

On the Physics and Metaphysics of Classification in Archaeology

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Abstract

In this chapter, we first present some reflections on theoretical issues related to classification in Archaeology, bringing a discussion that is more developed in Biological Sciences, but at the same time is far from being resolved. We discuss some issues that are pertinent to the theory (and even metaphysics) of classification in general terms, sometimes presenting the development of the discussion in Biology, sometimes bringing it to Archaeology. We believe that terminology problems that should have been resolved more than 70 years ago still cause confusion among both seasoned scholars and students, and they hamper the advancement of one of the pillars of the discipline, which is classification. The objective of this chapter is not to provide a general overview of the literature nor a history of archaeological classification, but mainly to point out recurring theoretical problems, that have accumulated since the mid-20th century, without being adequately addressed by contemporary approaches. Although we have tried to avoid an exclusively theoretical approach, we tend to focus on discussions from Evolutionary Archaeology. We also aim to discuss some methodological aspects, presenting examples and possibilities of application of some classificatory schemes in Archaeology. [This is not really an abstract because it does not summarize the entirety of the paper, including the conclusions].

Introduction

The placement of physical phenomena studied by archaeologists in a sense-making system by means of some sort of arrangement is one of the oldest practices within the profession. Even so, despite the large supply of theoretical models and fashions, and the increasing availability of technological devices and analytical methods, the discipline still suffers from enormous conceptual confusion regarding the construction of classes, types,

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and higher taxonomic units such as “cultures” or “technocomplexes”. Although many researchers regard metaphysics as separate from science, one can argue that, in fact, metaphysics can be considered as a continuum with science, as long as we consider it in terms of the ontological presuppositions of our theories and the language we use to express them. Accordingly, a naturalistic metaphysics can be either descriptive (stating what basic types of things are implied by science) or prescriptive (prescribing how one should conceive the basic sorts of things). We propose in this chapter to use both descriptive and prescriptive metaphysics to suggest how we can think about categories of artifacts based on the theoretical expectations of Evolutionary Archaeology, as well as to include discussion about classification approaches that are built in two main metaphysical positions (sets or individual-based approaches). The role of classification in the perception of cultural change results in entailments about the very nature of cultural change. Any classification involves two philosophically distinct, albeit closely connected, issues. First, there is a question about what the world is like, which is a metaphysical issue. Second, there is a choice among the numerous possible ways of classifying items, which is an epistemological issue. Archaeology suffers from a constant lack of clarity regarding which aspects classifications are supposed to represent, as well as regarding the meaning of important terms such as “types,” “classes,” or “culture”. Moreover, in any classificatory scheme, we must address the fundamental question related to the nature of worldly phenomena, or what is presented in the literature as the materialist versus essentialist ontologies. To take an example from Biology, are biological species “real” or just an arbitrary cut in the time–space continuum? The same reasoning can be applied to artifact types, or to the basic question about the meaning of the units derived by means of any classificatory scheme: were these artifact types real entities in the past or are they merely tools for conceiving a reasonable organization and description of the archaeological record? The aim of this chapter is also to explore, even if in a brief manner, the major characteristics of each kind of arrangement (classification, typology, and the grouping of artifacts by means of statistical methods) and the theoretical reasoning underpinning their use in Archaeology. In order to do this, we will complement the general debate about the metaphysics of classification with the discussions developed in the Biological Sciences regarding species classification. This choice is justified not only because the metaphysics of classification in Biology have been the subject of considerable discussion, but also because, as we emphasize, the theme of classification in Archaeology has used Evolutionary Archaeology as a theoretical approach.

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Metaphysics and Classification

It all comes, I believe, from trying to define the indefinable. (Darwin 1887: 88)

Taxonomists often confuse the invention of a name with the solution of a problem. (Gould 1981: 188)

The term, 'metaphysics,' appears to come from a compilation of Aristotle's (c.384-322 BC) works, where he defines the term as the study of being *qua* being ("being as such"), meaning that metaphysics involves studying the fundamental things and processes that exist (Richards 2010: 1). In this sense, metaphysics has been regarded as the set of writings that came after *The Physics*. According to the *New Oxford Dictionary of English*, metaphysics is the branch of philosophy "that deals with the first principles of things or reality, including questions about being, substance, time and space, causation, change, and identity (which are presupposed in the special sciences but do not belong to any one of them); [it is] theoretical philosophy as the ultimate science of being and knowing" (Pearsall and Hanks 1998). Metaphysics has been described as "the most abstract and in some views 'high-falutin' part of philosophy" (Hamlyn 2005). There are several different meanings for metaphysics in contemporary times, from "a pejorative term applied to whatever is regarded as illicitly nonempirical" (Seager 2000: 283) to an exploration of the general features of the world that we experience, what lies behind its appearance, including the nature and properties of objects (Richards 2016: 210; Seager 2000: 283). It aims to propose a coherent and general way of thinking about the world based on what we can find there (Richards 2010: 146). Moreover, some authors would consider metaphysics and ontology (defined in very simple terms as the study of what there is) as synonyms (Corbey 2005: 13). However, ontology was coined in the 17th century as part of the called general metaphysics¹ (Blackburn 2008; Hofweber 2023), that is dedicated to questions about the existence of things belonging to fundamentally different categories (Aune 1985: 10). Therefore, general metaphysics deals with the general nature of reality, including questions about the nature of universals and particulars, about abstract and concrete beings, as well as appearance and reality (Aune 1985: 11).

¹ Special metaphysics deals with particular kinds or aspects of being. Such questions include the dichotomy between the mental and the physical, the existence of human freedom and life after death, the nature of personal identity, and the existence of God (Aune, 1985: 11).

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It is a quite well accepted idea that science cannot be successful when missing a metaphysical idea about the world it is aiming to investigate (Dupré 1993:1). Although the metaphysics of modern science has proposed a world or a universe governed and ordered by laws and therefore a potential structure that can be completely understood, evidence suggests that this is probably an untenable concept (Dupré 1993: 2). Many scholars who are interested in using metaphysics to further our understanding of the nature of science use a naturalistic metaphysics, in which one starts with science and then follows to a more general account of nature (Richards 2016: 211). In this sense, such metaphysics would be on a continuum with science and one can think about metaphysics using ontological presuppositions of scientific theories, which are part of science (Richards 2010: 147; Richards 2016: 211). Quine (1969) wrote an essay “Epistemology Naturalized”, in which he states that Epistemology² is concerned with the foundations of science (Feldman 2001) because there is a continuum of gradation within the Natural Sciences and therefore, metaphysical questions cannot be considered as separated from or external to science (Richards 2016: 212). Another way of putting it is that an epistemological approach is only possible when one is aware of various pieces of knowledge that we already possess (Alston, 2006). This relation between metaphysics and the empirical world finds more support when one considers that they are both [?] derived from human minds that are part of such world (Seager 2000: 290). Moreover, metaphysics can be either descriptive (what sorts of things there are in the world) or prescriptive (how we should conceive things). Descriptive metaphysics aims to “describe the actual structure of our thought about the world” (Strawson 1859: 9) and it presents no need to judge whether such structure is correct or desirable (Goldman, 1989). Prescriptive metaphysics, also known as revisionary metaphysics, aims to prescribe “what ontological commitments we ought to adopt given the best available science and philosophy” (Goldman, 1989: 132).

These questions regarding the “things” of the world have been extensively explored. Plato, Aristotle, and other philosophers discussed about how we perceive the world, what is perceived and what is real. Since Locke, Hume, Kant, and Hegel, empiricism and subjectivism have been alternating as popular ways of describing the world that we experience (Freidheim 1982: xi). The ways how we can classify the entities of the world, as well as what is the relation between the world and the classification, are pivotal for

² Here broadly considered as the philosophical study of the nature, origin, and limits of human knowledge.

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further understanding both Philosophy and the discipline whose participants are aiming to classify the world (Chemistry, Physics, Biology, Archaeology, etc, Ereshefsky 2001: 15). In fact, classification is an important part even of prescientific language (Dupré 1993: 6).

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Classification and categorization are mechanisms for organizing information and there are many instances in the literature that show authors using these words to refer to the same process (for a more detailed discussion, see Jacob, 2004). The processes of classifying or categorizing are quite different, however. In a classification, the process refers to a systematic arrangement of entities based on analysis of necessary and sufficient characteristics. Categorization refers to a flexible synthesis of entities based on perceived similarity or context. In any classification it is mandatory that an entity belongs or not to a given class, classes are mutually exclusive (therefore, boundaries are fixed) and the criteria for assignment are predetermined by a set of established principles, while categorization allows more flexible and creative recognition of similarities across a set of entities in a specific context (therefore boundaries are "fuzzy") and the flexibility comes from the variation of such contexts. Moreover, in a classification, all members are equally representative, whereas in categorization members can be rank-ordered (Jacob, 2004). This chapter focuses on classification.

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There are at least two ways of beginning a classification of the world: using a theoretical approach (like the one previously proposed) or on the basis of pure observation³, meaning that classification is free from theory and strongly based in an empiricist approach (Richards 2016: 244). This last approach was supported by Francis Bacon, who advocated that observation precedes theory and leads to a proposed generalization and classification (Richards 2016: 246). This idea has attracted criticism because most if not all the observational terms are somehow "theory-based" (Dupré 1993: 22-23) On the other hand, there have been criticisms regarding the use of a theoretical approach, such as phylogenetic classifications in Biology, because they depend on the existence of homologies and such homologies can only be supported by a hypothesis of homology (Richards 2016: 251).

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³ For a discussion about observation being theory-free or theory-neutral, see Rothschaefter (1976).

One of the many problems with a theory-free classification is that there is no pure observation. Even language impacts the way we see, describe, and classify the world (Richards 2016: 254). As Wittgenstein (1922) famously said: “The limits of my language are the limits of my world”. Therefore, different expertise⁴ will require learning different concepts, all of which are theory-laden, and it represents most of the scientific observations of the world (Richards 2016: 257). This relates directly to a proposal by Hjørland (2014). He suggests that classification should focus solely on the precise analysis of terminology used in a certain field, given that such terminology can only be understood within a community whose members share theories or beliefs. Moreover, this can also be related to the problem of incommensurability; if the meaning of a general term depends on a belief or theory held by scholars, important changes in scientific belief will inevitably imply changes in that meaning⁵ (Dupré 2000: 314). According to Dupré (1993: 17), if one assumes that science concerns the discovery of the unique structure of nature (Dupré 1993: 51), and aims to contribute towards the metaphysics of order, then a classification should be discovered, not created. A classificatory scheme should also be based on genuine, objective, and significant properties of the objects and every classification should be finite, meaning that one will not attempt to classify all things in the world (Adams & Adams 1991: 45). Regardless of which view one chose to support, the classification of natural phenomena is central to science, providing a narrative of what kinds of things are in the world, and ideally it would be deeply connected with the proposal of new scientific theories (Dupré 2000:311).

There are two ways of thinking about classification. One is that classification features are features of the world that do exist regardless of humans (Richards 2016: 273). The other way is to think that classification features are theory-based (for example, classifications in Biology are based on Evolutionary Theory) because the terms and concepts can only be fully apprehended using a theoretical framework. That also means that classification can be used to test hypotheses about theoretical expectations that we might have regarding a given set of elements (Richards 2016: 274). If we can agree that classification ought to be theory-based, then the real question is which theory or theoretical concepts we should use (Richards 2016: 274).

⁴ In physical science there is a universal metalanguage (mathematics), however, both Biology and Archaeology lack a metalanguage that would allow universal communication, hypothesis formation and testing.

⁵ See a later discussion about theory change and meaning change.

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Most of the texts dealing with the philosophy of classification focus on Essentialism, Reductionism, Cluster or Historical approaches (Dupré 1993:2; Ereshefsky 2001: 16). Essentialism is a doctrine that sorts entities according to their (essential) natures (Ereshefsky 2001: 15). Reductionism refers to understanding the world through the study of its smaller and simpler components (Dupré 1993: 4). Cluster analysis aims to create groups whose members share similar (but not necessarily essential) traits, and the historical approach classifies entities according to their causal relations rather than their intrinsic qualitative features (Ereshefsky 2001: 15). Besides this, some scholars defend a pluralist approach, one that is opposed to essentialism (and monism), and they accept the existence of many equally proper ways of classifying (and therefore, dividing) the world (Dupré 1993: 6, 53). Such a pluralist approach need not be exclusive of scientific classification; in fact the ontogeny of common sense is greatly pluralistic (Dupré 1993: 19).

These different approaches might be related to distinct ideas about kinds. Richards (2016: 214) states that there are three ways of thinking about kinds: natural kinds that are independent of human beliefs and preferences, conventional kinds that depend on human beliefs and preferences, and artificial kinds (arbitrary kinds, meaning they do not fit in any of the two kinds just mentioned). Natural kinds are based on the assumption that something's belonging to a particular kind is independent of human beliefs and preferences, by virtue of possession of a given property or properties. The set of necessary properties, based on the concept of essentialism, is independent of time and space, resulting in a set of things that are also independent from these elements (Richards, 2016: 214). However, Slater (2013: 18) argues that a natural kind cannot be considered an ontological category, being more like a status enjoyed by several things (including categories and collections).

Essentialism presents a close relation to the doctrine of natural kinds⁶. Many different philosophers have been associated to Essentialism, from Plato and Aristotle to Linnaeus and Putnam, spanning literally centuries of ideas related to this doctrine. What they hold in common is the idea that the essence (understood as a set of traits) of a given group of entities is an exclusive feature of them, meaning that only the members of a kind present a group of features and that all the members have to present a given group of traits. Also,

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⁶ "Class of objects defined by a common possession of some theoretically important property" (Dupré 1993: 22). The opposite way of classifying would be using conventional or artificial kinds (Richards 2016: 10).

the essence is responsible for the traits that are usually associated **with** the members of a given kind. Once an essence can be stated for a given group, it is possible to predict⁷ and explain the behavior of any of the entities that comprise such group (Ereshefsky 2001: 16). The concept that entities have essential properties can be loosely applied to any entity. **However**, some essential doctrines emphasize the idea that natural kinds are the ones for which true scientific laws apply (Dupré 2000: 311) and that these natural kinds are independent of human minds and language (Richards 2010: 149). Another way of explaining natural kinds is that they are repeatable features of reality that may have instances (Slater 2013: 12). According to Rose (1998: 42), essences in Biology are always operational rather than absolute, **given** that such definitions (**which** the author **considers** synonymous with essences) **somehow depend on observations made by individuals**.

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Another important element in **classification based on essential traits** is the identification of necessary and accidental properties associated **with** entities grouped by essential traits. The necessary properties are the **ones required** for membership in a group. The real essence of any given chemical element is the unique atomic structure of that element⁸, which allows **us to predict** how such element will behave under a certain temperature, for example. The accidental properties refer to properties that do not affect the essence of an entity (Ereshefsky 2001: 17). Slater (2013: 19) proposes a “Stable Property Cluster” account of natural kinds, which requires only that the properties are stable across certain kinds of perturbations. The concept of natural kinds ultimately relies on the idea of monism, meaning that there is a single, uniquely appropriate set of kinds (Slater 2013: 17). Therefore, a monist approach would imply the acceptance of, for example, one species concept⁹ and the subsequent rejection of the others, which seems unlikely (Richards 2010: 210).

There is **wide variation in** accounts of essentialism, including the idea of teleological or material essentialism, which will not be the subject of further discussion here. What is important to emphasize when discussing essentialism and classification **is the feasibility** that a given set of traits will be found in the totality and in an exclusive way among the members of a kind. Such ideas have been important, **especially in the Biological Sciences**

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⁷ That also means that, once we deny the existence of natural kinds, we become unable to discover universal laws in nature (Dupré 2000: 318).

⁸ Not by coincidence, Chemistry and Physics have proposed that many natural kinds might present real essences (Dupré 2000: 313), given the example of chemical elements and the atomic structure.

⁹ It is not our goal to address the **different concepts of species** (Kimbel & Martin 2013). **For a review of pluralism and monism as applied to the subject**, see Hey (2006).

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and **regarding** the problem of species (Ereshefsky 2001: 23). It might be that, among the many problems that **scholars** have raised regarding the approach of species as natural kinds, the **simplest** and **most** direct one is that there are no laws **that are necessarily true** of their members (Dupré 1993: 40).

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The opposite concept of monism is pluralism: there are many equally legitimate ways of organizing reality¹⁰ (Slater 2013: 17). Slater (2013: 161) proposes different types of pluralist approaches. He calls pragmatic pluralism the attitude of supporting pluralism when there is a research problem far from being solved, **while** knowing that a monist approach would be the correct one¹¹. The opposite direction would be pluralism as a metaphysical approach (metaphysical pluralism), when one rejects a monist and a realist approach and embraces the assumption that there is more than one single correct way of addressing a given question (Slater 2013: 174). In terms of classification, that means that one could propose specific classification schemes, suited **to particular interests and** concerns. Other similar ways of supporting the idea that there can be several proper and legitimate ways of proposing a classification have been suggested and there are slight variations on their names (for example, Dupré [1993: 18] uses the term “a metaphysical approach of a radical ontological realism”).

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Realism states that universals exist independently of human mind, while nominalism¹² denotes the view that only particulars really exist (universal terms are just words or vocal utterances, Richards, 2010: 114) and that concepts are only names that lack any relationship to reality (Sattler 1986: 75)¹³. Therefore, such concepts are theoretically irrelevant (Richards 2010: 124). Conceptualism says that universals do exist but are concepts in our mind (Zachos 2016: 46), therefore, some concepts do exist and they reflect real features of the world (Richards 2010: 114), and they are universals (Sattler 1986: 75). According to Sattler (1986: 76), given that concepts¹⁴ (from Conceptualism) are abstractions from reality, they represent at least certain features of reality. A realist

¹⁰ For a **thorough** discussion about these concepts, see Ereshefsky (2001: 39).

¹¹ See also pluralistic realism (Kitcher 1992: 317).

¹² Darwin could be considered a nominalist (Richards, 2010: 114).

¹³ Concrete particulars have location in both space and time, they can have parts, and they present certain physical properties. Universals are abstract, they do not have a location in space and time, and they do not have bulk physical properties. The establishment of the boundaries of concrete particulars might be part of what some researchers consider as the first step of a classification because it allows us to see patterns in nature and in the world in general (Slater 2013:13).

¹⁴ Concepts can be classified as qualitative (usually considered as universals), comparative, and quantitative concepts (Sattler 1986: 78).

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approach might be appealing to some scholars, given that one would be using features that exist independently of the human reality. However, as Slater (2013: 168) states, using weight (“things weighing between 1 and 2 kg”) to classify things in the world will not generate a very useful classification, because even if there are features that exist regardless of a human mind (like weight, measured in kilograms), they do not necessarily are meaningful.

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Classes are ideational units of meaning (and not groups of objects; *pace* Adams & Adams 1991:45) defined by the formulation of the necessary and sufficient criteria for membership (or what Dunnell 1971:200 called *significatum* and Zachos 2016:46 called “essential properties”). Essential properties are both necessary and sufficient, meaning that all members of the class exhibit these properties and that all objects exhibiting these properties are members of the class. Such members can be considered as instances of the class (Zachos 2016: 46). However, the existence of an absolute identity does not imply an absolute meaning. On the contrary, the meaning of a given class can only be reasonably understood in relation to another one from the same system (Adams & Adams 1991: 46; Dunnell 1971: 56). Classes are also characterized by internal cohesion and external isolation, presenting central tendencies and boundaries (Adams & Adams 1991: 46). They exist regardless of time and space and there is an important discussion about the reality of universals. A class may exist even when it has no members at all. That, together with the lack of location in time and space, makes a class to be an "abstract" entity (Aune, 1985:4). It is reasonable to think of classes and individuals as ontological categories, instead of properties of ontological categories (Slater 2013: 105). In this sense, one can divide things in either concrete (individuals) or abstract categories (classes).

The Metaphysics of Classification in Biology

One of the most discussed questions regarding Biological Sciences and the problem of species is: Are species real? "When we look at nature, are the 'units' we recognise and name already there to be recognised or have we 'made' them in the process of looking?" (Briggs & Walters, 1997: 361). This question has important metaphysical and practical implications for the way that scholars have been classifying species.

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It might be important to make a distinction between taxonomy and systematics. Although there is some variation among authors, Simpson (1961: 7) proposes the following

definitions in Biological Sciences: “Taxonomy is the theoretical study of classification, including its bases, principles, procedures, and rules. Systematics is the scientific study of the kinds and diversity of organisms and of any and all relationships among them”. In other words, taxonomy is the theory and practice of classifying organisms, while systematics is the branch of a discipline capable of providing a map to navigate the genealogical history of elements (Schuh and Brower 2017: 48). Richards (2016:1), in his definition of Biological Classification, uses Taxonomy and Systematics to refer to the comparison and grouping of organisms, the naming of these groups, the theoretical basis for grouping, and the philosophical foundations for systems of grouping. Other authors stress that the term taxonomy implies clustering of elements into categories that convey hierarchical information (Adam & Adam 1991: 214) and types that are created by the division of larger clusters into smaller ones (Dunnell 1971:76). Dunnell also makes a distinction between systematics, as a basis for a conceptual approach, and classification, as a basis for an operational model. It is important to remember that, at least in the Biological Sciences, the realm of systematics includes both classification and phylogeny. Classification aims to organize and name empirical phenomena, while phylogeny aims to establish the evolutionary (ancestor-descendant relationship) history of the elements we want to study. In Biological Sciences, scholars often use Genetic Taxonomies, where types are considered to have descended from a common ancestor and, therefore, they are implying that time is an important (albeit implicit) dimension of such taxonomy (Adams & Adams 1991: 205).

Regardless of the diversity of species concepts that can be used according to the subject of study (for example, a paleontologist may benefit from a concept that focuses on morphology, while a researcher interested in genomes might not find that concept alone very useful; some researchers define a species as a polythetic set of genetic or biochemical polymorphisms), most scholars agree that biological classification should generate evolutionary knowledge of a given taxa. According to Evolutionary Theory, species are elements present in space and time, with an origin and an end (or extinction). Therefore, a biological classification should take into account this dynamic existence of species.

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One of the earliest classification schemes proposed that species were classes¹⁵, usually a particular instance of class¹⁶, the natural kind (Zachos 2016: 45). Natural kinds are part of species-as-sets approaches, which we will discuss in further detail soon.

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Richards (2016:213) presents two metaphysical positions: species-as-sets and species-as-individuals. The first approach proposes a membership relation, where species are sets of organisms that are members of a set only if they present certain properties. On the species-as-individuals approach, species are individual elements in space and time, similar to organisms, with an origin, an end, and changing through time. In this case, the relation is mereological, a part-whole relation. The species-as-individuals metaphysics indicates that some descriptions of species can represent facts which are independent from our ideas (Slater 2013: 14). There are several species-as-sets approaches, based on the natural kinds, cluster kinds, and historical kinds. We will review briefly these three approaches before discussing the species-as-individuals approach. Some scholars recognize important differences between classes and sets, while others use these terms as equivalents. In the first case, classes can be defined intensionally, while sets are defined extensionally (Zachos 2016: 47; Slater 2013: 108). The species-as-sets approach can be tentatively compared to species-as-mereological sums – the grouping of objects under the parthood relation -, which are also defined by their extensions, in the same way that sets are (Slater 2013: 111).

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In Biological classification, even if we aim to classify something as a bat because it shows a set of properties (echolocation, ability to fly, etc), most researchers will, even if unknowingly, consider an individual to be a bat because it is “part of a particular segment of that population lineage” (Richards, 2016: 215). In other words, if we consider species as evolving entities, then a natural kinds approach cannot be used (Richards 2010: 156). According to Gould (1979: 274) the “notion of species as 'natural kinds' fit splendidly with the creationist tenets of a pre-Darwinian age”. One cannot think about things that change over time using a metaphysical approach that does not allow change (Richards 2010: 158). According to Okasha (2002), if we aim to use an evolutionary-based approach, then classification in Biology should focus on identifying the units that are important to understanding the evolution of living beings and should not be concerned

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¹⁵Using classes (timeless abstractions), including natural kinds, might be challenging to address questions regarding evolutionary history (of living beings or artifacts, Zachos 2016: 49), given that, if species or artifacts were classes, they would be unchangeable, presenting no beginning and no end (Slater 2013: 74).

¹⁶ Ghiselin (1997) proposes that species are logical individuals, not classes (also see Hull 1976).

with causal generalization (frequently observed in classification in Chemistry, for example). The change that we observe in the definition of species, from a created entity to an evolving one (especially after Darwin) can be considered by some as a great example of the lack of difference ~~that~~ Quine ~~proposed~~ between theory change and meaning change (LaPorte 2004: 150¹⁷).

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Cluster kinds ~~are based on the assumption~~ that the necessary properties for a thing to belong to a kind would be a subset or “cluster” of a larger set of properties (Richards 2016: 219). There are different ways of relating or not clusters to the essentialist approach. A cluster approach does not necessarily demand that a property occur in all and only the members of a taxonomic unit (Ereshefsky 2001: 102). However, according to Stamos (2003: 123), cluster classes can be considered as essentialist, given that ~~no~~ single property from the set is necessary or sufficient for attributing membership in the class, although a minimum number of properties is required. Therefore, different things could present different sets of properties within a more comprehensive set of properties to belong to the same kind. Such ~~a~~ scenario seems better than the natural kinds approach, given the observed variability within a species, ~~in terms of ontogeny, sex, environmental responses,~~ etc. However, according to Richards (2016: 221), it is not clear which subset of properties would be important to consider something as belonging to a given species. In order to solve this, Boyd (1991: 141) proposes that the members of a cluster should present a cluster of co-occurring properties. In any case, if species are evolving, the problem described for the natural kinds is the same for cluster kinds.

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~~According to~~ the historical approach, causal relations are fundamental, and qualitative similarity is important when it can help point to causal connections (Ereshefsky 2001: 28). Such causal relations (here considered ~~synonymous with genealogical relationships~~) need to be selected ~~by~~ using a theory-based approach that is related to the historical entity that ~~someone~~ aims to identify (Ereshefsky 2001:31). In this sense, historical kinds might be a good approach in Biological Sciences because ~~the historical ancestor-descendant relation is crucial to species assignment.~~ However, given that a species can originate another one, at some point, members of a species (considered here as an evolutionary lineage) may become members of another species. Richards (2016: 224) calls attention to the problem about how to identify a break in the lineage when a new species ~~emerges~~.

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¹⁷ But see LaPorte (2004: 157) for a more detailed discussion.

The author offers a solution: a pluralist approach, using epistemic kinds (“categories that enable us to gain knowledge of reality”, Khalidi 2013: xi). In the words of Richards (2016: 224), “Epistemic kinds are whatever categories each of the sciences uses to successfully explain and predict phenomena”. In this sense, there might be multiple kinds of natural kinds, and these do not need to present the same features.

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Traditionally, the historical approach is exemplified by biological species. However, this approach is not exclusively applicable to the biological realm. Other disciplines, including Archaeology, Geology, History, and Linguistics, can also use historical approaches to build classifications when they are interested in recognizing the parts of a unit through time or the course of a causal process (Ereshefsky 2001: 30). However, even when we consider Biology, it is not possible to state that there is a unique correct approach. It is here that the metaphysical pluralism enters, once we accept that the great diversity of the world, not our lack of skills to classify it, can justify such approach. Ereshefsky (2001: 45) supports the metaphysical pluralism by arguing that a single discipline may need to use more than one approach to classification. Also, the fact that “some objects have a history and that we can learn from their history does not entail that we must classify them historically” (Slater 2013: 59). In fact, Slater states that, although biological systems are the product of historical processes, and such history must leave traces on these systems, scholars should not think about evolution and history as the only important aspects to address in the Biological Sciences (Slater 2013: 60).

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The species-as-individuals approach, which Ghiselin (1974: 536) calls “a radical solution to the species problem”, might look like a very simple concept, in which species are concrete things, that exist in a given time and space. However, for some scholars, individuality demands more than simple spatiotemporal continuity (Ereshefsky 2001: 94) and cohesion and continuity should be also addressed (Wiley 1981). Richards (2016: 225) proposes that we can consider organisms as parts, not as members, when using this approach. In this sense, both an individual organism¹⁸ and a species can be located in space and time, and both present parts, not members. Laws do not apply specifically to individuals (there are no particular laws that apply specifically to *Canis familiaris*), only to classes of individuals (there are particular laws that apply to biological species, Richards 2016: 227). However, species and individuals are not entirely analogous, as

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¹⁸ According to Hamilton et al. (2009), individuals are concrete entities that present a beginning and an end and that exist in both time and space.

some (but not all) individuals can perish when they lose parts, while species can lose parts (considered as individuals), usually without much impact. The problem is that individuals vary in their cohesion or in the way that they can or cannot lose parts without perishing (Richards 2016: 228), indicating that individuality can be present to different degrees. The species-as-individuals concept is also important to argue against natural kinds (essentialism) because individuals do not have essential properties, given their historically contingent nature. Therefore, if species are individuals, they cannot be defined on the basis of essential properties (Zachos 2016: 48). On the other hand, some scholars have tried to combine the concept of natural kinds and essentialism with the idea of historical entities. For example, Boyd, in proposing his Homeostatic Property Cluster (HPC) conception of kinds (Boyd 1988, 1991, 1999), assumes that biological kinds can be considered as historical entities (Slater 2013: 19). Likewise, Griffiths (1999) supports the possibility of natural kinds having historical essences. Of course, historical essences cannot be accountable as responsible for the traits typically associated with the members of a kind, making the definition of essentialism by Ereshefsky (2001: 16) unsuitable for historical essences.

Both approaches (species-as-sets and species-as-individuals) can be heuristic, depending on the importance given to the fact that species present patterns of similarity and are limited in time and space. Similarity evokes the species-as-sets approach, while the space and time constriction can be better accommodated in the species-as-individuals concept (Richards 2016: 235). While the first concept is helpful in generating generalizations about the members of a species, the last one is useful when studying evolutionary patterns of diversification and extinction (Richards 2016: 236).

The Metaphysics of Classification in Archaeology

Although one cannot deny the importance of the metaphysics of classification, this is a topic that has been very little explored, mostly on the basis of Chemistry and Biological Sciences. Very few authors have discussed the philosophy of classification in Archaeology (but see Boissinot, 2015, Jung, 2020 and the authors cited in the article for some recent approaches). Traditionally, classification in Archaeology presents a chronic lack of awareness of what exactly a classification represents, as well as the conceptual meaning of important classificatory elements such as “types,” or “culture”. Even worse

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has been the lack of discussion regarding a metaphysics of artifacts: an account of what sorts of things they are, and into what ontological category they would fit¹⁹. This question is important because one of the key debates in metaphysics about material objects concerns whether they may have genuinely indeterminate boundaries²⁰ (Slater 2013: 15).

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In the same way that biologists ask if biological species are “real” or not, archaeologists should also be applying the same reasoning to artifact types and inquiring whether these types are real or simply tools for organizing and describing the archaeological record. Of course, such transposed discussion regarding Archaeology and the classification of archaeological phenomena can, in principle, look simpler. After all, the units recognized by an archaeologist, unlike the living organisms, do not present evolutionary history. Or do they?

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First Things First: Classification or Typology?

Before continuing, we think it is necessary to clarify concepts. In our view, one of the main problems that plague classification, especially in Archaeology, is the confusion of terms that ends up resulting in a confusion of concepts. We understand classification as the whole process involving 1) the definition of a *field* (a classification system of lithics cannot be the same as a classification of ceramics); 2) the definition of *attributes* (length, width, shape of stem, shape of body, etc); 3) the definition of *attribute states* (small, medium, large, etc); 4) the actual *measurements*²¹ of the artifacts (15 mm; small, ovate, triangular); 5) and their assignment to *classes*. As commonsensical as it may seem, the actual usage of the term varies a lot. For some reason, Adams and Adams (1991: 333) decided to distinguish classification from typology²², arguing that classification should be understood as a “set of contrasting categories (...) which include all the entities or phenomena within a particular field study, or set of boundaries”. Classification in this

¹⁹ In “In Defense of Things”, Olsen (2010) proposes a “material turn” in Archaeology, claiming the presence of a collective amnesia in social and cultural studies regarding material things and the relation of dependence between things and humans. Such turn would aim to move the main focus from discourse to things, with emphasis on alternative and object-oriented ontologies (Olsen & Pétursdóttir, 2020).

²⁰ Such a debate can be important if we want to benefit from the previous discussions in Biology regarding species-as-individuals and the problem of cohesion and continuity.

²¹ Here by “measurement” we understand not only quantitative measurements, such as length or mass, but also scales (ratio, interval), and qualitative measurements (nominal, ordinal scales).

²² Here lies another source of confusion, since the majority of archaeologists (and other professionals) normally use “typology” as a synonym for classification.

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sense would encompass only steps 1 to 3 of our definition. Typology²³, on the other hand, would be “a special kind of classification made for sorting entities”, or the actual sorting of artifacts into categories called “types” (and not classes), therefore encompassing steps 4 and 5 of our definition. In their view, the major difference between classification and typology is that the latter would have a “practical goal”. We can hardly imagine somebody classifying something, at least in a scientific realm, without some “practical goal”. The practical goal of any scientific classification is manifold: 1) to analyze, i.e., “break” whole artifacts into its constituent parts, called attributes; 2) to manipulate these attributes in order to check how they behave in space, time, or in relation to some theoretical expectation; 3) to organize a large volume of entities into a smaller number of sets; 4) to manipulate these sets in order to extract novel information; 5) to cluster these sets into even larger sets in order to extract different information; 6) to convey the gathered information into a synthetic, simplified version of the reality; and 7) to build explanations. Note that these goals involve both analytic steps (1 and 2) and synthetic steps²⁴ (3 to 6), all of which should ultimately converge to some explanation (step 7) or, at least, to data organization and communication.

If “goal-directedness” is not enough to differentiate typology from classification, why should anybody use the term “typology” at all? We believe the answer is twofold: on one hand, we could invoke traditional usage, because the term was originally coined in theology, in order to classify and compare the characters and events that appeared in the Old and New Testaments (e.g., Baker 1976). Being used in theology up to this day, it is unfortunate that the sciences still maintain the term “typology” as a synonym for classification. The word is plainly misleading because it does not refer to “the study of types”, but to the simple creation of type designation. Perhaps the suffix “logy” seems more scientific and appealing, in the same way as researchers use the fancy word “methodology” when in fact they are simply referring to “methods”, and not to any higher-level epistemological question. Another possible explanation for the pervasive use of “typology”, at least in the archaeological literature, is the fact that in practice archaeologists tend to “lump and split” the artifacts over a table in a much more intuitive and unsystematic way than a formal classification would allow (for example, Adams and

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²³ According to Jung (2020), typology in prehistoric archaeology refers to a special kind of classification, because it is related to Montelius’ typological method.

²⁴ We believe that recognizing the difference between analytic versus synthetic steps in classification can be useful for clarifying matters, as we will try to demonstrate in the end of this chapter.

Adams [1991] is an excellent autoethnographic account of how this works), and from this point of view, the resulting units are not classes *per se*, but aggregates²⁵ of materials (or groups, following Dunnell 1971). These groups are called types, and therefore what is being performed is not a classification, but a system of type creation. These systems are, in all cases that we know about, hierarchically constructed, resulting in a taxonomic structure (Bordes 1981; Colton 1943; McKern 1939; Phillips and Willey 1953; Tixier 1963). The best way to explain this recurrence is that they are based on the researcher's common sense, and ethnotaxonomic studies show that hierarchical, taxonomic structures are always observed in folk classifications of non-western cultures (Richards 2006: 14). Some attributes are considered "more important" than others, without any need for a theoretical reasoning, since the only goal is to convey information (goal 6 in our definition above). In sum, what differentiates classification from typology is not presence or absence of a goal, but the way in which they are built.

Regarding the concept of "type", we think it can still be useful inside the classification realm if understood as a *label* to designate one or more classes that are lumped together for synthetic and communication purposes, and we will develop this later. In this way, types can be determined either by means of classification or typology. However, either being aggregates of several formal classes or the result of "table sorting", types can never be properly defined, only described. We will return to this point later.

Back to Metaphysics...

Archaeologists can greatly benefit from previous discussions about a theory-free or a theory-laden classification and how the simple absence of pure observation is one of the most important elements to argue against a classification based on a pure empiricist approach. If we assume that classifications are always and inescapably theory²⁶-laden, then different theoretical approaches in Archaeology will **be** related differently about how to classify material culture and what is the philosophy behind it. In the case of Evolutionary Archaeology²⁷, which aims to test the hypothesis that artifacts may

²⁵ Here defined following Boissinot (2015: 24): a "heterogeneous assemblage of substances or elements which adhere firmly to each other" (our translation from French).

²⁶ In this specific case, by "theory" we mean some mental construction, explicit or not, that governs the analyst's decisions during the classificatory process.

²⁷ We are focusing on this theoretical approach because this is the one we have been working to further understand cultural diversity in Eastern South America.

represent evolutionary lineages created by cultural transmission, scholars should take into account that an artifact classification should present evolutionary knowledge of a given lineage. Lineages are present in a limited space and time, and if we aim to benefit from previous discussions in Biological Sciences in order to inform classification in Archaeology, then this idea alone poses some challenges to the discipline. Such challenges include, but are not limited to, the not so popular idea that material culture evolves and that it is possible to establish archaeological lineages of things. A classification that does not take into account such basic ideas of material culture change together with a strong theoretical approach will be fated to reproduce the same failed ideas that most archaeological schools have been proposing.

The Metaphysics of Archaeological Kinds

The discussion in Biology about species-as-sets and species-as-individuals can be useful in Archaeology if we aim to understand and describe artifacts and lineages of artifacts in ways that are independent of our ideas (species-as-individuals metaphysics and species-as-sets based on natural kinds and cluster kinds) or not. Some archaeologists explicitly reject the idea that classification in Archaeology ought to “discover” these natural kinds (Adams & Adams 1991: 13; Dunnell 1986: 177-182; 2009: 47), while others explicitly put the ultimate goal of classification as the discovery of types (Spaulding 1953), or at least a quest for the reconstruction of the mental templates of the artisans (Read 2007). However, most works that present a classification of archaeological materials do not include any hint about the philosophical position of the authors (we suspect that most of them are not even aware of it). The “natural kinds” concept implies acceptance of a monist approach, which can be considered as a quite radical position in science. The natural kinds approach (as probably cluster kinds too) also brings conflicting views regarding our position that supports the idea of material culture as an evolving entity. Here we enter another metaphysical question, namely, the existence of natural kinds in the first place in Archaeology, and second, even if they do exist, the question about the very possibility of their discovery. It is worth considering whether archaeological artifacts are part of the natural world and, if so, if they can be part of a natural order. Most archaeologists would feel more comfortable working with another category, called *conventional kinds* (Richards 2006:192). Conventional kinds are culturally defined and work in order to give some order inside a cultural system. Good examples are money (banknotes and coins).

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Each one represents some value, but in themselves they are just paper or pieces of metal. There is no “natural” essence that implies that gold is valuable. The third kind is the arbitrary one, and its value resides on the fact that, if you are not imparting a lot of *a priori* and unverified expectations in the classification, the chances of finding something unexpected are greater, and unexpectedness is the hallmark of science. Almost everything we know about the Universe contradicts the expectations of our common sense, the notion of a round Earth included. So, the metaphysical question in Archaeology is not so much about natural versus arbitrary kinds, but *between two kinds*, one that was meaningful to the people who made and used the artifacts (conventional kinds), and the other that is meaningful for the scientists who study these artifacts (arbitrary kinds).

In his book “Artifact Classification”, Read (2007: 22) is adamant about the goal of classification: to define types, “where by a *type* we mean a class demonstrated to have cultural salience. (...) A typology is thus a way to represent systematically the patterning imposed on artifact material by the makers and users that has subsequently been uncovered analytically by the archaeologist”. In short, classification (or “typology”) is the set of procedures to discover conventional kinds. Once “discovered”, these types are “real”, at least in the mind of the archaeologist, because he or she believes that the types were real for the makers and users. The consequence of this reasoning is that the types have essences.

Conventional kinds are, of course, extremely important for the cultural systems ~~that~~ implemented them, but their importance dies with the people who created, used, and believed in them. In order to compare and study conventional kinds, ethnotaxonomy is well served with living people, and the conclusions were presented above: every living culture classifies the world according to a taxonomic structure, and since this mental stance is probably hard-wired in our brain, it can be extended to the past. In trying to use a plethora of statistical methods in order to “discover” conventional types that were meaningful for extinct cultures, several aspects have to be addressed: first, if you are able to find something that seems meaningful in a given site, ~~that was occupied~~, let’s say, from 1567 BC to 1565 BC, does it mean that the same “pattern” was followed 312 year later, when another site (or another layer in the same site) considered to be part of the same “culture” was occupied? Is there any room for cultural evolution once the “pattern imposed by the makers and users” is detected? It is hard to propose that one can predict and explain the behavior of a given type based on its essence. Second, all the reasoning

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presented by supporters of “type discovery” is based on formal artifacts, especially ceramics, where the products of the decisions made by the “user and maker” are more or less visible. Less ink has been spilled about lithics, but, when this happens, of course the lithics are formal artifacts, where intention and mental templates can also be invoked, such as bifacial points, scrapers, hand-axes and so on. What is hidden under the carpet is the fact that a huge number of archaeological sites are related to cultural groups that did not put any emphasis on flintknapping. Lithic materials, when manufactured at all, were used in a very cursory way, result of stone shattering and not so much flaking, with the choice of pieces (which most archaeologists would classify as “waste”) that had a suitable edge for immediate use, with rare edge modification (Sillitoe and Hardy 2003; White 1967; White and Thomas 1972; Miller Jr. 1979). Needless to say, according to ethnoarchaeological information, the “maker and user” classification of these artifacts is extremely simple; sometimes a single “type” encompass everything that is flaked (for instance, what the Wola of New Guinea call *aeray*; Sillitoe and Hardy 2003: 561). To give an example, in Eastern South America alone these industries are abundant and spread over large expanses of space and time (Araujo 2015; Araujo et al. 2017; Moreno de Sousa and Araujo 2018; Schmitz 1987). This leaves archaeologists in a curious situation: the vast majority of the materials they find are not worth classifying. Their study is useless, since no types that could be “meaningful for the makers and users” can be extracted. The solution that Read (2007: 186) finds to escape from this basic paradox is to use a strict and commonsensical definition of artifact: only things that were made intentionally. For him, an artifact “is a material object conceptualized by the members of a social group as belonging to a category that is part of the cultural repertoire for that group” (Read 2007: 187). One wonders how we can start studying something that, by definition, can only be considered a subject matter after the analysis is finished, and only if the conclusion would be “after measuring so many attributes and applying all the methods available, we can finally say that this material was conceptualized by members of a social group, was part of a category that they recognized as valid and, therefore, it is an artifact”. Even if we leave aside this logical problem, there remains a question about ethics (should we discard or simply refuse to analyze everything that is not considered to be made on purpose?) and a question about what to do when all the cultural repertoire of an extinct group is represented only by non-formal, simple lithics, as it is the case of several archaeological “traditions” or “cultures” all over the world.

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The Metaphysics of Archaeological Artifacts

In our view, the apparently simple question of what an artifact is, the basic subject matter of the discipline, the material stuff that justifies classification, is a metaphysical one. The concept of “artifact” has nothing to do with the actual materials, whether stone, bone or whatever, but with a primordial philosophical stance that informs us about how we should see the world. Compare Read’s definition of artifact, above, with the definition by Dunnell (1971: 201): “*anything* which exhibits any physical attributes that can be assumed to be the results of human activity” (emphasis in the original). The former is an exclusive artifact definition (EAD), with a thread of assumptions that can never be put into test. The latter is an inclusive artifact definition (IAD) and has only one assumption: that the object in hand was modified somehow by human action. This fundamental difference between definitions entails a whole chain of reasoning and will determine which kind of classification is going to be performed. If an artifact is anything modified by humans, the analyst is free to start the analysis without having to decide beforehand which are the “culturally salient” (Read 2007: 149) aspects of the artifact. Instead, we can choose the attributes to measure, according to theoretical (i.e., scientific) expectations, without any concern for the categorizations of the makers and users, especially because chances are great that the makers and users did not have categories that would be useful from the scientific point of view. After all, they were makers and users, and not lithic or ceramic analysts. An IAD allows attributes to be the basic unit of analysis, because there is no other way to analyze things that don’t have formal shapes. Attributes that are mutually exclusive, can be classified by means of a paradigmatic classification, where there is no difference in weight among them (c.f. Dunnell 1971; O’Brien and Lyman 2002), no *a priori* judgement of what is important or not. On the other hand, an EAD, given its basic assumption, must rely on whole objects, on sorting and forming groups of objects (and not classes) over the table, and establishing types. Since the types should be “culturally meaningful”, and only whole artifacts²⁸ can convey any meaning, the researcher has to choose which characteristics of the artifact are more important than others. This entails a hierarchical or taxonomic classification, which seems more “intuitive” and “right” because of our brain structure but carries a major problem: it is

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²⁸ Here by “whole artifact” we mean the single archaeological piece, even if it is a ceramic sherd, in contrast to the attributes of the whole artifact.

absolutely essentialist and cannot deal with change since the attributes are “glued” together into a type, and because some attributes have precedence over others. Therefore, if there is any spatial or chronological change affecting an attribute that analysts erroneously considered of minor importance, this change will not be detectable because, after all, the type remained the same. This will not happen with paradigmatic classes, since they are defined by several attributes, all with the same degree of importance. Needless to say, the obtained classes are arbitrary, in the sense that they do not attempt to approximate any “meaningfulness” of the extinct culture. Changes in attributes can be monitored, and this is a *sine qua non* condition from an evolutionary standpoint. The shortcoming of paradigmatic classes is that their “names” (which are actually their definitions) are given by the attribute states that happened together in some artifacts, for instance: “A2c5G776FN”, or “1101100010101”. They are cumbersome, their names are unpronounceable, but this is not a problem *if we understand that paradigmatic classes are part of the analytic step*. Several paradigmatic classes can be lumped into more inclusive units that we can call types or some such, more suitable for communication and synthesis. The problem is that, when performing a typology, *the researcher is skipping the analytic step*, since a type is already a synthetic unit (Araujo and Okumura 2021). Goals 1 and 2 of classification, as we previously put, are not achievable.

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The Role of Theory and Some Examples

The species-as-sets using historical kinds implies a theory-laden approach that aims to identify evolutionary lineages. Even if Biologists have raised some problems with using such an approach (for example, how to identify when there is a speciation event in a given lineage), the use of historical kinds might be useful for archaeologists who aim to identify artifacts as parts of a lineage through time. Archaeologists under the Evolutionary Archaeology approach would mostly agree that qualitative similarity can indicate causal relations among elements and such relations, which are theory-based, are essential to create explanations about the evolutionary history of artifact lineages. As mentioned previously, if we can agree that classification ought to be theory-based, then the important question is how such a theoretical approach informs researchers' trait choice. In the case of Evolutionary Archaeology, this is well illustrated by phylogenetic approaches, which commonly foreground functional traits.

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In a way, a pluralistic approach using epistemic kinds might be interesting for Archaeology, especially if conceptualism is applied. One could group and divide things into categories on the basis of pragmatic interests, using objective features to guide such grouping (Richards 2010: 115). We could call such an approach pragmatic pluralism, which entails that there are several ways of classifying phenomena because there are multiple kinds of research projects, each with distinct theoretical approaches. Metaphysical pluralism would be another way of accepting such diversity of classificatory schemes. If we can agree that a classification must be based on genuine, objective, and important properties of what is being classified, then such properties ought to be established using theoretical expectations and a pluralist approach, either a metaphysical or a pragmatic one, can be very useful. In this sense, we agree that there might not be a single way of creating a classification, even under the Evolutionary Archaeology theory and using a historical approach, much less when one considers the diversity of theoretical approaches that have been used in the discipline in the last decades. As Slater (2013: 59) has stated, the fact that some elements can present a history does not automatically mean that one ought to classify them using such information.

As mentioned before, in Biological Sciences (and also in Linguistics), genetic taxonomies are often used to sort elements considered to have descended from a common ancestor. In archaeological studies, very seldom are genetic taxonomies applied to artifacts (but see Buchanan & Collard 2007 for an example of hierarchical classification of North American Paleoindian points), while classifications of “archaeological cultures” most commonly present a genetic component (Adams & Adams 1991: 215). Such classifications in Archaeology are vulnerable to the same criticism as other genetic taxonomies, such as phylogenetic classifications in Biological Sciences; the proposed homologies are seldom tested (Barrientos 2010; Okumura & Araujo 2019).

There are several ways to arrange elements in Archaeology and the popularity of these arrangements in the discipline have varied through time. Dunnell (2009; 47) detected two main strands; the first, which he named “cryptic empiricism,” would recognize the process of classification but consider that the product (“type”) is not related to any theory. The second strand he called “systematic empiricism” (after Willer and Willer 1973), and involved using statistics to discover “real types”, also without the need for any theoretical reasoning. Other authors (e.g., Adams and Adams 1991: 266-275) propose four major strands associated with the main theoretical shifts of (North American) archaeology,

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namely a “classificatory phase” (linked to the first attempts to organize data), a “configurational/functional paradigm” (mostly related to Culture History), a “nomothetic paradigm” (fruit of the processualist attempt to be “scientific”), and an “electronic paradigm” (use of computer software to construct types). However, as these authors recognize, such periodization has to do with the scholarly debates, and had almost no effect on the ways archaeologists classified and named artifacts in practice.

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The two approaches that Dunnell (2009) presents are more accurate: either theory is implicit and *ad hoc* (and types can be real or not), or is explicitly lacking (and types can be real or not). Typological instrumentalism has been proposed as a useful approach in archaeological classification when one rejects the idea of discovering natural types in the archaeological record. This concept involves building typologies for specific scientific questions and the idea of evaluating these typologies on the basis of how effective they are to answer such questions (Adams & Adams 1991: 14). Of course, a proper typological approach will be theory-laden and will include variables that are deemed important for understanding artifact variability. Unfortunately, very few scholars explicitly explain why they take a given variant into account (Adams & Adams 1991: 51; Dunnell 1971: 139), although there are few examples of when this was made.

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In the case of a classification of arrowheads, under an Evolutionary Archaeology approach, the stem shape can be considered as related to stylistic choices that are very little associated with the actual performance of the point²⁹ (meaning that a point presenting a concave stem base might be as good as a point that has a bifurcated stem shape, Lipo et al 2010; Okumura 2018; Okumura & Araujo 2014; 2017; Araujo & Okumura 2017). Another example would be the measurement of the wall thickness of pottery, considering such a feature mostly as a functional one that could be related to thermal conductivity and resistance to thermal stress (O'Brien et al 1994; Muscio 2009). Muscio (2009), Under an Evolutionary Archaeology approach, patterns of changes in wall thickness of pottery vessels may explain the presence of directional selection (decrease of wall thickness through time) in pottery from the Argentinian Puna. Of course, the selection of some traits and their interpretations regarding style or function following theoretical expectations are better taken as a hypothesis to be tested. Most importantly, once one applies a typological

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²⁹ Of course, nobody denies that the stem is a key part of a hafted system in composite tools (Kuhn 2020). However, it is not clear whether one given stem shape can be considered to have a superior performance in comparison to another shape. Moreover, there are also projectile points that do not present a stem; in this case, the base of the blade is hafted to the shaft.

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approach to sort a given set of archaeological elements, the problem regarding natural kinds is solved, given that such classificatory scheme will be based on the choices of the researcher, according to that researcher's scientific questions and theoretical expectations.

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Methodological Issues

The name Computerized Taxonomies refers to the splitting of an original assemblage of objects using a process of binary division (Adams & Adams 1991: 206). Both this approach, as well as the grouping of artifacts using statistical methods³⁰ might find many similarities with phenetics (Numerical Taxonomy), a school of biological classification that was a reaction to the practices of evolutionary taxonomy and the use of homology (but not homoplasy) to build classifications. The pioneers in phenetics, Sokal and Sneath (1963: 7-8), criticize the fact that homoplasy is assumed, but not securely demonstrated in evolutionary taxonomy. In this theory-free approach, one records as many characters as possible from a set of elements. From the generated list of characters, a researcher has to calculate the similarity among specimens, followed by a measurement of the phenetic distances that are the basis for a classification (Ereshefsky 2001: 63). The generated "types" are the product of the splitting process and, although they can present identity, usually they lack meaning (Adams & Adams 1991: 207; Dunnell 1971: 98).

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Most of such classifications are applied to artifacts (in a broad sense, including stone tools, bone tools, pottery vessels, houses, graves, etc). However, the classification of "cultures" (a set of different artifacts made by a given human population in a certain space and time) seems to be much more complex. This is because one has to sort different artifact types (stone tools, pottery, etc) in order to "create" (or discover) a given archaeological culture. In other words, "Archaeological 'cultures', then, are synthetic taxa formed by the grouping together of more specific type concepts" (Adams & Adams 1991: 224; see also Araujo and Okumura 2021; Riede et al. 2020). Other approaches involve the chronological seriation of archaeological phases, which is very problematic because such phases usually do not share common features. The only element that leads a set of

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³⁰ Not necessarily through a binary division, it also does not need to have all attributes included in the analysis (Adams & Adams 1991: 291)

given phases to be considered an archaeological culture is evidence for a chronological cultural sequence associated with a particular human group (Adams & Adams 1991: 225).

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The lack of explicit recognition of the necessity of performing an analytic step in classification before synthesizing the data into types can be tentatively interpreted as a product of two factors. The first factor is more mundane, related to the “table sorting” approach; once you spread artifacts over a table and sort them into groups (of material things), you already can call these groups “types”, and the magic is done. This procedure can be called “grouping” (Dunnell 1971:44) or “categorization” (Maier et al. 2023:15).

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Undoubtedly, this is a more “intuitive” approach; it seems “natural” and does not necessitate much thinking. The second factor is more subtle, and we believe it is related to the strong impact that the aforementioned mathematical or computational methods of classification had in Biology in the 1960’s (Sokal and Sneath 1963; Sneath and Sokal 1973). Such approaches were quite popular among some archaeologists during the 1970s (e.g., Aldenderfer & Blashfield 1978; Clarke 1968; Read 1974; Whallon 1972), when the advent of relatively more affordable computers associated with a growing number of software programs for performing these analyses was partially responsible for their adoption (Blashfield & Aldenderfer 1978). However, one of the main goals of these computational methods in Biology was to find “natural kinds”, and one of the main assumptions was that the taxa defined by these methods should be *polythetic groups*, meaning that the objects assigned to the types could share most of the attribute states, but not necessarily all attribute states that were part of the group description.

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The alternative would be *monothetic groups*, when all individuals assigned to a given taxon would share all attribute states, because such attributes would be the necessary and sufficient conditions for membership (Figure 1a). From our earlier discussion, it is now clear that classes are monothetic, because they imply *significata*, or necessary and sufficient conditions for membership (Dunnell 1971:53), as seen on Figure 1a. In our example, seven attributes were used, named in roman numerals from I to VII. Each of these attributes can have several attribute states, numbered in Arabic numerals (1,2,3,...). Each class is explicitly defined by its attribute states, so we know exactly how class 1354432 is different from class 1053331; we know that they have the same attribute state (1) for the first attribute (I), the same attribute state (5) for attribute III, and the same attribute state (3) for attribute VI.

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Polythetic groups, on the other hand, cannot be properly defined, or ~~their~~ definition would be a “laundry list” of several attribute states that happen ~~to occur~~ in some (but not all) members of that group (Figure 1b). Since there was ~~consensus~~ that polythetic groups would be more “natural” (Sneath and Sokal 1973:22), this idea permeated all archaeological literature, and even more so because archaeologists, especially cultural historians, ~~had been~~ using polythetic groups since the beginning of the discipline. Henceforth, almost all archaeologists interested in classification began to advocate the use of polythetic groups as ~~the best way~~ to classify artifacts. For instance, Clarke (1968:35-36) criticized monothetic groups because “in practice” the ideal of all members sharing the same set of attributes “has never been demonstrated”. In his words “no group of cultural assemblages from a single culture ever contains, or ever did contain, all of the cultural artefacts” (op.cit.). This is not a problem if, again, we understand that concepts such as “assemblages” and “cultures” are synthetic ones, aggregates of thousands of artifacts from many sites. The problem ~~rests~~ on the foundations of the edifice, regarding how the individual artifacts are analyzed and what exactly happens after their attributes are recorded, if they are recorded at all (in “table sorting” there is no need to record attributes from individual artifacts, only lump them together in groups). These issues are not acknowledged either in “anglophone” or “francophone” research traditions, and it is fairly common to see the analytical step ~~overlooked~~ or bypassed. Even when the attributes are explicit (~~which~~ is mostly not the case), the arrival to a “type” ~~occurs~~ in an almost magical way, the attributes just lump together ~~to form~~ types (as in Clarke 1968). As another example, Bordes and followers (Bordes 1981; Sonnevile-Bordes 1974; Tixier 1963) do not even try to explain how their “types” were produced (see a throughout critique in Kolparov and Vishnyatsky 1989). Interesting in this context is that Binford and Sabloff (1982:142) ~~in trying to offer a survey of the theory behind “New World” and “Old World” classification methods,~~ mistakenly affirm that the “Bordes’ method” was based on a paradigmatic classification. This can give us an idea of the confused state of affairs that reigned and still reigns.

Be ~~this~~ as it may, if we accept Clarke’s suggestion and use attributes to construct sets of polythetic groups called “types”, the resulting “types” will not have a definition (because a definition presupposes necessary and sufficient conditions) and, therefore, there will be no way to make proper comparisons between assemblages. Again, there is nothing wrong with polythetic types, but there must be *proper classes* (monothetic) ~~before they can be~~

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lumped as types (polythetic). Only having access to the class definition can archaeologists decide if a specific artifact, that was originally affiliated to “type X”, should in fact be assigned to “type Y”. Moreover, many research problems that may begin to address a question originally posed by a given type will need access to the actual attribute measurements made on individual artifacts.

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In order to clarify this issue, let’s suppose that a set of individual bifacial points were assigned to a “Rover Type”, as in Figure 1b. Is “Rover” a well described (polythetic) group? Is it clear which attributes and which attribute states were used in order to construct the type? If the answer is yes, the path is paved. In our example, “Rover Type” is based on seven attributes. However, “Rover Type’s” polythetic description would be something like:

Rover Type: the majority of artifacts will show, for attribute I, states 1, 3, or 7; for attribute II, they can be 1, 3, or 5; for attribute III, it could be 5, 6 or 9 (...).

Looking at the example on Figure 1b, it is possible to imagine (but it is not clear) that attribute III, with attribute states 5, 6 or 9, is probably more important than the others, because this is the only one that is common in all artifacts. This is another common characteristic of the “type”: it always imply in some (generally cryptic, implicit, or unwarranted) decision about the relative weight or importance of one attribute over the others. To make things worse, in practice, it is common that the number of attributes used in the “definition of a type” varies from type to type (Whallon 1972: 15).

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Now, let’s continue our exercise and think about how to address any theoretical expectation regarding any feature that these artifacts display, whether it is related to cultural transmission, technological constraints, performance, style, function, or something else. At the most basic level, what are the descriptive statistics of points collectively designated “Rover”? What are the ranges of weight, length, width, thickness, and so on? Are they very tight or spread out? Is the distribution unimodal or bimodal for each one of the attributes? If bimodal in length and weight and unimodal in width, what does this mean? What is the coefficient of variation (CV) for each attribute of this set of artifacts? What do large CVs mean? If we run geometric morphometrics, or cluster analysis, or PCAs etc, is there a good match between them and other “Rover Type” points? If not, why? What are the differences in artifact weight between “Rover” and “Rex” types? Should we consider them to have been delivered by the same propulsion

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system? Part of the same cultural domain? Or related to different cultural groups? All these questions beg direct access to the *attributes measured in the individual artifacts*. None of them can be addressed using the concept of “Rover” or “Rex”. It is impossible to compare “Rover Type” and “Rex Type” using their polythetic group descriptions. Once we understand that types are the creations of researchers, as Thomas (1972:39) puts it, only two questions really matter: 1) are types operational, and 2) do they satisfy the purpose for which they were designed? After all this questioning and scrutiny over the statistical and morphometrical aspects of the individual points, is the “Rover Type” a good way to convey the information or should it be split into two types? Or lumped with “Rex”? This is really a secondary issue, *if the individual artifacts were measured and assigned to classes*. However, if they were table-sorted and assigned to “Rover” or “Rex” there is not much we can do. In practice, in the majority of cases, archaeologists just present a type without any explicit statement about the attributes that they used in its construction.

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It is worth mentioning that there are good attempts to escape this conundrum, and one can be found in Laplace’s *Typologie Analytique* (TA). As mentioned before, despite being hierarchical (divided into “orders”, “typologic groups”, “primary types”, and “secondary types”; see Laplace 1972, 1974; Laplace and Sáenz de Buruaga 2000), and retaining the archaic type names such as “end scrapers”, “side scrapers” and so on, the TA scheme can be considered hybrid. Inside a given “typologic group” (e.g., “side scrapers”) the individual artifacts had their attributes explicitly defined, recorded and conveyed in a way that made it possible for other researchers to compare their data. In spite of some theoretical fuzziness, from the methodological point of view, the TA proposal can be regarded as a better option than the Bordes’ type list, or Clarke’s unclear polythetic types. Unfortunately, the proposal never found wide acceptance, mainly for academic political reasons (Plutniak 2022).

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Another example can be found in Thomas (1981:16), where explicit attributes are used to classify bifacial points, which in turn are lumped into types. The types also have explicit descriptions, such as “*The Cottonwood triangular type consists of small, unnotched, thin, triangular projectile points (...) defined as follows: Small: Weight less than or equal to 1.5 g. Length less than 30 mm. Thin: Thickness less than 4.0 mm. Triangular: Basal width/maximum width ratio greater than 0.90.*”

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Lastly, O'Brien et al. (2001) present a case where a paradigmatic classification based on explicit attributes of Clovis points erves as the basis for cladistic analysis, allowing inferences about cultural phylogeny.

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Note that, in these three examples, the authors provide an explicit list of attributes and attribute states, but only O'Brien et al. (2001) integrate them into a proper classification *before* running a computerized taxonomy.

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Conclusions

The relation between Metaphysics and Science, and the importance of the first for better understanding of the nature of the later, have not seen deep discussion in most disciplines. We believe that Archaeology would greatly benefit from that, especially regarding classification, a practice that has been pivotal since the beginnings of the discipline. Moreover, the debate about monism or pluralism, as well as the possibility of a theory-free or theory-laden classification can illuminate questions in our field.

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Many authors have stated that analogies between biological and artifact classification have very limited value (Ford 1962: 13; Adams & Adams 1991: 206). We would partially agree, not so much for the reasons put forward by these authors, but because the (necessary?) taxonomic structure of biological classification does not need to be applied to artifacts. Archaeologists might be better served in most cases by the more parsimonious paradigmatic classification. Another point of disjunction concerns the natural versus artificial kinds debate; we support the idea that the contention is between two artificial kinds, one meaningful for people of the past (conventional kinds), the other meaningful to scientists (arbitrary kinds). However, the evolutionary rationale, the metaphysics, as well as the theoretical discussions in Biology are absolutely linked to Archaeology, both being historical sciences (Frodeman 1995; Mayr 1961). Specifically, for scholars interested in Evolutionary Archaeology, the role of Evolutionary Theory in the debate about classification in Biology offers important ideas.

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Another point is related to the entailments that some apparently innocuous definitions, such as "artifact", "typology", and even "classification", can have in the whole edifice of classification. In this sense, the lack of explicit definitions regarding the terms that archaeologists with different theoretical approaches use is the first obstacle that they face.

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before they can open dialogue with one another. We urge our colleagues to think carefully about the importance of their theoretical positions and their impact on the classificatory schemes they entail, as well as the importance of being explicit about how such theoretical approaches guide the proposed classifications (c.f. Lyman 2021).

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