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İÇİNDEKİLER

CORE-FORMING IN THE SECOND MILLENNIUM B.C.: RECENT PRACTICAL EXPERIMENTS (Lev. 9-10)

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Invented in the mid-second millennium B.C., some 1500 years before the discovery that glass can be blown, core-forming was the earliest technique to create a hollow glass object or vessel. The artisan coated a removable core with glass and subsequently scraped out the core. Early core-formed vessels are known from Mesopotamia and Egypt. Outside these areas early glass bottles come mainly from one site: Alalakh (modern Antakya) (see Erten in this volume).

Crucial for understanding the earliest glassforming methods is the basic recognition that in antiquity glassworking and glassmaking were separate crafts, each with its own pyrotechnology and techniques, a division that is also reflected in Greek and Latin terminology (Stern 1989, 121-123). Glassworkers bought raw glass which they turned into finished objects, much the same way as metalsmiths bought refined metals to create a finished product. The division between the two crafts had far reaching consequences for the art of glassworking. Instead of a crucible filled with molten glass, the glassworker began with a chunk of solid glass. No early glass object shows signs of the material having been worked in a molten stage. Toolmarks indicate that the glass was still quite viscous and needed to be manipulated and pushed around with force. In other words, it was worked at much lower temperatures than is currently customary (Vandiver 1991, 614-615). All available evidence points to the conclusion that the earliest glassworkers did not realize that glass could be worked in a molten state. Unaware of the potential of working "hot," the early glassworker thought in terms of solid, cold glass (room temperature) that could be fired like faience or softened to fuse to an existing surface. (Stern 1994, 21-24, 86-88).

Cold glass was also the point of departure for forming a vessel around a core. Two ancient methods for applying cold glass to a prefabricated core have been identified, but there may have been others as well. Fragments from Tell al Rimah, Aqar Quf, and Marlik illustrate the first method (von Saldern 1970, 206, 213, 215). The walls of the vessels are composed from tiny segments of monochrome canes meticulously arranged one next to the other. Obviously such vessels could not be made while the glass was hot because the glassworker would have burned his fingers and the canes would have lost their shape. The vessels had no handles or applied decoration that would have required tooling while the glass was hot. The vessel's shape and decoration were created simultaneously and "fired"

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afterwards. How this was done needs to be researched. The technique was apparently too laborious to attract many followers.

The second technique was widespread, presumably because of its simplicity. Excavated at numerous sites in Mesopotamia and Egypt, core-formed vessels with a monochrome "body" are decorated with tooled, applied decoration, such as eyes and threads. It is usually assumed that the vessels were made by winding a softened trail of glass around the core ("trailing or coiling") or by dipping the core into molten glass (Barag 1970, 133-134). Both methods would have required preheating of the core. Whereas no early vessel shows traces of spiral trails in the body of the vessel, so that this method can be ruled out, the hypothesis of dipping appears at first sight to be supported by the texture of the glass, which is clearly layered parallel to the surface of the wall. Bubbles are trapped between the layers.

However, dipping the core in molten glass would have required a highly developed furnace technology for which there is no evidence in this early period. To successfully cover a core by dipping it into a crucible filled with molten glass, the crucible had to be large enough to rotate the core (i.e. considerably larger than the planned vessel, often 20-30 cm high) and the glass would have had to be held at a steady working temperature over a prolonged period of time. In modern soda-lime-silica glass terminology that would mean about 1184° C. The layers observed in ancient core-glass are proof that the coating consisted of several layers of glass, applied one on top of the other, but recent experiments prove that layering could also have been achieved with cold glass (Stern, in press).

The American glass artist and inventor Dudley Giberson invented a successful method of making beads by applying layers of cold crushed glass to a prefired, cold core (Giberson 1996). He has now adapted this technique and perfected it to make core-formed vessels. The core is made entirely from materials dug up in his garden in New Hampshire. They are slaked down in a bucket of water, separating the heavier, coarse particles from the very fine clay particles. The coarse particles provide a fine sand, the finest particles a short, liquid clay slip. The sand and a small amount of the fine clay mixed with water are shaped into a core. After firing the core has a consistency like soft sandstone.

The core is mounted on a mandril, thoroughly wetted and packed with fine, crushed glass (Fig. 1). Water makes the glass stick to the core. This part of the process is similar to a modern technique known as pâte de verre but the rest differs. The core with crushed glass is carefully heated until the glass glazes over and fuses to the core. This is now heated farther above the furnace and rolled through crushed glass which sticks because it fuses to the glass already on the core. This operation is repeated several times until the glass is thick enough. Uneven patches and bubbles in the glass are smoothed out with a knife or bent metal rod (Fig. 2). The piece is now decorated with prefabricated glass rods, the rim finished with a bicolored twisted rod, and the handles, made from short lengths of rod, are applied (Fig. 3). After annealing, the mandril is pulled out and the soft, brittle core is removed with a bent wire. Giberson has made about 40 vessels in this technique (Fig. 4).

An important element in this reconstruction is the use of a furnace with a vertical heat chamber. Giberson's core-forming furnace is a slightly enlarged version of a beadmaking furnace he invented some years ago (Fig. 5). Working directly above and at times in the heat allows him to manipulate core and decoration while at the same time controling the temperature in his piece. The temperature of the glass is low, never exceeding 900° C. In antiquity the heat source might have been developed from fire pots like those used by Egyptian smiths in the 3rd millennium B.C. (Stern 1994, 24 and fig. 153). The glassworking furnace with a horizontal working port with which we are so familiar today probably does not predate the Roman empire. First documented on the disks of two early Roman clay oil lamps (Baldoni 1987, 22-29), the horizontal glassworking furnace appears to have been associated with glassblowing; available evidence suggests it was invented in Italy in the 1st c. A.D.

The coreforming experiment described above does not prove that ancient core-formed vessels were made this way. Its significance lies herein that it demonstrates beyond doubt that core-glass vessels could have been made on a cold core with cold glass and a minimum of pyrotechnic know-how and equipment, - a hypothesis that until now has received little attention because it seemed technically impossible. The furnace technology required for successfully coating a core with cold glass was well within the limits of pyrotechnology available in the second millennium B.C. and is in accordance with the low temperature tooling observed in ancient artifacts (Vandiver 1991, 614-615).

The concept of coating a "ceramic" core with fine, crushed glass is reminiscent of an ancient Mesopotamian glazing technique known as application glazing. One of three ancient methods for making faience, application glazing produced a thick layer of glaze (Peltenburg 1987, 9-11). The idea to remove the interior and leave just the glassy outer shell does not seem far fetched in an environment of faience production. Faience working was common in Nuzi, Assur and Tell al Rimah, i.e. in areas where the earliest core-formed glass vessels were excavated. A tripod glass beaker from Assur preserves the "faience-look", especially in the drippy festoon (Barag 1970, 143, fig. 18). If the principles of Giberson's reconstruction of the technique are correct, core-forming was most likely invented by faience workers and glassworking may have begun as a sideline of faience working.

Captions for illustrations:
Fig. 1: Coating a prefired, cold core with crushed glass (drawing D. Giberson).
Fig. 2: Smoothing the glass with a bent metal rod or knife. The furnace design is based on ovens excavated at Nuzi (drawing D. Giberson).
Fig. 3: Working above the furnace. Applying a short length of rod as handle (Photo Lois Dorfman, Toledo).
Fig. 4: Core-formed vessels made by D. Giberson (photo Lois Dorfman, Toledo).
Fig. 5: Beadfurnace designed by D. Giberson (drawing D. Giberson).

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THE PROBLEM OF SUBSTANCE IN ARISTOTLE

*Kamuran GÖDELEK

In *Metaphysics* Zeta (Book VII) ch 1, 1028 b 3-4 Aristotle mentions the question "what is being" as one which is always being raised. It may fairly be said to be one of the main questions of the *Metaphysics*. Aristotle identifies the question "what is being?" with the question "what is substance?" (1028 b 3-4).

This identification of the two questions may seem somewhat strange in the light of the facts that Aristotle has in the *Categories* a rather definite answer to the question "what is substance?"; and his answer there is quite different from the answers that he says some earlier philosophers gave to the question "what is being?"[1] If both questions are really the same question, why are the answers so different?

One simple answer to this latter puzzle would be that Aristotle and previous philosophers simply disagreed about what was the correct answer to the two questions, although they understood the two questions in the same way.

A somewhat more complicated answer to the puzzle why Aristotle identifies the two questions could be stated as following. Aristotle has an argument in *Metaphysics* Gamma (Book IV, ch 1 and Beta 998 b 20-28) for the view that the question "what is being" is asked perfectly generally, ie., if it means "what is being for any sort of thing?" is not a proper question. There is not a discussable kind, being, according to Aristotle, that would make the question "what is being?" a definite question like "what is a Beluga whale?". It is somewhat a problem to see what were Aristotle's reasons for saying that being is not a kind. However it is clear that he holds it and that that is his reason for thinking that the general question "what is being?" is not a reasonable question. Aristotle thinks, however, that one can ask an equally interesting and genuinely discussable question: "what is primary being?" or, in other words, "what is the primary kind of being?".[2]

Aristotle may have identified the question "what is being?" with the question "what is primary being?", ie. with the question "what is substance?" because he wanted to attribute an intelligible question to previous philosophers: if they were asking anyting reasonable at all, they were asking the question "what is the primary definite kind of being?". What Aristotle thinks is the primary definite kind of being he calls "substance". So to say that earlier philosophers

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1 Aristotle's discussion of the answers of previous philosophers to this question can be found in Books Alpha and Beta (I and III) of the *Metaphysics*.

2 The evidence for this can be found in Gamma ch 1. See also Zeta 1 for the remark that to understand any kind of being, you have to understand the primary kind.

were asking "what is substance?" is just to say that they were asking "what is primary being?". And we may still explain the disagreement between Aristotle and previous philosophers in the same way as indicated above: they both understood the phrases "substance" and "primary being" to mean the same thing, but they thought that they picked out different things. In a similar way you and I might agree on the meaning of the phrase "the greatest philosopher", but disagree about whether it referred to Aristotle or Plato.

The fact that there is disagreement in one way and agreement in another on the phrase "substance" will lead to some problems in reading the *Metaphysics*.

One problem is that sometimes where Aristotle says "substance is such and such" he means (a) what I call substance is such and such; in other places he means (b) what other people have called substance is such and such. There are some passages in which it is not clear which of the above meanings he has in mind. Examples of (a) are all the occurrences of "substance" in the *Categories*. In the *Categories* "substance" has the status of an Aristotalian technical term, and Aristotle explains very carefully what counts as substance in this technical sense. An example of an occurrence of kind (b) is the following remark of Aristotle: "Plato posited two kinds of substance (the forms and the objects of mathematics" (1028 b 19-20). An example of an occurrence where it is not perfectly clear which way Aristotle uses the word "substance" is: "If elements can be discovered at all, it is only the elements of substance" (992 b 23).

A second difficulty in understanding what Aristotle says about is that certain of the phrases which Aristotle uses to describe features of substance (whether his own technical sense or in a wider sense in which other philosophers used it) do not, without explanation, have a clear sense. For example, he says substance is separable (Zeta 1); he says substance is a "certain this" (Zeta 3); he says substance is "one" (eg. 1044 a 2-9). None of these expressions has an immediately obvious definition.

A third difficulty associated with reading Aristotle is that most of the time explanations of these difficult expressions he gives do not point in the same direction, i.e., they seem almost irreconcilable with each other. For example, in the *Metaphysics* substance is called a "this" or a "certain this" (1030 a 5-6; 1030 a 19; 1030 b 11) in passages where it is clear that man (the species(is a "this" (1070 a 11-12; 1049 a 35).[3] However, in the *Categories* Aristotle denies that secondary substances, genera like the animal, and species such as man, are a "this" (3 b 17-18); only individual substances like Socrates count as a "this". The different explanations and different results of the application to substance of what seems to be one and the same notion, as represented by one and the same phrase, could indicate that the same phrase is being consciously used with different meanings, or it could indicate that Aristotle is just coming to understand it better.

It is not clear whether Aristotle's varying explanations are to be viewed as various decrees on how to take some technical phrase that he is introducing, or whether they are to be viewed as evolving explications of phrases that already

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[3] Here a nature is said to be a "this". A thing's nature is a substance of it. See below for a discussion of "substance of".

have philosophical currency and application without having been reflected on much. It is not clear that Aristotle recognized any change in the sense of a phrase like "a certain this". For example, in Zeta 13 of the *Metaphysics* it seems to be used in both of the ways described above; one in the *Categories* sense (from which the third man argument is held to ensue), and the other in the sense that a species expression somehow counts as signifying a "this" (in a sense in which the third man argument should not ensue). A further complication for any evidence from Zeta 13 about Aristotle's usage is that the chapter may be a listing of merely apparent puzzles which rest on mistaken assumptions which Aristotle means to call our attention to.

A fourth difficulty is that Aristotle has apparently a list of several criteria for, or requirements on substance which at some points seem to be irreconcilable with each other: that is, some of the criteria seem to exclude as candidates for substance. It contains some examples which not only are allowed by other criteria but which even seem to be decreed substance by those other criteria. (Aristotle himself recognizes the difficulty in reconciling some of his criteria with others). For example, to take a simple case, in *Metaphysics Delta* 8Aristotle says that earth and air and fire are substances because they are not said of a subject; but other things are said of them, while in Zeta 16 he says they are not substances because they are not unities, but rather are "mere heaps".To take a more complicated case, at 2 a 11-19 he says that the animal (the genus) is a "secondary" substance. At 1038 b 11-13 he says that the animal is not a substance.

Some of the conflict of this latter sort may be merely apparent: perhaps some of it can be settled by taking each of his criteria as giving a merely necessary condition for what is to count as substance.

Perhaps it can be partly explained away by thinking of him as having an interest in picking out substance in the most full-fledged way or substance in the highest degree: Aristotle does speak of some things as being more substance than others (2 b 7, for example). He may have meant that items which satisfied some, or some important, criteria from his long list of criteria for substance, had some claim to be substance, or were substances in some way. But some items satisfied more of the conditions than others did, so he came to speak of some items, depending on which of the features they had, as more substances than others, or "most of all" substances. If we take this view to explain Aristotle's locutions "more a substance than" (1040 b 21-23; 1042 a 13-15; 3 b 33-35) we abandon the view of the list as giving any necessary conditions on being substance; we take the list as a list of conditions on being a substance in the fullest way.

A fifth difficulty is in seeing exactly how it seem to be his standard examples of substance do satisfy the criteria one finally takes his considered requirements on substance of the strictest kind and why his standard examples of non-substances do not. An example of a passage which presents interpretive difficulties of this kind is *Categories* 4 a 10.

A sixth difficulty, of rather a different order, is that of seeing why the topic of substance is an important topic. The problem can be viewed in one way as the problem to what question the answer "substance, understood as what fulfills these conditions" is the answer. It is easy enough to say that the question was:

"what is, primarily?". The grounds for this view of the question are partly that Aristotle observes that substance is prior in certain ways, and partly in Zeta 1 of the *Metaphysics* Aristotle asserts that the question "what is substance?" is the same as the question "what is being?". But it is not obvious that this latter question (for reasons Aristotle may recognize in Beta, Gamma, Epsilon of the *Metaphysics*) is a reasonable question (anymore than the question "what is the most" would be.

Aristotle appears to have adopted many, perhaps not all, of the reasons he had for calling something substance or primary being from earlier philosophers. For example, where an earlier philosopher had picked out a certain kind of being as primary for a certain reason or as fulfilling a certain criterion, Aristotle may take note of the criterion. He sometimes seems himself to accept and adopt the criterion; sometimes he rejects it; sometimes he disagrees about what actually fulfills it, while agreeing that it is a criterion that primary being must fulfill. For example at text 1028 b 8-10 items alleged primary being by someone worth mentioning are bodies; at 1029 a 35, sensible things; at 1028 b 16-17, limits of body (surfaces, points); at 1028 b 33-34, what a thing is, what it is for a thing to be (essence); at 1042 a 16-17, Platonic ideas, things said of a whole class (universals), kinds (genera); at 1042 a 33-35, matter and extracted criterion is that it underlies change; at 1028 b 35-36, what is a subject and extracted criterion is what is not predicated of something underlying, but that of which all else is predicated, i.e., what underlies as opposed to what has something underlying it.

In some passages Aristotle makes clear that he has a certain requirement for what counts as primary being or substance by rejecting some proposed candidate for primary being or substance for not fulfilling the criterion. For example, at 1060 a 36-b1 rejected candidate is being and unity, and extracted criterion is separability, independence; at 1029 a 28 matter is rejected for not fulfilling the criterion of separability.

In some cases Aristotle simply remarks that substance will have to have such and such a feature. For example, at 1087 a 10-15 he requires knowability and at 1086 b 14-19 separability.

These are only a few of the many passages from which features of or criteria for substance can be extracted. In understanding what Aristotle means with the word substance a necessary distinction between substances and substance of something should be made.

In the *Categories* Aristotle almost reserves the word "substance" for primary and secondary substances, that is, apparently, individuals such as individual animals and their species and genera. Accordingly, we may speak of "the *Categories*' sense of the word 'substance' ", meaning the sense in which "substance" means "individual animals (plants, planets ...) and their species and genera". We may also use the phrase "substances, simply" to cover the same things as the phrase "the *Categories*' sense of the word 'substance' ".[4] In that sense of "substance" qualities such as the color white or the virtue justice or the relation being larger than are <u>not</u> substances.

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[4]Aristotle does not use either of these phrases.

There is, however, another use of the word "substance" in Aristotle which it is possibly appropriate to call a different sense of the word from the *Categories*' sense. In this second use of "substance" it is a relational word: it picks out the substance <u>of</u> something. In this second use, a quality such as the color white is the substance <u>of</u> the color white, and the color white is also (part of) the substance of Della Robbia white. The substance of anything is indicated by the account or description which is definitory of that thing (*Metaphysics* 1017 b 22-24).

Here are some Aristotelian examples of substances <u>of</u> something which are not substances-simply, that is, thay would not have been called "substances" in the *Categories*: six is the substance of six (1020 b 7-8); Aristotle mentions the substance of good (1022 a 15); Aristotle mentions the substance of disease (1032 b 34); Aristotle mentions the substance of the circle (1063 a 33; mentioned in Cousin, 1935, p. 170). Here are some occurrences of the more general phrase "substance of something": "the substance of each thing and what-it-is-to-be for each thing" (1022 a 8-9); "the form and substance of each thing" (1022 a 14). The "and"s in both of these passages are exegetic, as in "the top and summit of the mountain"; "the joy and delight of my life".

The substance of something, say x, is often identified (see, 1017 b 22-24) with what-it-is-for-x-to-be, what Ross calls in his translation "the essence of x". It is clear from Metaphysics Zeta 4-6 that qualities and other items which are not substances-simply have essences, though perhaps ia weaker way than items which the *Categories* would have called "substances" do (1030 a 29-32); "what-it-is-to-be" will belong in the primary way, simply, to substance, and then to the other things... not what-it-is-to-be simply, but what-it-is-to-be a quality or a quantity.

It is important to distinguish substances simply from substances <u>of</u> something because some items which are substances simply are not the substances <u>of</u> anything. Further some items which are substances of something are not substances simply. For example, six is the substance of six, according to 1020 b 7-8, but since it is a quantity it is not a substance simply.

Aristotle does not use distinguishing passages like "substances-simply" and "substance of" to distinguish the two uses of substance. In fact, he often just uses the word "substance" by itself in such a way that one feels considerable doubt which of the two uses of "substance" he intends.[5]

Towards a better understanding of the language of substance, it would be useful to slightly reformulate Aristotle's question : "what is substance?". We know from the *Categories* that individual people , individual men are primary substances, in the *Categories*' sense of the phrase "primary substance". At 1030 a 5 Aristotle says "the pale man is not just what a certain "this" is, since (being a("this" belongs to substances only". Later in Zeta 4 at 1030 b 12-13 Aristotle says: "There will be an account and a definition of (a(white man, while in a different

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[5] In the Greek the locution for "____ is the substance of ____" would not have a separate word. This circumstance would not, of course, have prevented Aristotle from adopting some locution with the same effect as "substance of". He could have used "substance of something" (ousia tinos).

way (there will be an account and a definition(of white and of (a(substance" These remarks are some evidence that when Coriscus is pale,

(1) This man (Coriscus) is a substance

and

(2) This pale man is not a substance.

Together (1) and (2) are odd since, as we would naturally say, this pale man and this man are one and the same thing, Coriscus. In the light of (1) and (2) I propose following principle to use in most discussions of substance:

(I) Whatever are Aristotelian (primary) substances are substances only under certain descriptions.

An instance of this would be that Coriscus, this pale man, is a substance under the description "this man" but not under the description "this pale man".[6]

The example from Zeta 4 is particulary puzzling because the two descriptions "this man" and "this pale man" are so close, so similar. It would perhaps be easier to accept the example if Aristotle had said that this man, but not this pale thing, was a substance.

That (I) is a good way to describe some features of Aristotle's notion of substance would be disputed by Frank A. Lewis. He argues in his notable paper "Accidental sameness in Aristotle" that Aristotle would not have agreed that this man and this pale man are the same thing. If Lewis is correct (I do not think that he is, but his view is a possible one, and to argue aginst it would require more space than I want to give here(then (I) would not be a good way to describe Aristotle's notion of primary substance. If Aristotle denies that this man and this pale man are the same thing, then it would not be accurate to say that one and the same thing, i.e., this man, i.e., this pale man, is a substance under one description and not under another description. On Lewis' view one would say perhaps the primary substance, this man, is a substance no matter how we refer to it or describe it, but not many of our descriptions will succeed in referring to it or describing it. In particular "this pale man" will not succeed in referring to the same thing that "this man" refers to. We may summarize Lewis' view by saying:

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[6]The locution "under the description" is from G.E.M. Anscombe, *Intention*. I am borrowing its application to the interpretation of Aristotle's ideas about substance from D.C. Bennett (1965, p. 87).

Bennett objects to the phrase "under the description" as being one of the "expressions which dot the history of philosophy with obscurity". He says that its use in discussion of philosophy of action, which is what his paper, which has nothing to do with Aristotle, is about, leads to results which are "counterintuitive". I assume that his arguments, if they are successful in the connection in which he uses them, would also be successful against using the expression "under the description" in connection with interpretation of Aristotle. However, I propose to do so anyway, leaving as a residual difficulty the problem of avoiding the counterintuitive results.

If you accept the relevant parts of Quine's theory of meaning in *Word and Object* and if you accept that "this pale man" and "this man" refer to the same thing because this man is identical with this pale man, you may express the fact that

(1) This man is a primary substance

is true while

(3) This pale man is a primary substance

is false by saying that the position for a singular term in "___ is a primary substance" is not purely referential, or that the context "___ is a primary substance" is referentially opaque.

(L) The expressions which actually refer to, signify, pick out, or indicate primary substances are of a restricted kind.

Whether you accept Lewis' account (L) or my account (I), there is a similar upshot: there is a restricted part of language by means of which we may describe something as a substance. "This man" will succeed in referring to a subatance, but "this pale man" (and presumably "this pale thing") will not. We can take account of the complication which Zeta 4, however one understands it, introduces into our account of substances, by sometimes asking the questions: "What are the substance-signifying expressions?" or "what language describes substance?" instead of the question "what is substance?".[7]

For reasons similar to to the reasons I have for (I), I think it is also appropriate to say,

(II) Certain classes are secondary substances (that is, species and genera of primary substances (only under certain descriptions.

We know from the *Categories* that man is a secondary substance, or as I will say, a substance-species; i.e., it is a species and it is what Aristotle says is a substance in the *Categories*.

When I hear expressions such as "man" or "the Beluga whale" or "the horse", I think of the classes of men (i.e., all people), all Beluga whales and all horses, respectively. These are the sorts of expressions (a definite article followed by a common noun(which Aristotle uses in talking about species and genera, and accordingly I think of them as something like classes. Classes are somewhat familiar and unmysterious objects, and so there is the advantage of having a familiar notion with which to identify one of Aristotle's technical notions. However, apparently matters are not quite so simple that one can say that substance species are just certain classes. One has to describe matters in a more complicated way by saying something like (II) above. The reasons are these.

The expressions that Aristotle uses to talk about species are of the form "the S" where "S" is some common noun which is true of all and only those items which are members of the class that the whole expression "the S" ("the Mallard", "the dog", "the horse") refers to. Under these circumstances we can say that the expression "S" has the class as extension. Any other expression, say "D" which has the class as extension (is true of exactly the same items) can be used to name the class also. For example, from the *Topics* (122 b 39-123 al; 132 b 38-133 a3) we know that some differentia expressions have the same extension as theis associated species expressions. For our present purposes it does not matter what are the distinguishing characteristics of differentia expressions. An example of a differentia expression which therefore can be used to name the same class "man" names is "the biped pedestrian".[8]

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[7] For reasons similar to those given above, Lewis objects to using the notion of referential opacity in summarizing the feature of Aristotle's notion of substance that I am calling attention to. Lewis also has some further objections to saying that the context "___ is a substance" is referentially opaque.

[8] The biped pedestrian is a differentia of man. It is not appropriate to say biped pedestrianality is a differentia of man or pedestrian bipedality is a differentia of man. That is, the phrases Aristotle uses in talking about differentiae for substance-species consist of "the" followed by

Granted that "biped pedestrian" and "man" are true of exactly the same individuals, then man and the biped pedestrian are the same class. So we have:

(4) Man is the biped pedestrian.

We know from the *Categories*,

(5) Man is a substance (species)

The *Topics* tells us that a species never a differentia: "The species is not the differentia of anything" (107 b 33). It would seem to follow from that that a differentia is never a species of anything. So we have:

(6) The biped pedestrian is not a (substance) species.

It seems that we are entitled to say,

(7) The biped pedestrian is not a secondary substance.

Possibly a shorter but equally convincing argument would consist of the observation that man is a (secondary) substance but according to the *Categories* (3 a 21 and 3 a 33) a differentia such as the biped pedestrian is not a substance. That one and the same class is a substance under one description but not under another seems to be the same situation as, in the example of "this man" and "this pale man", that one and the same thing is a substance under one description but not under another.[9]

The upshot of the reflections which led to (II) is the same as the upshot of the reflections which led to (I). It is that only certain expressions pick out secondary substances. So it will sometimes be a good idea to reformulate the question "what is substance?" as the question : "what are the substance-signifying expressions?"

Given the way of reformulating Aristotle's question "what is substance?" sketched in the last section, I will discuss three conditions Aristotle has on such substance expressions:

a.substance-predicates reveal what a thing is; they are good answers to the question "what is that?"

b.substance-predicates are count nouns:[10] this seems to be what Aristotle often means when he says that substance is one and a certain "this".

c.substance-predicates have conditional omnitemporality: if they are ever true of something, they are true of it as long as it exists.

d.a substance-predicate is a nature predicate; it turns up in some explanatory laws about change and motion.

One of the features of substance expressions that Aristotle emphasizes is that they indicate what a thing is. *Categories* tells us that a reason for calling the species and genera of primary substances substances is:

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some common noun. They are not words ending in "ity" or "ness". Ackrill's translation of *Categories* may have suggested one that twofootedness is a differentia of man; actually the biped pedestrian is a differentia of man.

[9] It should perhaps be noted that Lewis' argument to show that this man is not actually the same thing as this pale man cannot be paralleled to show that man is not the same as the biped pedestrian. So the reasons he has against saying (I) cannot serve as reasons against saying (II).

[10] For the moment, let us understand a count-noun to be a noun such that the question "how many N's are there (in a room, e.g., or in such and such) ?" is an unambiguous question. That is, it is a question to which there is one correct answer.

> Only they, of things predicated, reveal the primary substance. For if one is to say of the ndividual man what he is, it will be in place to give the species or the genus... but to give any of the other things will be out of place (2 b 29, Ackrill translation).

Here Aristotle seems to be recognizing what seems a very striking and distinctive (hence the "only they") fact about substance expressions such as "horse", "sloth bear", "panther". If we are walking through a zoo and I ask you "what is that?" at each enclosure, it will not be appropriate for you to answer "it's abrown thing", "it's a five-year old thing", "it is a resting thing". Aristotle seems to recognize that in this ordinary situation substance-predicates,the expressions which pick out what he calls primary and secondary substances in the *Categories*, have some special claim on our attention.

Although Aristotle recognizes that the question "what is it?" can be asked and answered of items not called substances in the *Categories*, he sometimes distinguishes the question asked of a substance from the question asked of a non-substance. He would say that when one inquires "what is justice?" in order to get the answer "it is a virtue." one asks the question "what is it?", "not simply" (1030 a 18-25). "Not simply" has the effect, as in other places in Aristotle, of "not properly speaking" or "not primarily"[11] or "not strictly speaking"[12] Evidently because of the claimed special or primary or strict use of the "what is it?" question for items in the category of substance, that is, items he would have called substances in the *Categories*, Aristotle sometimes uses the phrase "what a thing is" as a label for the category of substance. Note that,

"what a thing is" belongs in the simple sense to substance, but in a limited sense to the other categories. For even of a quality we might ask what it is, so that quality also is a "what a thing is", not in the simple sense, however (1030 a 22-24, Ross translation).

Here Aristotle recognizes that we can ask "what is it?" of items in several categories. But in the following passage, he seems to think that the question is properly restricted to items in the category of substance: "when we say what it is, we do not say 'white' or 'hot', or 'three cubits long' but 'a man' or 'a god' "(1028 a 15).

Because reflection on trips to the zoo (or vacation tours, or walks through a garden) seem to bear out Aristotle's claim that substance-predicates have some favored status as answers to "what is it?" when asked about physical objects, it is the more disappointing to me that it does not seem to be possible to formulate this first condition on substance-predicates in such a way that it is not false or useless. For example, if we say that F is a substance-predicate only if F is always a natural answer to "what is it?" question asked when pointing to a physical object, our claim will not be true, for the predicate "a horse" will not be a natural answer

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11 *De Gen et Corr*: 317 b 17:" 'simply(signifies either what is primary with respect to each category of being or what is general and all-inclusive."

12 At *Topics* 103 b 28-29 Aristotle recognizes that you can ask "what is it?" of items not in the category of substance, and there he does not give a favored status to the question as it is asked of items in the category of substance.

during a conversation about horse ages with a horse expert in a field full of horses. On the other hand, "it is a five-year old" might be a good answer. Likewise, if we are walking through the zoo with someone taking an inventory of animal colors in order to select a pleasant looking wall paint, "it is a brown thing" might be an appropriate reply to the question "what is it?". Reflection on examples like this tells us that what is an appropriate answer to a question will be dependent on the asker's ignorance and interests, as well as upon what is true. But if we try to incorporate these reflections into our formulation of the condition on substance-predicates, we seem to come up with:

> F is a substance-predicate only if F is sometimes an appropriate answer to the question "what is that?" when it is asked about a physical object.

But this formulation would make the situation useless, in the respect that every predicate whatsoever that can be true of a physical object would satisfy it. hence the condition so formulated would not help us pick out what is distsinctive about substance-language.

There is some evidence that the question to which Aristotle thinks substance-predicates are appropriate answers is not the simple question "what is that?" but is rather the question "what is that G?" where some other predicate expression is used in the question.[13] If the "what is it?" criterion is relative to another predicate in this way, in order to use it to test whether a given predicate is a substance-predicate, we already have to know some other substance-predicates: there is some evidence that a substance-predicate F is an appropriate answer to a question "what is that G?" only where G is also a substance-predicate, either a genus predicate or a species predicate for the item of which F is true.[14]

The condition that substance-predicates indicate what a thing is is connected to one of Aristotle's technical notions thus: if a predicate reveals what a substance is, it is the predicate for its species, or one of the predicates for one of its genera or possibly one of the predicates for one of its differentiae.[15]

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[13]"An animal" is an appropriate answer (*Topics*, 103 b 28-29) when what is (ekkeimenon) "put before one" in Forster's translation, is a man. Possibly "proposed for discussion" would be a better translation than "put before one". To propose something for discussion if it is not the sort of thing we naturally can point at ask simply "what is that?", one needs to have some description of it. In this passage from *Topics* Aristotle seems to envisage having qualities (such as justice) put before one. In that case one will need to have a phrase to use to let the respondent know what topic is being introduced.

[14]*Topics* 102 a 32: a genus is predicated of something in the manner of what-it-is; 128 a 20: differentiaeare said possibly to be good answers to "what is it?" although they are less good answers than genera; *Categories* 2 b 32-34: species and genera answer the "what is it?" question asked of the individual man.

[15]This is the effect of 2 b 29 where is is said that only species and genera reveal the primary substance because only they are appropriate answers to the "what is it?" question.

Also at 128 a 20 cited the footnote 14 Aristotle says that the differentia is not as good an indicator of what a thing is as the genus. It is not clear whether one is to say that there is some reduced notion of the "what is it?" question under which differentiae fall.

The differentiae of substances are not substances in the *Categories*: that is, differentiae predicates are not substance-predicates (See 3a 21 and 3a through 33).

Species and genera and differentiae are predicated as of a subject of what they are predicated of.[16] So it turns out that satisfying the what-is-it? condition (however it is finally to be formulated) is a sufficient condition for satisfying this condition:

> If F is a substance-predicate, F is from something (from some species, genus, or differentia) which is predicated as of a subject of whatever F is true of.

However, the connection between the what-is-it? condition and the notion of predication as of a subject does not seem to be explanatory at the moment. It is just a sheer fact about Aristotle's treatment of two key notions. Ackrill seems to identify the what-is-it? condition and what we will call the predication as of a subject condition (p. 75): Aristotle does not offer an explanation of "said of something as subject" [at 1 a 20]... what is "said of" an individual x is what could be mentioned in answer to the question "what is x", that is, the species, the genus, and so on" (1a 20).

Aristotle says or implies in several places that substance is a "this" (e.g., Zeta 3, 1029 a 27) and he says or implies in several places that substance is one or is a unity (e.g., Zeta 16, 1040 b 5-8): "Evidently even of the things that are thought to be substances, most are only potencies... [for example] earth and fire and air; for none of them is a unity."

I would like to explain some of these remarks in a very simple way: I think that they mean that substance-signifying expressions are count-nouns: substance is a "this" in that substances are described by count nouns.

My simple proposal is meant to account only for <u>some</u> of Aristotle's claims that substance is a "this" and is a unity. In a frequent use of "this" the claim that something is a certain "this" means that it is particular like Socrates as opposed to something general such as species or form: this use of "this" occurs at *Categories* 3b 10. This passage, and passages like it, are not to be explicated by saying that they mean that a substance predicate is a count-noun.[17]

It is a second use of "this" which my simple proposal explains by use of the notion of a count noun. It occurs in passages where Aristotle's claim that substance is a "this" clearly allows that even general things like species and forms, but only certain ones, are "this'es".[18] It should be noted that there are

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[16] This follows from the account of predication as of a subject cat 2a 19 and the remarks at 3a 33 and 3a 21.

[17] Places "where" a certain "this" is used to mark off particulars from non-particulars: 3b 10; 1038 b 34; 178 b 39.

[18] These are some passages in which being a certain "this" or being one is a condition that certain species and forms satisfy (as well as particulars under the relevant descriptions). It is very natural to try to reformulate this condition as a condition on substance-predicates. Species are (according to Aristotle, which I agree) classes under certain descriptions; part of what determines whether or not they are substance species is under what description they appear. In the case of some of the following passages, some discussion is needed to show that they state criteria which even species and genera can satisfy.

In *Metaphysics* Delta nature is described as the essenceof things (this, I think, would include the species of them) which have in themselves a source of motion: "a certain 'this' belongs to most of all to substance so that form and that made up out of both [form and matter]

passages in which Aristotle says that substance is a "this" where I am not sure which, if either, of the two uses of "this" I have indicated above he is employing.

Aristotle seems to connect each of these ways of being a "this" with a special way of being one thing. What is a "this" in the first way is, according to Aristotle, one, but one in a different way from the way what is "this" in the second way is.[19]

In the attempt to understand what it is for a form or a species to be a certain "this" I take four clues from passages in Aristotle. That is, given my interpretation of four groups of passages in Aristotle, I take him to be making four important claims. These claims I take as data which can all be explained by one hypothesis: the hypothesis is that substance-predicates are count-nouns.

This hypothesis explains the four data, that is, explains why Aristotle said the four things I take as data, in the sense that the data follow from the hypothesis or they follow from it and some other claims that Aristotle clearly makes. In this way, the data are evidence for the hypothesis –in roughly the way that the claim that a given raven is black is evidence that all ravens are black.

I will use the following simple notion of a count-noun or counting predicate: a predicate F is a count-noun or a counting predicate or provides a non-ambiguous principle of counting if and only if it is not usual for there to be two equally plausible answers to the question: How many F's (or, how many F thingas) are there in that finite spatio-temporal region (e.g., this room now where I am writing)?

The full collection of data for which my hypothesis is supposed to account is this. The first one is a completely uncontroversial report of what Aristotle actually says. The others involve some interpretation on my part of some passages which by themselves are not perfectly clear.

Datum 1: What is a "this" is one in a certain way; it can be counted (i.e., it is described by a predicate which picks out units.)

Datum 2: Earth, air and fire are not substances in the fullest way because they are not ones. (i.e., the predicates "earth", "air", "fire" are not counting predicates.) The evidence for this is Zeta 16.

Datum 3: Matter is not a "this" or at least not actually but only potentially (i.e., matter-predicates such as "bronze", "mud", "flesh" are not counting predicates). Some evidence for this is in Zeta 3.

Datum 4: Genera are matter and genera are not substamces in the fullest way (i.e., genus-predicates are like matter-predicates in not being counting predicates). Some evidence for this is in Eta 3 and 6 in which genera are compared

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seems to be a substance more than matter does" (1029a 28); "when what is predicated is a form and a 'this' " (1049 a 35). Passages where a things nature is said to be a certain "this" are at 1030 a 1-6; 1030 a 19-20; 1037 b 25-27; 1070 a 11-14.

19 A connection between being a certain "this" and being one is made at 1052 b 15-18. In the following passages form or species is said to be one: 1040 b 5-16; 1016 b 12; 1052 a 30-35 (here there is a connection between being one and being whole. Wholes are discussed at 1016 b 12; 1024 a 11.); 1041 b 11 ff and 1034 b 34 ff all oppose being one to being a heap. Aristotle, at 1044 a 2-9 compares the way a substance is one to the way a number is one. It is not clear just what this way is, but again it is opposed to being a heap; he again at 1039 a 3ff opposes being one in this sense to being many.

to matter and in Zeta 13 in which (on one interpretation) itis said that genera are not substances; Eta 1 says that genus is not a substance.

Datum 5: Individual men, horses, and trees are "this'es". (they are substances according to the *Categories* and hence"this'es" if substance is a "this".)

My hypothesis is meant to give Aristotle's reasons for the five claims which are the data. The data do not singly or jointly have the hypothesis as a consequence, as should be obvious. But, they are evidence for it in somewhat the way that "this is a black raven" is evidence for "all ravens are black".

The fifth datum is an immediate consequence of some things Aristotle says, and the evidence for it can be found in *Categories* and in some passages of *Metaphysics*. The other four data consist of a part which gives an unexplicated paraphrase or virtually direct quotation of what Aristotle says and a part in parantheses which gives the way I understand what Aristotle means.

For datum 1 the evidence is everal paasges whose outcome can be summarized thus.[20] What is a "this" is one. What is one is one something or other, i.e., for some predicate --- "one ---" applies to what --- applies to. What can be counted is a plurality of units or ones. Datum 1 follows from our hypothesis in that it is a part of it.

The evidence for datum 2, the assertion that Aristotle intends to say that earth is not a substance because earth is not a counting predicate, is rather complicated. Aristotle says that earth and fire and air are, finally, not substances because they are not unities or ones.[21] He does not go on to claim explicitly that they are not ones becaause the predicates "earth", "air" and "fire" are not counting predicates. What he actually says in Zeta 16 is this:

Evidently even of the things that are thought to be substances, most are only potencies... [e.g.] earth and fire and air; for none of them is a unity but as it were a mere heap untill they are worked up and some unity is made out of them (1040 b 5-8, Ross translation).

Elsewhere Aristotle says that earth, air, and fire are homeomerous.[22] Roughly this means, their parts are what they are; roughly again, it means that a predicate such as "earth" is true of parts of what it is true of. One suspects that Aristotle finds their homeomerity the objectionable feature of earth, air and fire. However, since he does not actually say that being homeomerous precludes

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20 Here are the references with paraphrases of part of each passage: Being one ia being a "this" (1052 b 15-23); Being one is not by itself the nature of anything. What is one is something which is one (1053 b 25 ff); What is one is a measure of some plurality. In every case where we speak of one (or of plurality) there is some other subject besides the one (or of a plurality) (1087 b 34, 1088 a 9); What is divisible into constituents each of which is a one and a "this" is a quantity. A quantity is a plurality which is countable (1020 a 7 ff).

21 I say "finally" because he has some inclination elsewhere say that they are substances: 1028 b 10-12; 1017 b 9-11. You will recall that above (p.) I offer a way of dealing with the circumstance that Aristotle sometimes declares in one place that such and such is a substance and declares in another place that it is not (e.g., the parts of animals are said to be substances at 1017 b 9-11 and said not to be substances at 1040 a 5-10).

22 992 a 7 for fire.

something's being a "this", some complicated discussion is needed to establish datum 2.

Datum 3 was that according to Aristotle matter is not a "this" at ieast not actually but only potentially. See, for example, *Metaphysics* Eta 1 1042 a 27 where he utters: "By matter I mean that which, not being a 'this' actually, is potentially a 'this' ".Some examples of matter from Eta are wood, fat, paper and water.

Datum 4 is the claim that genera are matter: it appears in Eta 3 and 6, Delta 28 and Iota 8 of the *Metaphysics*. It appears most emphatically in Eta 3 and 6, and Aristotle does not, there, say what he means by the remark. Is is also Eta (1, 1042 a 27) quoted above, in which matter is said not to be a "this" in a way that almost has the sound of a definition: "I call matter ..." It is reasonable to suppose that in Eta 3 and 6 Aristotle meant that genera were matter because they were not "thises". On our hypothesis, that is to say that genus-predicates are not counting predicates. The reason for this can be explained by the following example: the question, e.g., "how many animals are there in that zoo?" is ambigous between a request for the individual count and a request for a count of the species.

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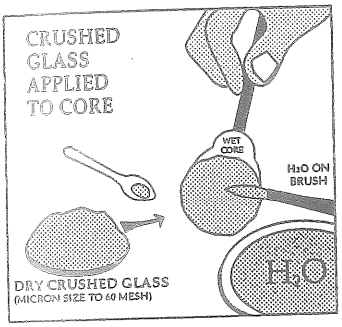

Figure 1

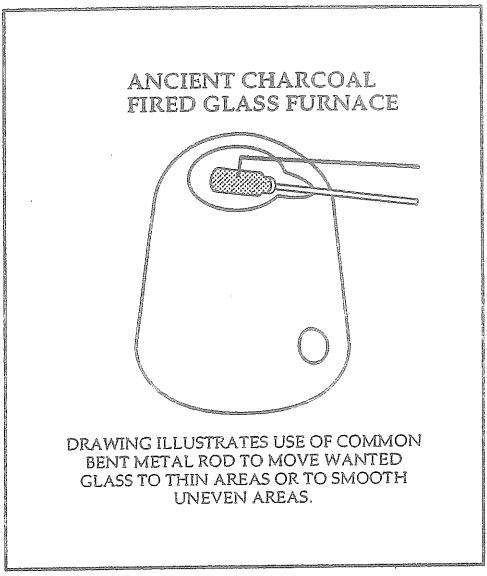

Figure 2

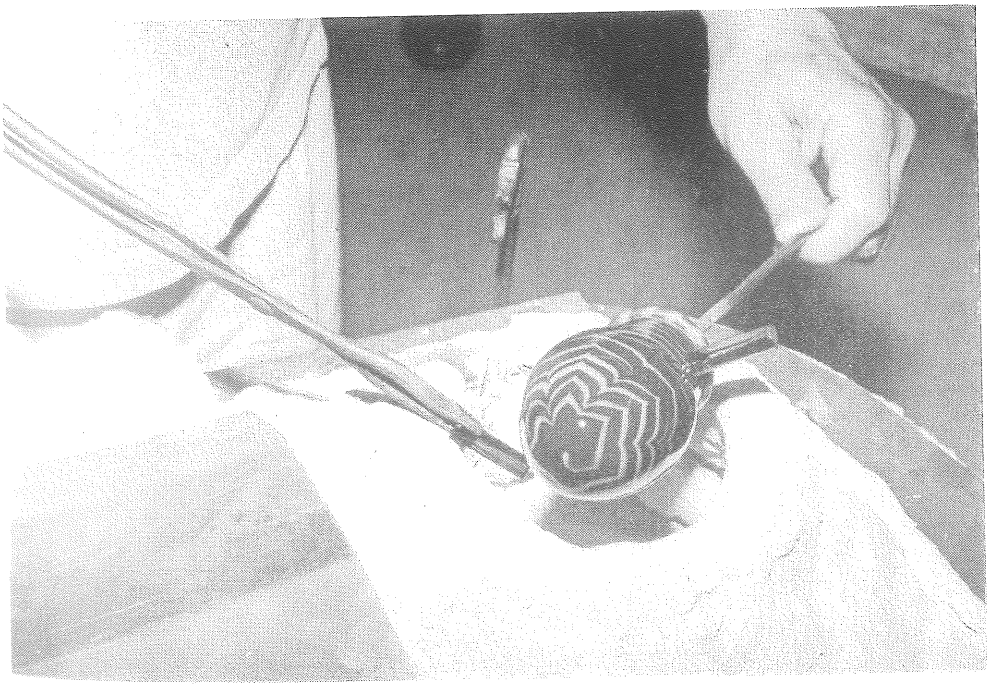

Figure 3

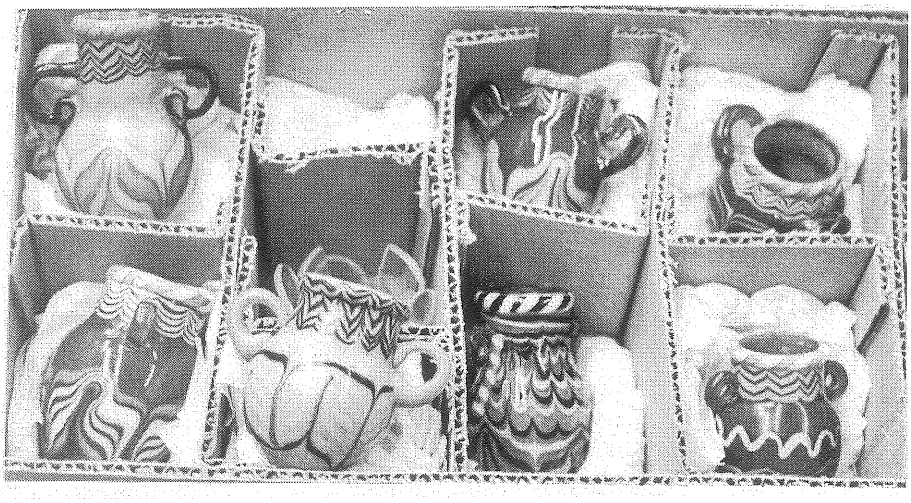

Figure 4

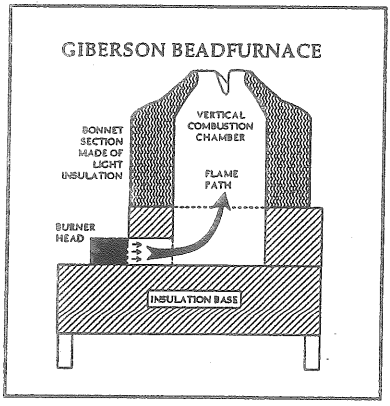

Figure 5