

**ARISTOTLE'S CAUSAL FRAMEWORK: THE STANDARD
MISINTERPRETATION OF ARISTOTLE'S THEORY OF BIOLOGICAL
REPRODUCTION**

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by

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ABSTRACT

Aristotle's Causal Framework: The Standard Misinterpretation of Aristotle's Theory of Biological Reproduction

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In the standard literature today, the prevalent view concerning Aristotle's theory of reproduction in *Generation of Animals* is the argument that Aristotle conceives of a system in which the end goal of reproduction is the generation of the male. This teleological system then would only produce female animals as the result of a failure in the process of reproduction. This belief has prompted contemporary commentators to charge Aristotle with gender bias underlying his theory of reproduction. In this thesis, I challenge the standard view of Aristotle's theory of reproduction, particularly the 'Degrees of Perfection' model which lies at the heart of the male-oriented teleological conception, an interpretation argued for by Karen Nielsen. I argue that this interpretation is influenced by a currently standard account of Aristotle's causal framework and does not accurately portray Aristotle's account of biological reproduction. The standard view leaves out several key passages on external efficient causation that undermines the standard reading's causal framework. I advance the position that Aristotle does not operate on a 'Degree of Perfection' model, but rather in a framework in which opposites anchor a continuum. In this

framework, external efficient causation plays more than a preventative role in Aristotle's causal account. Without this standard account of Aristotle's causal framework, I believe there is still a lot to uncover about the relationship of external efficient causation in natural processes, and to the extent in which it plays as a means to an end.

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INTRODUCTION

Aristotle's causal framework, defined in his four modes of causal explanation; formal, material, efficient, and final causation, played a fundamental role in all of his philosophical commitments. Being the first of the ancients to combine these separate modes of explanation into one unified theory, Aristotle was the first to offer a robust theory of causation with his four causal account that acted as a powerful tool of investigation in understanding the phenomena around us. More meticulously, his theory also provided a unique understanding of the systematic interrelations between the four causes that identified the roles they played in causal interactions. With such a rigorous account of causation, you could say that it's bound to lead to some degrees of misinterpretation when applying his causal theory to a wide range of causal processes.

In this thesis, I set out to research and explore this causal theory by looking specifically into Aristotle's biology to see what his biological causal framework offered us in terms of understanding his overall causal theory. I was drawn particularly to his theory of reproduction which, in the recent literature, his causal framework has been under fire for, facing many criticisms by leading contemporary philosophers and sociologists.

In our contemporary view of Aristotle's theory of reproduction, papers coming out of the recent literature charge Aristotle's reproductive theory with sexism, arguing that his theory of reproduction is based on underlying gender bias against the female sex. In Aristotle's *Generation of Animals*, several of these contemporary commentators argue that Aristotle's theory of reproduction is teleologically ordered towards the production of an offspring in the form of the male, and that female animals are the result of a failed teleological process. Therefore, with no

basis in which to assert that female animals are the deficient sex, Aristotle's theory is informed by an underlying sexist slant against females.

This topic caught my attention particularly because the line of argumentation makes specific reference to the teleological end of the process of reproduction; the final cause. That makes these criticisms of Aristotle inherent to his causal framework and the role of final causation in his reproductive process. Through extensive research into the topic, I analyzed the arguments and the framework that these criticisms were based on and noticed a fundamental mistake that led these commentators to the conclusions they arrived at; they all base their arguments on, what I will argue, is a traditional misinterpretation of Aristotle's causal framework, the Thomistic tradition, which today can be treated as the standard view of Aristotle's account of causation.

The Thomistic interpretation of Aristotle's four causal account, attributed to the 13th century philosopher and theologian St. Thomas Aquinas, has come to be the standard view of Aristotle's theory of causation today because of the fact that so many of today's contemporaries draw their understanding of causal interactions from this model. As I mentioned before, such a rigorous account of causation being applied to so many various frameworks of phenomena were bound to lead to some misinterpretation somewhere along the line when taking into account the systematic interrelationships between the four causes, and here I will argue that this standard view, the Thomistic model, is indeed built off of a fundamental misinterpretation of Aristotle's causal framework.

In this thesis, I will aim to show that the Thomistic model is actually a traditional misinterpretation of Aristotle's causal framework, and that it does not accurately reflect the causal relationships Aristotle outlines in the text, particularly in the *Physics* and *Generation of*

Animals. The criticisms that we see in the recent literature targeting Aristotle's theory of reproduction then are actually generated from a traditional misinterpretation since they base their argument on this standard view. Aristotle may have and probably did hold sexist attitudes, but here I will argue the charges toward his reproductive framework are not accurate to what we find in the text.

In the *Physics* and *Generation of Animals*, Aristotle draws specific attention to the role of efficient causation through external forces that play an important role in his theory of reproduction. I will show the passages from the text where Aristotle explicitly calls attention to these external forces and argue that this account of efficient causation is lost in the standard view. By leaving out the role of these external efficient causes, the standard view gives into a fundamental misinterpretation of Aristotle's causal framework, and it is this misunderstanding that generates the criticisms that we see in the recent literature. After recognizing the role of external forces in Aristotle's theory of reproduction, moving forward we will see that there is still much more to be understood about efficient causation in Aristotle's robust causal framework.

1. THE STANDARD VIEW

We will begin with understanding what this standard view of Aristotle's theory of reproduction is that we see generally reproduced again and again in the recent literature. It should be noted that the standard reading of Aristotle's theory of reproduction is by definition just a consensus of generally related points, albeit some of these points being necessary to constitute being part of the standard view that we will address later, that make up our traditional understanding of his framework; that's what makes it the standard view. But in an effort not to commit to a fallacy of weaving together differing accounts and presenting them as one unified "standard view", I will instead draw the model predominantly from Karen Nielsen, a contemporary philosopher who advocates for Aristotle's sexist bias and the main philosopher I will address in this thesis. In her paper, *The Private Parts of Animals: Aristotle on the Teleology of Sexual Difference*,¹ Nielsen outlines what I will later argue keeps in line with the standard reading.

Here is the standard reading of Aristotle's theory of reproduction: It begins with a process of concoction (Nielsen 375). This process of concoction is applied to both of the sexes, but yields different results due to the difference of natures between the male and the female.² In males, the process of concoction results in the production of semen, a hot and airy residue that preserves high levels of vital heat. In females however, the concoction halts prematurely, yielding a wet and relatively cold menstrual fluid, or menses, with low levels of vital heat. The male's semen

¹ Nielsen, Karen M. "The Private Parts of Animals: Aristotle on the Teleology of Sexual Difference." *Phronesis* 53, no. 4/5 (2008): pp. 373-405.

² Aristotle indicates in *GA IV 1* that the male and female are distinguished by the capacity or incapacity to complete this process of concoction: "For the male is that which can concoct and form and discharge a semen carrying with it the principle of form" (*GA IV, 1, 765b9-11*).

contains both a formal principle and material elements, or matter, whereas the female's menses contains only matter. Aristotle clarifies what is meant by the formal principle contained in the male semen:

The semen of the male differs in that it contains a principle within itself of such a kind as to set up movements also in the embryo and to concoct thoroughly the ultimate nourishment (...). (*GA IV, 1, 766b12-14*)

By 'principle' I do not mean a material principle out of which comes into being an offspring resembling the parent, but I mean the first moving cause, whether it have power to act as such in the thing itself or in something else. (*GA IV, 1, 765b11-14*)

After the process of concoction is complete, the process of generation begins once copulation takes place. The male's formal principle acts as the catalyst which begins the formation of the embryo once combined with the female's matter, creating a generative residue (*GA IV, 3, 767b15*). The menses in this process provides the matter for the semen to shape through formal and efficient causation resulting in the formation of a fetus. What happens after this unity is determined strictly by the heat present throughout the process. A male will be produced only if the level of the semen's vital heat is sufficiently hot to resist the excessive coldness of the menstrual fluid. If the semen is sufficiently hot enough, the generative residue successfully concocts in the menstrual fluid, resulting in an offspring of the male form in the likeness of the father. If the semen is insufficiently hot, it is unable to 'master' the female's menstrual fluid in the womb, the generative residue unable to successfully concoct, thus resulting in the production of a female. Aristotle illustrates this all in a passage from *GA IV, 3*:

If the generative residue in the menstrual fluids is properly concocted, the movement imparted by the male will make the form of the embryo in the likeness of itself. (Whether we say that it is the semen or this movement that makes each of the parts grow makes no difference; nor again whether we say that it makes them grow or forms them from the beginning, for the formula of the movement is the same in either case.) Thus if this movement prevail, it will make the embryo male and not female, like the father and not like the mother; if it prevail not, the embryo is deficient in that faculty in which it has not prevailed. (*GA IV, 3, 767b15-24*)

The male's formal principle is in the likeness of the male, but subsequent movements afterward depart it from the original form:

For when the first principle does not bear sway and cannot concoct the nourishment through lack of heat nor bring it into proper form, but is defeated in this respect, then must the material change into its opposite. Now the female is opposite to the male (...). (*GA IV, 1, 766a17-21*)

This is the standard view of Aristotle's theory of reproduction within which our contemporary commentators operate within. The standard view is articulated best by the contemporary philosopher Gad Freudenthal:

[A]ccording to Aristotle, the offspring receives its form from the male parent: the male semen, by virtue of the vital heat it has received during concoction in the sire's body, informs the matter supplied by the female (the menses). The ideal-type case is that in which the male semen informs the female matter into its like: the offspring is then a male closely resembling the male parent. The condition for this to happen is that the semen carry sufficient vital heat as to enable it to master thoroughly the (relatively cold) female matter (*cf. GA 4. 3, 767b21ff; 768aff*): the greatest vital heat thus generates in the matter the most perfect form, that of the sire. (*G. Freudenthal, Aristotle's Theory of Material Substance. Heat and Pneuma, Form and Soul, Oxford: Clarendon Press, 2002, p. 24.*)

As we can see, Freudenthal's statement above keeps with the standard reading we see from Nielsen. Completely unaltered by means of sufficient vital heat of the embryo in the womb, a male will be born in the father's likeness. In this way, Aristotle seems to identify a system in which, if the process of concocting the generative substance in the womb is successful, a male will always be produced. Montgomery Furth, another contemporary commentator charging Aristotle with sexism, argues that this process of reproduction is teleologically ordered towards producing a male in the like of the father.³ Similarly, the previously quoted Freudenthal deems the production of the male as the ideal-type case in which the process of reproduction is naturally ordered towards. Karen Nielsen also goes on to argue that Aristotle construes the female as

³ Montgomery Furth, *Substance, Form and Psyche: an Aristotelian Metaphysics* (Cambridge: Cambridge University Press, 1988), p. 140.

deficient relative to the male as the result of coming about from an incomplete and failed teleological process.

So what is the argument for the male form being the final cause of reproduction? According to Nielsen, when the semen lacks the sufficient amount of vital heat necessary to overcome the coldness of the female's menstrual fluid, the material must change to its opposite, resulting in a female (*GA IV, 1, 766a16-22*). In these cases, nature has departed from the type that would have resulted had the process been successful. Because females result from nature departing from the type, males must be the ideal-type case: "(...) for in these cases nature has in a way departed from the type. The first departure indeed is that the offspring should become female instead of male" (*GA IV, 3, 766b7-10*). This is the male-first principle. Since this male-first principle is intrinsic to the reproductive process, it appears that nature aims at producing offspring in the form of the male, and that females result only from the failure of this process. Thus, Aristotle's reproductive process seemingly is teleologically ordered towards the production of male animals.

Drawing on the previous work of Charlotte Witt,⁴ Nielsen goes further and coins this teleological theory as the "Degrees of Perfection" model. In this model, the form of a species can be held to greater and lesser degrees depending on the success of the generative process. To make this work, Nielsen also endorses a view from Witt that in order to remain members of the same species, male and female members must have identical forms (Nielsen, 378). Thus, males hold the human form to a greater degree than females, and while female animals still hold the capacities that are essential to being a part of a species, they hold the species' form to a lesser

⁴ Charlotte Witt, "Form, Normativity, and Gender in Aristotle. A Feminist Perspective", in C. A. Freeland (ed), *Feminist Interpretations of Aristotle* (University Park, PA: The Pennsylvania State University Press, 1998), pp. 118-137.

degree of perfection. Another way to look at these degrees is by measuring the form in terms of actualization. A male is the fully actualized form of man, while females are deficient forms that never fully actualized during the generative process.

Overall, in this model, a deficient amount of vital heat in the process of reproduction correlates to the formation of a less actualized, deficient form to a lesser degree of perfection, the female. Under this model in which nature seems to aim at producing males, the charge of sexism against Aristotle seems pretty compelling. The criticisms from Nielsen, Furth, Freudenthal, and others all build off of the notion that Aristotle's theory is teleologically ordered towards producing males in the father's likeness. All of these commentators have something else in common however that brings them to the conclusion that the final cause of reproduction is the generation of an offspring in the form of the male; what they all have in common is that all of their arguments draw from the standard view.

2. THE STANDARD CAUSAL ACCOUNT

Up to this point we have seen the description of our contemporary view of Aristotle's theory of reproduction. It is a model containing two processes, one of concoction and one of generation. During the process of concoction, semen is formed in the male while menstrual fluid forms in the female. Throughout the formation of the offspring in the generative process, the disparity between the semen and the menstrual fluid in terms of vital heat plays a key role in determining the resulting sex. If the generative residue lacks a sufficient amount of vital heat, the process fails producing a female. Given a sufficient amount of vital heat however, the generative residue concocts unhindered producing offspring in the male form.

We have also seen the arguments that have come out of the recent literature from a range of contemporary commentators that argue Aristotle's theory of reproduction is informed by an unjustifiable case of gender bias against females. Because Aristotle indicates that the male form is the ideal-type case given his comments about females resulting when nature departs from the type, this leads to the conclusion that the production of male offspring must be the teleological end of the reproductive process. This conclusion then identifies a sexist bias embedded in Aristotle's four causal account as it's related to reproduction, specifically in final causation.

Nielsen reframes Aristotle's theory of reproduction, emphasizing the teleology that lies in its roots. She titles this theory the "Degrees of Perfection" model, and in this model she argues that Aristotle is committed to a hierarchy of form in each species. The generative process operates within its ability to fully actualize the embryo in its development. If the semen's vital heat is sufficient enough to overcome the female's menstrual fluid, a fully actualized male forms

as a result. If the semen is insufficiently hot, the generative process produces a deficiently actualized form of the species, the female.

Everything we've gone over up until now is considered to be the standard view of Aristotle's theory of reproduction considering this view is commonly assumed in the literature. And given this standard view, the criticisms we see coming out of the literature against Aristotle are compelling. But where exactly does this standard view come from? And is this standard view that's assumed in the literature actually accurate to the text?

The idea that a defectively actualized substance can result in any case in which a formal and material cause combine is not a new concept coming from the recent literature. The idea has roots going back all the way to the 13th century philosopher and theologian St. Thomas Aquinas. Christopher Byrne is a contemporary philosopher who, in his book *Aristotle's Science of Matter and Motion*,⁵ draws specific attention to this standard view and connects it to Aquinas. He outlines this standard account (Byrne, 5) as such:

- 1) All entities are hylomorphic; combinations of form and matter
- 2) In a process of generation, a formal cause is combined with a material cause
- 3) The efficient cause brings about the change in the material cause
- 4) If the efficient cause bringing about the change is not powerful enough to master the material substance, the result is a defective substance, one in which the formal cause has not completely actualized
- 5) The defective actualization of the formal cause causes the substance to be abnormal, and all physical substances can be prevented from behaving normally by external causes.
- 6) In addition to 5, other external substances can act on them in ways that prevent them from exercising their distinctive capacities
- 7) In either case, only the material cause is responsible for irregular or abnormal behaviors
- 8) The regular, unimpeded behavior of a natural substance is due to its formal cause

⁵ Christopher Byrne, "Aristotle's Science of Matter and Motion", Toronto; Buffalo; London: University of Toronto Press, 2018.

This Thomistic account is an interpretation of Aristotle's causal framework, and it begins with Aristotle's concept of hylomorphism, a fundamental principle to Aristotle's philosophy that treats substances as a combination of form and matter. During any process in which a hylomorphic substance is produced, this happens as a result of the combination of some formal cause with some material cause, or a combination of form and matter. So this not only applies to reproduction, but it also occurs when any hylomorphic entity is produced.

During this process of combination however, efficient causation plays a vital role in the success of the process. As I alluded to earlier, a detailed account of the relationships between the four causes becomes more challenging to interpret from Aristotle, but the following is the Thomistic view, which the standard view derives from: If the efficient cause throughout the process of combination of form and matter is not powerful enough to 'master' some aspect of the material cause, the resulting hylomorphic substance becomes defective, one in which the formal cause never completely actualizes. As a result, the defective actualization of the formal cause leads the substance to be abnormal and vulnerable to external influences. Following this vulnerability, these external influences can act on them in ways that prevent them from exercising their distinctive capacities. This framework entails two conclusions, the first being that only the material cause is responsible for the defective, and thus the resulting substance's irregular or abnormal behaviors. The second conclusion is that the regular, unimpeded behavior of a natural substance is due to its formal cause.

Now let us compare this Thomistic interpretation of Aristotle's causal framework with our standard view understanding of Aristotle's theory of reproduction that we find dominating the literature. After the process of concoction occurs, the semen and menstrual fluid combine during the process of generation. A formal cause combines with a material cause in that the

male's semen provides the formal principle while the female contributes the majority of the matter. As these two combine into one unified generative fluid, the efficient cause now plays the pivotal role of actualizing the substance, in this case the embryo. If the efficient cause is not powerful enough to master the material cause, specifically here by a lack of vital heat, the result is a defective substance, one in which the formal cause, the male's formal principle, never fully actualizes. Coming about from this defective substance is a female offspring, and it is the female's material deficiency that allows external causes to alter the process later on when that female animal undergoes the process of reproduction.

It is clearly evident here that our standard interpretation of Aristotle's theory of reproduction perfectly aligns with this Thomistic interpretation of Aristotle's causal framework, and this is actually no surprise. Nielsen makes specific reference to Aquinas in her argument, agreeing with him "as far as the broad strokes are concerned" (Nielsen, 374). What she agrees with Aquinas about comes from *Summa Theologiae* 1a, q. 92, 1 ff ("*De productione mulieris*"). Aquinas frames the male's formal principle as the "active force" in the male seed, the semen. This active force aims at the production of a male in the likeness of the father, while a female results when there is some defect in the active force or through some material indisposition. Despite some difference in terminology, we can see that the standard view stretches all the way back at least to Aquinas.

Aquinas' views expressed in the *Summa* and the resulting Thomistic framework we see embedded in our standard view of Aristotle's theory of reproduction naturally gives rise to the criticisms of gender bias that we have seen coming out of the literature. The arguments we have seen by contemporary commentators like Nielsen describe Aristotle's theory of reproduction as teleologically ordered towards the production of male offspring. It is important to note however

that this identification of final causation arises from this Thomistic causal framework. Because of the role efficient causation plays in generation, the formal cause must ‘master’ the material cause in order to fully actualize. We arrive then at the conclusion that only the material cause is responsible for defects, and that the successful generation of an offspring comes from the full actualization of the formal cause. From here we can see that the final cause of reproduction then is reducible to the formal cause. The final cause aims at producing a male offspring, and the male offspring is the fully actualized formal cause. Therefore, the Thomistic model of Aristotle’s causal framework itself generates the teleological aspect that gives rise to the criticisms of embedded sexism by the nature of its causal framework reducing final causation to the actualization of the formal cause.

The rise of teleology and the previously mentioned criticisms from the Thomistic framework also naturally leads to Nielsen’s “Degrees of Perfection” model. The hierarchy of perfection in Nielsen’s model comes from degrees of actualization, and it is the ability for the material cause to become defective through a deficient efficient cause that produces hylomorphic substances that are not fully actualized. As I mentioned previously, Nielsen takes the male and female members of the same species to hold identical forms, and it is the degrees of perfection that distinguish their characteristics (Nielsen, 378). This is consistent with the Thomistic model which indicates that the generative process aims at producing a fully actualized offspring, the male. Females are then just defective forms of the male, occupying the form to a lesser degree of actualization. This leads the Degrees of Perfection model, following in line with the Thomistic framework, to make the bold claim that a species’ true form is that of the male since that is the fully actualized form of the species.

In conclusion of this section, we can see that the standard view of Aristotle's theory of reproduction is consistent with the Thomistic framework that we find in the *Summa*. Byrne's outline of the standard, Thomistic view reframes some of the 13th century language of Aquinas with terms more in keeping with what we would find in Aristotle's text about his causal framework. The causal framework the standard view operates within gives efficient causation a role that aims at fully actualizing the formal cause. The efficient cause lacking the power to master the material cause however results in a defective, not fully actualized substance whose form is held to a lesser degree of perfection than the fully actualized formal cause. Since the full actualization of the formal cause defines the success of the process, this indicates that the final cause of reproduction is the full actualization of the formal cause, and thus the final cause of reproduction is reducible to the formal cause. This Thomistic model then generates the criticisms of sexism it faces since the criticisms rest on the concept of teleology towards male offspring.

Is this Thomistic interpretation of Aristotle's causal framework actually accurate to what we find in Aristotle's texts though? This is an important question. If it is inaccurate, not only does this mean our standard understanding of Aristotle's theory of reproduction is wrong and that we must reject the criticisms that generate from it. But it also means that there is a fundamental misunderstanding in our interpretation of Aristotle's causal framework. Such a misunderstanding in something as fundamental as Aristotle's four causal account can have consequences that extend far beyond just Aristotle's biology. The systematic interrelationships between the causes in Aristotle's causal framework during generation are fundamental to his physics, and his physics are the basis for many other realms of Aristotle's scientific inquiry.

In the following section, I am going to give reasons for us to reject the Thomistic model after looking into the text. There are several key passages left out of our traditional

understanding of Aristotle's theory of reproduction that shed light on how we should understand Aristotle's causal framework. Once we see how these passages give us reason to reject the Thomistic model, we will be able to understand our need for a more robust account of Aristotle's causal framework.

3. EXTERNAL EFFICIENT CAUSATION IN ARISTOTLE'S FRAMEWORK

The Thomistic model currently dominates the contemporary literature surrounding Aristotle's theory of reproduction. As we previously saw, Aristotle's reproductive process included both the process of concoction and the process of generation. Once the semen and the menstrual fluid combine, the process of generation ensues following the standard, Thomistic interpretation of Aristotle's causal framework outlined by Byrne. This framework gives efficient causation a role that aims at fully actualizing the formal cause. However, the efficient cause lacking the power to master the material cause results in a defective, not fully actualized substance whose form is held to a lesser degree of perfection than some substance in which the formal cause fully actualized.

In this section, we're going to go into the text of Aristotle to see if this standard view is an accurate account of his causal framework. Several passages are going to indicate that it does not, particularly from Aristotle's *Physics* and *Generation of Animals*. We will see that there are many external factors that play into Aristotle's theory of reproduction that aren't mentioned in the standard view. The role that Aristotle gives these external factors challenge our standard interpretation of his reproductive framework, and the resulting claims of gender bias that build off of this standard view I will argue are baseless by the nature of being generated from an inaccurate interpretation of Aristotle's causal framework.

To begin, when we look deeper into Aristotle's texts, we find that this standard view actually does not give us the full picture of his theory of reproduction. There are several profound passages that tell us a different story of not only Aristotle's theory of reproduction, but

also ultimately of his causal framework. I am going to begin with one very short, but deeply significant sentence from Aristotle's *Physics* that fundamentally challenges the standard conception of Aristotle's theory of reproduction: "Man is begotten by man and by the sun as well" (*Phys II, 2, 194b13-15*).

In this sentence, Aristotle indicates that not only does man come from man, but also from the sun. But how are we to make sense of this? Man comes from man via reproduction, so it seems as though Aristotle is suggesting that the sun too plays a role in the reproductive process in some way. But how so? Remember, it is the vital heat of the material causes in the semen and menstrual fluid throughout the process of generation that determines the offspring's sex. A sufficient amount of vital heat in the semen allows it to overcome the menstrual fluid to produce a male whereas an insufficient amount of vital heat causes a departure from the male to the generation of a female animal. The sun's role in this process then it seems is to alter the temperature of the vital heat through external efficient causation. By affecting the external temperatures surrounding the material causes before and after the process of reproduction, the vital heats of both the semen and the menstrual fluid are altered, and as a result, the impact of the sun via external temperature plays a key role in determining the outcome of the reproductive process. The sun's role in the reproductive process then would be as an external efficient cause.

In the standard view of Aristotle's theory of reproduction, we are not introduced to the idea at all of this external efficient causation; that the external temperature of the environment could have an impact on the material causes by external efficient causation. If the sun can have an impact on generation by altering external temperatures, then we should expect to see other instances where other external efficient causes too can alter temperature. And that is exactly

what we see in several passages throughout *Generation of Animals*. He mentions the role of external heat again, this time related to the moon:

Also the fact that menstruation occurs in the course of nature rather when the month is waning is due to the same causes. For this time of the month is colder and moister because of the waning and failure of the moon; as the sun makes winter and summer in the year as a whole, so does the moon in the month. This is not due to the turning of the moon, but it grows warmer as the light increases and colder as it wanes. (*GA IV, 2, 767a1-7*)

In this passage, Aristotle explicitly draws attention to the moon's impact as an external efficient cause on the female animal's menstrual fluid. The external temperature grows warmer as the light increases due to the phases of the moon. Particularly in the time when the moon enters the waning phases, the external temperature becomes colder, making this time of the month colder and moister. Aristotle also indicates that for the same reasons, menstruation occurs more often during the waning parts of the month. What we can conclude from this is that more male animals will be born in the warmer parts of the year, while more females will be born in the colder parts.

It makes sense now that the sun and moon would have a drastic impact on the external temperatures of an organism and therefore would play some role of external efficient causation in the reproductive process. The light generated from the sun or reflected from the moon carries heat, and so obviously will have an impact on external temperatures. But does Aristotle mention any not-so-obvious sources that too could act as external efficient causes in the reproductive process? The answer is yes; *Generation of Animals IV, 2* is full of them. Aristotle acknowledges that factors such as the food an organism eats varies the temperature of the semen and menstrual fluid as well (*GA IV, 2, 767a30-32*), and even something as particular as the direction the wind is blowing during copulation has an effect on the temperature:

Again, more males are born if copulation takes place when north than when south winds are blowing; for animals' bodies are more liquid when the wind is in the south, so that they produce more residue – and more residue is harder to concoct; hence the semen of

the males is more liquid, and so is the discharge of the menstrual fluids in women. (*GA IV, 2, 766b33-37*)

In this passage, Aristotle illustrates exactly how it is that the wind affects the material causes in the semen and the menstrual fluid. Furthermore, just to show to the degree of mutability his reproductive process allows based on these external factors in the production of offspring of either of the sexes, Aristotle gives a very particular account of external efficient causation:

The shepherds also say that it not only makes a difference in the production of males and females if copulation takes place during northern or southerly winds, but even if the animals while copulating look towards the south or north; so small a thing will sometimes turn the scale and cause cold or heat, and these again influence generation. (*GA IV, 2, 767a8-12*)

Once again, the standard Thomistic account does not draw any attention to these external efficient causes. But why do these external efficient causes matter? And do they oppose the standard view? As we saw before in the standard view, during generation the formal cause brings about the change in the material cause via the efficient cause. And if the efficient cause bringing about this change is not powerful enough to master the material cause, the process results in a defective substance in which the formal cause never completely actualizes. In this view, efficient cause only plays a preventative role, either actualizing the formal cause or preventing it from actualizing from a lack of power; in the case of reproduction, a lack of insufficient heat.

By adding external efficient causation into the mix however, you begin to see a shift in the language. Instead of a preventative role, external sources give efficient causation more of a regulatory role. These external sources, like the sun for example, create periods of hot and cold, and these periods regulate between producing males or females via external temperature impacting the material causes always or for the most part. Going back to Aristotle's simple quote in *Physics*, man is begotten by man and the sun, why would Aristotle reference the sun as part of the reproductive process and not the other external sources like, for example, the wind? As

opposed to the sun, wind is inconsistent, and as such, the amount of fluctuation does not play a consistent regulatory role. The sun however is responsible for the seasons, and the seasons are consistent throughout a year. Therefore, it seems like Aristotle is aiming away from the preventative role of efficient causation we see in the standard view. Rather, it seems like he is indicating that the role of efficient causation through external sources plays more of a regulatory role in which males and females are produced consistently always or for the most part.

Not only does this shift in the role of efficient causation align with the text, but it also responds to some more criticisms coming out of the recent literature targeting Aristotle's theory of reproduction. Nielsen, after arguing that Aristotle's theory of reproduction is teleologically ordered towards the production of males, finds trouble reconciling this teleology with respect to his general criteria for attributing teleology to a process that he is committed to in *Physics* II, for, as Nielsen claims, "nature does not produce males always or for the most part" (Nielsen, 374). Nielsen is operating under the standard Thomistic framework and so assigns teleology in this reproductive process towards the production of males. But, as she notes, this leads to an inconsistency in the *Physics* in which teleological processes must produce their teleological end always or for the most part to fit the general criteria for attributing teleology to a process. Nielsen calls this the "frequency" problem.

By acknowledging external efficient causes and shifting our language as I mentioned previously, Nielsen's problem can be altogether avoided, as the "frequency" problem arises from the Thomistic model. Allowing efficient causes like the sun to play a regulatory role rather than a preventative role has an impact on the causal framework altogether. Instead of the final cause being reduced to the formal cause; in reproduction the final cause being reduced to the production of the male, the teleology changes when introduced to the consistent regulatory role

of the sun. Since Aristotle indicates that the sun plays a role in the process of reproduction, the final cause of reproduction wouldn't be the male, as that is not produced always or for the most part. But because the sun regulates the external temperature through consistent seasons, and since the varying temperatures produce both males and females always or for the most part, I would make the claim that Aristotle acknowledges that by means of the sun's external efficient causation, the process of reproduction is teleologically ordered towards the preservation of the species, producing both males and females which is necessary for continuation.

So now we have seen how changing the role of efficient causation from inhibitory to regulatory changes our perception of the final cause. But the ability for the efficient cause to be unable to 'master' the material substance still leaves room for a substance to hold differing degrees of actualization. In the next section, I will show how the Thomistic model disregards Aristotle's framework of opposites, and why this gives us cause to further reject it.

4. THE ROLE OF OPPOSITES IN ARISTOTLE'S FRAMEWORK

In the previous sections, I started out by presenting Nielsen's account of Aristotle's theory of reproduction. I gave her arguments for how Aristotle misconstrues the female as deficient to the male in generation and how his theory ultimately identifies as being teleologically ordered towards the production of male animals. I then showed how this teleology and the resulting 'Degrees of Perfection' model required a treatment of Aristotle's causal framework that aligned with what is considered the standard view in contemporary literature. This standard view interpretation was outlined by Byrne, and, after some research into the text, several passages from Aristotle showed a different treatment of efficient causation contrary to the standard view. Finally, we saw that the telos of reproduction as the male wasn't consistent with the regulatory nature of the sun as Aristotle indicated in *Physics* when he explicitly said that man and the sun beget man.

In this section, I will argue further reasons to reject the standard view. The Thomistic causal framework gives rise to the idea of actualization, and it is this concept that has developed into the 'Degrees of Perfection' model which identifies the male's form to be fully actualized while everything else of the species holds that form to a lesser, defective degree. This hierarchy model is contrary to some of Aristotle's major philosophical commitments however, particularly his framework of opposites. The role opposites play in Aristotle's philosophy highlight a fundamental concept seen all throughout the text; and that is ratio. I will end by explaining how the standard view does not utilize the concept of opposites and ratio in Aristotle's causal framework, and how it is these fundamentals that are an important mechanism that make a richer, more robust causal framework.

Aristotle's framework of opposites is a fundamental concept that presupposes almost all of his philosophy, and a framework of opposites naturally gives rise to the concept of ratio. Ratio is just the measured relation between two opposites. For example, this framework of opposites can be seen in his famous concept of the 'golden mean' in which Aristotle conceives of some ratio existing between two extremes of excess and deficiency that would be considered virtuous. His framework exists with two opposite forms anchoring a continuum. Although the ratio can vary, it will always lie somewhere on the continuum as a measure between the two opposites.

With this framework of opposites in mind, let us now return back to Aristotle's theory of reproduction. The 'Degrees of Perfection' model, a consequence of the standard view, insists on a hierarchy, not opposites. A hierarchy identifies something ideal with degrees of defect, and this does not parallel with Aristotle's framework of opposites in which not only is there defect, but excess as well. The ideal in the framework of opposites would be the 'golden mean', and this ratio would not be at the end of the continuum like we see in the 'Degrees of Perfection' model. As I previously mentioned in section two, Nielsen explicitly agrees with Witt that every species only has one ideal form, that of the male. And following the standard view's hierarchy structure, everything else would just be defective forms of the male.

The next question is to ask whether or not Aristotle intended for his framework of opposites to apply to his theory of reproduction. If we can show that Aristotle is committed to a continuum of opposites here, this will once again challenge the validity of the standard view which relies on the hierarchy structure. To answer this, once again we return to the important concept completely left out of the standard reading's account; external efficient causation. Aristotle makes specific reference to the role these causes play in reproduction. Whether minor or major factors, any external source that can cause a change in the material cause plays a role in

reproduction. This change shifts the material cause, and if we were to apply these external efficient causes to the standard view, they would only play a preventative role by shifting the material cause away from the type, preventing the formal cause from fully actualizing.

Going back to the passages I previously mentioned regarding the external efficient causes like the sun, moon, wind, etc., we see once again that Aristotle is not committed to the causes only playing a preventative role. These efficient causes don't just shift the material causes towards defect, but also shift the other way. Consider a case of reproduction in which the male's semen, without the influence of external sources, is insufficient in mastering the female's menstrual fluid. With the help of external efficient causation, the material cause can be shifted positively in order to produce a male but only in a framework of opposites. Under the standard view, the hierarchy structure fails to explain this as a result of the causal framework, particularly clause 7 of Byrne's outline which states that only the material cause is responsible for irregular or abnormal behaviors.

Looking into the text, we can once again find more textual evidence to give us reason to reject the standard view. Under this Thomistic framework, there is only one form of a species and it's held to greater and lesser degrees of actualization. But this opposes what Aristotle says in *Generation of Animals*:

For when the first principle does not bear sway and cannot concoct the nourishment through lack of heat nor bring it into its proper form, but is defeated in this respect, then must the material change into its opposite. Now the female is opposite to the male (...).
(*GA IV, 1, 766a17-21*)

Aristotle here clearly identifies the female form as existing opposite to the male form, and his framework of opposites becomes evident. He even expands upon this framework by pointing to ratio:

However, [the forms of male and female] also need a certain correspondence with one another; for all things that come into being as products of art or of nature exist in virtue of

a certain ratio. Now if the hot preponderates too much it dries up the liquid; if it is very deficient it does not solidify it; for the product we need the due mean between the extremes. (*GA IV, 2, 767a15-20*)

Once again, the hierarchy model, the framework where the continuum runs from defect to ideal form, is refuted by Aristotle's comments here where he mentions the "due mean between the extremes", the extremes confirming the framework of opposites in which the continuum runs from two extremes, defect to excess. By showing that Aristotle's theory of reproduction operates on a framework of opposites, we now have another piece of evidence to show just how the standard, Thomistic view misinterprets Aristotle's causal framework.

Aristotle never suggests that the male form is the teleological end of the reproductive process. Rather, this is assumed by Nielsen and the other commentators that tap into the standard view who use it to generate the criticisms they argue. At most Aristotle indicates that the process begins with male not because it is the final goal of some teleological process, but because the male form is included in the male's material contribution via the previously mentioned formal principle contained in the semen, and it is this contribution that initiates the process. In terms of this process, the male form is prior to the female's in a temporal sense, and this is because the male contributes what is actual, the formal principle, while the female only contributes potential. These characterizations would not then be a result of sexist attitudes, but a description of his causal process.

CONCLUSION

In conclusion, today I called your attention to the arguments coming out of the recent literature charging Aristotle with underlying gender bias in his biology. In this thesis, I did not argue that Aristotle did not hold any sexist attitudes, but rather my position was that the charges laid out by Nielsen and others based their arguments on what I refer to as the standard view, a reading of Aristotle's theory of reproduction that I believe is a long-held misinterpretation.

In the first section, we went through the standard view. It is a model containing two processes, one of concoction and one of generation. During the process of concoction, semen is formed in the male while menstrual fluid forms in the female. Throughout the formation of the offspring, the disparity between the semen and the menstrual fluid in terms of vital heat plays a key role in determining the resulting sex. If the generative residue lacks a sufficient amount of vital heat, the process fails producing a female. Given a sufficient amount of vital heat however, the generative residue concocts unhindered producing offspring in the male form.

After explaining the standard view, I laid out the arguments that have come out of the recent literature from a range of contemporary commentators that argue Aristotle's theory of reproduction is informed by an unjustifiable case of gender bias against females. Because Aristotle indicates that the male form is the ideal-type case, this leads to the conclusion that the production of male offspring must be the teleological end of the reproductive process. This conclusion then identifies a sexist bias embedded in Aristotle's four causal account as it's related to reproduction, specifically in final causation.

Nielsen expands on this standard view by drawing attention to the implications of the standard view's teleology. She titles this theory the "Degrees of Perfection" model, and here she

argues that Aristotle is committed to a hierarchy of form in each species. The generative process operates within its ability to fully actualize the embryo in its development. If the semen's vital heat is sufficient enough to overcome the female's menstrual fluid, a fully actualized male forms as a result. If the semen is insufficiently hot, the generative process produces a deficiently actualized form of the species, the female.

In the next section, I presented Byrne's outline of the standard model which he traced all the way back to the 13th century philosopher and theologian, St. Thomas Aquinas. Byrne's outline of the standard, Thomistic account fit perfectly Nielsen's arguments and the standard view of Aristotle's theory of reproduction. I showed that the causal framework the standard view operates within gives efficient causation a role that aims at fully actualizing the formal cause. The efficient cause lacking the power to master the material cause however results in a defective, not fully actualized substance whose form is held to a lesser degree of perfection than the fully actualized formal cause. Since the full actualization of the formal cause defines the success of the process, this indicates that the final cause of reproduction is the full actualization of the formal cause, and thus the final cause of reproduction is reducible to the formal cause. This Thomistic model then generates the criticisms of sexism it faces since the criticisms rest on the concept of teleology towards male offspring.

In the third section, I presented some passages from Aristotle's texts to test if this standard view was an accurate account of his causal framework. Several passages indicated that it did not, particularly from Aristotle's *Physics* and *Generation of Animals*. There were passages that referred to external factors that played into Aristotle's theory of reproduction that couldn't be found reconciled with the Thomistic interpretation. The role that Aristotle gave these external factors challenged our standard interpretation of his reproductive framework, and the resulting

claims of gender bias that built off of this standard view I argued were baseless by the nature of being generated from an inaccurate interpretation of Aristotle's causal framework.

In section three and four, I gave key arguments that utilized our understanding of the standard view's shortcomings and sought to give evidence for why the Thomistic framework didn't match the causal framework Aristotle outlined throughout his texts. In the second half of section three, I first attacked Nielsen's identified "frequency" problem, which only was a problem because of the misinterpretation. I showed that to solve the problem required a change in our perception of the telos. Changing reproduction to be teleologically ordered towards the preservation of the species instead of the production of the male allowed external efficient causation to play a regulatory role instead of the standard view's preventative role.

In the last section, I compared the hierarchy model of form found in the concept of 'Degrees of Perfection' with Aristotle's fundamental framework of opposites. The hierarchy model stated that only one ideal form existed of a species, the male, and that everything else is a defective, unactualized form of the male. This opposed Aristotle's framework of opposites however which drew upon the idea of extremes that anchor a continuum. The causal framework in which efficient cause shifted the material cause resulted in a change of ratio on the continuum in either direction which the hierarchy model is limited from doing based off of their framework. This framework of opposites also was consistent with assigning final causation not to the formal cause, the male, but to the preservation of the species.

I will now conclude with calling our attention to our need to explore more of this subject matter. How are we supposed to understand external efficient causation in Aristotle's theory of reproduction after we move away from the standard Thomistic tradition and how it relates to final causation? We can now understand external factors like the sun and food as external

efficient causes playing more than just a preventative role, and instead varying the ratio of female and male elements during the reproductive process. These efficient causes then have the ability to shift the material cause towards or away from both the male or female form resulting in something regulated by temperature and not aimed specifically at the production of the male. This raises some interesting questions that I am going to end on. With efficient causation varying complex systems in the way we have seen, how then are we to understand final causation in, for instance, the process of reproduction? And to what extent does efficient cause act incidentally or as part of an end?

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