that we can discern these connections immediately whenever the need arises. (AT X 383-4; CSM I 22-3)

On Descartes's view, simple conceptions are self-evident, but it takes effort to distinguish one from the other within a composite (AT X 425; CSM I 48). Given that knowledge is built up through compositions of simple conceptions, the skill of perspicacity allows one to attend to and identify the simplest natures and thereby contributes to the further skill of comparing things by their shared simples and composing conjunctions of simples.

The second special mental faculty of discernment allows one to order and connect the simples. Descartes lists number games and arithmetic games as well as weaving, carpet-making, and embroidery as helpful for exercising our minds in the proper observance of order (AT X 404; CSM I 35). Practicing discernment helps us grow accustomed "to penetrating always to the deeper truth of things. In this way we shall gradually find—much sooner than we might expect—that it is just as easy to deduce, on the basis of evident principles, many propositions which appear very difficult and complicated" (AT X 405; CSM I 36). Recall that deduction can involve breaking down or reducing a proposition to its simplest parts from which one can then build back up through intuitive inferences to one's conclusion (AT X 379–380; CSM I 20). Discernment is concerned with how to order deductions properly.

Perspicacity and discernment help one make precise comparisons. Most knowledge comes down to recognizing simples and being able to make comparisons among things on the basis of their commonalities or differences. And so, "the business of human reason consists almost entirely in preparing" for the operation of comparison (AT X 440; CSM I 57). Preparation is needed because a potential common nature between two things being compared is often "not present equally in both, but only by way of other relations or proportions which imply it" (AT X 440; CSM I 57–8). Perspicacity allows the mind to identify and focus on the simplest things. Discernment allows one to break down compound propositions into their simplest constituents and efficiently order those simples. The combination of these epistemic virtues allows one to identify the overlap or differences between the compared propositions and then clearly apprehend through discernment the appropriate order for deduction.

In summary, the certainty of deduction is partially mind dependent; it depends on the mental power of the mind in which it takes place. The way that a mind produces a deduction, with the help of memory or as a single act of intuiting, will determine the certainty of the conclusion in the mind where the deduction is performed. The mental power of the mind can be improved by developing the two special mental faculties of perspicacity and discernment. Perspicacity focuses on distinguishing the simple natures one from another; discernment gives insight into the ordering and connection of ideas, which helps us determine what can be deduced from what (AT X 403-6; CSM I 35-6).

6. Conclusion

I have argued that a deduction acquires its certainty when the

[23] Garber (2001[1998]) discusses the cultivation of the intellect but does not explicitly connect it to the certainty of deduction. Owen (1999: 20, 24) offers some details about the role of epistemic virtue in deduction. Saja Parvizian (2021) argues that certainty comes through virtuous habits of belief for Descartes, which is different than my claim here.

relations between its steps are (1) intuited as compositions of simple conceptions that involve necessary connections based on common notions. On this view, it is not compositions *per se* that lead to lack of clarity and certainty, as Rogers and Nelson (2015) claim. When the relations between deductive steps are necessary compositions, such as when self-evident common notions link the steps, the deduction has still only partially fulfilled the conditions for preserving the certainty of an intuition. (2) A deduction preserves the certainty of an intuition depending on how many "acts of conceiving" it requires. Owen (1999) recognizes this but goes wrong by associating the certainty of a deduction with self-evidence. I argue that deductions can produce conclusions with certainty even while not retaining the self-evidence of an intuition. On my view, a deduction must be apprehended all at once to preserve certainty, and longer deductions can fulfill this criterion. This opposes my view to Wong (1982), who holds that the mind cannot ever intuit longer deductions in one act. (3) The certainty of a deduction is also a matter of how complex or difficult the inferential steps are, which is determined by the content of the inferences or by external factors such as how distracted or inebriated a person is. Lastly, (4) the certainty of deduction depends on the intellectual aptitude of the person using the deduction. The intellectual aptitude of a person is determined in part by how many acts of conceiving they can intuit simultaneously, accounting for other factors (such as the complexity or difficulty of a deduction). A deduction lacks certainty when it is not apprehended all at once. However, the mental capacity and speed of a mind can be increased by training the special faculties of perspicacity and discernment, which identify simples and properly order them into deductions. The ability to perform longer deductions—including enumerations—is a capacity that can be developed and improved to help one attain certain knowledge (AT X 388; CSM I 25).[24]

CRediT authorship contribution statement

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