# Ontology Evaluation Criteria

Asunci´on G´omez-P´erez lists the following criteria (G´omez-P´erez, 2004):

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| **Criteria** |  |
| **Consistency:** capturing both the logical consistency (i.e. no contradictions can be inferred) and the consistency between the formal and the informal descriptions (i.e. the comments and the formal descriptions match) |  |
| **Completeness**: All the knowledge that is expected to be in the ontology is either explicitly stated or can be inferred from the ontology. |  |
| **Conciseness**: if the ontology is free of any unnecessary, useless, or redundant axioms |  |
| **Expandability**: refers to the required effort to add new definitions without altering the already stated semantics. |  |
| **Sensitiveness**: relates to how small changes in an axiom alter the semantics of the ontology. |  |

Thomas Gruber defines the following criteria (Gruber, 1995):

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| **Criteria** |  |
| **Clarity**: An ontology should effectively communicate the intended meaning of defined terms. Definitions should be objective. When a definition can be stated in logical axioms, it should be. Where possible, a definition is preferred over a description. All entities should be documented with natural language |  |
| **Coherence**: Inferred statements should be correct. At the least, the defining axioms should be logically consistent. Also, the natural language documentation should be coherent with the formal statements |  |
| **Extendibility**: An ontology should offer a conceptual foundation for a range of anticipated tasks, and the representation should be crafted so that one can extend and specialize the ontology monotonically. New terms can be introduced without the need to revise existing axioms. |  |
| **Minimal encoding bias**: An encoding bias results when representation choices are made purely for the convenience of notation or implementation. Encoding bias should be minimized, because knowledge-sharing agents may be implemented with different libraries and representation styles. |  |
| **Minimal ontological commitment**: The ontology should specify the weakest theory (i.e. allowing the most models) and defining only those terms that are essential to the communication of knowledge consistent with that theory. |  |

Obrst et al. name the following criteria (Obrst et al., 2007):

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| **Criteria** |  |
| **Coverage** of a particular domain, and the richness, complexity, and granularity of that coverage |  |
| **Intelligibility** to human users and curators |  |
| **Validity and soundness** |  |
| Evaluation against the **specific use cases**, scenarios, requirements, applications, and data sources the ontology was developed to address |  |
| **Consistency** |  |
| **Completeness** |  |
| The sort of **inferences** for which they can be used |  |
| Adaptability and reusability for wider purposes |  |
| Mappability to upper level or other ontologies |  |

Gangemi et al. define the following criteria (Gangemi et al., 2005

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| **Criteria** |  |
| **Cognitive ergonomics:** this principle prospects an ontology that can be easily understood, manipulated, and exploited. |  |
| **Transparency (explicitness of organizing principles):** this principle prospects an ontology that can be analyzed in detail, with a rich formalization of conceptual choices and motivations. |  |
| **Computational integrity and efficiency**: this principle prospects an ontology that can be successfully/easily processed by a reasoner (inference engine, classifier, etc.). |  |
| **Meta-level integrity:** this principle prospects an ontology that respects certain ordering criteria that are assumed as quality indicators. |  |
| **Flexibility (context-boundedness):** this principle prospects an ontology that can be easily adapted to multiple views. |  |
| **Compliance to expertise:** this principle prospects an ontology that is compliant to one or more users. |  |
| **Compliance to procedures for extension, integration, adaptation, etc.:** this principle prospects an ontology that can be easily understood and manipulated for reuse and adaptation. |  |
| **Generic accessibility (computational as well as commercial):** this principle prospects an ontology that can be easily accessed for effective application. |  |
| **Organizational fitness:** this principle prospects an ontology that can be easily deployed within an organization, and that has good coverage for that context. |  |

Summarized above criteria’s into a concise set.

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| **Criteria** | **Explained Criteria for news dataset** |
| **Accuracy:** A higher accuracy comes from correct definitions and descriptions of classes, properties, and individuals. | 1. We need to identify correct classes and properties in the news ontology. 2. All inferences for the ontology should be true. 3. For example, When stating that the **foaf:knows** property is a superproperty of a **married property,** then this axiom would only be accurate if indeed all married couples know their respective spouses. If we find counterexamples (for example, arranged prenatal marriages), then the ontology is inaccurate. |
| **Adaptability** measures how far the ontology anticipates its uses | 1. It should be possible to extend and specialize the ontology monotonically, i.e. without the need to remove axioms 2. It should allow for methodologies for extension, integration, and adaptation, i.e. include required meta-data. 3. New tools and unexpected situations should be able to use the ontology. |
| **Clarity** measures how effectively the ontology communicates the intended meaning of the defined terms | 1. Names of elements should be understandable and unambiguous. 2. An ontology should use definitions instead of descriptions for classes. 3. Entities should be documented sufficiently and be fully labeled in all necessary languages. 4. Complex axioms should bedocumented. Representation choices should not be made for the convenience of thenotation or implementation, i.e. the encoding bias should be minimized. 5. For example, an ontology may choose to use URIs such as ex:a734 or ex:735 to identify their elements (and may even omit the labels). In this case, users of the ontology need to regard the whole context of the elements in order to \_nd a suitable mapping to their own conceptualizations. Instead, the URIs could already include   hints to what they mean, such as ex:Jaguar or ex:Lion. |
| **Completeness** measures if the domain of interest is appropriately covered | 1. All questions the ontology should be able to answer can be answered. 2. There are different aspects of completeness: 3. **Completeness with regards to the language** (is everything stated that could be stated using the given language?), 4. **Completeness with regards to the domain** (are all individuals present, are all relevant concepts captured?) 5. **Completeness with regards to the applications** **requirements** (is all data that is needed present?),etc. 6. Completeness also covers the granularity and richness of the ontology. |
| **Computational efficiency** measures the ability of the used tools to work with the ontology, in particular, the speed that reasoners need to fulfil the required tasks, be it query answering, classification, or consistency checking. | The size of the ontology also affects the efficiency of the ontology. |
| **Conciseness** is the criteria that state if the ontology includes irrelevant elements with regards to the domain to be covered or redundant representations of the semantics. | 1. An ontology should impose a minimal ontological commitment, i.e. specify the weakest theory possible. 2. Only essential terms should be defined. The ontology's underlying assumptions about the wider domain (especially about reality) should be as weak as possible in order to allow the reuse within and communication between stakeholders that commit to different theories. 3. For instance: News ontology will cover all the news. It should not require what is news? Why we should read news? These all are unnecessary additions to the ontology. |
| **Consistency** describes that the ontology does not include or allow for any contradictions | Logical consistency is just one part of it, but also the formal and informal descriptions in the  ontology should be consistent, i.e. the documentation and comments should be aligned  with the axioms. |
| **Organizational fitness** aggregates several criteria that decide how easily an ontology can be deployed within an organization. | 1. Tools, libraries, data sources, and other ontologies that are used constrain the ontology, and the ontology should fulfill these constraints. 2. Ontologies are often specified using an ontology engineering methodology or by using specific data sets. 3. The ontology metadata could describe the applied methodologies, tools, and data sources, and the organization. Such metadata can be used by the organization to decide if an ontology should be applied or not. |