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Identity Puzzles and Supervenient Identities

Abstract

This paper argues that each of the so-called puzzles of the ship of Theseus, of Tibbles-and-Tib, and of the Statue-and-its-matter has a straightforward solution within ontologies that allow Aristotelian form-matter dualities and what is dubbed "supervenient numerical identity". All three puzzles are concerned with part-to-enduring-whole problems, in turn, exchange of parts, loss of a part, and having as a constitutive part the same matter as another entity. In the light of the solutions put forward, these identity puzzles appear to be strong arguments against nominalism and reductive materialism. They point towards the view that the world contains real non-reducible enduring supervenient entities.

1. The puzzle of the ship of Theseus

The relation of supervenience has primarily been discussed in relation to properties (qualities) or sets of properties. The paradigmatic claims have been that the property of moral goodness supervenes on natural (non-evaluative) properties, and that mental properties supervene on physical properties.[1] Sometimes, supervenience has been discussed also in relation to sortals and claims such as "cells supervene on molecules and molecules on atoms".[2] As will be shown in this paper, however, the supervenience relation is also of relevance for problems of enduring *numerical* identity. As the point of departure for this undertaking, I will use the old puzzle of the ship of Theseus:

> Over a period of years, in the course of maintenance a ship [the original ship, O] has its plank replaced one by one – call this [renovated] ship A. However, the old planks are retained and themselves reconstituted into a ship – call this ship B. At

[1] For an overview of analyses of supervenience, see Ingvar Johansson, "Hartmann's Nonreductive Materialism, Superimposition, and Supervenience" (2001), sections 2–6, and "Critical Notice of Armstrong's and Lewis' Concepts of Supervenience" (2002).
[2] Johansson, "Hartmann's Nonreductive Materialism, Superimposition, and Supervenience" (2001), section 1.

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> the end of the process there are two ships. Which one is the original ship of Theseus?[3]

It might seem natural to identify a ship with the collection of its material parts plus the mutual spatial relations that these parts enter into when they are put together in such a way that a ship is created. Where is the ship, if not where its material parts are? However, if Theseus' ship is so identified, then the reconstituted ship (B) is necessarily identical with the original ship (O), but this view has at least two quite counter-intuitive consequences. First, it means that the ship of Theseus has an intermittent existence; originally, it is ship O, then it disappears for a while, and then it reappears as ship B. Second, despite the functional continuity between the ships O and A, ship A is not Theseus' ship.

For my purposes, it is of no importance that the puzzle is stated in relation to an artifact and not in relation to an organism. In today's heart transplants, the transplanted heart is for some time kept "alive" in a solution outside both the bodies involved, and it is in principle possible to do so with all the parts of at least simpler organisms. On this basis, one can construe the Theseus-puzzle in relation to an organism, too.[4] One might even say that nature itself poses us parts of such a puzzle. The major part of human organisms is made up of cells,[5] and the major part of all the cells are such that old cells die and new cells are born all the time.[6] However, the old cells do never reconstitute another organism.

I would now like to present the traditional puzzle as follows. Let us assume that ship O consists of thousands bits of planks and sail fabric, p_1 to p_{1000}, and let us call the new corresponding bits, which make up ship A, q_1 to q_{1000}. If we let the expression "Ship O^{+1}" be short for "ship O with one part exchanged for a new one", and if we symbolize the spatial connections between the parts with "+", we can argue as follows:

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[3] Michael Clark, *Paradoxes from A to Z* (2002), p. 184.

[4] For this reason, I find Peter van Inwagen's comments on the Theseus-puzzle to be beside the point. He regards organisms as real material beings but all artifacts (e.g., Theseus) and ordinary inanimate visible objects as merely virtual; see his *Material Beings* (1990).

[5] Exceptions are: fluids such as the cerebrospinal and the synovial, and dead matter such as the nails and the shafts of the hair.

[6] Exceptions are some millions of brain neurones, which are with us from birth to death; in females, all the egg-cells are there from the start.

(i) Assume that a ship is identical with its material parts and their mutual spatial relations:
Ship O = $(p_1 + p_2 + \ldots + p_{1000})$.

(ii) When p_1 is exchanged for q_1 a ship O^{+1} emerges:
Ship $O^{+1} = (q_1 + p_2 + \ldots + p_{1000})$.

(iii) Assume that ship O preserves its identity when p_1 is replaced by q_1: $(p_1 + p_2 + \ldots + p_{1000})$ = Ship O = Ship $O^{+1} = (q_1 + p_2 + \ldots + p_{1000})$.

(iv) Since $p_1 \neq q_1$, but statement (iii) entails that $p_1 = q_1$, we have a *reductio ad absurdum* of the conjunctions of the assumptions spelled out in (i) and (iii).

Either assumption (i) is false or (iii) is false; either a ship cannot be identified with the collection of its material parts and their mutual spatial relations or it cannot be repaired; at least not by replacing old pieces of material with new ones. The logically possible third view, that both (i) and (iii) are false, I will not consider. It seems too odd. This puzzle of the ship of Theseus can profitably be compared with a story that might be called the *non-puzzle* of the organization of Theseus:

> Over a period of years, an organization for promoting interest in philosophy, created by Theseus and called O, has its members replaced one by one – call this ["renovated"] organization A. However, the old members are still living and one day they create a new but similar organization for promoting interest in philosophy – call this organization B. At the end of the process there are two organizations. Which one is the original organization created by Theseus?

Here, the answer is simple: organization A is identical with the organization O, since an organization is not identical with the collection of its members and their mutual organizational relations. An organization can lose and gain particular members while retaining its numerical identity. Therefore, let us apply to the organization O the argumentation schema (i)-(iv) used above in relation to the ship O, and see what the conclusions are this time. Now, the variables p and q become variables for members, "+" symbolizes mutual organizational connections, and "Organization O^{+1}" is short for "organization O with one member exchanged for a new one":

(i) Assume that an organization is identical with its members and their mutual organizational relations:
Organization O = $(p_1 + p_2 + \ldots + p_{1000})$.

(ii) When member p_1 is exchanged for q_1, an organization O^{+1} emerges: Organization $O^{+1} = (q_1 + p_2 + \ldots + p_{1000})$.

(iii) Assume that organization O preserves its identity when p_1 is replaced by q_1: $(p_1 + p_2 + \ldots + p_{1000})$ = Org. O = Org. $O^{+1} = (q_1 + p_2 + \ldots + p_{1000})$.

(iv) Since $p_1 \neq q_1$, but statement (iii) entails that $p_1 = q_1$, we have a *reductio ad absurdum* of the conjunctions of the assumptions spelled out in (i) and (iii).

In contradistinction to the ship case, this *reductio* gives rise to no puzzle at all. Assumption (i) is false and assumption (iii), i.e., Org. O = Org. O^{+1}, is in all probability true. Our views on the identity of organizations seem to be more simple and straightforward than our views on the identity of ships. In the latter case there is, as noted by Peter Simons, a certain tension. In a comment on the puzzle of Theseus he writes:

> We must recognize that the sortal concepts associated with terms like 'ship' in everyday life constitute a working compromise between two opposing tendencies. One tendency is to link the identity of a material continuant with the identity of its matter: *x* is identical with *y* only if the matter of *x* is identical with the matter of *y*. The other tendency is to link the identity of a material continuant with the identity of its form: *x* is identical with *y* only if the form of *x* is identical with the form of *y*. […] Instead of attempting to dispel the tension, let us simply use it. […] So in addition to the sortal 'ship' we suppose there are two other sortal terms, 'matter-constant ship' and 'form-constant ship'.[7]

I will develop this proposal and at the same time bring in relations of supervenience. Simons is introducing Aristotelian form-matter thinking. According to such metaphysics, an entity like a ship can be *constituted* by some matter (meaning: some material parts and their mutual spatial relations) without being identical with this matter; not even if the ship and the matter completely *coincide* in space and time.[8] In what follows, I will take

[7] Peter Simons, *Parts* (1987), pp. 199-200.
[8] It should be noted that such ontologies are, both in principle and in Aristotle, not confined to two levels. On top of one form-matter unity there might be another form, and the matter itself might be constituted by both form and a lower-level-kind of matter.

the existence of such a constitution relation – which is asymmetrical and posits coinciding objects – for granted.[9] This constitution relation must not be conflated with any of the supervenience relations that will be introduced in section two. On the assumptions now stated, there are in the puzzle of the ship of Theseus three kinds of enduring identities to be discussed:

(a) form-constant ships
(b) matter-constant ships
(c) form-and-matter-constant ships (or, simply, ships).

Trivially, ship B is matter-identical with ship O, since B is constituted by the matter of ship O in the same kind of spatial relationships; ship A is neither matter-identical nor (therefore) form-and-matter-identical with ship O. But is it ship A or ship B that is form-identical with ship O? Or, is perhaps none of them identical with O? If ship A is form-identical with ship O, then it is *only* form-identical with O, whereas if ship B is, then B is also form-and-matter-identical with O. The questions posed are questions about enduring *numerical* form-identity, i.e., about instances or tokens of forms. By assumption, all the three ships are – both with respect to form and matter – *qualitatively* identical. It is, in what follows, important to keep in mind either a distinction between universals and particulars or a corresponding distinction between types and tokens.[10] The concepts of "form",

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Instead of "Aristotelian form-matter metaphysics", one may speak of "level ontologies"; see e.g. Johansson, *Ontological Investigations* (2004), chapters 2 and 9.3.

[9] For elaborate defenses of such a relation of constitution, see Simons, *Parts* (1987), chapters 4.6-7, 6.1, and 6.5; Lynne Rudder Baker, *Persons and Bodies. A Constitution View* (2000), chapter 2; E. J. Lowe, *A Survey of Metaphysics* (2002), chapter 4. See also Johansson, *Ontological Investigations* (1989, 2004), pp. 134-136, and Barry Smith, "On Substances, Accidents and Universals. In Defence of a Constituent Ontology" (1997). Baker, remarkably, regards her view as anti-Aristotelian; see also note 16.

[10] I regard all the three kinds of numerical identities distinguished as being absolute identities in the sense defined by David Wiggins, *Sameness and Substance* (1980), chapter 1.1. Each identity spoken of relates to one particular only. None of the particulars spoken of can have different (relative) identities in relation to different sortals, since the sortal instances referred to (form as well as matter) are constitutive parts of the particulars in question. The form-and-matter identity is an instance of a complex unity that has the form-instance and the matter-instance in question as parts; this identity is complex *and* absolute, not relative. Compare the matrix that follows after the next sentence. I regard the view I will put forward as being consistent with Wiggins' remarks on the ship of Theseus; op. cit. pp. 72-73 and 90-96.

"matter", and "form-matter unity" are, out of context, ambiguous in the way shown in the following matrix:

	"form"	"matter"	"form-matter unity"
Universal (Type)	form of kind F	matter of kind M	unity of kind U
Particular (Token)	instance of kind F	instance of kind M	instance of unity U

Form-matter metaphysics lends itself easily to representations by means of (non-mathematical) operator symbolism, the operators representing forms and the variables operated on representing matter. If one lets the expressions "^{T}O", "^{T}A", and "^{T}B" refer to instances (tokens) of the sortal (type) ship-of-Theseus-form (T) and the matter pieces p_n and q_n be instances of matter of the same kind, M_n, then the claims and questions of the last paragraph can be represented thus:[11]

(1) ship O = $^{T}O\ (p_1 + p_2 + \ldots + p_{1000})$
(2) ship A = $^{T}A\ (q_1 + q_2 + \ldots + q_{1000})$
(3) ship B = $^{T}B\ (p_1 + p_2 + \ldots + p_{1000})$
(4) Is $^{T}A = {}^{T}O$?
(5) Is $^{T}B = {}^{T}O$?

Ship O is *constituted* by its matter $(p_1 + p_2 + \ldots + p_{1000})$ and its instance of the form T (^{T}O); the three spatiotemporal entities referred to by means of "ship O", "^{T}O", and "$(p_1 + p_2 + \ldots + p_{1000})$", respectively, are more or less *coinciding entities*.[12] Partly, the puzzle of Theseus is due to a tendency of ours sometimes to reduce the complex form-and-matter unity $^{T}O(p_1 + p_2 + \ldots + p_{1000})$ to a mere matter unity, i.e., to think that "Ship O = $^{T}O(p_1 + p_2 +$

[11] If genus-species talk is allowed in relation to artifacts, then, in this presentation, "ship" is a genus and "T" is a species of this genus. The statements (1) to (5) are about instances (tokens) of T.

[12] Ship O and ^{T}O, on the one hand, and $(p_1 + p_2 + \ldots + p_{1000})$, on the other, are only "more or less coinciding" since a ship has cavities as essential parts. A ship cannot be wholly identified with its material parts and their mutual spatial relations; see Roberto Casati and A. C. Varzi comments on the ship of Theseus in *Holes and Other Superficialities* (1995), pp. 130-131. The solution that I will propose is compatible with the view that ships have "holes" as parts, whereas the view that Theseus is only a collection of planks and sail fabric in a certain spatial configuration is not.

… + p_{1000}) = (p_1 + p_2 + … + p_{1000})”, but I will argue that this tendency must be resisted. When so it is, the ship of Theseus becomes, from an ontological point of view, analogous to the organization discussed, which means that ${}^{T}A = {}^{T}O$. This is the conclusion to be reached, now the arguments.

2. Supervenience

The questions whether ${}^{T}A = {}^{T}O$ or ${}^{T}B = {}^{T}O$ are questions about the *numerical* identity of the particulars referred to. Nonetheless, I will start by making a detour to the traditional relation of supervenience, which relates *kinds* of properties or sortals (including kinds of *forms* in the sense distinguished); set-theoretic formulations of supervenience will not be taken into account. In the philosophy of supervenience, there are nowadays many different concepts and correspondingly denoted supervenience relations around, but it is R.M. Hare’s original non-reductionist conception that I will use. According to this, a supervenient property/sortal cannot be reduced to the properties/sortals on which it rests. As I have argued elsewhere,[13] Hare used, when he claimed that moral goodness supervenes on natural properties, two requirements explicitly (1 and 2 below) and two other requirements implicitly (3 and 4 below). If we apply this concept of supervenience to the sortal “(ship of) Theseus-form”, we get:

- *Definition of Supervenience for Theseus-form*:
  The sortal Theseus-form supervenes on kinds of matter *if and only if* the following four requirements are met:

  1. *The indiscernibility requirement*: Necessarily, if (p_1 + p_2 + … + p_{1000}) constitutes a ship with an instance of a Theseus-form, and q_n is qualitatively identical with p_n, then (q_1 + q_2 + … + q_{1000}) constitutes a ship with a Theseus-form, too.

  2. *The non-entailment requirement*: Descriptions of p_1 to p_{1000} and all the spatial relations these entities have to each other do not entail the description that (p_1 + p_2 + … + p_{1000}) is a Theseus-form; or, speaking loosely by means of symbols, “p_1 + p_2 + … + p_{1000}” does not entail “${}^{T}O$”.

[13] Johansson, “Hartmann’s Nonreductive Materialism, Superimposition, and Supervenience” (2001), and “Critical Notice of Armstrong’s and Lewis’ Concepts of Supervenience” (2002).

3. *The multiple realizability requirement*: A Theseus-form may in principle be realized in at least two qualitatively different kinds of bases, i.e., even if a Theseus-form is realized in both $(p_1 + p_2 + \ldots + p_{1000})$ and $(q_1 + q_2 + \ldots + q_{1000})$, the latter are not necessarily qualitatively identical.

4. *The existential dependence requirement*:[14] A Theseus-form cannot possibly have a spatiotemporal existence without resting on some matter; in other words: necessarily, if an instance of a Theseus-form ^{T}O exists, then an instance of $^{T}O(p_1 + p_2 + \ldots + p_{1000})$ or $^{T}O(q_1 + q_2 + \ldots + q_{1000})$ or $^{T}O(r_1 + r_2 + \ldots + r_{1000})$ or … exists.

As the ship of Theseus is traditionally described, the sortal Theseus-form meets these requirements: (1) if one of two qualitatively identical collections of material pieces (where also spatial relations are taken into account) is a ship, then the other collection is a ship, too; (2) from a mere description of the planks and fabric of the ship of Theseus, and their spatial relations to each other, one cannot deduce that they constitute a ship; (3) several parts of the ship might be exchanged for similar parts made of other materials without any reduction of its functional abilities, i.e., the functional form of the ship of Theseus can be multiply realized; and (4) there are no ghost ships. That is, the sortal Theseus-form is a supervenient sortal.

In relation to the last claim, I want to repeat: I am talking only of supervenience in Hare's sense. David Lewis identifies supervenience with only the indiscernibility requirement; David Armstrong turns the non-entailment requirement upside down into an entailment requirement from which, then, trivially, the indiscernibility requirement can be derived; Jaegwon Kim comes close to Hare, but he leaves the existential dependence requirement out.[15]

[14] Note that this kind of ontological dependence is neither a direct ontological dependence between two particulars *as particulars* (often called *individual dependence*) nor a dependence where a particular *as particular* depends for its existence on objects of a certain type (often called *generic dependence*); for classic discussions of such ontological dependencies, see Simons, *Parts* (1987), chapter 8, and Lowe, *The Possibility of Metaphysics* (1998), chapter 6. The *existential dependence* relation used relates particulars that are *instances of universals*; it is presented in more detail in Johansson, *Ontological Investigations* (2004), chapter 9.

[15] See note 13, op. cit.

To be a supervenient sortal or property (quality) is to have certain kinds of existence conditions. Therefore, a general definition also of supervenience for instances (tokens, individuals) comes naturally: An instance of S supervenes on some base instances *if and only if* S is a supervenient property/sortal. In the case of Theseus' ship, we get:

- *Definition of Supervenience for an Individual Theseus-form*:
  An individual Theseus-form supervenes on its matter *if and only if* the sortal Theseus-form is a supervenient sortal.

From what has already been said, it follows that ^{T}O, ^{T}A, and ^{T}B are supervenient individual forms of the same kind; all three are instances of T.

As long as the supervenience relation is restricted to properties and sortals, it is clearly distinct from the relation of constitution, since the latter is usually regarded as a relation between particulars (tokens). But what is the difference between *individual* supervenience and constitution? One difference is the following: if an S supervenes on p, then p is not part of S, but if an S is constituted by p, then p is part of S. The pure Theseus-form instance, ^{T}O, *supervenes* on ($p_1 + p_2 + \ldots + p_{1000}$), but the whole ship O is *constituted* by ($p_1 + p_2 + \ldots + p_{1000}$) *plus* this supervening form instance. Since the pure form T can be realized in different kinds of matter, its instances, which are qualitatively identical, cannot possibly have the matter in question as parts. Since constitution is distinct from identity, there must be an entity that is, so to speak, the constituted whole *minus* its matter, namely a form instance.[16]

3. Supervenient numerical identity

We are now in a position to face the problem whether any of the supervenient individual forms ^{T}O, ^{T}A, and ^{T}B are, in fact, numerically identical. Let us first take a look at only the change whereby p_1 is replaced by q_1. This change consists of two processes (taking away p_1 and inserting q_1, respec-

[16] This fact is seldom made clear in the literature on the constitution relation. Here, one often moves too fast from claiming, explicitly and rightly, that something (A) is constituted by something else (B) to claiming, implicitly and falsely, that A is constituted *only* by B. For instance, L. R. Baker writes quite correctly that "constitution must be distinguished sharply from supervenience" (*Persons and Bodies. A Constitution View*, p. 34), but she does not notice that a constituted whole nonetheless has to *contain* at least one supervenient entity. This neglect might be the explanation of why she regards her "constitution view" as being anti-Aristotelian; compare note 9.

tively) and three stages. The first question is what we are to say about the ship that exists when neither p_1 nor q_1 is there; let's call it "ship O^{-1}". Is it a ship with a Theseus-form (T) or not? In symbols, we have two unproblematic assertions (about stages 1 and 3, respectively) and one question (in relation to stage 2):

stage 1:	ship O	$= {}^{T}O\ (p_1 + p_2 + \ldots + p_{1000})$.
stage 2:	ship O^{-1}	$= {}^{T}O^{-1}\ (p_2 + \ldots + p_{1000})$?
stage 3:	ship O^{+1}	$= {}^{T}O^{+1}\ (q_1 + p_2 + \ldots + p_{1000})$.

The four requirements for supervenience do not imply that the sum $(p_2 + \ldots + p_{1000})$ has to have a Theseus-form as a supervenient sortal; nor do the requirements imply that $(p_2 + \ldots + p_{1000})$ cannot be a base for such a form. In particular the requirement of realizability implies that there is no general answer to the question whether $(p_2 + \ldots + p_{1000})$ can be a base for a supervenient instance of a Theseus-form. This implication conforms well to common sense. What kind of ship ship O^{-1} is depends on what p_1, the piece that is taken away, is. If p_1 is merely a little stick, there is still a Theseus-kind-ship, but if p_1 is the main sail there is no longer such a ship. Let me now simply postulate that p_1 is of such character that even ship O^{-1} is a ship with a Theseus-form, and then think through the consequences.

The assumptions now made imply the existence of a phenomenon that is well known and investigated in technology, medicine and linguistics, the existence of *redundancy*. Both in many machines and in many organisms there are functional redundancies; in language there is often information redundancy. In relation to a supervenient entity, one may talk of "base redundancy". If both $(p_1 + p_2 + \ldots + p_{1000})$ and $(p_2 + \ldots + p_{1000})$ can be a base for the same kind of supervenient ship form, then there is in the case of $(p_1 + p_2 + \ldots + p_{1000})$ redundancy of matter in relation to the supervenient ship form.[17] That is, the piece p_1 is, *ceteris paribus*, redundant for the supervenience of the Theseus-form (thereby, it is redundant for the constitution of Theseus-kind-ships as well). The following principle can be stated:

- *The Possibility of Base Redundancy for Supervenient Qualitative Identity*: If an instance of kind S supervenes on $(p_1 + p_2 + \ldots + p_{1000})$, it might be the case that p_n can be taken away but that nonetheless

[17] The same point about redundancy can be made with "ship form" exchanged for the classical examples of supervenience, "moral goodness" and "mental event", too.

another or the same instance of kind S supervenes on the new base, too.

From what has already been said, it follows that ship O, ship O^{-1}, and ship O^{+1} have exactly the same *kind* of form; all three ships are instances of the same sortal. But are they also numerically form-identical? Where in time do instances of sortals begin and end? Since the whole puzzle of Theseus is presented in terms of enduring pieces of wood and sail fabric, one possible first-hand reaction is that ontologists should make a wholesale rejection of enduring entities. However, I will make the opposite. I will take it for granted that there can be, and are, in the world enduring entities.[18] Also, I will rely on the following somewhat commonsensical but often in ontology neglected principle:

- *The Requirement of Having a Boundary*: Every finite spatiotemporal entity has to have both spatial and temporal bona fide boundaries; be the entity a substance or merely an instance of a sortal or a property.[19]

It has been argued that there are no bona fide boundaries, but I will leave this curious view out of account.[20] Where there is a spatial or temporal boundary, there is a discontinuity located in a continuum, in continuous

[18] For arguments against the view (four-dimensionalism) that there can be no enduring entities, see e.g. Lowe, *A Survey of Metaphysics* (2002), chapter 3.

[19] The fact that boundaries are of utmost importance in ontology has in contemporary philosophy been stressed mainly by Barry Smith. Going further back, there are R. M. Chisholm and Franz Brentano. Smith writes: "In order to arrive at a definition of substance, then, it is the notion of boundary which we shall need to take as our guiding clue (something that has not been done in standard treatments of substance in the literature of analytic metaphysics –"; from "Objects and Their Environments: From Aristotle to Ecological Ontology" (2001), pp. 79-97. Smith's definition of substance draws on a distinction between substances in the narrow sense (such as one's body), and substantial entities (such as one's arm or one's head). This in turn rests on a distinction between bona fide boundaries (such as the surface of one's skin) and fiat boundaries (such as the boundary between one's arm and one's torso, or between Utah and Montana). See Smith, "Fiat Objects" (2001). His definition of substance starts as follows: "x is a substance =df. (1) x is substantial, (2) x has a boundary, …". The Requirement of Having a Boundary stated expands on this in two ways: (a) it applies the requirement also to instances of sortals and properties, and (b) it brings in temporal boundaries, too. If there are finite purely temporal entities such as Descartes' thinking substances, they need and can of course only have temporal boundaries.

[20] For discussions see, e.g., A. C. Varzi, "Boundary" (2004), and B. Smith, "Boundaries: An Essay in Mereotopology" (1997).

space and in continuous time, respectively. In the point of time where the form of the original ship (^{T}O) ceases to exist, there has to be some kind of relevant discontinuity, but on the assumptions made, there simply is during the two processes and between the three stages under discussion no such point. During this time interval, there is complete qualitative identity with respect to kind of form; even though there is discontinuity with respect to matter, there is no discontinuity between the individual forms ^{T}O, $^{T}O^{-1}$, and $^{T}O^{+1}$. That is, there is no boundary between these instances and, therefore, they have to be one and numerically the same instance. We can state yet another principle:

- *The Possibility of Base Redundancy for Supervenient Numerical Identity*: If an instance of kind S supervenes on $(p_1 + p_2 + \ldots + p_{1000})$, it might be the case that p_n can be taken away but that nonetheless the same instance of S supervenes on the new base, too.

Supervenient individual forms might endure even though some base entities are lost, changed, or exchanged. As already stated: in the sequence from ^{T}O $(p_1 + p_2 + \ldots + p_{1000})$ via $^{T}O^{-1}$ $(p_2 + \ldots + p_{1000})$ to $^{T}O^{+1}(q_1 + p_2 + \ldots + p_{1000})$ there is numerical form-constancy, i.e., $^{T}O = {}^{T}O^{-1} = {}^{T}O^{+1}$. In short, we have here a case of supervenient numerical identity.

4. Conclusions in relation to the ship of Theseus

In the formulation of the Theseus puzzle, all the substitutions that transform ship O into ship A are assumed to be such as to preserve the *qualitative* identity of the form of ship O. Let us now add the assumption (to be discussed in section 5) that each whole step consisting of (i) removal of a piece, (ii) the ship lacking such a piece for a while, and (iii) the inserting of a new piece is such that there is base redundancy for supervenient numerical identity. If so, then, according to the analysis made at the end of section 3, even the *numerical* identity of the form of ship O is preserved through the whole process. On the assumptions stated, three conclusions emerge:

(a) Ship A is numerically form-identical (but not matter-identical) with ship O.
(b) Ship B is numerically matter-identical (but not form-identical) with ship O.
(c) Only ship O is numerically form-and-matter identical with ship O.

This solution deepens Jonathan Lowe's proposed solution of the puzzle. Explicitly, he uses no form-matter distinction, but implicitly he does. He thinks that ship A is identical with the original ship, and central to his argument is a concept of "appropriation". According to Lowe, when ship B is being built, the old pieces from ship O become *appropriated* by ship B and can, therefore, no longer be parts of either ship O or ship A. He says he uses:

> the intuitively plausible principle that I [Lowe] advanced earlier, namely, that if sufficiently many of a thing's parts are incorporated into *another* thing, then those parts are appropriated by that other thing and cease to be parts of the first thing.[21]

Where there is such a kind of appropriation, a ship cannot be identical with the collection of its material parts and their spatial relations. A collection appropriates nothing. Therefore, Lowe's solution implies the existence of some entity that is distinct from the matter of the ships, and which is responsible for the appropriation in question. What kind of entity is it? Well, the exact answer is for Lowe to give, but it seems to me as if it has to conform to some kind of form-matter metaphysics. Only in such metaphysics makes it good sense to say that something (the forms) "appropriates" or "forms" matter.[22]

In what follows, I will take my way of solving the puzzle discussed above (case 1) for granted. With its help, solutions to similar puzzles are easily found. Here come three other cases.

Case 2: What kind of numerical identities and/or non-identities are there between ship O and the ship (ship A/2) that is there half-way during the process that transforms ship O into ship A? Since the matter identity at hand consists in the identity of a *collection* of pieces of matter (and spatial relations), it can take degrees: The more pieces that stay the same, the

[21] Lowe, *A Survey of Metaphysics* (2002), p. 33.
[22] In Platonist dualism, one ought to say, as is usually done, that matter *participates* in the idea; not that the idea or form *appropriates* the matter in question.

higher the degree of matter-identity. Therefore, the answers to this case are:

- Ship A/2 is numerically form-identical and 50% matter-identical with ship O
- Ship A/2 is *not* numerically form-and-matter identical with ship O.

Case 3: What identities are there if ship O is in some way cut in the middle into two big parts, and then each part is, with new material, re-built into the ships C and D? Since the cut is made in such a way that the functional ability is lost, both the form-instance ^{T}O and, consequently, the ship O pass out of existence. We get:

- Ship C is 50% matter-identical (but not form-identical) with ship O
- Ship D is 50% matter-identical (but not form-identical) with ship O.

Case 4: To begin with, there are two qualitatively identical Theseus-kind-ships, ship O_1 and ship O_2; then the corresponding matter pieces of the ships are exchanged, one by one, for each other. If the resulting ships are called "ship A*" and "ship B*", the following holds true:

- Ship A* is numerically form-identical with ship O_1 and matter-identical with ship O_2
- Ship B* is numerically form-identical with ship O_2 and matter-identical with ship O_1
- Only ship O_1 is numerically form-and-matter identical with ship O_1 (and O_2 with O_2).

Related to the common sense tension between form-constancy and matter-constancy spotted by Simons, there is often also a natural longing for form-and-matter-constancy. Neither in the Theseus puzzle, nor in the other cases discussed, can such a longing be wholly satisfied. Let me show what I mean.

Assume the existence of a couple who once made a romantic trip on the original ship O, and who now wants to make a new trip on the ship hoping that, at least partly, some nice feelings will come back. But then the travel agency tells them the story about the exchanges of parts and asks them whether they want to make their voyage on ship A or on ship B. If ship O had simply been burnt to ashes, they would have felt sorrow for not being able to make another trip with the ship, but they wouldn't have had the decision problem they now face. Since they hope to re-live a certain atmosphere, their emotions are essential parts of the problem, and they pretty soon get an intense longing for a ship that is form-and-matter-identical with ship O. I wouldn't be astonished if, partly because of this longing, they pose their decision problem in form of the question: "Which of the ships A and B is *really* ship O?" According to the analysis made, however, this question rests on the wrong presupposition that there is only one kind of identity to consider. Instead, they should ask: "Shall we make our trip on ship A which is form-identical with our beloved ship O, or shall we make the trip on ship B which is matter-identical with it?" Since their emotions were originally attached to the form-and-matter unity ship O, it is not an easy task to find out whether today these emotions are associated more with the form or more with the matter of the old ship O. Perhaps it is an impossible task.

If, instead, the travel agency tells our couple that ship O in a sense still exists, but that it has been renovated into what I have called "ship A/2", their decision problem takes on another character. Since there is in this case only one ship, their problem becomes whether to make the trip on this ship or not to make it at all. What tells against making the trip is that ship A/2 is not *really* the old ship O. It is not form-and-matter-identical with ship O. Even though ship A/2 is numerically form-identical with their love-ship, there is only 50% matter-identity. Therefore, they get a curious feeling that something is missing in relation to their original wish. This kind of situation is, by the way, quite common in today's European tourism. Several churches and old houses that were partly destroyed during the World Wars have been re-built in such a fashion that they look and function the way the old buildings did. They are form-identical but only partly matter-identical with the original buildings. I know for sure that there are tourists who have asked themselves: "Is this *really* the old church or not?"

With respect to case 4 (i.e., the two ships O_1 and O_2, which exchanged all their parts with each other), an even more complicated scenario can be construed for our romantic couple. Let us assume that the nice voyage they want to re-live was made on ship O_1, but also that they once made an awful quarrelsome trip on ship O_2. Ought they now to make their new trip on ship A*, whose form gives rise to nice associations (since it is form-identical with O_1), but whose matter gives rise to unpleasant associations (since it is matter-identical with O_2); or, ought they to make the trip on ship B* whose matter gives rise to nice associations but whose form gives rise to unpleasant associations? Whatever they choose, I guess they will be longing for a ship that is simply form-and-matter-identical with ship O_1.

5. Absolute identities and linguistic-pragmatic identities

Some philosophers, who do find the puzzle of the ship of Theseus a real philosophical problem, do not find a situation in which this ship is first disassembled into pieces and then reassembled again (case 5) at all problematic.[23] The reassembled ship is the same old ship O. However, I can't say the same. Being true to my solutions of cases 1 - 4, I have to claim that when ship O is disassembled, the form ^{T}O passes out of existence, and that when the matter pieces are reassembled again, we get a ship (ship P) with a numerically new form instance. That is, I have to claim that ship P is not *numerically* form-and-matter-identical with ship O, even though, of course, the ships are *qualitatively* identical with respect to both form and matter. But isn't this a very counter-intuitive claim to make? Yes, it is. However, there is a good explanation of this fact. I have so far been talking about *absolute* numerical identities. But in ordinary language, normally, we don't care too much about such absoluteness. When this difference is clearly seen, even my solution to case 5 becomes acceptable. Let me explain by commenting on a paper, which, by not taking the dynamics of language into account, over-emphasizes the point I need and want to make.

Trying to combine the truthmaker idea with the so-called supervaluationist approach to singular reference, Barry Smith and Berit Brogaard writes that:

> The truthmaker theory rests on the thesis that the link between a true judgement and that in the world to which it corresponds is not a one-to-one but rather a one-to-many relation. An analogous thesis in relation to the link between a singular term and that in the world to which it refers is already widely accepted. This the thesis to the effect that singular reference is marked by vagueness of a sort that is best understood in supervaluationist terms.[24]

Let me relate this quotation to perceptual judgments (but neglect the theory of supervaluation). If I truly say to someone "I am seeing a red house over there", then my report would be true independently of whether I was seeing a dark red, a medium red, or a light red house. In fact, it is consistent

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[23] See e.g. Lowe, *A Survey of Metaphysics* (2002), pp. 30-34.

[24] Smith and Brogaard, "A Unified Theory of Truth and Reference" (2000), pp. 49-93; the quotation is from the abstract.

with me seeing one of several possible different hues of red. Since the word “red” is poorer in content (intension) than the perceived hues of redness that it is used to describe, we have an example of the one-to-many relation mentioned in the quotation. Something similar is true of many names, too. If I truly say to a friend “Now we can see the whole Mont Blanc”, this judgment is true for both of us even if I and my friend are drawing the geographical boundary for Mont Blanc somewhat differently. In everyday conversations, normally, we care as little about exact such boundaries as we care about what exact color hues we perceive.

This kind of one-to-many relation between words and the perceptual world becomes even more obvious if one also takes into account, as Smith and Brogaard do and stress, the fact that the extensions of many terms, both universal and singular, are context dependent. As they say, the sentence “This glass is empty” is made true by different partitions of reality when uttered by beer drinkers and by hygiene inspectors; and this difference relates to both the singular term “this glass” and to the universal term “empty”. Based on observations like these, they claim, although only in passing, to have a solution also to the puzzle of the ship of Theseus. I quote them at length:

> In some contexts, our terms will refer in such a way that it will be true that the ship is, even after all the repairs, still the same as the original ship. These might be contexts in which we are interested only in the ability of the ship to do its job in sailing from port to port. Our partitions in those contexts trace over the separate planks within the ship. In other contexts, however, for example inside museums of naval archaeology, our terms may refer in such a way that it is precisely these planks which are important, so that the ship may for example enjoy continued existence even when it is in a disassembled state.
>
> Simons (1987) has proposed that these two ways of looking at identity through time involve appeals to different notions of identity: functional identity, in the eyes of the shipowner, and material identity in the eyes of the curator. Simons comes close to provide a correct account of the problem in hand. But once again our contextualist theory is more thoroughgoing, since it grants to a much wider range of actual and possible contexts in which successor relations are tracked across time the power to determine corresponding true judgements of identity. Thus in particular both the shipowner and the museum curator can make true judgements of identity relating to the original ship, though there is of course no context in which these two sets of judgements can come out true together.[25]

[25] Smith and Brogaard, “A Unified Theory of Truth and Reference” (2000), section 9.

First comment: This cannot possibly be the whole solution of the Theseus puzzle, since it does not take account of the situation where ship B (the curator's ship) is as much sailing the seas as ship A. Second comment: Simons' proposal ("So in addition to the sortal 'ship' we suppose there are two other sortal terms, 'matter-constant ship' and 'form-constant ship'") can be given two interpretations. Smith and Brogaard seem to take it as saying that *already* when the puzzle arises, the terms 'matter-constant ship' and 'form-constant ship' are there, whereas I have taken it as saying that such terms can and have to be constructed in order to solve the puzzle. On the first interpretation, Simons says something that is probably wrong, but on the second interpretation he is right. Let us next take a brief look at the flexibility of language.

Often, when needed, one-to-many relations between words and world can be turned into "one-to-not-so-many" relations. For instance, we can easily turn from speaking about only redness to speak about dark red, medium red, and light red. It is even possible to create terms which give us one-to-one relations between color hue terms and perceived hues. In fact, the so-called Munsell Hue Designations come close to it. They divide red into ten reds (1R, 2R, …, 10R), yellow-red into ten yellow-reds (1YR, 2YR, …, 10YR), and red-purple into ten red-purples (1RP, 2RP, …, 10RP). Similarly, we can very well create many names, "Mont Blanc 1", "Mont Blanc 2", "Mont Blanc 3", and so on, each of which denotes a mountain with a very precise boundary.

As in everyday contexts we do not care too much about very specific color hues and the precise spatial boundaries of things, neither do we normally care about the differences between form-identity, matter-identity, and form-and-matter-identity of ships. We simply speak about the identity and non-identity of ships. If a ship is first disassembled and then reassembled, we can trace over the difference between form-identity and matter-identity, and, consequently, also trace over the disassembled state, without getting any linguistic-pragmatic problems. The point of the puzzle of Theseus is that it describes a situation where this is no longer possible. When both ship A and ship B are sailing, they belong to the same context; and if in this context one can refer only to one kind of absolute all-or-nothing numerical identity, "ship identity", then either (i) both the ships A and B are wholly identical with ship O, or (ii) none of these ships are at all identical with ship O, or (iii) one of the ships is wholly identical with ship O and the other is not at all identical. Since all these three options are absurd, we have to develop language in order to make it catch hitherto neglected partitions of reality. When this is done, we can truly claim that ship A is form-identical with ship O, and that ship B is matter-identical with it.

Ordinary language has not been created in order to fit the needs ontologists have. It has been, and is, developed mainly in order to make ordinary living easier. Nonetheless, it can be developed to fit the philosophers' needs, too. My claim, that the reassembled Theseus in case 5 is not the same ship as the original ship, is counter-intuitive only if it is falsely understood as contradicting common sense statements to the effect that the ships are identical. However, I am not trying to change the truth-value of such common sense statements of non-absolute identity. I think that in everyday life we should continue to say that the reassembled ship is the same ship as the old one, ship O, but as philosophers we should remember that the ships are not absolutely identical with respect to their form instances. The original puzzle (case 1) is different. Here, the distinction between form and matter cannot even in everyday language be disregarded.

In my opinion, when making ontological thought experiments, one is often allowed to write as if words that normally have a one-to-many relation to the world have suddenly got a one-to-one such relation. In my argumentation in the earlier sections, I have implicitly used this semantic move. I have written as if my terminology is of the one-to-one character. Now, I want to make my assumptions in this respect explicit. First some words about matter-identity and then some about form-identity.

In the real world, it would be impossible for the ships A and B to be absolutely *qualitatively* identical with regard to all their matter. This would mean that all the corresponding planks of these ships had absolutely the same shape and absolutely the same kind of chemical composition. Nor would it be possible for ship B to be absolutely *numerically* matter-identical with ship O. Of physical necessity, there has to be some wear during the reconstruction. Both these kinds of complications have so far been neglected, and, starting with the next section, they will again be so treated.

Can then, in the real world, ships A and B be absolutely *qualitatively* identical with regard to their forms, i.e., with regard to their functional identity? Let me give just some brief remarks. As an extended thing continues to be extended (in the absolute sense) even when it is shortened, and as a person is absolutely the same person both when healthy and sick, I think a function can stay absolutely the same even when its actual functioning changes a bit; and even if it changes in such a way that it is no longer functioning well. Functioning takes degrees, just as length takes quantities; in other words, a ship has its ship-function even when it functions badly.[26] Therefore, I think that absolute form identity is a real possibility; both qualitatively between two ships and numerically over time for one single ship. This view is quite consistent with my earlier claim that if Theseus loses its main sail, it is no longer a Theseus-kind-ship, even though there is a ship. This ship is then only "the corpse" of Theseus.

The difference between absolute and linguistic-pragmatic identities now explicated does not only help me to explain why, at first, my solution to case 5 looks counter-intuitive. It also allows me to distinguish between absolute and pragmatic base redundancy. At the beginning of section 4, I assumed that in the Theseus puzzle each exchange step – removal of a piece, the ship lacking the piece, and the inserting of a new piece – has such a character that in the sequence O, O^{-1}, and O^{+1} even O^{-1} is *exactly* the same kind of form as O and O^{+1}. However, such an absolute requirement is not necessary. To common sense, and the puzzle of the ship of Theseus is a problem even for common sense, it doesn't matter if O^{-1} is a form that differs a bit from O and O^{+1}. If there is no base redundancy for the supervening form O, and one piece is taken away from ship O, then the form O disappears; and when a new piece is inserted a new individual form (of the same kind as the first one) starts to supervene. That is, from an absolute ontological point of view. But from a more pragmatic point of view there is no reason to bother. Let's *say* it is the same form.

6. The problem of Tibbles, Tib, and the tail (or: Theseus, Thes, and the sail)

Back to philosophical absolute identity. I will now show that the form-matter distinction that I have used in cases 1-4 can be used in order to solve also the related so-called problem of Tibbles and Tib. All the first four cases have to do with how *exchanges* of parts seem to create problems for ordinary intuitions about the numerical identity of a whole, and case 5 has to do with how *dis- and reassembly* of parts are related to such intuitions, but the Tibbles-Tib problem (case 6) is a problem about how *loss* of a part is related to the identity of some wholes.

In the usual presentations of this problem, Tibbles is a cat that loses its tail and becomes Tib, but it makes no difference to the problem if it is stated as a problem about a ship called Theseus that loses a sail and becomes Thes. In order to keep not only the readers' ordinary associations to

[26] More about this in Johansson, "Functions, Function Concepts, and Scales" (2004), section 7.

Tibbles and Tib intact, but also to keep the link to the puzzle of the ship of Theseus visible, I will use Tibbles as a name of a big sailing ship; one that loses a small and not too important sail. Lowe's presentation of the problem can then be paraphrased as follows:[27]

> The sailing ship Tibbles has many sails; among them one rather small sail called 'Tail'. Tail is clearly a component part of Tibbles. But now consider the rest of Tibbles – the whole of Tibbles apart from Tail – and let us call this 'Tib'. Tib seems to be a component part of Tibbles just like Tail. Clearly, Tibbles and Tib are not identical with one another, for Tibbles has Tail as a part whereas Tib does not. However, big sailing ships can survive loss of one sail; and in an accident this happens to Tibbles. Since Tail was no part of Tib, this accident can have no bearing on the existence of Tib. Therefore, after the accident, Tibbles and Tib exactly coincide with one another. And the question is: how is it possible for them exactly to coincide and yet to remain numerically distinct from one another?

Achille Varzi states the same problem as follows, I quote:

> 1. Tibbles at $t \neq$ Tib at t (one is a proper part of the other)
> 2. Tibbles at t = Tibbles at t' (Tibbles survives the loss of Tail)
> 3. Tib at t = Tib at t' (Tib is not affected by whatever happens to Tail)
> 4. Tibbles at t' = Tib at t' (both have the same parts)
>
> Yet 2-4 jointly imply the negation of 1 by transitivity of identity, so we are in plain contradiction.[28]

[27] Lowe, *A Survey of Metaphysics* (2002), p. 74.

[28] A. C. Varzi, "Basic Problems of Mereotopology" (1998), p. 33. Varzi proposes no definite solution. The quotation continues as follows: "If, on the other hand, we deny that Tibbles and Tib have become one and the same thing, i.e., if we deny 4 (and extensionality with it), then we must abandon the traditional identity criterion according to which two distinct material bodies cannot occupy the same spatial region at the same time. And this is just as high a cost to pay. Of course we could also keep 1 and 4 and give up either 2 or 3. Rejecting 2 takes us back to the case of Theseus' ship, suggesting a form of mereological essentialism: the removal of a part (even a tiny and seemingly inessential one) affects the identity of the whole. But rejecting 3 seems to

Let me again distinguish between matter-identity and form-identity. If we identify Tib with its matter (m_1), which is the same during the whole process, and Tibbles with its matter, which originally is $m_1 + m_2$, the four statements in Varzi's presentation look as follows:

M1. $(m_1 + m_2)$ at $t \neq (m_1)$ at t
M2. $(m_1 + m_2)$ at $t = (m_1)$ at t'
M3. (m_1) at $t = (m_1)$ at t'
M4. (m_1) at $t' = (m_1)$ at t'

Again, of course, we get a contradiction. Statements M2 to M4 jointly imply the negation of M1. But now there is a difference. If the ships are identified with their matter, the second premise is obviously false (and all the other are obviously true), and there is no problem. Tibbles without Tail cannot then possibly be Tibbles anymore. If statement M2 is rejected, the contradiction disappears. So much for matter-identity; let us next bring in the forms of Tibbles and Tib. That is, let us identify Tibbles and Tib with the unity of their respective forms (O) and their respective matter (m). In the kind of operator symbolism earlier used, we get:

- the original Tibbles = ${}^{\text{Tibbles}}O(m_1 + m_2)$
- the damaged Tibbles = ${}^{\text{Tibbles}}O^{-1}(m_1)$
- Tib = ${}^{\text{Tib}}O(m_1)$.

If the statements 1-4 of Varzi's presentation are turned into statements about identities and non-identities only of forms, we get:

F1. ${}^{\text{Tibbles}}O$ at $t \neq {}^{\text{Tib}}O$ at t
F2. ${}^{\text{Tibbles}}O$ at $t = {}^{\text{Tibbles}}O^{-1}$ at t'
F3. ${}^{\text{Tib}}O$ at $t = {}^{\text{Tib}}O$ at t'
F4. ${}^{\text{Tibbles}}O^{-1}$ at $t' = {}^{\text{Tib}}O$ at t'

As it should be, again statements 2 to 4 jointly imply the negation of 1. What is then wrong here? Consider premise F2. Whereas M2 is false, F2 is true. Since Tail is an unimportant sail, there is base redundancy, and the form ${}^{\text{Tibbles}}O$ is both qualitatively and numerically identical with the form ${}^{\text{Tibbles}}O^{-1}$, which means that F2 is true. Next, consider F4; it is true, too.

imply an equally doubtful form of essentialism to the effect that the removal of a part affects the identity of another, adjacent but mereologically disjoint part."

Since both the forms in question ($^{Tibbles}O^{-1}$ and ^{Tib}O) are supervenient individual forms, the indiscernibility requirement can be applied. Perhaps it is not immediately obvious, but this requirement entails that if two supervenient entities have the same base (as $^{Tibbles}O^{-1}$ at *t'* and ^{Tib}O at *t'* have) then they are identical. And this means that F4 is true. What then about F3? It might give the impression of being true by definition, but it is not; to the contrary, it is false. Of course, *if* there is a form ^{Tib}O at *t*, then this form is surely identical with ^{Tib}O at *t'*, but is there one? The statement F3 must be interpreted as saying "There is a form ^{Tib}O at *t*, and this form is identical with ^{Tib}O at *t'*". Now, with Lowe, I am of the opinion that there is no such form ^{Tib}O at *t*.[29] Why? Because there is no *actual* functional identity that is Tib; the Tib thought of is merely a potential functional identity. And, since a potential form (^{Tib}O at *t*) cannot be identical with an actual form (^{Tib}O at *t'*), F3 is false. Left to consider is F1, which, on the basis of what has been said must be true. It maintains that an actual form, $^{Tibbles}O$ at *t*, is distinct from a potential form, ^{Tib}O at *t*.

In short, if form-identity and matter-identity are kept apart, the problem of Tibbles and Tib is rather easily solved. In the pure "matter formulation" premise M2 is false, and in the pure "form formulation" premise F3 is false. The conclusions can be stated thus:

- Ship (cat) Tibbles is form-identical, but not matter-identical, with ship (cat) Tib
- Only ship (cat) Tibbles is form-and-matter identical with ship (cat) Tibbles.

7. Theseus and the lump of bronze

In all the situations discussed so far (cases 1 to 6), the central matter of the form-matter dualities in question have been distinct pieces. In the so-called problem of the statue and the lump of bronze (or clay or whatever), this is not the case. Here (case 7), the matter consists of some stuff that is regarded as a homogeneous matter unit. I will discuss a bronze statue called Theseus; so called because it is a statue of the ship of Theseus. The problem of the statue Theseus can, just like the puzzle of the ship of Theseus, be stated as a dilemma between two intuitions. On the one hand, we seem to identify a statue with its matter; especially when we are looking at it. On

[29] Lowe, *A Survey of Metaphysics* (2002), pp. 74-76.

the other hand, we seem to make a distinction between statues and what they are made of; especially when we are thinking of a statue (T) that is melted down and then re-shaped into another statue (U).[30] According to the analyses of cases 1 to 6, it ought to be the last intuition that we should let win. And so it is. Here come the details.

Even though the matter of the statue is assumed to be a homogeneous unit, this identity problem can be shown to have the same kind of structure as the other ones in which the matter consists of distinct pieces. Even the problem of the statue and its matter can be represented by means of the operator symbolism introduced. When statue T exists (stage 1), the bronze matter in question (m) has one specific three-dimensional geometrical shape (s_1); when the statue has been melted down (stage 2) there are other such shapes (let's bring them together under the expression s_2); and when this pure lump of bronze (m) has been turned into the new bronze statue U (stage 3), there is a third specific geometrical shape (s_3). Statue T has the statue form ${}^{T}O$, statue U has the statue form ${}^{U}O$, and when the matter is melted down there is no statue form at all. In analogy with the earlier analyses, we can write:

stage 1: Statue T = ${}^{T}O(m + s_1)$
stage 2: The lump of bronze melted down = $(m + s_2)$
stage 3: Statue U = ${}^{U}O(m + s_3)$.

The conclusions to be drawn can immediately be read off from the symbolism.

- The statue Theseus is form-different from, but matter-identical with, the statue U
- Both the statues are matter-identical with the pure lump of bronze.

The two different *supervening* statue forms, ${}^{T}O$ and ${}^{U}O$, have, as the indiscernibility requirement requires, different bases; ${}^{T}O$ supervenes on $(m + s_1)$, and ${}^{U}O$ supervenes on $(m + s_3)$, respectively. Theseus is *constituted* by ${}^{T}O$ and $(m + s_1)$ and the statue U by ${}^{U}O$ and $(m + s_3)$. Both the statues *coincide* in space with the lump of bronze, m.

Lowe has written: "A statue, for instance, is a kind of object which, unlike a lump of bronze, cannot survive much change to its shape. Con-

[30] Compare Lowe, *A Survey of Metaphysics* (2002), pp. 63-64.

versely, a lump of bronze is a kind of object, which, unlike a statue, cannot survive any change to its material composition."[31] I agree. It doesn't matter to the statue if some very small amount of bronze disappears, even though, of course, it makes a difference to the matter-identity. But this can mean one of two different things. If we are talking about *absolute* form-identities, then we have to say that the statue form in question has *base redundancy*, but if we are talking everyday language, then we might only be taken to imply that we find such small material changes of no pragmatic importance.

8. Aristotelianism, nominalism, and reductive materialism

As has been now shown, the paradoxes, puzzles, or problems of the ship of Theseus, of Tibbles-and-Tib, and of the Statue-and-its-matter can be solved within a metaphysics that allows some kind of Aristotelian form-matter dualities. Conversely, these problems are not only puzzling but unsolvable, if one tries to squeeze out one single and unique kind of identity in spite of the fact that there are three kinds of identity around. But who should embark on such an impossible undertaking? In my opinion, at least nominalists and reductive materialists have to make the attempt. Nominalists, with their view that there are only particulars and no repeatable sortals or properties, can allow neither a form-matter duality nor the ensuing relations of supervenience and constitution. According to them, there is only one kind of non-linguistic identity, the identity of simple particulars. Reductive materialists, with their view that only the basic entities recognized by physics can rightly be claimed to exist, make, of course, themselves dependent on the present state of physics. Yesterday they said that there are only protons, electrons, and neutrons; today they say that there are only quarks or strings. In neither case are there any form-matter dualities

Individually, but even more collectively, the problems discussed (cases 1-7) are strong arguments against nominalism and reductive materialism. They point towards the view that the world contains real non-reducible enduring supervenient entities.

[31] Lowe, *A Survey of Metaphysics* (2002), p. 70.

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