MIS Quarterly

RESEARCH NOTE

Senior Editor Note

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The next two papers in this issue are, first, a critique of an earlier *MIS Quarterly* paper by Graeme Shanks, Elizabeth Tansley, Jasmina Nurendini, Daniel Tobin, and Ron Weber, "Representing Part–Whole Relations in Conceptual Modeling: An Empirical Evaluation" (32:3, pp. 553-573), and, second, a response to that critique. As may or may not be clear from the two papers, this represents a continuation of a debate between the two sets of researchers that has persisted over some years and over several papers. Because an underlying issue of contention between the two sets of authors has been what Bunge said and meant in his book, *Treatise on Basic Philosophy: Volume 3: Ontology I: The Furniture of the World* (Boston: Reidel, 1977), and how that might inform the practice of modeling, it seemed appropriate to include selections from that book as a Senior Editor Appendix so interested readers can come to their own conclusions. The SE Appendix is available on the *MIS Quarterly*'s website (http://misq.org) in the "Online Supplements" section. An initial selection of quotes was compiled by the senior editor, and both sets of authors have had the opportunity to add other appropriate quotes.

The following researchers also made helpful comments to one or the other set of authors. We note that the authors have stated that in no way do these other researchers necessarily support either point of view, nor do they bear any kind of responsibility for the content of either paper.

Palash Bera
Andrew Burton-Jones
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Senior Editor Appendix to Shanks and Weber, "The Hole in the Whole: A Response to Allen and March"

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Selected Portions of Text from M. Bunge (1977), *Treatise on Basic Philosophy: Volume 3: Ontology I: The Furniture of the World* (Boston: Reidel)

Introduction

P. 5: Bunge describes that aspect of metaphysics and ontology in general in which he is interested.

> We adopt the latter position: we maintain that the ontologist should stake out the main traits of the real world as known through science, and that he should proceed in a clear and systematic way. He should recognized analyze and interrelate those concepts enabling him to produce a unified picture of reality. (The word "reality" is here understood in a strict and non-Platonic sense, namely as the concrete world.) In this sense the reader is real and so is any utterance of the word 'reader'; but the concept designated by this word is unreal.

P. 5: Bunge explains why objects that are not concrete (e.g. constructs with no physical existence) are not included in his ontology.

> Because unreal objects have nonphysical properties, they satisfy nonphysical laws if any. For this reason it is impossible to make any nontautological statements applying to all objects: ontology, as construed by Mienong and Lesneiewski, i.e. as a general theory of objects of any kind, and yet different from logic, is impossible. So is the modern version of this doctrine, namely general system theory constructed as mathematical theory "dealing with the explanations of observed phenomena or conceptual constructs in terms of information-processing and decision-making concepts" (Mesarovic in Klir 1972, p. 253). If the "system" is purely conceptual, as is the case with a number system, then it cannot combine with material systems to form supersystems, it cannot interact with them, it does not obey laws of the same kind, and therefore it cannot be studied with the special method of factual science.

P. 6: Again, he restricts his ontology to concrete objects.

> We leave formal science, i.e. logic, mathematics, and semantics, the task of studying (and creating) formal or ideal objects of the law-abiding kind, such as sets and categories. (More in Sec. 6.) We take factual (natural or social) science and ontology to be the only disciplines concerned with concrete objects. And we assign ontology the task of constructing the most general theories concerning such and only such objects.

P. 7: A graphic depicting four possible categories of ontology shown, suggesting that the last (exact, scientific: compatible and interacting with science) is his target.

> This kind of ontology, both exact and scientific, is the one we wish to develop and systematize.

P. 9: Bunge lists 10 guidelines that he will try to abide by in the development of his ontology. One of these is:

> R8 Do not reify whatever is not thing, and do not treat as an autonomous entity what is but the result of abstraction. E.g. do not talk about events apart from or even as constituting changing things.

P. 12: Bunge reiterates that the ontology he intends to develop concerns only concrete things.

> The ontological frameworks and theories to be developed in the present volume and its sequel, Vol. 4, will turn out to be both naturalistic and pluralistic: we will assume only concrete existents but will assert their qualitative variety.

I. Substance

1. Association

1.2 Axiomatic Foundation of the Association Theory

P. 29: Bunge defines composite things.

> Definition 1.1 An individual is composite iff it is composed of individuals other than itself and the null individual. I.e. x an element of S is composite iff there exist substantial individuals y, z that are elements of S such that x = y (associated with) z and each differs from x as well as from the null individual. Otherwise the individual is simple.
>
> Remark 1 According to the definition, the trivial composition" x (associated with) x = x" does not count. Remark 2 Note the difference between the composite entity z = x (associated with) y and the set {x,y} of its constituents or components. The latter is a concept and does not satisfy Postulate 1.1

P. 29: Bunge defines the part/whole relationship.

> Definition 1.2 If x and y are substantial individuals, then x is a *part* of y iff x (associated with y) = y.

2. Assembly

2.7 Concluding Remarks

P. 50: Bunge explains he doesn't call his theories *calculi of individuals*, because his ontology and his focus is only on things (i.e. not all individuals but only individuals that are concrete things as opposed to concepts).

> One reason is that every first order mathematical theory is a calculus of individuals: whether it is a calculus of physical individuals is another matter. Another reason is that, unlike Lesniewski and his fellow nominalists, we draw a radical distinction between physical and conceptual individuals, and reject the thesis that a single theory should be able to account for both kinds of individuals. In particular our part-whole relation applies only to ontic [real, concrete] individuals, i.e. "(is a part of)" is defined on S x S [where S is the set of all substantial or concrete individuals].

3. Entities and Sets

3.2 Entities and Concepts

P. 52: Bunge further emphasizes that his focus is on things not concepts.

> To us the basic dichotomy in any set of objects is not that between individuals and sets but that between physical objects and conceptual ones.

II. Form

1. Property and Attribute

1.1 Difference between Property and Attribute

Pag 58: Bunge explains that substantial individuals possess properties (as described below, a "thing" is defined to be a substantial individual with its substantial properties). Properties are objective characteristics of things and not dependent on human observation or agreement. He also explains the relationship between properties and attributes.

> All objects have properties. If the objects are conceptual or formal, their properties will be called *formal properties* or *attributes* or *predicates* for short. If the objects are substantial individuals, their properties will be called *substantial properties*, or *properties* for short. Because every model of a substantial individual is built with concepts, it contains attributes or predicates; and insofar as the model represents a substantial individual, some of those attributes or predicates represent substantial properties.
>
> In the case of a conceptual object, such as a set or theory, the words "attribute" and "property" are exchangeable because a conceptual object has all the properties we consistently attribute to it. But in the case of a substantial individual we must distinguish a substantial property of objective trait from the corresponding attribute(s) if any. A substantial property is a feature that some substantial individual possesses even if we are ignorant of this fact. On the other hand an attribute or predicate is a feature we assign or attribute to some object: it is a concept. A predicate may conceptualize or represent a substantial property; but then it may not or it may do so poorly, i.e. with a large margin of error. On the other hand the possessing of a property is not a matter of truth or falsity; only our knowledge of properties can be more or less true or adequate.

1.2 Attribute-Property Correspondence

P. 60: Bunge explains that attributes may or may not represent substantial properties of a concrete thing. However, attributes that do not correspond to properties are "fictions" and therefore outside the scope of his ontology.

> This correspondence [between attributes and properties] is not isomorphic because some attributes represent no substantial properties, others represent several properties and finally some properties are represented by no attributes (because we ignore either or both) or by several predicates (often belonging to different theories of the same kind of thing).
>
> The representation function is a correspondence between a proper subset of all the conceivable attributes (predicates) and the ill-defined set of all (known and unknown) substantial properties. That is, there are attributes with no ontic correlate. Among them we find membership in a set, the negative attributes and the disjunctive ones.

2. Analysis

2.2 Intrinsic and Mutual, Primary and Secondary

P. 65: Bunge explains the difference between intrinsic and mutual properties, and that mutual properties only have meaning in relation to a collection of individuals.

> Some properties….are inherent properties of individuals….We call such properties *intrinsic*. Other properties …. are properties of pairs, or in general, n-tuples of rank 2 or higher….Such properties will be called *mutual* or *relational*. All mutual properties must be represented by predicates of rank higher than one.

III Thing

1. Thing and Model Thing

P. 110: Bunge defines what a thing is.

> We stipulate that a thing is an entity or substantial individual (Ch. 1) endowed with all its (substantial) properties (Ch.2).

1.3 Thing and Construct

P. 116: Here Bunge clarifies the distinction between concrete things versus constructs.

> In the previous chapters we have distinguished between objects of two kinds: substantial or concrete entities, and constructs.…..We feign that there are constructs, i.e. creations of the human mind to be distinguished not only from things (e.g. words) but also from individual brain processes. (Only, we do not assume that constructs exist independently of brain processes.) We distinguish four basic kinds of construct: concepts, propositions, contexts and theories. Concepts, such as the notion of a thing, are the building blocks of propositions – such as "all things change" – which are in turn the constituents of contexts – such as the set of all propositions concerning dogs – and of theories.

P. 117: Bunge continues to distinguish between things and constructs.

> Constructs do not have all the properties of things. For example, sets add and intersect, but do not aggregate, do not move around, have no energy, and no causal efficacy, etc. Constructs, even those representing things or substantial properties, have a conceptual structure not a material one. In particular, predicates and propositions have semantical properties, such as meaning, which is a nonphysical property. We summarize and extrapolate:
>
> Postulate 3.4 Every object is either a thing or a construct, no object is neither and none is both.

P. 118: Continuing the distinction, Bunge suggests that things are real; constructs are fictions.

> Postulate 3.4 is an axiom of *methodological dualism*. It does not commit us to metaphysical dualism: we are not claiming that there are two kinds of thing, the *res extensa* and the *res cogitans*, or things proper and ideas. We take it that constructs, whether useful or idle, scientific or mythical, are fictions not entities. Hence they are not part of the real world even when they take part in our representations of the latter.

P. 118: And on the same page,

> Another obvious consequence of the preceding considerations is that concrete objects (things) have no intrinsic conceptual properties, in particular no mathematical features.

P. 119: Continuing the distinction between things and constructs.

> Any construct that violates Postulate 3.4 will be declared *metaphysically ill formed*. The attribution of conceptual properties to things, and the attribution of substantial properties to constructs, are in the category of metaphysically ill formed statements.

1.4 Model Thing

P. 119: Here Bunge explains the relationship between concrete things and our models of those things.

> Theoretical science and ontology handle not concrete things but concepts of such, in particular conceptual schemata called *model things*. Our construal of a thing as a substantial individual together with the set of all its properties (Definition 3.1) is of course such a model thing – albeit a rather poor one. A richer characterization of a [model] thing is given by a set equipped with specified relations, such as functions or operations.

P. 121: Here Bunge continues to emphasize the distinction between the things modeled and the model constructs.

> *Remark 1* The failure to distinguish the thing represented from its model is not just a form of mental derangement; it is also at the root of black magic and subjectivism. The idealist who does not distinguish a thing from any of its models cannot account for the multiplicity of schemata of one and the same thing. Consequently he cannot understand the history of theoretical science, which consists partly in the replacement of some schemata by others. *Remark 2* Our

characterizations of a functional schemata is consistent with current scientific practice. However, two notes of caution are in order. Firstly, more sophisticated modes of representation are conceivable, e.g. with the help of the concept of a category (cf. Padulo and Arbib, 1974). Secondly, sometimes a thing is defined as a certain relational structure, i.e. it is identified with one of its model objects. This is mistaken, for only (some) constructs can be defined: things can only be represented (or misrepresented), and occasionally also manipulated. But the mistake is harmless if we are aware of it.

4. The World

4.1 What Does the World Consist in and of?

P. 152: Bunge defines what are the constituents of "the world" of his ontology.

> Most metaphysicians have asked, and some have answered, the following questions: (i) What does the world consist in—i.e. what basic kinds of things are its constituents?, and (ii) What does the world consist of—i.e. what is there? We have an answer to the first question not to the second.
>
> Our answer to the question about the kinds of thing the world is "made" of follows from Postulate 3.2 and Definition 3.5: *The world is the aggregation of its constituents, which are things*. Or, if preferred, the world is that thing which is the physical sum of all concrete or material existents.

III Change

1. Changeability

1.2 Changeability

PP. 218-219 Here Bunge elucidates the notion of mutability or changeability for concrete things, and continues his insistence on the difference between concrete things and constructs. He clarifies that concrete things are either changeable or unchangeable, but that the notion of change has no meaning for constructs in his ontology, since his ontology is an ontology of concrete things, not constructs.

> Definition 5.1 Let x be a thing. Then (i) x is unchangeable iff [the set of all possible lawful states of x] is a singleton for all choices of state function for x; (ii) x is changeable (or mutable) iff [the set of all possible lawful states of x] has at least two distinct members for all choices of state functions for x.
>
> Postulate 5.1 Every (concrete) thing has at least two distinct states, and the state space of any construct is empty. That is, (i) if x is a thing then, for all choices of state function for x [the number of lawful states] >= 2; (ii) if y is a construct then there are no state functions for y.
>
> Corrollary 5.1 All (concrete) things are changeable, and constructs are neither unchanging nor changeable.
>
> Remark 1 We are not (yet) stating that every thing is actually undergoing some change or other, but only that it can change. Remark 2 The second part of Corrollary 5.1 states that the categories of change and immutability do not apply to constructs. Constructs are neither eternal objects (Plato) nor changeable ones (Hegel). What do change from person to person are the brain processes occurring when constructs are thought.