

Soul's Tools

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According to the embryological theory in *de Generatione Animalium* (*GA*), the male parent—or, as Aristotle will sometimes say, the male parent's nature or nutritive soul—is the agent of generation. The father provides the principle of form, and generation is effected when the matter that is supplied by the mother comes to take on that principle of form.¹ The male's nature accomplishes this by means of what Aristotle calls “movements” or “motions” (*kinêseis*).²

And as the products of art are made by means of the tools of the artist, or to put it more truly by means of their motion, and this is the activity of the art, and the art is the form of what is made in something else, so is it with the power of the nutritive soul. As later on in the case of mature animals and plants this soul causes growth from the nutriment, using heat and coldness as its tools (for its motion is in these), and each thing comes into being in accordance with a certain formula, so also from the beginning does it form the product of nature. (*GA* II.4, 740b25-34)

Just as an artist uses tools, or more properly speaking, the motions of the tools, to bring about some product, so too does nutritive soul. Heat and coldness, or more properly speaking, the heating and cooling—the motions that are “in” them—are the means by which

¹ Cf. *GA* I.2, 716a4-7; I.20, 729a9-11; I.21, 730a27; II.4, 740b24-5.

² *Kinêseis* is a difficult word to render in English. Perhaps a useful model for conceiving of these would be the metabolic changes taking place in certain bio-chemical processes, such as the rising of bread dough, or the fermentation process involved in making beer. Those familiar with *GA* will also notice that I sometimes talk about “movements” or “motions” in the plural where the Greek has the singular. My reason for doing so is ease of presentation. I think the *kinêsis* Aristotle refers to earlier in *GA* is complex, consisting of a multitude of *kinêseis*, which he only has reason to discuss separately when accounting for sexual differentiation and inherited traits in Book IV.

nutritive soul activities are performed. Just as the eyes are the tools by means of which an animal exercises its perceptual capacities, or the hand is the tool by means of which humans grasp and use other tools (the “tool of tools”³), the motions that heat and coldness give rise to are the tools by means of which various vital activities are accomplished, such as self-maintenance and reproduction.

Some scholars, however, have supposed that Aristotle’s references to the instruments by which nutritive soul activities are performed are simply references to the soul. So, for instance, David Balme claims that Aristotle “equates the soul with ‘movements’ in the bodily tissues and blood.”⁴ Using cybernetic processes as a model, he proposes that we think of soul as a “complex of self-limiting interactions” in the blood and generative residues. The motions in the spermatic fluids are, on Balme’s view, “potentially [the offspring’s] adult soul.”⁵ In a similar vein, Gad Freudenthal argues for an interpretation according to which nutritive soul and what he calls “vital heat” are “two equivalent descriptions” of the same thing.⁶ In his view, “it is erroneous to think of Aristotle’s vital heat as merely an efficient cause used by the soul as an ‘instrument’.”⁷

One advantage of such interpretations is that they obviate the need to puzzle about how the using of tools by soul is to be spelled out. The soul is incorporeal, and a nature is not an intentional agent, so it is not completely obvious what it means to say that soul or nature uses tools. That is a difficult question, one that afflicts not only the talk of a nature using heat or motions as tools, but also the descriptions of natures and incorporeal souls as agents throughout Aristotle’s biological works. If, as some have claimed, the motions or vital heat are merely another way of describing the soul or nature, there is no need to explain how

³ *DA* III.8, 432a102

⁴ Balme 1987b: 279

⁵ Balme 1987a: 292

⁶ Freudenthal 1995: 31. Vital heat, according to Freudenthal, is “heat carrying informing movements” (*ibid.*: 28) or heat “charged with specific, formative movements” (*ibid.*: 29). Those formative movements endow vital heat with the ability to “inform” and so transform matter into a living substance. On his interpretation, vital heat is “capable of effecting the operation in which we are interested: the generation of structured composite substances, specifically ensouled substances, and their subsequent material persistence” (*ibid.*:22). Insofar as vital heat has this ability, it can do precisely what Aristotle says that nutritive soul does. Freudenthal infers from this that soul and vital heat are identical.

⁷ *ibid.*: 3.

an incorporeal soul or nature can be using tools in the way that a carpenter can physically manipulate a hammer.

In my view, the identification of soul with either the motions or heat is a mistake. But it is instructive to see why it is a mistake, and what we miss out on if Aristotle's biological theory is read in this way. In section 1, I will present the details, as I understand them, of the causal roles that the motions are playing in animal generation. In section 2, I will argue that the way Aristotle resolves a particular problem for his embryological theory shows that he really does view the motions of heat and coldness as tools or intermediate agents. Finally, in section 3, I will indicate two ways in which it is significant that these are tools, and not identical to soul.

I.

For Aristotle, an animal's generative and self-maintaining activities (such as digestion and growth) are continuous processes, both of which constitute the exercise of nutritive soul capacities.⁸ All of these processes take place by means of concoction (*pepsis*). As Aristotle explains in *Meteorology* IV, concoction is the process whereby the natural heat in a body acts upon the matter proper to that body,⁹ making the "indeterminate" moisture evaporate.¹⁰ Since living organisms perform various vital activities by concoction, and since concoction requires heat, living organisms must have a source of internal, natural heat.¹¹ In blooded animals, this heat has its origin in the heart, which is the seat of nutritive and perceptive soul.¹²

Although it is somewhat overly simplistic, we can think of animal generation as unfolding in three main stages. The first stage is the process of transforming food into blood and blood into spermatoc residues. Once food is broken up in the mouth, it is first concocted

⁸ *DA* II.4, 415a25-6; 416a19.

⁹ Concoction can also occur with the aid of external heat, such as by fire for cooking, or warm baths for assistance in digestion (at least according to *Meteor* 379b21ff).

¹⁰ *Meteor* 379b18. Heat, like coldness, is an active power that effects changes by "mastering" the passive powers, the moist and the dry. At the most basic level, the action of heat and cold on moist and dry gives rise to the elements—earth, air, fire and water (*GC* II.3, 330a30-b1).

¹¹ *DA* II.4, 416b28-30; *de Juv* 470a19-20

¹² *GA* II.6, 743b25-6. In the remainder, I am restricting the discussion to blooded animal kinds.

in the stomach.¹³ The nutriment then passes into the blood vessels that attach to the intestines and then, by means of further concoction, is turned into blood. The blood moves through the body in the blood vessels and as it is “divided into portions”¹⁴ it both nourishes and promotes the growth of the limbs and organs. Thus the blood is the “final form of nourishment”.¹⁵ An organism’s nutritive blood is its living body *in potential*.¹⁶

Since there is usually more blood than is needed for the maintenance of the organism, the excess blood can be further concocted into residues that provide some benefit—the so-called “useful” residues—such as the spermatoc ones. Females have weaker internal heat than males do, so female blood is only concocted into menses (*katamēnia*). The menses is the matter for the new organism, and is, in potential, all the parts of the organism that will come to be formed out of it.¹⁷ The male’s blood is concocted into a “pure” residue—semen.¹⁸ This semen is composed of water and *pneuma*, which is described as “warm air”, a frothy or foam-like substance, akin to the tiny bubbles formed by heating milk.¹⁹

The male’s semen, at least typically, is that through which (*dia*) the source of movement and generation and the principle of form is supplied.²⁰ The semen has this power to impart form, not because of any bodily part of it, but in virtue of “motions” that are present in it,²¹ residing in the *pneuma* that the semen contains. Although Aristotle does not tell us exactly how they acquire these motions, it is clear that the spermatoc residues inherit the specific motions (*kinēseis*) that were in the parents’ blood.²² These residues, he says,

¹³ *PA* II.3, 650a13-14; III.1, 662a15ff

¹⁴ *GA* II.3, 737a18-20

¹⁵ See also *PA* III.5 668a1-4: “The reason why the blood vessels are distributed all over the body is that blood (and in bloodless creatures, its counterpart) is the material out of which the whole body is constructed, and blood vessels (and their counterparts) are the channels in which this material is carried.”

¹⁶ *PA* III.5, 668a23-4

¹⁷ “The female’s contribution, of course, is a residue too, just as the male’s is, and contains all the parts of the body *potentially*, though none *in actuality*; and ‘all’ includes those parts which distinguish the two sexes.” (*GA* II.3, 737a22-25)

¹⁸ *GA* II.3, 737a27-9

¹⁹ *GA* II.2, 736a13-17; II.3, 736b36

²⁰ *GA* I.2, 716a5-6; I.21, 729b12-14; II.1, 732a4-5

²¹ Although not entirely clear what Aristotle means, in *GA* IV.3 we learn that the male’s motions are present “in actuality” while the female’s motions are present only “in potential.”

²² This becomes clear once Aristotle appeals to these motions to explain inherited characteristics in *GA* IV.3.

“move with the same movement as that in virtue of which the body grows through the distribution of the ultimate nourishment,” i.e., the blood.²³

The second stage occurs once the semen enters the uterus and imparts the motions that were produced by the heat in the *pneuma* to the female’s residue. This stage of generation involves “setting” or congealing the menses, making it assume its determinate form.²⁴

There are, then, some animals which are not formed from *sperma*, as I have in fact said already.²⁵ All blooded animals are formed from *sperma*, as many as are formed as the result of copulation, with the male emitting semen into the female; when this has entered the female, the animals are “set” and take on their proper form. (*GA* II.1, 733b18-21)²⁶

After the initial setting is complete, a rudimentary heart is formed.²⁷ Now, at stage three, the new embryo possesses its own principle of life, having its seat in the heart, and it is this new embryo’s nutritive soul principle that controls the ensuing process of development.²⁸ The new organism’s nutritive soul controls the subsequent growth, using

²³ *GA* II.3, 737a18-20, Peck trans. These motions, moreover, are said at 740b32 to be “in” (*en*) heat and coldness, which I think natural to understand as meaning that they are the motions of heat and coldness, i.e., the specific processes of heating and cooling that heat and coldness bring about. Cf. “Now heat and coldness and the motions they set up as the bodies are solidified by the hot and the cold ...” (*Meteor.* IV.12, 390b2ff). See also *de Motu* XI, 703b14-5: “The cause of the motions is heat and coldness...”

²⁴ Aristotle likens this initial “setting” to the coagulation of milk by fig-juice or rennet: *GA* I.20, 729a9-14; *GA* II.4, 739b20-30.

²⁵ I am transliterating here, since it is not clear how *sperma* should be rendered. Peck translates *sperma* as “semen,” presumably taking it to be a reference to those organisms that directly impart motion at 729b22-25 and 738b10ff. It could also be translated as “seed” and taken as a reference to spontaneously generated organisms, mentioned in I.1, 715a24-5.

²⁶ Cf. *GA* II.4, 739a6-7: “When the *sperma* from the male enters, it sets the purest portion of residue.”

²⁷ “After the *archê* is formed, the other parts are formed, the internal ones earlier than the external, as I have said” (*GA* II.6, 741b25-26; trans. Peck). The context makes clear that the heart is the *archê*. Cf. *de Juv* 468b28; *GA* II.5, 741b15-17; *GA* II.6, 743b25-6.

²⁸ *GA* II.6 742a32-b2: “...it is necessary that some part in which the principle of change [exists] obtain first (for straightaway this part is one and most controlling for the end), and then after this the whole and the end, and third and last the parts instrumental to these for

those motions that were transferred at stage two to produce the developing parts and organs out of the nourishment provided by the mother, typically *via* the umbilicus.²⁹ The motions that were carried in the semen are, in this last stage of generation, used to directly build all of the embryo's body parts.³⁰

In *GA* IV.3, we are told more about the way in which these motions (derived from the parents' blood) figure in explaining how offspring come to inherit particular traits not shared by members of the kind. He opens the chapter with a statement of the phenomena he is going to explain: offspring tend to resemble their parents and ancestors, though they sometimes do not, and in extreme they cases do not even look like a member of their kind, but merely like an animal.

Some offspring take after their parents and some do not; some take after their father, some after their mother, both with respect to the whole body and with respect to each part, and they take after their parents more than their earlier ancestors, and they take after their ancestors more than after any chance persons. Males take after their father more, females after their mother. Some take after none of the ancestors, although they take after some human being at any rate; others do not take after a human being at all in their appearance, but have gone so far that they resemble a monster. (*GA* IV.3, 767a35-b5)

In discussion that follows, Aristotle says that there are motions not only for producing the offspring's particular traits but also for more general ones. In the course of that discussion, he refers to "motions and potentials" corresponding to the generator insofar as he is a male,

some uses. So that if there is some such thing which in fact necessarily obtains in animals, the thing having the principle of the entire nature and the end, this necessarily comes to be first: *first*, insofar as it is moving, but *at the same time as the whole*, insofar as it is part of the end." Cf. *GA* II.4 740a5-7; *de Juv* 469a5-7; 469b4-6.

²⁹ *GA* II.5, 740a29-31; 740b8-11

³⁰ Cf. *GA* II 1, 734b22-24: "Well then, the semen is such, and has such a motion and principle in it, with the result that when the motion stops, each of the parts comes to be and is ensouled." The motions that are used will be, Aristotle says, "correctly proportioned" to each of the parts (*GA* II.6, 743a26-9). To the extent that the heating and cooling motions are not proportionate, the parts that are formed will be correspondingly deformed (743a29-32).

insofar as he is a particular male, insofar as he is a human, and even insofar as he is an animal.

The generator is not only a male but also such a male, e.g. Coriscus or Socrates, and he is not only Coriscus but also human.... In each case the *idion* and individual is stronger. For Coriscus is both human and animal. But human is nearer to the *idion* than animal. Both the individual and the *genos* generate, but the individual more... For this reason, motions are present from the potentials in the spermatic residues of all such things. (*GA* IV.3, 767b24-6, 29-33, 35-6)

If the motions are directly constructing the embryo's body, Aristotle is here saying that there are motions for producing not only the very determinate parts and features any particular organism will come to have, but also motions for parts and features it will have in virtue of being merely a human, or merely an animal. This is, admittedly, odd, and most scholars have opted to read the references to "potentials and motions" corresponding to Coriscus *qua* human and *qua* animal in a way that would not have this implication.³¹ But the thought that there are such 'general' motions, e.g., motions for producing merely 'human' or 'animal' parts, is reinforced by a passage at 768b10-15, where Aristotle claims that in extreme cases, the motions—and he seems to be talking about the motions for very particular features—get so "blurred" that the offspring will fail to resemble any of its ancestors and is "merely human."³² And again, at 768a12, he refers to motions "of the universal (*katholon*),

³¹ For example, Charlotte Witt claims that there are two explanatory tasks being accomplished by Aristotle's invocation of *kinêseis*: one is to explain the "presence of form...which is contributed by the motions in the male sperm" (Witt 1985: 52), and the other is to explain familial resemblances. In her view, "movements of the universal" is an oblique reference to movements that bear the form or soul (*ibid*, 56). It is undeniable that the motions or changes in the male sperm are "conferring" or conveying form or soul. But that need not mean, as Witt supposes it does, that any subset of the changes are to be identified with the specifically soul-conveying motions.

³² Andrew Coles denies that "there is a motion which is universal or common to the species apart from the aggregated motions from each of the particular parts normally causing resemblance" (Coles 1995: 80). He proposes that we understand Aristotle to be saying that in cases of extreme failure, such as when the offspring is "merely human", what has happened is that the *kinêseis* derived the particular parent's blood (and which "carry the individual characteristics of this or that individual") undergo a loss of "sharpness and

such as animal and human.” Assuming these are motions for producing body parts, it appears that there are, in fact, motions for producing animal- and human-specific parts and organs, just like the ones for producing the individual-specific traits, such as some particular nose shape. Although odd, I think there are at least three options for understanding this in a way that is more plausible than it might first appear.

The ‘general’ motions could be those used in the early stages of development. For, embryonic development proceeds, according to Aristotle, from most general to most specific:

For, an animal and a human do not come to be at the same time, nor an animal and a horse, and similarly in the case of the other animals. For the end (*telos*) comes to be last, and the peculiar (*idion*) is the end of each *genesis*. (*GA* II.3, 736b2-5)

Perhaps general motions are for producing the body parts formed in the early stages of development, whereas the particular ones are for later stages of the embryo. So, for instance, Socrates’s semen might carry a motion for producing a human nose, distinct from the motion for producing the particular snub-nose that Socrates has. The general, “mere-nose” motion could make the mere-nose by creating two passages at the front of the face, or perhaps by creating a roughly nose-shaped mass of flesh. Later, the particular nose shape motion gives that mere-nose its particular snub-nose shape. In some passages, Aristotle appears to indicate that this is his view:

In the early stages the parts are all traced in outline; later on they get their various colors and softness and hardness, for all the world as if a painter were at work on them, the painter being nature. Painters, as we know, first of all sketch in the figure of the animal in outline, and after that go on to apply the colors. (*GA* II.743b20-25; trans. Peck, modified)

specificity” (Coles 1995: 81).

So, it is possible that Aristotle is thinking of general motions as those for producing “sketches” or “outlines” of parts. But a second, perhaps more plausible option is to think of those motions for being merely human or merely animal as changes for producing the internal parts and organs shared by members of the kind, in virtue of which an organism is a member of that kind. An organism might be merely an animal when it has, for example, a heart. For, sentient soul resides in the heart,³³ and possession of sensation distinguishes animals from plants. So, perhaps a motion for being merely an animal is one that will produce a heart.

I suspect that part of the oddity in thinking that there could be general motions stems from the assumption that causes can be read off from effects, and there are not any “general” effects. After all, all of the new organism’s parts and organs are fully determinate. However, there is a way to think about the motions responsible for the offspring’s body parts such that these can be general, despite there being no general effects.

Consider an analogy with the sort of explanation that a Newtonian physicist might give for a body moving in an elliptical orbit. The elliptical orbit will be explained, perhaps, in terms of gravitational and inertial forces or motions. The interaction between the two forces (depending on the mass, distance from other bodies, etc.) results in the elliptical path in which the body actually ends up traveling. The elliptical orbit is not caused by any particular elliptical motion or force. Rather, the cause of the elliptical orbit is a complex force or motion.³⁴

Similarly, an Aristotelian biologist might explain the particular nose shape of some offspring in terms of the general nose motion interacting with particular motions. A mere-nose never actually comes to be formed, but that does not mean that a motion for producing something so general is not operative. The nose that is actually formed is not caused by a motion for producing precisely that nose shape, but rather is a product of several motions, some of which are general, and some particular.

However we iron out this particular wrinkle, what is important to take away is that in Aristotle’s theory, the motions are assigned a direct role in producing different body parts out of matter. This is, of course, also what the soul or nature does, in so far as it is the agent of generation. However, it does not follow from the fact that both soul and the motions are

³³ *GA* II.6, 743b25-6; *de Juv* 469a5-7.

³⁴ I owe the example to conversations with Alan Code.

said to produce the new organism³⁵ that they are simply “equivalent concepts”³⁶ or “equivalent descriptions”³⁷ of the same thing, as Freudenthal claims.³⁸ This does not follow, because Aristotle can ascribe agency to two things while not intending to identify them. For instance, Aristotle says in *GC* I.7, 324a29-30, that the doctor heals, and that the wine heals, but surely he does not expect us to infer that the medical art or the doctor is identical to the wine. So, the inference from ‘both assigned role of producing the same thing’ to ‘identical’ is not warranted in general. And that inference is not warranted in this particular case, either. The motions are not identical to soul but rather are related to soul as tools are related to a user. In fact, Aristotle’s embryological theory requires that they be so related, as will be seen in the next section. In the final section, I will argue that the conflation of soul and the tools involved in the production of a living organism entirely overlooks what is significant about Aristotle’s relegating those motions to the status of tools.

II.

Earlier in *GA*, when discussing the way that the male makes his contribution to generation, Aristotle draws on an analogy with the way a craftsman imparts the form of the product to the material:

The male does not emit semen at all in some animals, and where he does this is no part of the resulting embryo. Just as no material part comes from the carpenter to the material, i.e. the wood in which he works, nor does any part

³⁵ It is not clear whether Freudenthal’s view is that vital heat produces new organisms. Although he sometimes says that vital heat is capable of generating substances, e.g. in the passage quoted above in footnote 6, he says elsewhere that the “account in terms of heat applies to homoeomerous substances only” (Freudenthal 1995: 46). Regardless whether he is making the stronger or weaker claim, it would still seem a mistake to identify nutritive soul with the instruments by which it operates.

³⁶ Freudenthal 1995: 19

³⁷ *ibid.*: 31

³⁸ “[H]ow does the physiological account in terms of vital heat *qua* informing power relate to the psychological one in terms of nutritive soul? It would seem that where both accounts are applicable, Aristotle holds an identity theory: Aristotle’s physiological theory assigns to the vital heat the role of producing the forms of homoeomerous parts, a role which the psychological theory attributes to the working of the nutritive soul” (*ibid.*: 1995: 29-30).

of the carpenter's art exist within what he makes, but the shape and form are imparted from him to the material by means of the motion he sets up—it is his hands that move his tools, his tools that move the material; it is his knowledge of his art, and his soul, in which is the form, that move his hands or any other part of him with a motion of some definite kind, a motion varying with the varying nature of the object made—so, too, in the male of those animals which emit semen, nature uses the semen as a tool and as possessing motion in actuality, just as tools are used in the products of any art, for in them lies in a certain sense the motion of the art. Such, then, is the way in which these males contribute to generation. (*GA* I.22, 730b9-23; trans. Platt)

Just as the craftsman imparts the form to the material by means of the motions of his tools, so too the nature of the male imparts substantial form by means of *sperma* which has “motion in actuality”.

Both in this passage and elsewhere in *GA*, Aristotle makes clear that it is the motion residing in the semen, and not some bodily part of it, that is the tool by which the male imparts form.³⁹ For example, among animals that do not emit semen, the motion is transferred directly:

For some of them do not emit semen but, just as those which do emit it fashion by the movement in the semen the mass forming from the material supplied by the female, so do the animals in question bring the same to pass and exert the same formative power by the motion within themselves in that part from whence the semen is secreted. (*GA* II.4, 738b11-15; trans. Platt)

Sometimes, the male's nature is “too weak” and cannot be productive “through others”, as the semen-emitting males can, but are rather like a craftsman who has the material brought to him.⁴⁰ In certain insect kinds, the female inserts some part of herself into the male, since his motions are “only just strong enough when nature watches over the business” (730b28-9,

³⁹ *GA* I.21, 729b4-21; II.4, 738b23-5

⁴⁰ *GA* I.22, 730b24-7

Peck trans.). The male's nature is, in these cases, like a modeler working directly with his hands on the clay, rather than like a carpenter. Either through semen or directly, substantial form is conveyed through the motions set up by the male parent and transferred to the matter.

This particular detail of his embryological theory—namely, that the father acts by means of the motions—is used to resolve a particular problem about generation. In a difficult passage at 733b23-735a29, Aristotle announces that there is a “considerable puzzle” about how plants and animals come to be out of seed (*ek spermatos*) (733b23).⁴¹ He refines the question to make clear that this is a puzzle not about the matter for generation, but about the agent. What is it “by which” the new organism is formed (733b31-32)? The problem is that there seems to be no obvious candidate that satisfies the following two principles to which Aristotle is committed.

First, just as nearly all of his contemporaries, and just as most people until Newton discovered the existence of gravitational forces, Aristotle does not believe in action at a distance.⁴² A mover can only move, and an agent can only act, by making contact with that

⁴¹ Since he is including plants, it seems that he means by *sperma* the first combination of the male and female principles, since these are not separate in plants. This is further confirmed by his use of *kuêma* at 734a5 to refer to the same thing that he uses *sperma* for elsewhere in the passage.

⁴² As an aside, it is unclear whether or not Newton thought bodies act on one another at a distance, even though the discovery of gravity appears to be responsible for subsequent acceptance of action at a distance: “... I have not as yet been able to deduce from phenomena the reason for these properties of gravity, and I do not feign hypotheses. For whatever is not deduced from the phenomena must be called a hypothesis; and hypotheses, whether metaphysical or physical, or based on occult qualities, or mechanical, have no place in experimental philosophy” (*Principia*, General Scholium, in Newton 2004: 92).

“It is inconceivable that inanimate brute matter should, without the mediation of something else, which is not material, operate upon and affect other matter without mutual contact, as it must be, if gravitation in the sense of Epicurus, be essential and inherent in it. And this is one reason why I desired you would not ascribe innate gravity to me. That gravity should be innate, inherent, and essential to matter, so that one body may act upon another at a distance through a vacuum without the mediation of anything else, by and through which their action or force may be conveyed from one to another, is to me so great an absurdity, that I believe no man who has in philosophical matters a competent faculty of thinking can ever fall into it. Gravity must be caused by an agent acting constantly according to certain laws; but whether this agent be material or immaterial, is a question I have left to the consideration of my readers.” (Letter to Richard Bentley, 25 Feb. 1692/3 in Newton 2004: 102). Thanks to Jasper Reid for pointing me to these passages.

which is moved or acted upon. Call this the “contact requirement.”⁴³ In *GA* II.1, this contact requirement is explicitly flagged as a constraint on any adequate theory of generation:

It is not possible to move something without touching, and nothing can be affected in any way by another if it does not move it. (*GA* II.1, 734a3-4)

Second, Aristotle repeatedly says that “all the things coming to be by nature or by art come to be by something which is actually such as that out of which it comes to be is in potential.”⁴⁴ Call this the “agential synonymy requirement.”⁴⁵ So, given that what is being generated is a living being, the agent needs to be “some part of soul or soul or something having soul.”⁴⁶

Aristotle’s favorite and often repeated example of a synonymous agent of substantial change is the parent who is the agent producing the offspring: Human begets human. But the male parent does not make contact with the matter, at least not directly. The *sperma*, on the other hand, does make contact. But *sperma* does not have the form—in this case, soul—in actuality.⁴⁷ Aristotle’s resolution of this puzzle involves showing how it is possible for the male parent to be the agent of generation, despite not being in direct contact with what is

⁴³ Cf. “Action and passion properly understood are not possible between things which cannot be in contact with each other.” (*GC* I.6, 322b22-4).

⁴⁴ *GA* II.1, 734b2-2. Cf. *GA* II.1, 734a30-1

⁴⁵ Cf. “It is clear from what has been said that in a way everything comes to be from something synonymous.” (*Metaph* VII.9, 1034a21-30) “That which is in actuality always comes to be out of something that is in potential by (the agency of) something that is in actuality, e.g. human begets human, and a musician produces a musician; there is always some first mover, and the mover is already in actuality. It has been said in our discussions about substance that the thing coming to be comes to be out of something and by the agency of something, and this is the same in form.” (*Metaph* IX.8, 1049b24-29) “Each substance comes to be from something synonymous” (*Metaph* XII.3, 1070a4-5). This principle would seem to be violated in the cases of spontaneously generated organisms and hybrids. I am going to leave this to the side here, but see Burnyeat 2001: 33-7 for a discussion of such exceptions to the principle.

⁴⁶ *GA* II.1, 733b33-734a1

⁴⁷ Before the male’s semen “sets” the *katamênia* and forms the rudimentary heart, *sperma* only has soul potentially (*GA* II.1, 735a8-11). As Preus rightly points out, this is “not simply a tricky way of saying that it does not have it” (Preus 1975: 79). Semen “has or is soul potentially” in the way that the sleeping geometer is potentially doing geometry (*GA* II.1, 735a8-11)

being moved. He can be the agent in virtue of the motions providing a link between him and the matter, and thus satisfying the contact requirement.

Perhaps something that was said cannot be said without qualification, for example how in the world it is not possible to come to be by something external. For in a way it is possible, and in a way it is not. Surely, to speak of semen or that from which semen comes makes no difference insofar as semen has the movement in it that the other [i.e., that from which the semen comes—the male parent] moved. And it is possible for A to move B, and B to move C, and to be like the amazing puppets. For the parts, while resting, have in a way a power. Whenever something external moves the first of the parts, straightaway the next one comes to be in actuality. Just as in the puppets, then, in a way that one [i.e., the external mover] moves not now being in contact with anything, but having been in contact. And similarly that from which the semen came to be or that which made the semen, although having made contact with something, is no longer in contact. And in a way the internal motion [moves], just as the house-building [produces] the house. (*GA* II.1, 734b5-17)

Although there is no agreement about exactly what kind of puppets Aristotle has in mind,⁴⁸ the point of the analogy is fairly clear. The puppet model is supposed to provide a way to think of *both* the father as well as the motions in the semen as that “by which” the organism comes to be. The motions in the semen make direct contact with the matter, but since the motions in the semen came from the father, he can still be the agent. The father is like the first external mover of the puppets, who can move the moving puppets without being in direct contact with the parts, in virtue of having set up the motions in his semen that make contact with the *katamênia*.

The motions are like the intermediate, “last” agents in Aristotle’s discussion of contact in *Generation and Corruption* I.6-7. There he says that in typical cases, contact is direct and reciprocal. This is the sort of contact that we encounter “for the most part.”⁴⁹ In some

⁴⁸ See Henry 2004 for a discussion of various embryological models.

⁴⁹ *GC* I.6, 323a25

cases, however, the agent can make contact with the patient indirectly, by way of intermediate “last agents.” In a way, a first agent is in contact with that upon which it acts, though not directly or reciprocally; the first agent is not “touched by what it touches.”⁵⁰ The first agent makes contact in this attenuated way in virtue of the last agents being in direct, reciprocal contact with the patient. For instance, a *technê*, the “*logos* without the matter” in the artist’s soul, is a “first agent” that acts without being reciprocally acted upon.⁵¹ The doctor’s medical art, for example, unlike the wine or drugs he prescribes, is not acted upon in return by the patient he heals.

An organism comes to be from its father, Aristotle says, just as the “healed patient comes to be from the medical art.”⁵² Like the medical art, the father is not in direct, reciprocal contact with that upon which it acts. What makes direct contact with the *katamênia*, analogous to the food or drugs that the doctor prescribes, is the male semen, which contains motions.⁵³ The motions are the last agents through which the father, or the father’s nutritive soul, acts. By positing these motions, Aristotle is providing an account that satisfies his own principles of change: ascribing mediated agency to the motions ensures that there is a continuous line of contact between the father and the matter. That is what it means to say that the motions are soul’s “tools”. They do the work, so to speak, of the soul that uses them.

III.

⁵⁰ *GC* I.6, 323a29-30

⁵¹ *GC* I.7, 324a30

⁵² *GA* I.21, 729b20-21

⁵³ That the motions are in reciprocal contact with the *katamênia* is evident from Aristotle’s explanation of what happens when the motions for producing the father’s traits fail to “master” at *GA* IV.3, 768b15-23: “The cause of the motions relapsing is that the agent is also acted upon by the patient. For example, what is cutting is dulled by what it cuts, and what is heating is cooled by what it heats, and generally the mover—except the first one—is moved with a certain movement in return, such as what pushes gets pushed in return, and what squeezes gets squeezed in return. And sometimes it is entirely acted upon more than it acted, and the thing heating is cooled, or the cooling thing heated.”

So, Aristotle's resolution of the puzzle in *GA* II.1 indicates that he is conceiving of the motions as tools or subsidiary agents in generation, and not simply identical to soul.⁵⁴ They are "tools" in that they are that by which the male parent conveys form, just as the motions of an artist's tools convey the shape and form of the product by means of the motions of the tools.⁵⁵ I want now, finally, to turn to the respects in which the motions are like tools in craft production, and the mileage Aristotle gets from exploiting this analogy. There are two ways in which they are analogous to an artist's tools, both of which is doing some important work in the biological theory, and both of which is lost if one neglects to take the tool-language seriously.

The first has to do with how Aristotle can account for inherited traits not common to all members of a species. Aristotle's discussion of inherited characteristics has been thought to raise an obstacle to reading his embryological account as employing a form common to members of a species. For, since the male passes along his traits, but does not contribute matter, these resemblances cannot solely be due to differences in matter. But they cannot be due to a species-level form, either, since the traits in question are not shared by all members of the species.

If form and matter were exhaustive of the causal factors involved, there would indeed be a problem. Fortunately, however, there are additional causal factors in his account, namely, the *kinéseis* or motions that are the tools used in the formation of the embryo. As with other tools, the motions can have effects that are more determinate than those of the first agent that uses them. The doctor, for example, has a general ability to heal bodies in virtue of his medical art.⁵⁶ The particular drugs or the wine he prescribes, however, have far more determinate powers. Some drugs might cool the body, and others warm it. Similarly,

⁵⁴ In fact, if the motions were simply identical to soul, as Balme claims, it is hard to see why there would any puzzle at all. If this complex of motions were simply the soul, it would not only satisfy the contact requirement, but would also be a synonymous agent.

⁵⁵ *GA* I.22, 730b9-23

⁵⁶ This is not to deny that a doctor looks towards the health of some particular patient, and not towards simply health, as Aristotle says at *NE* I.6, 1097a10-15. This is only to say that the *technê* the doctor has is a general one, it is not a *technê* to cure any particular patient. The doctor knows "universally" (*katholon*) what is good for the patient (*NE* X.9, 1180b13-22). Cf: "No art (*technê*) considers the individual. The medical art (*iatrikê*), for instance, [does not consider] what is healthy for Socrates or Callias, but [what is healthy] for this sort or these sorts (for this is in the province of art (*entechnon*), but the individual is indefinite and not knowable)." (*Rhetoric* I.2, 1356b30-33)

the motions that are the tools in animal generation can and do have effects that are far more determinate than that of nutritive soul.

Since the motions are the tools of soul, and not identical to it, Aristotle can explain how organisms come to resemble their parents and ancestors more than other members of the species, and also maintain that the form that is imparted in animal generation is the one shared by members of the kind. For, the motions, unlike the species form that the father provides, can vary from one individual to another.

It is worth emphasizing that this is not simply an *ad hoc* addition to the theory of generation, or something that Aristotle has to tack on once he attempts to explain inherited traits. These motions were, throughout *GA*, the tools building the embryo's body. Early on in *GA* Aristotle claimed that it is because semen and *katamênia* are derived from the ultimate nourishment—i.e., concocted blood that gets differentiated into each of the body parts—that “it is reasonable that children resemble their parents: because there is a resemblance between that which is distributed to the various parts of the body and that which is left over.”⁵⁷ When Aristotle turns to explain sexual differentiation and familial resemblance, he reminds us of this:

To resume then: We repeat that *sperma* has been posited to be the ultimate residue of the nourishment. (By “ultimate” I mean that which gets carried to each part of the body—and that too is why the offspring begotten takes after the parent which has begotten it, since it comes to exactly the same thing whether we speak of being drawn from every one of the parts or passing into every one of the parts, though the latter is more correct.) (*GA* IV.1, 766b7-12)

The motions in the generative residues, not the form, are particular to the individual organism. In Aristotle's embryological theory, as I understand it, these motions are the particular instruments by means of which an organism exercises its general nutritive soul capacity to reproduce and grow, doing the work of soul in building the offspring's body parts and organs. These motions are not identical to soul, but are rather soul's tools.

⁵⁷ *GA* I.19, 726b13-15, Peck trans, modified.

Consequently, there is no reason to think that because these motions vary from one individual to the next, so, too, must the soul or form.⁵⁸

The second, perhaps most obvious pay-off to treating the motions as tools is that doing so *demotes* them: tools have a subordinate status relative to the agent that uses them. This ensures that the primary agent of animal generation—the soul or form of a living body—has a privileged causal role. For, in general, last agents such as tools can only be agents insofar as they are used by a first agent that possesses the principle of form in actuality.

We describe both the last and the first agents as agents of change, but a first agent of change is, properly speaking, more of an agent of change, because it is responsible for changing the last agent, and not vice versa, and because the first agent is needed for the last agent to be an agent of change, but the converse is not true. The stick, for example, will not cause movement unless the person causes it to move. (*Physics* VIII.5, 256a8-13, Waterfield trans., slightly modified)

The last agents of generation—the motions—only get to be productive in virtue of being used by a first agent who has form or soul in actuality. By treating the motions as subordinate causes or last agents, Aristotle is making clear that there is an indispensable role for form or soul, the first agent that uses them as tools.

Why Aristotle thought one could not explain substantial generation without appealing to substantial form or soul is, to my mind, the really interesting question. And it is a question that does not even arise in connection with Aristotle's embryology if one dismisses the tool language as unimportant. It is important, and it shows that Aristotle's commitment to there being a causal role for form or soul is of central concern to him while he is working out the details in his biology.

There have been far too many discussions of why it is that form must have such a causal role to rehearse them all here. My own hunch, I will say in closing, is that the indispensability of soul's causal role has much to do with the implications it would have for the status of the beings so generated, if it were true that elemental matter and its motions,

⁵⁸ For a fuller discussion of this issue, see Gelber 2010.

such as heat and coldness and their motions, were exhaustive of the causes of generation.⁵⁹ A central point of disagreement between Aristotle and his predecessors, as we know, is about which things are substances. For Aristotle, living beings are substances; they are *per se* unities and not merely compounds of more fundamental substances. Even if there were nothing, in principle, preventing material level factors from coming together in just the way required to create a living organism, this would be merely by chance, and the organism that resulted would have no great claim to being a genuine substance.⁶⁰ And this, for Aristotle, is out of the question. So, the generation of a living being, if it truly is a substance, requires that something—namely, form or soul—be the principle of organization for the various motions that jointly operate in the generation of a living substance. Without such a principle, *genesis* risks collapsing into a mere series of discrete alterations, rather than a single, unified change.

Conclusion

In Aristotle's biological explanation of animal generation, the motions of heat and coldness are, as he says, tools. These are not, as some have claimed, references to the soul. What these various tools are doing is what nutritive soul is doing, but only in the way in which what my hammer is doing is what I am doing, or in the way in which what the roofer, window-installer, frame-maker, painter, and pavement-layer are doing is what the general contractor is doing when he builds a house. None of these sub-contractors would be in the business of building a house at all, if not for the fact that they are being used by the general contractor whose activity they are jointly carrying out.

References

⁵⁹ This is the kind of view found in Waterlow 1982 (*Nature, Change, and Agency in Aristotle's Physics*), Ch. 3, and Sauve Meyer 1992 ("Aristotle, Teleology, and Reduction").

⁶⁰ According to some ways of understanding Aristotle's view of spontaneous generation, in fact, material level causes are exhaustive. (See e.g., Stavrianeas 2008.) Given that such creatures appear to occupy a position low on the *scala naturae*, perhaps they are less clearly substances. They cannot reproduce another the same in kind as themselves (*HA* 539b11ff.) and so cannot partake of the 'eternal and divine' in the way that other perishable substances can (*GA* II.1). So, it is possible that they are not full-fledged living substances, in Aristotle's view. (See Lloyd 1996 (*Aristotelian Explorations*), Ch. 5, "Spontaneous generation and metamorphosis" esp. 123-4).

- Balme, David M. 1987a (1980). "Aristotle's Biology was Not Essentialist" in Gotthelf, Allan and Lennox, James G. (eds.) *Philosophical Issues in Aristotle's Biology*. Cambridge University Press, 291-312. First published in *Archiv für Geschichte der Philosophie* 62: 1-12.
- 1987b. "Teleology and Necessity" in Gotthelf, Allan and Lennox, James G. (eds.) *Philosophical Issues in Aristotle's Biology*. Cambridge University Press, 275-86.
- Burnyeat, Myles 2001. *A Map of Metaphysics Zeta*. Pittsburgh, Mathesis Publications.
- Coles, Andrew 1995. "Biomedical Models of Reproduction in the 5th Century BC and Aristotle *Generation of Animals*" in *Phronesis* 40: 48-88.
- Drossaart Lulofs, H. J. 1965. *Aristotelis De Generatione Animalium. Recognovit Brevique Adnotatione Critica Instruxit*. Oxford, Clarendon Press.
- Freudenthal, Gad 1995. *Aristotle's Theory of Material Substance: Heat and Pneuma, Form and Soul*. Oxford, Clarendon Press.
- Gelber, Jessica 2010. "Form and Inheritance in Aristotle's Embryology," *Oxford Studies in Ancient Philosophy* 39: 183-212.
- Henry, Devin 2004. "Embryological Models in Ancient Philosophy," *Phronesis* 50 (1), 1-42.
- Lloyd, G.E.R. 1996. *Aristotelian Explorations*. Cambridge University Press.
- Newton, Isaac 2004. *Philosophical Writings*, ed. Andrew Janiak, Cambridge University Press.
- Peck, A. L. 1937. *Aristotle: Parts of Animals*. Loeb.
- 1942. *Aristotle: Generation of Animals*. Loeb.
- Platt, Arthur 1910. *De Generatione Animalium* (OT trans. with notes). Oxford, Clarendon Press.
- Preus, Anthony 1975. *Science and Philosophy in Aristotle's Biological Works*, Hildemsheim and New York, Georg Olms Verlag.
- Sauve Meyer, S. 1992. "Aristotle, Teleology, and Reduction" *Philosophical Review*, Vol. 101 no. 4, 791-825.
- Stavrianeas, Stasinos 2008. "Spontaneous Generation in Aristotle's Biology" *Rhizai* V.2, 303-338.
- Waterlow, Sarah 1982. *Nature, Change, and Agency in Aristotle's Physics: A philosophical study*. Oxford, Clarendon Press.

Witt, Charlotte 1985. "Form, Reproduction, and Inherited Characteristics in Aristotle's *Generation of Animals*," *Phronesis* 30, 46-57.