

Is Extensible Markup Language Perspectivist?


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Abstract: Both Extensible Markup Language [XML] and Formal Ontologies [ISOs] have something to do with partitioning. XML partitions data using elements. FOs partition domains using representational primitives. On the basis of the partitioning of FOs, the philosophical debate has outlined an epistemological view about FOs, namely perspectivism. For perspectivism, partitioning a domain means making a mental distinction between those entities on which we focus and those that fall outside our interest. This partitioning provides a perspective on the domain. In Tambassi (2023) it has been argued that perspectivism is an underlying assumption of FOs. In this paper, I investigate whether the same is true of XML: that is, whether and how XML is perspectivist. I begin by defining FOs and presenting the main claims of perspectivism in order to discuss how these claims apply to FOs. Then I move on to XML, showing both the perspectivism of XML and how the claims apply to XML. The purpose is therefore purely speculative. Discussing whether XML is committed to perspectivism may help to clarify some of the theoretical assumptions of this markup metalanguage. More generally, the idea is that since the creators of markup languages develop these languages under the guidance of some theoretical assumptions, for

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the sake of methodological accuracy these assumptions should be subjected to critical analysis rather than remain implicit and unexamined.

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[1] If someone were to argue that Extensible Markup Language [XML] and Formal Ontologies [FOs] have little in common, they would have many strings to their bow. The most important one, in my view, is this. As its name suggests, XML is a markup language – or rather, a metalanguage that allows users to define their own customized markup languages (Attenborough 2003). FOs are neither languages nor metalanguages; they are artifacts specified by ontological languages (Gruber 2009). And XML is not even one of those languages. As for the “little” that XML and FOs have in common, there is one similarity that caught my attention. Both XML and FOs have something to do with partitioning. XML partitions data using elements. FOs partition domains of interest using representational primitives. Precisely on the basis of this partitioning performed by FOs, the philosophical debate has outlined an epistemological view about FOs, namely perspectivism.¹ For this kind of perspectivism – which does not coincide with perspectivism in the philosophy of science² – partitioning a domain means making a mental distinction between those entities on which we focus and those that fall outside our (domain of) interest. According to this view, this partitioning provides a perspective on the domain. Moreover, according to perspectivism, whatever domain we consider, there can in principle be multiple, equally valid, and overlapping perspectives on the same domain.

[2] Now, in Tambassi (2023) it has been argued that perspectivism is not just one of the philosophical views that populate the debate on FOs, but an underlying assumption of FOs. In other words, FOs are perspectivist. In this paper I investigate whether the same is true of XML. I begin by defining FOs and presenting the main claims of perspectivism. The idea is

¹ See Munn and Smith eds. (2008); Keen et al. (2012); Tambassi (2022, 2023).

² On perspectivism in philosophy of science, see Chakravartty (2010); Agazzi (2014, 2016); Massimi (2022); Massimi and McCoy eds. (2020).

not to prove the perspectivism of FOs, but rather to show how these claims apply to FOs. This is also to avoid any overlap with Tambassi (2023). I then move on to XML, showing both the perspectivism of XML and how the claims (of perspectivism) apply to XML. The argument is based on a parallel between FOs and XML. More specifically, the facets of perspectivism about FOs that I present in Sects. [5–9] correspond to the facets of perspectivism about XML that I present in Sects. [11–15]. This is not intended to exhaust the ways in which perspectivism relates to FOs and XML, nor the debate about FO and XML partitions. The only aim is to clarify whether and how XML is perspectivist. On the grounds that XML and FOs have little in common, it is not even ruled out that perspectivism might apply differently to FOs and XML.

[3] The purpose of this article is therefore purely speculative. I believe that discussing whether XML is perspectivist may help to clarify some of the theoretical assumptions of this markup metalanguage. More generally, the idea is that since the creators of markup (meta)languages develop those languages under the guidance of some theoretical assumptions, for the sake of methodological accuracy these assumptions should be subjected to critical analysis rather than remain implicit and unexamined. The focus on XML is not accidental. First, XML is still widely used, and there are many other markup languages based on XML. This means that the present critical analysis is, at least in principle, extendable to other markup languages. Second, XML not only supports the exchange of data, but is also both human- and machine-readable. In other words, XML – like FOs – supports communication between humans, between humans and machines, and between machines (Goy and Magro 2015). And while supporting this communication is certainly not the prerogative of XML and FOs alone, we cannot even rule out the possibility that determining whether XML is perspectivist may also shed new light on some of the theoretical assumptions behind such communication.

[4] According to Gruber (2009),³ FOs are sets of representational primitives used to model a domain of knowledge. Primitives are instances,

³ For further competing definitions of FO, see Gruber (1993); Guarino and Giarretta (1995); Borst (1997); Studer et al. (1998); Uschold and Jasper (1999); Noy and McGuinness (2003); Tambassi and Magro (2015).

classes, relations, and properties.⁴ Instances are the basic units of FOs. Classes, which may contain sub-classes and/or be sub-classes of other classes, are sets of instances that share common features. Relations represent the ways in which both classes and instances interact with each other. Properties describe the various features of a class and of its instances. Perspectivism is an epistemological view about FOs that makes three distinct claims: 1) there are different ways of representing a domain (of interest); 2) there can be multiple, equally valid, and overlapping perspectives on a domain; 3) a perspective partitions a domain, drawing a mental division between the entities we focus on and those that are outside our interest. In the next five sections, I explore how these claims relate to and apply to FOs.

[5] The first claim, one might say, is not exactly theoretical: it simply helps us to define what perspectivism refers to, namely representation(s) and domain(s) of interest. Regarding the domain of interest, the first claim does not impose any restriction. Accordingly, we can represent any domain of interest. Regarding representations, the first claim does not exclude any way of representing a domain of interest (Munn and Smith eds. 2008). Therefore, even though perspectivism is about FOs, FOs are not the only way to represent a domain. This means that, at least in principle, perspectivism does not apply only to FOs, which is the theoretical basis for our investigation of perspectivism about XML.

[6] The second and third claims concern the partitioning of the domain, which in terms of FO development involves at least two stages: outlining the entities that populate the domain *and* systematizing these entities within representational primitives (Noy and McGuinness 2003). Although this division is intended to preserve the possibility that different systematizations may follow from the same outline, we should also note that the two stages are interrelated. Indeed, the second stage is based on the first. However, outlining the entities without systematizing them would mean not including them in a FO, which would obscure why the partition is specifically concerned with FOs. For this reason, even though the process of partitioning the domain seems to be more related to the first stage, I consider the second stage to be part of the same process.

⁴ For competing lists of representational primitives, see Noy and McGuinness (2003); Jaziri and Gargouri (2010); Laurini (2017).

[7] Regarding the first stage (outlining the entities that populate the domain), the third claim provides the main guidance on how to outline the entities. (The question of whether such a stage also deals with the definition of the domain is discussed in Tambassi 2023). This guidance does not impose any constraint on how to (cognitively) partition the domain and, thus, on the entities resulting from the partition. In other words, according to the third claim, no partition or entity is excluded in principle. This is also confirmed by the second claim, which further specifies that we can also partition the same domain in multiple ways. To summarize: each partition results in a list of entities (in principle a different list for each partition); the partitions of a domain can be multiple; there are no restrictions on domains, partitions, and entities.

[8] Regarding the second stage (systematizing the entities within representational primitives), both the second and the third claim do not impose any restriction. Suppose, then, that the partition of a domain results in a list of entities that includes “love”. How do we systematize such an entity? Under one of the four representational primitives, of course. Therefore, we could regard “love” as a class with different loves as instances or sub-classes, as the relation “is in love with” between two instances, as the property “being in love” of an instance, and so on. Much depends on how we model the domain (Gruber 2009) – that is, on the perspective (on the domain) that we adopt. Not restricting the systematization of entities is perspectivism’s response to the (potential) multiplicity of perspectives on the same domain that we might adopt and then represent (Tambassi 2023). And to those who argue that perspectivism must face a multiplicity of perspectives because it assumes such a multiplicity, a perspectivist could reply that since perspectives are cognitive partitions, their multiplicity can hardly be denied.

[9] Perspectivism about FOs cannot go beyond the limits set by the IT advances of FOs. (Of course, this does not exclude the possibility that FOs may go beyond these limits in the future, also because of perspectivism.) To say the opposite would be to say that perspectivism is not about FOs. Now, regardless of the language in which FOs are expressed, the current debate generally recognizes four representational primitives: instances, classes, relations, and properties. Each representational primitive can, in

principle, include any entity. Systematization thus results in entities of these representational primitives. Returning to our example, this means that, depending on how we systematize “love”, it will still result in one of these representational primitives. Otherwise, “love” would not be an entity of the FO, which would contradict the results of the domain partition. Systematization, some critics might say, proves that perspectivism is inconsistent: for it both rejects any constraint on systematization and accepts constraints on the representational primitives within which entities are systematized. But I am not sure that the inconsistency holds. First, the constraints on representational primitives seem to refer to the limits of FOs, not to those of perspectivism. (At most, the limits would refer to perspectivism in a transitive way, that is, as far as it deals with FOs; but perspectivism in itself, as the simple sum of the three claims of Sect. [4], does not have these limits.) Second, the fact that representational primitives are currently four, but potentially include any entity, should, at least in principle, limit, if not eliminate, any constraint.⁵

[10] According to Dykes (2005), the purpose of XML is (to serialize and) to represent data (more precisely, documents). The building blocks of any XML document are elements, which consist of content, tags (markups), and

⁵ Because of this, and because the advances in FOs may modify the current representational primitives (and thus bring new limits and possibilities to the systematization of entities), Cumpa (2019, 149) considers FOs to be “variantist”, meaning that their structure «can change due to certain practical preferences». Although I agree with Cumpa about the variantism of FOs, I think we need to be careful here not to equate variantism about representational primitives with variantism about the entities they contain, and perhaps also variantism with perspectivism. With respect to representational primitives, variantism concerns the fact that the list of representational primitives might vary due to the advances in FOs. Therefore, future systematizations might lead to entities of other representational primitives. With respect to entities, variantism concerns the fact that they can vary from FO to FO. FOs can thus model different domains of inquiry, support different perspectives on those domains, and so on. All this should also explain how variantism and perspectivism differ. The former is ontological, in that it is about representational primitives and their entities as such; the latter is epistemological, in that it is about the perspectives (on any domain) that we can represent by means of entities belonging to representational primitives.

attributes, but can also be empty or contain other elements. Content indicates data (sometimes named and represented by entities). Tags have the primary function of labeling data within the document. A tag may also have any number of attributes (name-value pairs) that provide further information about the element for which they are declared. Discussing whether XML is perspectivist means understanding the three claims of perspectivism (see Sect. [4]) as not just about FOs, and showing whether and how XML is committed to these claims.

[11] Now, the first claim of perspectivism is that there are different ways of representing a domain. The claim thus refers to representation(s) and domain(s). Regarding representation(s), Sect. [5] shows that FOs are only one way of representation and that the first claim does not exclude that XML could be another. I would add here that XML does not claim to be the only way. Rather, as its name suggests, XML is extensible: that is, we can create other markup languages from XML (Canducci 2022), and thus new ways of representing. This means that, in terms of representations, XML makes the first claim of perspectivism. What can be represented? Perspectivism does not exclude any domain, whereas XML is about any arbitrary data (Dykes 2005). Therefore, perspectivism applies to XML if and only if “(any arbitrary) data” (henceforth, “data”) is a proper or improper subset of “any domain”. However, considering “data” as a proper subset of “any domains” (i.e., if x is an element of “data”, then x is also an element of “any domain”, but not *vice versa*) would imply that XML imposes a constraint on perspectivism: the domain(s) must be domain(s) of data. Conversely, considering “data” as an improper subset of “any domain” (i.e., “data” and “any domain” have the same elements) would remove such a constraint, implying that XML adopts the first claim of perspectivism. That said, I think that both alternatives approach the issue in the wrong way. “Data” and “any domain” are here the two sides of the same coin: for data can refer to, or be data of, any domain. For this reason, not only does the first claim apply to XML, but XML also assumes the first claim of perspectivism.

[12] Perspectivism is specifically about partitioning domains. There are the second and third claims to witness this. Now, Sect. [6] says that FO partitioning involves two consecutive stages: outlining the entities that

populate the domain and systematizing these entities within representational primitives. I think that both stages apply to XML as well, although there is a difference regarding the second stage. Indeed, XML has no representational primitives within which to systemize entities; rather, the XML systematization is done through elements consisting of content, tags, and attributes (name-value pairs). As for the first stage, the only element of confusion can be represented by “entity”, which has a technical meaning in XML (see Sect. [10]) and a non-technical meaning in the two stages of the partition of the domain and in the third claim of perspectivism. However, since the non-technical meaning also concerns XML partitioning, I will only refer to the non-technical meaning of “entity” from now on. This should avoid any confusion.

[13] Also with regard to the first stage (outlining the entities that populate the domain), the most I can add to what is said in Sect. [7] is this. The fact that XML can describe any arbitrary data should be the reason why XML has, at least in principle, no restrictions on entities, partitions, and domains, as well as on multiple partitions of the same domain. (And insofar as the building blocks of XML are elements, those elements should have no restrictions either.) However, to show specifically that both the second and the third claims apply to XML, and vice versa, suppose that the domain consists of the starting grid of a Formula 1 race. We can certainly represent such a domain by an XML document that focuses on entities such as drivers and drivers’ cars, and not on entities such as (best) lap times. But nothing prevents us from representing the domain by another XML document that focuses on entities such as drivers and (best) lap times, leaving aside entities such as drivers’ cars. These two XML documents provide two different perspectives on a domain. This means that we can provide a perspective on a domain by using XML, but also that XML can provide a perspective on a domain, because XML assumes the third claim of perspectivism. Moreover, to the extent that the XML documents provide two examples of multiple perspectives on the same domain (resulting in different lists of entities), we could also say that we can provide different perspectives on the same domain by using XML, but also that XML can provide different perspectives on the same domain, because XML assumes the second claim of perspectivism.

[14] The second stage (systematizing these entities within representational primitives) concerns the systematization, on which neither the second nor the third claim imposes any restriction. Now, since XML assumes both, and the third claim imposes no constraint on the entities, any XML document can in principle include and (thus) systematize any entity. But how can entities be systematized? Sect. [12] states that XML systematization is done by means of elements consisting of content, tags, and attributes (name-value pairs). Sect. [10] adds that each element can also be empty or contain other elements. I further state here that the entities resulting from the first stage are ultimately systematized as contents and/or attribute values of an XML document. In other words, regardless of the entities resulting from the partition, these entities result in contents and/or attribute values. What about tags and attribute names? Tags label contents, and attribute names do the same for attribute values. This means that if we were to systematize the partition of a domain resulting in a list of entities that includes “love” by means of an XML document, then “love” would be a content or an attribute value within such a document – regardless of the tag or the attribute name we label “love”. The choice of systematization of the elements, as well as their contents, tags, and attributes, will depend on how we model the domain – that is, on the perspective (on the domain) that we adopt. Therefore, we can simply conclude this Sect. by re-reading the last two sentences of Sect. [8]. (Not restricting the systematization of entities is the response of perspectivism to the (potential) multiplicity of perspectives on the same domain that we might adopt and then represent. And to those who argue that perspectivism must face a multiplicity of perspectives because it assumes such a multiplicity, a perspectivist could reply that, since perspectives are cognitive partitions, their multiplicity can hardly be denied.)

[15] Like perspectivism about FOs, perspectivism about XML cannot go beyond the limits set by the standards defined by XML. To say the opposite would be to say that perspectivism is not about XML. Unlike FOs, however, XML cannot be separated from the language in which XML is expressed, since XML is itself a language, whose building blocks are elements consisting of content, tags, and attributes (name-value pairs). Contents and attribute values can, in principle, include any entity. And any

tags and attribute names can be associated with those contents and attribute values (respectively). Depending on how we systematize “love”, the systematization will thus be one of contents and attribute values. Otherwise, we would contradict the results of the domain partition. As with perspectivism about FOs, this might prove the inconsistency of perspectivism about XML: it rejects any constraint on systematization and accepts constraints on where to systematize entities. For the very same reason stated in Sect. [9], I think there is no inconsistency. The constraint refers to the limits of XML, not to those of perspectivism. Moreover, since contents and attribute values are potentially inclusive of any entity, any constraint should be limited, if not eliminated.

[16] If the argument of Sects. [11–15] is correct, then I should have given the reason(s) to believe that XML is perspectivist. If so, then communication between humans, between humans and machines, and between machines based on XML would embrace the claims of perspectivism. Moreover, since many markup languages are based on XML (see Sect. [3]), I suggest that these languages might themselves be perspectivist. And the same can be said for whatever uses XML – unless that “whatever” and those languages provide some defenses against (the claims of) perspectivism. Finally, insofar as perspectivism applies differently to FOs and XML (simply because FOs and XML are different), we cannot even rule out the possibility that perspectivism also applies differently to the languages based on XML, or to whatever uses XML. Nor can we rule out the possibility of a combination of the various applications, resulting in mixed forms of perspectivism.

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