Instrumental Causes and the Natural Origin of Souls in Antonio Ponce Santacruz’s Theory of Animal Generation

**Summary**

This article studies the theory of animal seeds as purely material entities in the early seventeenth-century medical writings of Antonio Ponce Santacruz, royal physician to the Spanish king Philipp IV. Santacruz adopts the theory of the eduction of substantial forms from the potentiality of matter, according to which new kinds of causal powers can arise out of material composites of a certain complexity. Santacruz stands out among the late Aristotelian defenders of eduction theory because he applies the concept of an instrument of direction developed by the medieval Avicenna commentator Gentile da Foligno and gives a novel turn to this concept by interpreting animal seeds as separate instruments. The article situates Santacruz’s theory in the context of early modern debates about the concept of the eduction of forms, as well as in the context of early modern debates about the concept of separate instruments. Particular attention is paid to Santacruz’s responses to the biological views of Julius Caesar Scaliger and Thomas Feyens. Santacruz’s response to Scaliger turns out to be central for his explication of the eduction relation, and Santacruz’s response to Feyens turns out to be central for his explication of the nature of instrumental causation.

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1. Introduction

The view that animal seeds are animated was highly influential in early modern natural philosophy.[[1]](#endnote-1) Only a few thinkers regarded animal seeds as purely material beings, and these thinkers had to struggle with the question of how animate beings can come into being from inanimate beings. Perhaps the most prominent author in this respect is Gómez Pereira (1500-c. 1558), who develops a theory of animals (and their seeds) as inanimate machines. This theory strikingly anticipates some traits of Descartes’ natural philosophy,[[2]](#endnote-2) but resolves the problem of explaining the origin of animate beings by denying that animals have souls. A different solution can be found in the Louvain-based physician Thomas Feyens (1567-1631), who held both that animals have souls and that animal seeds as well as the mixtures that arise from them are purely passive material entities that function neither as instrumental causes nor as efficient causes.[[3]](#endnote-3) His suggestion takes the widely accepted creation theory of human souls and extends the theory to plant souls and animal souls—according to his view, these souls are infused by God from the outside into the mixture of seminal matter.[[4]](#endnote-4) This, of course, resolves the problem of explaining the origin of animate beings by denying that the processes involved are purely natural.

Yet, conceptions of animal seeds as merely material entities can also be found in the work of two physicians active at the court of the Spanish kings Philip III and Philip IV: Juan Gallego de la Serna and Antonio Ponce de Santacruz.[[5]](#endnote-5) What can be seen as a motivation common to both thinkers is the intuition that this transition from inanimate to animate beings should be explained by purely natural processes.[[6]](#endnote-6) While Gallego and Santacruz accepted the traditional view that animals possess animal souls, they nevertheless rejected the view that animal seeds are animated. Gallego’s theory of animal generation is built upon the late scholastic notion of body and soul as incomplete entities. Santacruz’s theory of animal generation is built upon the late scholastic notion of the eduction of forms from the potentiality of matter. Since I have given a detailed interpretation of Gallego’s theory elsewhere,[[7]](#endnote-7) I will here focus on Santacruz’s views on biological reproduction, developed in his *De Hippocratica Philosophia* (1622)—a commentary on the Pseudo-Hippocratic *Regimen*—and his commentary on the first book of the first *Fen* of Avicenna’s *Canon* (1624).

While other aspects of early modern theories of animal generation have found close attention in recent scholarship,[[8]](#endnote-8) and while there is some work on the role of the eduction of forms in medieval natural philosophy,[[9]](#endnote-9) as far as I can see, the notion of the eduction of forms in early modern natural philosophy has not been discussed in any detail. Perhaps this may not appear to be a deplorable lacuna since sixteenth-century accounts of eduction face two serious difficulties: (1) In late Scholastic works the notion of eduction was frequently used but the explication of its meaning remained seriously underdeveloped. (2) Critics of eduction theory identified a number of unresolved theoretical problems with the theory. However, Santacruz was aware of these difficulties and tried to solve them.

I will proceed as follows: Section 2 will outline a series of difficulties identifiable in sixteenth-century treatments of the notion of eduction of forms. These difficulties are not only connected with the sketchy nature of many of the available characterizations of forms educed from the potentiality of matter but also with objections concerning the nature of material causation and the nature of essences that forms were believed to constitute. Having these difficulties in mind will make it clear in which respects Santacruz’s version of eduction theory goes beyond other versions. Section 3 will examine how Santacruz’s theory of animal generation was meant to offer solutions to objections against eduction theory, in particular those formulated by the Agen-based natural philosopher Julius Caesar Scaliger (1484-1558). As it turns out, Santacruz used the active characteristics of elementary qualities to give an account of the active aspects of material causation and used an analysis of the notion of temperament to reconcile the compositional structure of animal seeds with the unity and substantiality of forms required to define essences. Section 4 will explore how Santacruz uses the notion of instrumental causation to explicate further the nature of the material causation involved in the eduction relation. Arguably, this is Santacruz’s most important contribution to remedy the problem of the incomplete explication of the notion of eduction. Santacruz develops his views through a response to Feyens’s critique of the notion of a separate instrument—roughly, the contested idea that some instruments can operate without a continuous causal influence from the agents whose goals they realize. As it turns out, Santacruz explicates the notion of a separate instrument through adopting from the Avicenna commentator Gentile da Foligno (d. 1348) the notion of an instrument of direction—roughly, the idea that some instruments work through modifying the direction of the motions of surrounding bodies.

2. Difficulties with the Notion of the Eduction of Forms

2.1. The Problem of Incomplete Explication

Santacruz’s account of the eduction of forms uses a conceptual framework well established in sixteenth-century natural philosophy. Still, his aim is to give a novel turn to this framework, in particular a turn that offers the theoretical resources necessary to find solution to two kinds of difficulties found in the work of his predecessors. One kind of difficulties arises from the incompleteness of the characterizations given to the eduction relation. To be sure, the eduction relation itself may be resistant to further analysis. However, what the proponents of eduction theory thought that it can be analyzed are the material changes that immediately precede the eduction of forms, as well as the causal role of the substantial forms once they have been educed from the potentiality of matter. Still, the notion of eduction, as it is used in late scholastic texts, is surprisingly elusive in both respects. This can be seen in a group of Iberian authors who certainly were on Santacruz’s horizon since, in a variety of matters, he refers to them, although he does not explicitly mention their views concerning eduction. For instance, Antonio Ruvio (1548–1615) gives a sketchy characterization of the eduction relation, boiling it down to the view that a substantial form that is educed from the potentiality of matter depends, in being and becoming, on matter.[[10]](#endnote-10) The Coimbra Commentators are hardly more forthcoming. According to their view, for the eduction of substantial forms a twofold necessary and sufficient condition has to be met: (1) natural powers must inhere in a subject, and (2) the form cannot be brought about and persist without the assistance of the subject.[[11]](#endnote-11) A more detailed list of properties of forms that are educed from the potentiality of matter is found in Benito Pereira (1535–1610):

1. All such forms are generated by material agents, through material actions and material dispositions; that is, those that inhere and are fixed in matter itself. 2. In coming into being, these forms depend on matter, i.e., they cannot be generated except within matter and are entirely conjoined with it, for they are not produced by themselves, and they do not arise from the outside and then become joined with matter. 3. They depend on matter in being; for outside the matter in which they were initially produced, they cannot subsist by themselves even for a moment of time nor can they exist in another matter; rather, to separate them from their own matter and to cease to exist is for them one and the same thing. 4. They depend on matter for their operations, from whence it comes about that the operations of such forms do not exist subjectively in the form but exist in the whole composite. 5. They depend on matter with respect to their quiddity, which is why they cannot be defined or be perfectly understood without it.[[12]](#endnote-12)

As Pereira explains, “the term ‘quiddity’ designates all that belongs to the integrity of the substance and nature of a composite.”[[13]](#endnote-13) But in spite of these detailed specifications of forms thought to have been educed from matter, Pereira does not say anything about the way in which matter has to be prepared in order for forms to be educed.

2.2. The Problem of the Passivity of Matter

To make things worse, the few thinkers who tried to give a somewhat richer explication of this relation very quickly got into theoretical troubles that did not elude their contemporaries. For instance, in Domingo de Soto (1494-1560) one finds a characterization of the eduction relation that is not only underdeveloped but also threatened by inconsistency. The first author to point out these weaknesses has been Gómez Pereira. Especially two murky passages in Soto attracted Pereira’s critique. In the first of these passages, Soto writes that “matter sustains and preserves form, but not by properly giving being to it, but by assigning it potentiality for being through form.”[[14]](#endnote-14) In the second passage, Soto writes about the eduction relation that “a form being in the potentiality of matter is nothing other than depending in coming-to-be and being on matter as the receptive and passive cause”[[15]](#endnote-15) and goes on to affirm that material causation is “a kind of causing passively” (*genus causandi passive*). Against the first passage, Gómez Pereira argues that it contains an open contradiction for it “amounts to saying that the same thing is active and passive in the same respect.”[[16]](#endnote-16) As the second passage, he asks: “How could it be conceived that the entity that receives being from another entity could preserve it; for the entity that receives being will necessarily be posterior to the entity that confers being onto it, even if not in time, then with respect to nature?”[[17]](#endnote-17) Consequently, Gómez Pereira rejects the notion of the eduction of forms.

The problem of the passivity of matter is also present in the Portuguese natural philosopher Pedro da Fonseca (1528-1599). Like Soto, Fonseca accepts the view that “the actuality of form depends on matter as a sustaining principle, for in no other way can an actuality depend on a passive potentiality insofar as it is passive …”[[18]](#endnote-18) Fonseca gives an argument why this must be so: Matter is the same in all things, but the active powers of things are not all the same; hence, active power cannot arise from matter.[[19]](#endnote-19) Unlike Soto, however, Fonseca does not hold on to the notion of eduction. Rather, Fonseca holds that in the generation of composite substances an external agent disposes matter suitably and introduces a substantial form from the outside.[[20]](#endnote-20)

By contrast, Franciscus Toletus (1532-1596) defends the eduction relation by giving a richer characterization to it. In Toletus one finds the additional qualification that eduction is a process during which the substantial form comes into being as a consequence of the action by means of which a composite (*compositum*) comes into being.[[21]](#endnote-21) Also, he offers the explication that it could be described as a process through which matter becomes more perfect.[[22]](#endnote-22) Moreover, he gives an explication of the sense in which matter can become more perfect when he discusses two objections against eduction theory. According to the first objection, eduction theory cannot account adequately for the dependence of a substantial form of a composite whose parts change in such a way that of the matter present at the beginning nothing remains. If so, it was argued, then the persisting form was educed from matter that is no longer present and now depends on matter in whose potentiality it never was.[[23]](#endnote-23) The second objection notes that, according to eduction theory, the whole form depends on the whole matter in such a way that a part of the form depends on a part of the matter. But if the form is inseparable from the whole matter, it was argued, how can the form remain the same when the matter on which it depends loses a part?[[24]](#endnote-24)

In response, Toletus adopts the view that in nutrition a new part of the soul is always educed and in every diminution of the body a part of the soul decays.[[25]](#endnote-25) In this sense, Toletus accepts the view that animal souls are divisible.[[26]](#endnote-26) At the same time, he holds that souls are always co-extensive with the whole body.[[27]](#endnote-27) This suggestion solves the first problem because eduction is understood as a continuous process that regards changing part of the extended and divisible animal soul as being educed from changing material parts. However, it is not clear how it could solve the problem of the diachronic identity of animal souls—after all, an extended, divisible soul comprising ever changing soul-parts seems to be as little the same entity over time as a material composite with ever changing material parts from which the soul-parts are educed.

2.3. Problems with Essences and Substantiality

Arguably, the version of eduction theory developed by Toletus avoids the inconsistency problems identified by Gómez Pereira. However, it is exactly an understanding of the eduction relation along the lines proposed by Toletus that is attacked by Scaliger. Scaliger offers three objections: (1) He argues that, because the preparation of one part of matter through the mixture of elements takes place after the preparation of another part of matter, it follows that one part of the form would be educed after another part of the form. In this sense, eduction would be a kind of motion, and all motion is divisible. The view that forms come about through a kind of motion clashes with the traditional doctrine of the indivisibility of substantial forms.[[28]](#endnote-28) (2) He sides with the interpretation of the notion of entelechy as denoting a kind of perfection.[[29]](#endnote-29) But, as he argues, the preparation of matter through mixture consists in a qualitative change, and the change of accidents cannot be a perfection in the relevant sense because it would be an accidental perfection, not the perfection of a substance. This follows from the traditional view that the highest degree of the relevant change must be of the same genus as the previous degrees.[[30]](#endnote-30) (3) Scaliger holds to an Aristotelian one-seed theory of animal generation: “Because form is simple and indivisible, it cannot be composed out of two.”[[31]](#endnote-31) Moreover, he provides a clear-cut argument against the divisibility of the substantial forms of living beings: “Species are not mixed … If they could undergo mixture, it would happen that essences could increase and diminish. But all essence is indivisible.”[[32]](#endnote-32) Here, Scaliger brings out a consequence of the essentialist conception of biological species widely shared in the Aristotelian tradition.[[33]](#endnote-33) More specifically, he explains that essence is what determines the activities characteristic of individuals belonging to a certain species: “A fly cannot exist unless by means of a fly essence. And the essence determines and constitutes that it nourishes by sucking.”[[34]](#endnote-34) And if essences are regarded as something that does not allow for differences of more and less, as many Aristotelians did,[[35]](#endnote-35) then a mixture of species is unthinkable. This is why Scaliger argues that the indivisibility of essence speaks against the possibility that the substantial forms of animals could arise out of the mixture of two seeds.

Consequently, Scaliger conjectures that the animal soul is actually contained in the animal seed and is said to be in the potency of the seed only because “the seed is capable of giving the form that it contains in itself. But the form is educed from this remote potentiality, which is first actuality, to proximate potentiality, which is secondary actuality …”[[36]](#endnote-36) The two senses of potentiality that Scaliger identifies here differ from the sense of potentiality in the Coimbra Commentators, Ruvio and Benito Pereira: Scaliger is talking about substantial forms that always have actual existence, the Coimbra Commentators, Ruvio and Benito Pereira are talking about substantial forms that at the beginning have no actual existence. Souls of animal seeds, for Scaliger, at the beginning have “remote potentiality” since they have not yet begun to animate a living being; later, they do have “proximate potentiality” since they have the capacity of animating a living being.

For this reason, Scaliger is clear that what he has in mind is not the eduction of form through the influence of some external causes. He departs from the Aristotelian view that animal souls always need organic instruments to exist and to be active.[[37]](#endnote-37) Scaliger has a precise explanation for why the substantial form that later functions as the soul of an animal can exist and be active in the seed before any organic instruments are formed: The form can act upon the primary qualities present in matter—hot, cold, moist, and dry—and thereby bring about all of the secondary qualities—such as rarity and density, heaviness and lightness, colors and textures—arising from the tempering of primary qualities.[[38]](#endnote-38) In this way, the form itself brings about the preparation of matter that ultimately leads to organic structures, such that the form “itself changes itself and the whole and prepares the parts. Therefore, it educes itself.”[[39]](#endnote-39) In this sense, Scaliger reinterprets the eduction relation as the transition from actual presence without operations specific for a living being to actual presence with the capacity for operations specific for a living being. Evidently, in this process no new entity comes into being but rather becomes connected with instruments, such as animal spirits, which allow a preexistent entity to become operative in a particular way.[[40]](#endnote-40)

To argue for the animate nature of spirits contained in the seed, Scaliger draws an analogy between the role of seed sprits and animal spirits:

[T]he body is moved because it is animate. For it is not moved by an external but by an internal principle. Also, the spirits are internal and possess an internal principle of motion. Therefore, it follows that they are parts of the member. However, they are called instruments by similarity. For the motion that is transmitted from a principle of motion to the body itself uses spirits as means.[[41]](#endnote-41)

Thus, in Scaliger’s view animal spirits share with other body parts the ability to initiate motion, which they could not do if they were inanimate. Likewise, Scaliger takes animal spirits to be present in animal seeds. As he describes them, these spirits are informed by the soul that inheres in the seed, such that no further instrument is necessary to set the spirits in motion.[[42]](#endnote-42) Animal spirits thus are instruments only by similarity since, unlike usual instruments, they are not just the passive recipients of an influence originating from a cause external to them.

These, then, are the challenges that any project aimed at defending the theory of the eduction of forms at the beginning of the seventeenth century had to face. It is time now to examine whether Santacruz was able to solve the difficulties connected with the incomplete characterizations of the eduction relation, as well as the systematic difficulties arising from the concept of eduction. Following the development of his thought, I will first turn to his development and defense of eduction theory in *De Hippocratica Philosophia* (section 3) and then examine how his theory of instrumental causation, only outlined in *De Hippocratica Philosophia* and more fully developed in his commentary on the first book of the first *Fen* of Avicenna’s *Canon*, can be seen as a remedy for the incompleteness problem (section 4).

3. Santacruz on Animal Generation and the Eduction of Forms

3.1. Natural Qualities and the Nature of Animal Seeds

Santacruz develops his own views on the function of animal seeds in an extended commentary on a passage from *On Regimen* I.9.[[43]](#endnote-43) This is how Santacruz represents what the Hippocratic text says about portions of seminal matter (apparently combining Janus Cornarius’s translation with his own):

At first, while they are still rather rarified, each of them in a similar way on all sides is rendered dryer by motion and fire and made solid. Then the enclosed fire can no longer attract sufficient nutriment, nor can it expulse spirit, due to the density of the surface; hence [fire] consumes the humidity that exists inside.[[44]](#endnote-44)

As Santacruz explains, the seminal substance at first is like a sponge that attracts humidity. Subsequently, the outer parts harden through the drying effect of heat, and thereby spirit remains enclosed in the seed.[[45]](#endnote-45) Of course, the astonishing thing about the Hippocratic passage upon which Santacruz comments is the extreme sparseness of ontological assumptions that it makes. And Santacruz is clearly aware that this passage raises the question of whether the interaction of fire, humidity and “spirit” (understood in a sense to be spelled out in a moment) can be sufficient to explain the origin of the seed. As Santacruz points out, for Hippocrates these extremely sparse assumptions offer sufficient explanatory resources because they involve several aspects that can be distinguished on a conceptual level, although they all describe the same faculty:[[46]](#endnote-46)

[S]ometimes he calls this faculty nature, sometimes the temperament of fire and water, sometimes spirit, sometimes fire, in different determinate respects. Nature, because it is a principle of motion; a temperament of fire and water, due to the reasons explicated above; spirit due to the subtlety of acting, or the thin parts in which heat resides; fire because of heat that is the proximate and immediate instrument by means of which matter is ordered.[[47]](#endnote-47)

Santacruz maintains that the seed “is governed by a spirit tempered in such a miraculous way that all action rightly is founded upon it.”[[48]](#endnote-48) Here, spirit is characterized as the bearer of a particular temperament, and Santacruz subsequently ascribes the activity of tempered heat to sprit:

[Hippocrates] only teaches that the seminal instrument consists of spirit and miraculously proportioned heat and that these operate, according to the similarity to the parent, by some merely natural action, namely, by heating and drying some parts more, some parts less, as it is convenient with respect to the goal, and as the dispositions of matters require it.[[49]](#endnote-49)

Hence, the action of the heat contained in seminal spirit is what explains heating and drying of the various parts contained in the seed, through which the similarity between parents and offspring comes about. As Santacruz maintains, no further explanatory principles have to be invoked: “We say that heat directed in this way and tempered in this way suffices to fulfil these functions.”[[50]](#endnote-50)

Subsequently, he connects the concept of heat directed in a specific way with the concept of an instrument that acts independently of a continuous causal influence from a principal agent:

This spirit, this heat, in so far as it operates in virtue of the parent, you can call endowed with generative potency; in so far as it forms diverse members out of diverse dispositions of matter, you can call it endowed with formative potency; in so far as it is similar to a celestial quality, you can call it celestial; in so far as it is separated from a living being, you can call it a little portion of souls; in so far as it carries out all actions in virtue of the principal agent, you can call it a separate instrument.[[51]](#endnote-51)

As Santacruz explain, parents can be regarded as principal agents with respect to the fetus because the fetus is assimilated most closely to them.[[52]](#endnote-52) The question, of course, is what it could mean to operate “in virtue of” a principal agent without requiring a continuous causal influence from this agent. Santacruz holds that “because … the seed by itself is something imperfect, it requires the concurrence of many causes that supplement its defective activities …”[[53]](#endnote-53) In particular, he specifies factors such as the conservation of heat through the uterus, the bodily constitution of the mother, the optimal temperature of the ambient air, and the favorable influence of celestial bodies.[[54]](#endnote-54) In this sense, causal influences from the bodies of the parents together with environmental factors shape the qualitative constitution of the seeds.[[55]](#endnote-55) Seeds operate “in virtue of” their parents because their natural, non-vital qualities derive (largely) from their parents: “because the operation of the seed is natural and not vital it is not compulsory to suppose a soul in it, but rather to assume an action of the heat contained in the spirit, which is the instrument of the parent and moved by the parent.”[[56]](#endnote-56) What Santacruz seems to have in mind here is that the seminal spirit is “moved by” by the parents in the sense that it is moved through the active powers of the heat imparted upon the spirit by the parent. But if so, it becomes clear why the seed can function as a separate instrument: Under favorable environmental circumstances, heat can be preserved without any continued influence from the parents.

3.2. Temperament and the Eduction of Forms

Restricting the causal role of the parents to the natural operations of seeds implies that parents do not impart any vital operation upon seeds. In fact, Santacruz uses the distinction between natural and vital operations to defend a version of the doctrine of the eduction of forms from the potencies of matter. As he maintains, the substantial forms underlying vital actions arise from natural actions once these actions have reached the required degree of complexity. As we have seen, in his reading of Hippocrates Santacruz invokes the notion of temperament. This is so for good reasons since, in Santacruz’s view, what happens in the temperament explains the occurrence of causal powers that go beyond the causal powers of primary qualities.

The notion of temperament itself is open to diverging interpretations. As Santacruz notes, Avicenna understands temperament as “a quality that derives from the mutual action and passion of contrary qualities that are found in elements.”[[57]](#endnote-57) Likewise, he paraphrases what Alexander of Aphrodisias maintains in *De mixtione* as follows: “The fight between elements is carried as far as, once the excesses of contrary qualities have been abolished, through which they were different from each together, they generate a single quality out of all faculties.”[[58]](#endnote-58) Santacruz rejects such a view and adopts Aquinas’s understanding of temperament as an “intermediary quality” (*qualitas media*) that takes up the nature of all contraries.[[59]](#endnote-59) Much of what Santacruz says about the nature of the temperament can be understood as an explication of this enigmatic notion.

Santacruz is clear that he accepts a compositional analysis of temperament, according to which the temperament “contains” (*continent*) or is “composed” (*compositum*) of primary qualities (hot, cold, wet, dry).[[60]](#endnote-60) At the same time, he sets his view apart from another compositional analysis of the notion of temperament, the one found in the natural philosophy of the French physician Jean Fernel (ca. 1497-1558).[[61]](#endnote-61) Fernel takes the temperament to be an aggregate of modified primary qualities that has *no new causal powers*.[[62]](#endnote-62) Rather, he maintains that the temperament is a relation or “harmony” between qualities and therefore something causally inert.[[63]](#endnote-63) For this reason, he holds eduction to be nothing other than the preparation of matter necessary to receive a form from the outside.[[64]](#endnote-64) Evidently, Fernel’s reinterpretation of the notion of eduction gives up the idea, central to the late Scholastic notion of eduction, that the potentialities of matter actively concur in the production of a new substantial form. Rather, Fernel’s account of the origin of substantial forms through celestial causation can be seen as a version of the theory of the induction of forms into matter.

Against Fernel, Santacruz claims that the temperament is not an accidental being like a heap of stones.[[65]](#endnote-65) As he argues, this is for two reasons: (1) The temperament possesses unity with respect to the dependence relations between the primary qualities: Each primary quality is modified by the other primary qualities to such a degree that it could not be what it is independently of the other primary qualities. He holds that, in this sense, the primary qualities that compose the temperament constitute a single, accidental form.[[66]](#endnote-66) (2) The temperament possesses unity with respect to disposition in the sense that the primary qualities that compose the temperament constitute a single disposition toward a single form of the mixture.[[67]](#endnote-67) That is, once the primary qualities have reached a certain complex balance, a new entity with new causal powers (the form of the mixture) comes into being. In the case of animals, which are understood as particularly complex mixtures, this “single total disposition” toward the animal soul is called “natural heat.”[[68]](#endnote-68) And a quotation from Aquinas makes clear that what Santacruz has in mind here is *substantial* form: “in this way, the quality of the mixture is the proper disposition for the substantial form of the mixture, for instance of a stone or of whatever soul.”[[69]](#endnote-69)

Due to the mutual dependence between qualities in the temperament, Santacruz rejects Fernel’s view of the temperament as a mere aggregate; and due to the role of the temperament as a disposition toward a form, Santacruz rejects Fernel’s view of the temperament as something causally inert. According to Santacruz, temperament derives its active properties from the active properties of the elementary qualities that are modified in mixture. As an empirical confirmation, he invokes the causal powers of a color that results from the mixture of colors and that differ from the causal powers of colors that enter into the mixture.[[70]](#endnote-70) Moreover, he invokes medical experience that indicates that every change in the temperament leads to an impairment of all the actions that depend on it (such as nutrition and growth).[[71]](#endnote-71) Due to the active nature of the temperament, he maintains that one does not have to distinguish between natural powers (such as the nutritive power) and the temperament itself. One of the arguments that Santacruz gives runs as follows:

[T]hrough the same dispositions through which one form is preserved in matter, another similar form can be introduced into matter anew. The first premise is explained as follows: Fire is preserved by heat and dryness; hence, through heat and dryness the form of fire can be introduced without any additional disposition … But the soul is preserved in its matter alone through the temperament of primary and secondary qualities; hence, it is introduced into the matter of the nutriment through nutrition alone by means of the temperament.[[72]](#endnote-72)

Clearly, then, it is the active nature of the temperament arising from active elementary qualities that is seen as causally responsible for the eduction of the substantial form of a living being. As Santacruz points out, his conception of active powers inherent in elementary heat and tempered heat is what sets his views apart from views that ascribe the origin of substantial forms to the influence of the heavens[[73]](#endnote-73)—one may think here of the account of celestial heat in Bernardino Telesio (1509-1588),[[74]](#endnote-74) although there is no explicit reference to Telesio in Santacruz.

3.3. The Eduction of Forms and the Circle of Causation

Of course, ascribing the origin of substantial forms mainly to active powers of elementary qualities and their temperaments raises the question of what the empirical basis for the thesis of the eduction of substantial forms in living beings could consist in. Santacruz offers the following argument for the existence of powers that surpass the powers of the temperament:

[M]ore is required to change matter than to preserve form in matter. For to preserve the form, no passive resistance has to be overcome; but to change matter, there intervenes some passive resistance; and hence a greater power is required for transforming matter. And this is the reason why inanimate bodies, such as stones, do not transmute their proximate matter, because they have power limited to self-preservation only. Therefore, living bodies have faculties in order to augment the power of their primary qualities.[[75]](#endnote-75)

Hence, it is the capacity for self-change that speaks in favor the eduction of substantial forms in living beings. What Santacruz has in mind are changes in the organic body that cannot be explained by the active powers of elementary qualities. That such changes occur is suggested by the tendency of the organism to return to toward its optimal state:

The quality that arises from the soul, by means of potency, is something added to the temperament in the mode of a more perfect actuality and form. And it is not necessary that it is of the same specific nature as the first qualities, but stands in a more eminent relation that regards the temperament united as such, and preserves and confirms this unity.[[76]](#endnote-76)

In particular, the tendency of returning to the optimal state shows itself when the temperament, due to some disease, is impaired but nevertheless is redirected toward the state of health.[[77]](#endnote-77) Does it make sense to ascribe to qualities arising from the soul a function in preserving the unity and optimal state of the temperament? Santacruz conjectures that mixtures decay out of themselves, through their internal contraries, even if no extrinsic cause acts upon them.[[78]](#endnote-78) Preventing decay therefore is a task that cannot be fulfilled by the primary qualities alone since the tendency toward decay results from their contrariness. By contrast, preventing the internal tendency toward decay is a genuine task that the powers of a substantial form could fulfil. This is why Santacruz takes qualities arising from soul powers to be something added to the temperament.[[79]](#endnote-79) And what is added could be characterized as causal powers that express themselves in a kind of downward causation, leading from soul powers to changes in the material basis on which the soul depends for its existence.

This account of the origin of vital functions, of course, does not imply that the action of seeds itself is vital. As Santacruz explains, “the action of the seed is natural and, in its kind, does not include vitality; but it will be vital due to its specific disposition towards the soul as a conjoined principle in the same subject that moves itself.”[[80]](#endnote-80) However, the soul of the living being that is generated is not the only substantial form involved in the process of animal generation. The mixture of a male and a female animal seed, too, is described as having a substantial form, even if this form is not a soul:

[B]ecause it is not a soul, we are held to say that it is some form of a mixture, which the erudite call intermediary form, because it is directed towards another form; hence, this intermediary form and its temperament fulfil the function of instrument, according to some order, such that the immediate quality that disposes matter is temperate heat; for passive qualities are accidents that are acquired specifically for the sake of the generation of substances. And for this reason, Aristotle said: “Generation and corruption is the work of primary qualities.” For these qualities penetrate and dispose matter internally up to the production of form. And if local motion is necessary (in order for formation and the diverse position of parts in place to come about), it arises from the primary qualities secondarily; such that the powers of change and of local motion only play an assisting role.[[81]](#endnote-81)

What Santacruz has in mind could be described as a process that involves two causal circles: (1) The tempered heat in animal seeds, which give rise to qualitative changes and local motions, both within the seeds and within the material compounds on which seeds act. In this process, substantial forms are educed from the potentiality of matter. These substantial forms have a causal role in changing the temperament of the mixtures out of whose potentiality they are educed. Thereby, they function as intermediary forms that prepare the matter from which vital forms emerge. This is why both the non-vital forms of animal seeds and the temperaments from which they are educed fulfil the function of instrumental causes with respect to the generation of animals. (2) Vital substantial forms arise from the temperament of more complex mixtures that has been modified through non-vital forms. These vital forms give rise to vital operations, which in turn make use of, and thereby change, the temperament of their organic bodies. In this sense, once they are part of a living being, qualities that are non-vital in their own nature become vital in a derivative sense, because they function as instruments of the activities of a vital substantial form.

3.4. The Response to Scaliger

From this perspective, two aspects of Santacruz’s response to Scaliger can be understood as a defense of the central tenets of the theory of the eduction of forms. First, Santacruz concedes that animal spirits are involved in vital actions; however, he objects that “for created vital actions, it is not necessary that all instruments are alive. What is required is that all of them are directed by a vital principle.”[[82]](#endnote-82) The reasons that Santacruz gives invoke the concept of direction: “In order to be an instrument, direction suffices, and in order to be a vital action, direction connected with a vital principle suffices.”[[83]](#endnote-83) This is how he analyzes the relation between the soul and spirits contained in the organic body of an animal:

The soul is the intrinsic form of the muscle and there exerts its intrinsic moving power. In the muscle, as in its proper and suitably disposed matter, you find as component parts implanted spirit, nerves, flesh, etc.; hence the soul moves by means of a living muscle; and this (in order to concede something to Scaliger) is sufficient, but not all of the parts that concur there need to be alive: spirit that is extended throughout the nerves is not alive, even if the nerve is alive …[[84]](#endnote-84)

Here, animal spirits are characterized as parts that are only contained in animate body parts, not as parts that are animate themselves. They play a mechanical role in the transmission of motions that are initiated by the soul, but their motions are not directly triggered by the soul. This implies that also the spirits contained in animal seeds could be understood as instruments that transmit motion without any need to assume that they could fulfil this function only under the assumption that they animate. No need then, to assume that the spirits contained in animal seeds are animate beings.

Second, Santacruz rejects Scaliger’s one-seed theory of animal generation, according to which the single male seed is already a complete animate being that develops into a new animal, and adopts a medical two-seed theory of sexual generation, according to which both male and female parents produce seeds.[[85]](#endnote-85) In particular, Santacruz regards the male and female seeds as two separate beings that undergo mixture and thereby develop new causal powers and new substantial forms. With a view to Scaliger’s argument that essences that define species membership cannot be regarded as composite entities, Santacruz admits that “Scaliger would have had a proof if a seed were a perfect being and an adequate origin of the being to be generated.”[[86]](#endnote-86) However, against Scaliger he argues:

Two seeds are not to be called distinct with respect to species but rather two parts that together constitute an entire instrument, for they are removed from the true reason and nature of a species as far as they are removed from the goal, hence, they are united, as partial beings, in order to acquire a single form …[[87]](#endnote-87)

Thus, because male and female seeds on their own are incapable of pursuing any reproductive goals, none of them should be understood as belonging to a natural species of its own. If such an assumption is dropped, the mixture of two seeds does not amount to a mixture of two distinct species, and thereby the difficulty that Scaliger has identified with respect to the indivisibility of essences dissolves—if male or female seeds do not belong to the same species as the living being that they can generate together, there is no implication that the essence of the living is in some way composed out of the essences of the seeds. Santacruz therefore concludes:

[E]ven if someone would think that the father and the mother are adequate causes of the same order, with respect to the generation of offspring, this has to be understood substantially and with respect to the origin, with a view to the souls, that are entirely of the same nature and formal principles from whence [something arises], but not with respect to immediate instruments. This is why each requires the assistance of the other and each emits partial seeds.[[88]](#endnote-88)

This passage documents that Scaliger’s arguments concerning the indivisibility of essences push Santacruz toward regarding male and female seeds as partial causes, which implies that none of them can be regarded as an instrument of generation in isolation. Rather, the mixture constituted by a male and a female seed should be regarded as the proper subject in which the tempered heat resides that brings forth the form of the mixture and, after a period of nutrition and growth, the substantial form of an animal.

4. Animal Seeds as Separate Instruments

4.1. The Concept of a Separate Instrument

Although these considerations spell out a conceptual framework for the analysis of biological reproduction, Santacruz leaves ends open in one crucial respect. He concedes that the action of the seed is so artful that it seems to be a sign for being alive. Nevertheless, he holds that this appearance can be explained away by the “direction” (*directio*) that the seed receives from the principal agents (that is, the parents).[[89]](#endnote-89) This concept is certainly puzzling and needs further explication. It is for this purpose that Santacruz develops his theory of seeds as separate instruments—that is, instruments can realize the biological goals of the parents without continuing to be connected efficiently with the parents. This is a crucial argumentative move since, without giving substance to the notion of a separate instrument, Santacruz would lack the conceptual resources necessary for explicating the nature of the material causation operative in the eduction of substantial forms from the potentiality of matter.

On first sight, Santacruz’s argumentative move may seem problematic since the concept of a separate instrument has been challenged by Thomas Feyens a few years before the publication of Santacruz’s works. However, Santacruz was aware of this challenge and, unimpressed by it, developed his own ideas partly in the context of a response to Feyens. It will therefore be helpful first to outline the reasons why Feyens rejected the notion of a separate instrument, and then to see whether Santacruz has good answers to these reasons. Feyens argues that, if a seed were an instrument, it would have to be able to act in the absence of the principal agent.[[90]](#endnote-90) This, he notes, is contrary to Aristotle’s understanding of an instrument as a moved agent.[[91]](#endnote-91) Feyens takes this definition to imply that “an instrument cannot act unless it is first moved by a principal agent.”[[92]](#endnote-92) The crucial question, however, is whether the demand that the instrument is first moved by a principal agent coincides with the demand that the instrument is continuously moved by a principal agent. Feyens argues that the distinction between “separate” and “conjoined” instruments found in Thomas Aquinas presupposes a continuous causal influence from a principal agent.[[93]](#endnote-93) In fact, For Aquinas the difference between a conjoined and a separate instrument is that the former is united to the principal agent, such as a body part, while the latter instrument is distinct with respect to substance and place from the principal agent, as in the case of simple mechanical tools (think of hammers), but which have to be handled by their users.[[94]](#endnote-94) As Feyens emphasizes, Thomas’s separate instruments are not separate with respect to causality and activity.[[95]](#endnote-95) Feyens also rejects the possibility that seeds could function as instruments that can be active in the absence of the principal agents because they have acquired substantial forms of their own.[[96]](#endnote-96) Feyens objects that in this case seeds would not act as instruments but rather as principal agents that act by means of a power internal to them.[[97]](#endnote-97) For this reason, Feyens concludes: “To act as an instrument is to act according to some own power, but assisted and directed through an actual influence from the principal agent, through which it is guided toward producing an affect that is much nobler than what it could achieve by its own internal power.”[[98]](#endnote-98)

Santacruz’s account of seeds as separate instruments is meant to spell out how seeds could be understood as being independent of a continued causal influence from the parents without thereby falling into a conception of seeds as principal agents. In his commentary on the Hippocratic *Regimen*, he uses an analogy between animal seeds and artificial devices such a clocks to develop a rejoinder to Feyens: “[I]f these machines and clockworks now move in the absence and without the governance of the craftsman, this is a most certain sign that the contact with the craftsman took place earlier and that it left behind an impressed direction of motion, produced by the initial impression of artificial power …”[[99]](#endnote-99) As he explains it, the craftsman is the agent who is responsible for the fact that the motions in the clock take place as they do, while the weight appended to the mechanism functions as the principle from whence motions arise.[[100]](#endnote-100) But also the weights do not display a purely natural motion: They have to be connected with the mechanism and elevated through artificial motion; and due to their connection with the mechanism they do not descend at the speed they would if they would move naturally by their own gravity. As Santacruz concludes, the mover is the mechanism by means of modified and directed gravity. Likewise, Santacruz suggests, “the seed receives its power from the parent through a real physical and mathematic contact …”[[101]](#endnote-101)

4.2. The Concept of an Instrument of Direction

Still, the notion of an “impressed direction” certainly is puzzling. Santacruz develops the necessary conceptual resources to spell out this concept in his commentary on the first book of the first *Fen* of Avicenna’s *Canon*. In this work, he draws in numerous places on the monumental Avicenna commentary of Gentile da Foligno.[[102]](#endnote-102) In particular, Santacruz suggests that Gentile’s notion of an instrument of direction could be applied to and extended for the purposes of the analysis of the causal role of seeds. Gentile had developed the concept of an instrument of direction in the context of his discussion of the role of animal spirits in the living organism:

[S]pirit transmits potency as a moved instrument transmits something from the principal mover; but spirit is of this kind because it is the instrument of the soul … But you will say, what is the mode of this transmission? It has to be said that if the spirit transmits potency, it does not transmit potency itself; since potency and the soul give to the spirit its form; but because the potency gives to this spirit a mode of motion, and when such a spirit reaches the members, the members acquire formal powers in their operations. And it is as when we see that the art that is in the soul of the smith does not give its form to the fire and the hammer; but surely it gives to them a mode of motion by means of which they can lead the form of a small knife from the potentiality that lies in the matter of iron to actuality.[[103]](#endnote-103)

In this dense passage, spirit is characterized as an instrument of the soul not in the sense that it transmits motions originating from the soul—in this case, sprit could not fulfil a causal function when separated from the soul. Rather, it is characterized as an instrument of the soul because it can modify motions that originate from other causes, external to both the spirit and the soul.

In particular, the modification of motion is described as a change of direction. What is more, the potency of the spirit to bring about changes of direction is ascribed to the form of the spirit. In this sense, by conferring to the spirit the capacity of influencing the mode of motion of other bodies, the soul confers form to the spirit. This form differs from the form of the entire organism but rather is brought forth from the potentiality inherent in the matter of the spirit. In one important respect, Santacruz departs from Gentile since he does not regard animal spirits as instruments of the *soul* but rather as instruments of the principal organs—the heart and the brain. But as to the role of animal spirits in modifying the motions of other body parts, Santacruz’s view is close to Gentile’s: “as the spirit receives its mode of motion from the heart and the brain, the same spirit afterwards directs the body parts toward motion. In the generation of spirit, its matter receives a form to move, or motion itself, and subsequently in the body part, it communicates this motion.”[[104]](#endnote-104) In spite of taking up from Gentile the idea that spirits function as instruments by modifying motions of other body parts, he does not take sides with Gentile as to the question of whether animal spirits are conjoined instruments or separate instruments:

If conjoined, as Gentile’s words seem to suggest, and as the example of the artisan declares, there arise great difficulties. For if spirit acquires its motion in the brain, as the hammer receives its motion from the smith, how can Gentile contend with Averroes that this sprit articulates itself in such a way that it develops its own motions? If this were the case, one would have to say that it is not a conjoined instrument of the brain or the heart, for it does not operate by means of the same form that it received but by means of another, partial form.[[105]](#endnote-105)

The worry articulated here seems to be that the motions that sprit receives in the brain cannot remain unchanged while it travels from its origin to other body parts. But if spirit initiates motion in body parts by means only of a part of motions that it received initially, then it would act as a principal agent, not as an instrument of a principal agent. This problem seems to arise from the consideration that animal spirits operate in locations more distant from the source of the motions internal to the spirits than the motion of the hammer is from the motion of the hand that operates it.

Santacruz argues that Gentile could reply that what matters is not the preservation of motion but rather the “preservation of the mode of motion.” This, of course, sounds enigmatic. What dos the concept of the preservation of the mode of motion mean? Santacruz offers the following analogy:

When I receive the influence of the heavens, I do not destroy it but rather receive it according to the mode of the recipient. Similarly, spirit receives this quality from the brain and the heart, namely, motion with a purpose. Again, when it enters single parts, it does not lose this mode but rather confers dispositions to body parts themselves to move in such-and-such a way, although this motion is determined by the temperament and the form of the body part.[[106]](#endnote-106)

This analogy between celestial causation and causation through animal spirits suggests that, as the celestial influence does not remain unchanged in human organism on which it acts, so do the motions of the heart and the brain not remain unchanged in the spirits. Rather, as the structure of the human organism modifies celestial influences, so does the structure of animal spirits modify the motions of the heart and the brain. Still, animal spirits fulfil a particular function, namely, the function of regulating the motions of body parts. In this sense, they can be said to receive a “mode of motion.” In order to fulfil this task, animal spirits not *initiate* the motion of other body parts; rather, it is sufficient that they possess active qualities that *modify* in a consistent way the dispositions of other body parts; and the own modified dispositions of body parts initiate the motions of these body parts.

All these features of Gentile’s conception of spirits as instruments are relevant for Santacruz’s analysis of animal seeds as instruments of direction. As Santacruz argues, such an extension of what Gentile had in mind makes sense because the structure of material parts of the seed modifies the motions of particles external to the seed.[[107]](#endnote-107) The seed thus does not need any capacities of initiating motion for this purpose; all that is required is that the structure of its constituents change the motion of external particles that come into contact with them. The capacity of modifying the motions of other particles in this way does not presuppose any continued influence of the parent’s soul on the seed; all that is needed is that the parent’s soul previously conferred a certain structure to the constituents of the seed.[[108]](#endnote-108)

How plausible is this line of reasoning? In a response to Santacruz, Feyens concedes that Santacruz’s analysis of what happens in mechanical clocks is illuminating. However, he objects that between artificial and natural objects there may be some analogies that, nevertheless, should not obscure that artificial and natural objects are dissimilar in the most important respects.[[109]](#endnote-109) Now, Santacruz would certainly concede some dissimilarities between mechanical clocks and animal seeds. Most importantly, that the form that can be brought about by art is restricted to figure and organization,[[110]](#endnote-110) while in animal seeds and their mixtures substantial forms are brought about. However, he maintains that human arts use dynamics that occur elsewhere in nature, even if human agents often do not realize this.[[111]](#endnote-111) This general attitude is relevant for his treatment of the analogy between mechanical clocks and animal seeds since, in his view, a part of the processes in which animal seeds are involved are of exactly the same kind as the processes in which clockworks are involved: animal seeds change the speeds and directions of surrounding bodies. However, Santacruz expands the concept of an instrument of direction in a way that goes beyond Gentile’s analysis of spirit by including the notion of qualitative change into his analysis of instrumental causes. The elementary qualities of the material parts of the seed modify the elementary qualities of the parts that are added during the process of nutrition and growth.[[112]](#endnote-112) It is exactly this capacity of qualitative change that explains why the resulting material composites can give rise to new substantial forms, while clockworks are unable to do this. But again, the causal powers of elementary qualities inherent in seeds are independent of a continued causal influence from the parent’s soul;[[113]](#endnote-113) all that is needed is that the parent’s soul has previously tempered these qualities in a suitable way.[[114]](#endnote-114) Moreover, since the powers of local and qualitative modification inherent in seeds are the outcome of the agency of the parents’ souls and since these powers realize the reproductive goals of the parents, seeds function as instruments of the parents.[[115]](#endnote-115) And since these powers do not depend on any continued causal influence of the parents’ souls, seeds are what Santacruz calls “separate instruments.”[[116]](#endnote-116)

5. Concluding Remarks

Compared with the analysis of the characteristics of forms that are educed from the potentiality of matter found in Ruvio, the Coimbra Commentators and Benito Pereira, Santacruz thus develops a much fuller account of the processes that prepare the coming-into-being of animal souls. Santacruz’s analysis of how animal seeds could be understood as instruments of direction in the dual sense of changing the local motion and the qualitative makeup of material parts external to them offers an analysis of the material causation involved in the eduction of substantial forms. Thereby, it also offers an alternative to position such as those of Gómez Pereira and Fernel, who denied (for different reasons) that such a relation can be found in nature. It also provides answers to Scaliger’s objections against eduction theories since Santacruz specifies two senses of unity involved in the eduction of forms: (1) the temperament from which the form is educed possesses unity in the sense of a mutual dependence between qualities in the temperament; and (2) the form educed from the temperament possesses powers specific to the entire living being, not only to some of its parts. Moreover, since the powers deriving from the form have the function of upholding the unity of the temperament, the powers of the form are more perfect than the powers of the temperament.

 Yet, there is one theoretical problem that has not been addressed so far. What I have in mind is the problem (mentioned in section 2) that, if an animal soul depends on the whole organic body and the parts of the organic body change (perhaps to the extent that at one time none of the material parts constituting the body at a previous time are still present), this does not imply that the soul emerging from a different set of material parts is not a different soul. The problem is clearly articulated by Toletus, and I have not said anything about whether Toletus has found a solution for it. Perhaps he made some steps toward a solution since he inserts an element from the Neoplatonic analysis of the soul into his Aristotelian natural philosophy—an element that also can be found in Santacruz: the view that the soul is contained as a whole in the whole body and as a whole in each part of the body.[[117]](#endnote-117) This goes a step toward a solution of the problem of diachronic identity because the loss of a body part is compatible with the persistence of the same soul in the remaining whole body and in each of the remaining body parts. Still, if one assumes that the loss of some body parts brings with it qualitative changes in the remaining body parts, then the question arises of how the soul that emerges from the altered temperament still can be regarded as the same soul.

This problem is particularly pressing for Santacruz since, as we have seen, the reason for positing the existence of substantial forms whose powers exceed the powers of the temperament is exactly the capacity of changing the organic body. How, then, can the ever-changing qualities of an organic body be thought to bring forth a soul that has identity over time? Santacruz offers some theoretical resources relevant here. These resources derive from his concept of a “latitude” (*latitudo*) of temperaments qualities that can underly a substantial form. According to this concept, elementary qualities can change within certain limits while the substantial form educed from their temperament persists.[[118]](#endnote-118) He argues for the adequacy of the concept of latitude by pointing out that, in different materials, a different degree of heat is required to educe the form of fire.[[119]](#endnote-119) And he points out that experience shows that the same holds with respect to vegetative and sensitive powers—they persist over a great variety of changes in the temperament (even if their actions may be impaired to some degree).[[120]](#endnote-120) Thus, while a change of substantial form cannot take place without a change of temperament, not every change of temperament leads to a change of substantial form. And this seems to offer a possible explanation of why animal souls also can survive the qualitative change arising from the loss of body parts: the animal soul can persist as long as losses of body parts lead to changes of the temperament that lie within certain limits.

I hope that these considerations show that Santacruz’s theory of animal generation offers considerable theoretical resources for solving some of the difficulties associated with the concept of the eduction of forms. I have also tried to make clear what is distinctive about his views by setting them apart from thinkers whom he discusses in detail, such as Scaliger, Fernel, and Feyens, as well as from thinkers in his more proximate Iberian context. Of course, further instructive questions concerning how Santacruz’s views relate to other influential thinkers in early modern natural philosophy could be asked. The notion of the eduction of forms plays an interesting, although often overlooked, role in the work of Lutheran thinkers such as Jacob Schegk (1511-1587), Nicolaus Taurellus (1547-1606) and Jacob Martini (1570-1649).[[121]](#endnote-121) It also plays a significant role in the natural philosophy of Jacopo Zabarella (1533-1589).[[122]](#endnote-122) However, the writings of these thinkers pose intricate textual problems of their own, and a systematic comparison between their views and Santacruz’s would go beyond the scope of a single article. Suffice it here to say that none of the thinkers just mentioned made any use of Gentile’s notion of an instrument of direction. Nor did Santacruz’s colleague at the Spanish court, Gallego de la Serna. Quite probably, then, Santacruz was right when he thought that applying this concept to the question of the nature of material causation involved in the eduction of forms is an argumentative move no-one else had thought of.[[123]](#endnote-123)

1. This view was accepted, among others, by Girolamo Cardano, Julius Caesar Scaliger and Daniel Sennert; for a detailed exposition of positions before Sennert, see Thomas Feyens, *De formatrice foetus* (Antwerp: Gulielmus a Tongris, 1620), pp. 44-54; on Sennert, see Michael Stolberg, “Particles of the Soul. The Medical and Lutheran Context of Daniel Sennert’s Atomism”, *Medicina nei secoli* 15 (2003), pp. 177–203; Hiro Hirai, “Atomes vivants, origine de l’âme et génération spontanée chez Daniel Sennert”, *Bruniana & Campanelliana* 13 (2007), pp. 477–495; on Scaliger, see below section 2. [↑](#endnote-ref-1)
2. Gómez Pereira, *Antoniana Margarita* (Medina del Campo [no publisher], 1554); see below, notes 16-17. On Descartes’s relation to Pereira, see Gabriel Sanhueza, *La pensée biologique de Descartes dans ses rapports avec la philosophie scholastique: Le cas Gómez Pereira* (Paris: L’Harmattan, 1997). [↑](#endnote-ref-2)
3. Feyens, *De formatrice foetus*, p. 91. [↑](#endnote-ref-3)
4. Feyens, *De formatrice foetus*, p. 69; Feyens is better known as a proponent of the imagination theory of trait acquisition. On this aspect of his biological thought, see L.J. Rather, ‘Thomas Fienus’ (1567-1631) Dialectical Investigation of the Imagination as Cause and Cure of Bodily Disease’, *Bulletin of the History of Medicine* 41 (1967), 349-367; Jan Papy, ‘The Attitude towards Aristotelian Biological Thought in the Louvain Medical Treatises during the Sixteenth and Early Seventeenth Century: The Case of Embryology’, in *Aristotle’s Animals in the Middle Ages and Renaissance*, edited by Carlos Steel et al. (Louvain: Leuven University Press, 1999), 317-337. [↑](#endnote-ref-4)
5. Gallego’s and Santacruz’s biographical data are not recorded by any of the specialized libraries holding his writings, nor are they documented in Antonio Fernandez Morejon, *Historia Bibliográfica de la Medicina Espanola*, 4 vols., Madrid: [n.p.], 1846. So, one has to go by the dates of their major publications: Antonio Ponce Santacruz, *De Hippocratica Philosophia* (Madrid: Iunta, 1622) [henceforth: HP]; Antonio Ponce de Santacruz, *Opuscula in Primam Primi Avicennae* (Madrid, Iunta, 1624) [henceforth: OP], both published, with separate paginations and, in the case of HP, as separate title page, as parts of Antonio Ponce de Santacruz, *Opuscula Medica et Philosophica* (Madrid: Iunta, 1624); Juan Gallego de la Serna, *Opera physica, medica, ethica, quinque tractatibus comprehensa* (Lyon: Iacobus & Petrus Frost, 1634); Juan Gallego de la Serna, *De naturali animarum origine* (Brussels: Franciscus Vivienus, 1640), published posthumously; Gallego’s preface is dated May 1638. [↑](#endnote-ref-5)
6. For Gallego, see *Opera physica, medica, ethica, quinque tractatibus comprehensa*, p. 158; for Santacruz, see HP, p. 60, cited below note 49. [↑](#endnote-ref-6)
7. [note suppressed for anonymous review]. [↑](#endnote-ref-7)
8. See especially the pioneering work in Hiro Hirai, *Le concept de semence dans les théories de la matière à la Renaissance* (Turnhout: Brepols, 2005); *The Problem of Animal Generation in Modern Philosophy*, edited by Justin E. H. Smith (Cambridge: Cambridge University Press, 2006); Hiro Hirai, *Medical Humanism and Natural Philosophy: Renaissance Debates on Matter, Life and the Soul* (Leiden and Boston: Brill, 2011); *The Life Sciences in Early Modern Philosophy*, edited by Ohad Nachtomy and Justin E. H. Smith (Oxford: Oxford University Press, 2014). [↑](#endnote-ref-8)
9. See Olaf Pluta, “How Matter Becomes Mind: Late-Medieval Theories of Emergence.” In *Forming the Mind. Essays on the Internal Senses and the Mind/Body Problem from Avicenna to the Medical Enlightenment*. Edited by Henrik Lagerlund (Dordrecht: Springer, 2007), pp. 149-167. [↑](#endnote-ref-9)
10. Antonio Ruvio, *Commentarii in octo libros Aristotelis de Physico auditu* (Lyon: Antoine Pillehotte, 1620), p. 135. [↑](#endnote-ref-10)
11. Collegium Conimbricensis, *In octo libros Physicorum Aristotelis Stagiritae* (Lyon: Buysson, 1604), vol.1, p. 193 (lib. 1, cap. 9, quaest. 12, art. 5). [↑](#endnote-ref-11)
12. Benedictus Pererius, *De communibus omnium rerum naturalibus principiis & affectionibus*, (Paris: Michael Sonnius, 1579), p. 338: “1. est, quod tales formae, producuntur ab agentibus materialibus, per actiones materiales, & per dispositiones materiales, hoc est haerentes & infixas in ipsa materia. 2. est, quod tales formae pendent in fieri a materia, hoc est non possunt gigni nisi intra materiam, eique penitus copulatae, non enim per se producuntur & extrinsecus adveniunt & adiunguntur materiae. 3. est, quod pendent a materia in esse; nam extra eam materiam in qua ab initio productae sunt, ne puncto quidem temporis aut per se subsistere, aut in alia materia existere possunt; sed plane idem est eas separari a sua materia, quod ipsas penitus interire. 4. est, quod pendent a materia in operationibus suis, ex quo fit, ut operationes huiusmodi formarum, subiective non sint in forma, sed in toto composito. 5. est, quod pendent a materia quidditative, quamobrem sine ea nequeunt, aut definiri, aut perfecte intelligi.” [↑](#endnote-ref-12)
13. Ibid., p. 364: “nomen quiditatis significant totum id quod pertinet ad integritatem substantiae & naturae ipsius compositi …” [↑](#endnote-ref-13)
14. Domingo de Soto, *Super octo libros Physicorum Aristotelis subtilissimae quaestiones* (Venice: Franciscus Zilettus, 1582), p. 73: “materia sustinet quidem, consevatque formam, at non proprie dando illi esse: sed tanquam potentia ad esse per formam.” [↑](#endnote-ref-14)
15. Ibid., p. 90: “formam esse in potentia materiae, nihil aliud est quam dependere in fieri et esse a materia in genere causae receptivae et passivae.” [↑](#endnote-ref-15)
16. Gómez Pereira, *Antoniana Margarita*, col. 460: Implicat … idem respectu eiusdem dici agens et passum.” [↑](#endnote-ref-16)
17. Ibid., cols. 461-462: “Quo enim modo concipi potest, id, quod recipit esse ab ullo, conservare illud: cum recipiens esse, posterius necessario futurum est conferente illud, etsi non tempore, saltim natura?” [↑](#endnote-ref-17)
18. Pedro da Fonseca, *In Metaphysicorum Aristotelis libros* (Cologne: Zetzner, 1615), vol. 2, col. 74 (lib. 5, cap. 2, quaest. 1, sect. 3): “eius actus pendeat ab illa ut sustinente (neque enim aliter actus potest pendere a potentia passiva, ut passiva est) …” [↑](#endnote-ref-18)
19. Ibid., vol. 2, col. 97 (lib. 5, cap. 2, quaest. 4, sect. 1.) [↑](#endnote-ref-19)
20. Ibid., vol. 2, cols. 98-99 (lib. 5, cap. 2, quaest. 4, sect. 2.) [↑](#endnote-ref-20)
21. Franciscus Toletus, *In octo libros Aristotelis de Physica auscultatione. Item in libros Aristotelis de generatione et corruptione* (Cologne: Mylius, 1603), fol. 41v (lib. 1, cap. 9, text. 83, quaest. 19). [↑](#endnote-ref-21)
22. Ibid. [↑](#endnote-ref-22)
23. Ibid., fol. 271r (lib. 1, cap. 5, quaest. 9). [↑](#endnote-ref-23)
24. Ibid. [↑](#endnote-ref-24)
25. Ibid., fol. 271v. [↑](#endnote-ref-25)
26. Ibid. [↑](#endnote-ref-26)
27. Ibid. [↑](#endnote-ref-27)
28. Julius Caesar Scaliger, *Exotericarum exercitationum liber XV. De subtilitate, ad Hieronymum Cardanum* (Paris: Vascovani, 1557) [henceforth: EE], fol. 13v. [↑](#endnote-ref-28)
29. On this interpretation, see Sascha Salatowsky, *De anima. Die Rezeption der aristotelischen Psychologie im 16. und 17. Jahrhundert* (Amsterdam: Grüner, 2006), pp. 80-84, 186-189. [↑](#endnote-ref-29)
30. EE, fol. 13v. [↑](#endnote-ref-30)
31. EE, fol. 340r: “Forma enim cum sit simplex, & indivisibilis, ex duobus componi non potest.” On Scaliger’s biological views, see Kuni Sakamoto, *Julius Caesar Scaliger, Renaissance Reformer of Aristotelianism* (Leiden and Boston: Brill, 2016), chapters 6-7. [↑](#endnote-ref-31)
32. EE, fol. 339v: “Species non miscentur … Si miscerentur, fieret: ut essentiae intenderentur, ac remitterentur. At essentia omnis impartibilis.” [↑](#endnote-ref-32)
33. See David L. Hull, “The Effect of Essentialism on Taxonomy—Two Thousand Years of Stasis. Part I,” *British Journal for the Philosophy of Science*, 15 (1965), pp. 314-326; Scott Atran, *Cognitive Foundations of Natural History. Towards an Anthropology of Science* (Cambridge: Cambridge University Press, 1990), pp. 138-142. [↑](#endnote-ref-33)
34. EE, fol. 323v-324r: “Muscam, nisi per Muscae essentiam esse non posse. Essentia vero hoc proprium in ea ponit, atque constituit, ut alatur suctu.” [↑](#endnote-ref-34)
35. On the medieval origins of this principle, see Jean-Luc Solère, “Les degrés de la forme selon Henri de Grand”, in *Henry of Gent and the Transformation of Scholastic Thought*, ed. Guy Oldentops and Carlos Steel (Leuven: Leuven University Press, 2003), pp. 127-156. [↑](#endnote-ref-35)
36. EE, fol. 324r: “semen est potens dare formam, quam in se continet. Educitur autem de ea potentia remota, qui est actus primus, ad potentiam propinquam, qui est actus secundus …” [↑](#endnote-ref-36)
37. See Aristotle, *De anima* II, 2, 412b1-4. [↑](#endnote-ref-37)
38. EE, fol. 324r. [↑](#endnote-ref-38)
39. Ibid.: “Ipsa … sibi & alterat totum, & disponit partes. Ipsa igitur educeret se.” [↑](#endnote-ref-39)
40. EE, fol. 15r. [↑](#endnote-ref-40)
41. EE, fol. 354r: “movetur corpus, quia animatum est. Non enim movetur ab externo, sed ab interno principio. Spiritus ipsos quoque & internos esse: & ipsis internum principium motionis. Quare sequetur: ut membri pars sint. Dicuntur autem instrumenta, per similitudinem. Propterea quod a motionis principio motus exiens ad ipsum corpus, spiritus habet tanquam medios.” [↑](#endnote-ref-41)
42. EE, fol. 15r-v. [↑](#endnote-ref-42)
43. On this work, see Hynek Bartoš, *Philosophy and Dietetics in the Hippocratic* On Regimen. *A Delicate Balance of Health* (Leiden and Boston: Brill), 2015. [↑](#endnote-ref-43)
44. HP, p. 57: “Primum quidem undequaque similiter, dum adhuc valde rarum est, a motu autem & igne siccatur, & solidum redditur. Et ignis inclusus non amplius sufficiens alimentum attrahere potest, neque spiritum expellit, propter ambientis densitatem; consumit enim humorem intus existentem.” The second sentence follows the Latin translation in *Hippocratis Coi medicorum omnium longe principis Opera quae ad nos extant omnia*, translated by Janus Cornarius (Basel: Froben, 1558), p. 156; the first sentence seems to be Santacruz’s own translation. [↑](#endnote-ref-44)
45. HP, p. 57. [↑](#endnote-ref-45)
46. Santacruz uses “faculty” synonymously with “power” [*virtus*] and “potency” [*potentia*], understood as the “proximate principle of acting, connatural to a created agent” (*principium proximum agendi, connaturale agenti creato*); OP, p. 184. [↑](#endnote-ref-46)
47. HP, p. 58: “aliquando naturam vocat istam facultatem, aliquando temperamentum ex igne & aqua, aliquando spiritum, aliquando ignem; diversis certe rationibus. Naturam, quia pricipium motus; temperiem ex igne & aqua, propter rationes superius explicatas; spiritum, propter subtilitatem agendi, aut ob partes tenues quibus calor insidet; ignem propter calorem, qui proximum est & immediatum instrumentum quo materia disponitur.” [↑](#endnote-ref-47)
48. HP, p. 59: “Idem intellexit Hippocrates philosophandum esse in semine, quod spiritu mire temperato gubernatur; ita ut merito omnem actionem in illum refundat.” [↑](#endnote-ref-48)
49. HP, p. 60: “[Hippocrates] solum docet instrumentum hoc seminale constare spiritu, & calore mire proportionato, & haec operari, ad generantis similitudinem actione quadam mere naturali, scilicet, calefaciendo, exsiccando illas partes magis, has minus, prout respectu finis conveniebat, & prout materiae exposcebat dispositio.” [↑](#endnote-ref-49)
50. HP, p. 59: “dicamus sufficere taliter directum calorem, & taliter temperatum, ad ista munia exercenda.” [↑](#endnote-ref-50)
51. Ibid.: “Hunc spiritum, hoc calidum, prout operatur in virtute generantis, voca tu potentia generativa praeditum; prout efformat ex diversa dispositione materiae varia membra, voca formatrice exornatum; prout similatur caelesti qualitati, voca caelestem; prout a vivente decisum, voca animae portiunculam; prout omnia agit in virtute principalis agentis, voca instrumentum separatum.” [↑](#endnote-ref-51)
52. OP, p. 125. [↑](#endnote-ref-52)
53. HP, p. 59: “quia … semen ex se imperfectum quid est, indiguit multiplici causarum concursu, eius mutilam actionem supplentium …” [↑](#endnote-ref-53)
54. Ibid. [↑](#endnote-ref-54)
55. Ibid. [↑](#endnote-ref-55)
56. HP, p. 61: “cum operatio seminis naturalis sit, & non vitalis, non opus erat ponere animam in ipso, sed docere actionem illam caloris in spiritu contenti, qui est instrumentum generantis, & a generante motum.” [↑](#endnote-ref-56)
57. OP, p. 14: “qualitas, quae provenit ex mutua actione & passione contrariarum qualitatum in elementis inventarum.” See Avicenna (1595), liber 1, fen 1, doctrina 3, cap. 1. [↑](#endnote-ref-57)
58. Ibid.: “Pugnam elementorum eo usque progredi, donec abiectis contrariarum qualitatum excessibus, per quas inter se diversa erant, unam ex omnibus facultatibus gignant qualitatem.” See Robert B. Todd, *Alexander of Aphrodisias on Stoic Physics. A Study of the De Mixtione with preliminary essays, text, translation, and commentary* (Leiden: Brill, 1976), p. 158 (*De mixtione* 233.2–5). [↑](#endnote-ref-58)
59. OP, p. 14; see Aquinas, *Summa Theologiae*, I, q. 76, a. 4, ad 4. [↑](#endnote-ref-59)
60. OP, p. 17. [↑](#endnote-ref-60)
61. On Fernel’s biological views, see James J. Bono, “The Languages of Life: Jean Femel (1497-1558) and Spiritus in Pre-Harveian Bio-Medical Thought,” Harvard University Ph.D. thesis, 1981; Antonio Clericuzio, “Spiritus vitalis: Studio sulle teorie fisiologiche da Femel a Boyle,” *Nouvelles de la République des Lettres* 8 (1988), pp. 33-84; James J. Bono, “Reform and the Languages of Renaissance Theoretical Medicine: Harvey versus Femel,” *Journal of the History of Biology* 23 (1990), pp. 341-387; Cristina Dessi, “Marsilio Ficino, Jean Femel e lo spiritus,” in *Filosofia, scienza, storia.* Edited by A. Cadeddu. Milan: FrancoAngeli, 1995, pp. 203-219; Vicent Aucante, “La théorie de l'âme de Jean Femel.” *Corpus* 41 (2002), pp. 9-42; Hirai, *Le concept de semence*, pp. 88-96. [↑](#endnote-ref-61)
62. John M. Forrester and John Henry, *Jean Fernel´s On the Hidden Causes of Things: Forms, Souls, and Occult Diseases in Renaissance Medicine* (Leiden: Brill, 2005), p. 404. [↑](#endnote-ref-62)
63. John M. Forrester and John Henry, *Jean Fernel´s On the Hidden Causes of Things*, p. 165. [↑](#endnote-ref-63)
64. Ibid., p. 234. [↑](#endnote-ref-64)
65. OP, p. 19. [↑](#endnote-ref-65)
66. OP, p. 20. [↑](#endnote-ref-66)
67. Ibid. [↑](#endnote-ref-67)
68. Ibid. [↑](#endnote-ref-68)
69. Ibid., citing Aquinas, *Summa Theologiae*, I. q. 76, a. 4, ad 4: “huiusmodi qualitas mixtionis est propria dispositio ad formam substantialem mixti, puta lapidis, vel animae cuiuscumque.” [↑](#endnote-ref-69)
70. OP, p. 16. [↑](#endnote-ref-70)
71. Ibid. [↑](#endnote-ref-71)
72. OP, p. 228: [E]isdem dispositionibus quibus una forma conservatur in materia, potest alia similis forma introduci de novo in sua materia. Hoc antecedens declaratur: Ignis conservatur calore et siccitate; ergo calore et siccitate poterit induci forma ignis in ligno citra aliam superadditam dispositionem … Sed anima conservatur in sua materia per solam temperiem primarum, et secundarum qualitatum; ergo per solam temperiem inducetur in materia nutrimenti per actionem nutritivam. [↑](#endnote-ref-72)
73. OP, p. 129. [↑](#endnote-ref-73)
74. On Telesio’s account of celestial heat, see Hiro Hirai, “Il calore cosmico in Telesio fra il *De generatione animalium* di Aristotele e il *De carnibus* di Ippocrate,” in *Bernardino Telesio tra filosofia naturale e scienza moderna*, edited by Guiliana Mocchi et al. (Rome: Serra, 2012), pp. 71-83. [↑](#endnote-ref-74)
75. OP, p. 232: “magis … requiritur ad conservandam formam in materia. Nam ad conservandam formam nulla advertitur resistentia passi; ad transmutandam vero materiam intervenit aliqua resistentia passi: & sic maior virtus requiritur ad transmutandum. Et haec est ratio quare corpora inanimata, ut lapides, &c. non transmutent materiam sibi proximam, quia limitatam habent virtutem ad se conservanda tantummodo. Quare corpora viventia habent facultates, ut augeantur virtus suarum primarum qualitatum.” [↑](#endnote-ref-75)
76. OP, p. 231: “Illa autem qualitas, quae dimanat ab anima, media potentia, est aliquid superadditum ipsi temperamento per modum actus & formae perfectioris, Neque est necessarium, ut sit eiusdem specificae naturae cum primis, sed eminentialis cuiusdam rationis, quae respicat temperamentum unitum ut sic, & illam unionem conservet & confirmet.” [↑](#endnote-ref-76)
77. Santacruz (1624), 10: “Sola … temperies naturalis conservatur a forma substantiali membri per se: & si amittitur talis temperies (ut per morbos fit) potest a principio interno emanare, semoto prohibente.” [↑](#endnote-ref-77)
78. OP, p. 12. [↑](#endnote-ref-78)
79. OP, p. 231. [↑](#endnote-ref-79)
80. HP, p. 61: “quantum attinet ad ipsum esse actionum, omnes sunt naturales, neque in sua ratione includunt vitalitatem: at vero vitales erunt ex peculiari habitudine ad animam, ut ad principium coniunctum in eodem supposito se movente.” [↑](#endnote-ref-80)
81. HP, p. 62: “cum non sit anima, tenemur dicere esse quamdam formam mixti, quam eruditi vocant formam mediam, quia ordinatur in aliam; igitur forma haec media & suum temperamentum, rationem induunt instrumenti, servato tamen ordine; ita, ut immediata qualitas, qua materia disponitur sit calor temperatus, passibiles enim qualitates sunt accidentia, quae proprie ad generandas substantias assumuntur. Et ob id dicebat Aristoteles: *Generatio & corruptio primarum qualitatum est opus*. Istae enim penetrant, & disponunt intime materiam usque ad inductionem formae. Quod si motus localis necessarius est (ut formatio fiat, & diversa positio partium in loco) etiam a primis qualitatibus secundario proficiscitur; ita ut virtus alterativa, & loco motiva, tanto inserviant operi.” The quotation that Santacruz ascribes to Aristotle is, as far as I can see, not found in the Latin version of *De generatione et corruptione*; cf.Aristotle, *De generatione & interitu …, Meteoron …, De mundo …, De animalibus …* Translated by Petrus Alcyonius (Venice: Bernardus Vitalis, 1521). On the scholastic doctrine of *forma media*, see Annelise Meier, “Die Struktur der materiellen Substanz”, in Annelise Meier, *And der Grenze von Scholastik und Naturwissenschaft*, 2nd ed. (Rome: Edizioni di Storia e Letteratura, 1952), pp. 1-140. [↑](#endnote-ref-81)
82. HP, p. 63: “ad actiones vitales creatas … non requiritur, ut omnia instrumenta vivant; sed requiritur, ut omnia dirigantur a principio vitali.” [↑](#endnote-ref-82)
83. Ibid.: “ut sit instrumentum, sufficit sola directio: & ut sit actio vitalis, sufficit directio connexa principio viventi.” [↑](#endnote-ref-83)
84. HP, pp. 63-64: “Anima est intrinseca forma musculi, ibi exercet suam potentiam motivam intrinsecam. In musculo, ut in propria & disposita materia, invenies componentes partes spiritum implantatum, nervum, carnem, & movet igitur anima per musculum viventem; & hoc sufficit (ut aliquid demus Scaligero), sed non omnia, quae ibi concurrunt, vivere oportet: spiritus per nervum delatus non vivit, licet vicat nervus: ita similiter spiritus vitalis cordis; sed diriguntur ad actiones vitales modo quo possunt dirigi ab anima; non tamen est necessarium ut vivent …” [↑](#endnote-ref-84)
85. On the origins of two-seed theories of animal generation, see Michael Boylan, “The Galenic and Hippocratic Challenges to Aristotle’s Conception Theory.” *Journal of the History of Biology* 17 (1984), pp. 83–112. [↑](#endnote-ref-85)
86. HP, p. 160: “Probaret certe Scaliger, si unumquodque semen perfectum quoddam esset, & adaequatum rei producendae exordium.” [↑](#endnote-ref-86)
87. Ibid.: “Non sunt appellanda duo semina, species distinctae, sed duae partes, quae unum conficiunt integrum instrumentum, distantque a vera ratione, & natura speciei, quantum distant a fine. Uniuntur ergo, ut entia partialia, in unum, ad unum formam adquirendam …” [↑](#endnote-ref-87)
88. Ibid.: “[L]icet patrem, & matrem adaequatas causas eiusdem ordinis esse aliquis putet, quantum ad productionem prolis, hoc intelligendum substantialiter, & radicaliter, inspiciendo animas, quae sunt eiusdem prorsus naturae, & principia formalia quo, non vero quantum ad instrumenta immediata. Sic enim alter alterius indiget adminiculo, & semina emittunt partialia.” [↑](#endnote-ref-88)
89. HP, pp. 61-62. [↑](#endnote-ref-89)
90. Feyens, *De formatrice foetus*, p. 94. [↑](#endnote-ref-90)
91. Ibid., p. 97; see Aristotle, *Physics*, 256a22-256b2. [↑](#endnote-ref-91)
92. Ibid.: “instrumentum non potest agere, nisi prius motum ab agente principali.” [↑](#endnote-ref-92)
93. Ibid., p. 99. [↑](#endnote-ref-93)
94. Thomas Aquinas, *Summa Theologiae*, III, q. 62, a. 5, co. [↑](#endnote-ref-94)
95. Feyens, *De formatrice foetus*, p. 99. [↑](#endnote-ref-95)
96. Ibid., p. 100. [↑](#endnote-ref-96)
97. Ibid., p. 102. [↑](#endnote-ref-97)
98. Ibid., p. 103: “Agere in ratione instrumenti, est agere per virtutem aliquam sibi propriam, sed adiutam ac directam influxu actuali agentis principalis; quo attollitur ad producendum effectum multo nobiliorem, quam virtute propria assequi posset.” [↑](#endnote-ref-98)
99. HP, p. 71: “[S]i tunc istae machinae et horologia moventur absente artifice et gubernante; signum est certissimum, praecessisse contactum illius, et reliquisse impressam motus directionem, per impressionem virtutis artificialis factam in principio …” [↑](#endnote-ref-99)
100. Ibid.: [↑](#endnote-ref-100)
101. Ibid.: “semen recepit virtutem a generante per verum contactum physicum et mathematicum …” [↑](#endnote-ref-101)
102. E.g., OP, pp. 23-24, 26-27, 38 [erroneously paginated as 44], 41, 44, 46, 48, 55, 58, 126, 130, 143-144. On the philosophical aspects of Gentile’s work, see Roger French, *Canonic Medicine. Gentile da Foligno and Scholasticism* (Leiden and Boston: Brill, 2001). [↑](#endnote-ref-102)
103. Gentile da Foligno, *Primus Avi[cennae] Canon. Avicenne medicorum principis canonum liber. Una cum lucidissima Gentilis Fulgi[nei] expositione* ([Venice], 1520), fol. 83v: “[D]ico quod spiritus defert virtutem sicut instrumentum motum defert principale movens: sed spiritus est huiusmodi, est enim animae instrumentum … Sed tu dices quis modus delationis est iste? Dicendum quod si spiritus defert virtutem, non defert ipsam: quia virtus & anima spiritui dat suam formam: sed quia virtus dat illi spiritui modum motus per quem spiritus ad membra perveniens possunt membra formaliter in eorum operationes: et est sicut videmus quod ars que est in anima fabri non dat suam formam igni & malleo; sed bene dat illi modum motus per quem possunt ad actum deducere formam cultelli de potentia materie ferri.” [↑](#endnote-ref-103)
104. OP, p. 285: “sicut spiritus recepit modum motus a corde & cerebro, ita ipse spiritus postea active dirigit ipsa membra ad motum. In generatione spiritus illius materia suscepit formam ad movendum, seu ipsam motionem, postea vero in membris ipsis communicavit illam.” [↑](#endnote-ref-104)
105. Ibid.: “si coniunctum, ut verba Gentilis explicare videntur, & exempla artificis declarant, magnae oriuntur difficultates: nam si spiritus in cerebro acquirit istam motionem, ut malleus a fabro, quo pacto ipsemet Gentilis cum Avicenna contendit spiritum in partibus dearticulari ad proprios motus obeundos? Ita enim dicendum est, non esse instrumentum cerebri coniunctum, vel cordis, siquidem non operatur per illamet formam, quam recepit, sed per aliam partialem.” [↑](#endnote-ref-105)
106. Ibid.: “ego, qui nunc recipio influxum caeli, non illum destruo, sed ad modum recipientis recipio. Ita similiter spiritus qualitatem istam recepit a cerebro, & corde, motionem, scilicet ad opera. Rursus cum in partes singulares inciderit, non amittit modum illum, sed in talem motionem membra ipsa disponit; quantumvis determinetur a temperie, & forma partis.” [↑](#endnote-ref-106)
107. OP, p. 72; pp. 284-285. [↑](#endnote-ref-107)
108. OP, p. 285. [↑](#endnote-ref-108)
109. Thomas Feyens, *Pro sua de animatione foetus tertia die apologia* (Louvain: Apud Vidua Henrici Hasteni, 1629), p. 73. [↑](#endnote-ref-109)
110. HP, p. 77. [↑](#endnote-ref-110)
111. HP, p. 113. [↑](#endnote-ref-111)
112. HP, p. 72. [↑](#endnote-ref-112)
113. HP, p. 69. [↑](#endnote-ref-113)
114. HP, p. 74; OP, p. 290. [↑](#endnote-ref-114)
115. OP, p. 284. [↑](#endnote-ref-115)
116. OP, p. 285. [↑](#endnote-ref-116)
117. Toletus, *In octo libros Aristotelis de Physica auscultatione. Item in libros Aristotelis de generatione et corruptione*, fol. 271v; OP, p. 280; on the doctrine of the whole soul being as a whole in each part of the body, see Marleen Rozemond, “Descartes, Mind-Body Union, and Holenmerism,” *Philosophical Topics* 31 (2003), pp. 343-367. [↑](#endnote-ref-117)
118. OP, pp. 13; 58. [↑](#endnote-ref-118)
119. OP, p. 129. [↑](#endnote-ref-119)
120. OP, p. 218. [↑](#endnote-ref-120)
121. See [note suppressed for anonymous review]. [↑](#endnote-ref-121)
122. See [note suppressed for anonymous review]. [↑](#endnote-ref-122)
123. OP, p. 284. [↑](#endnote-ref-123)