

Ad Hoc Categories and Geospatial Ontology
Position Paper for COSIT Ontology Workshop
Jeffrey S. Galko
State University of New York at Buffalo

Theories that attempt to set forth an upper level ontology (Niles and Pease 2001), a systematic taxonomy that is designed to describe the types of entities that are capable of existing, are missing an entire level within their ontology. This level is occupied by ad hoc categories which are collections of a peculiar sort (Barsalou 1983, 1991). Ad hoc categories show that ontologies that limit themselves to the classification of entities, aggregates, and events are awkward. This is especially because humans interact with the world in special ways when performing certain tasks. Namely, they create categories whose function it is to group entities together which seem to have nothing else in common other than membership to a particular category. An example of this would be the category *things which could be smuggled into the country*. Instances of such a category could include such entities as “non-indigenous fruit,” “stolen merchandise,” and “bombs” which have a wide degree of variance along several dimensions. This position paper is meant to provide a starting point towards developing an ontology that deals specifically with the issues related to the domain of preventing contraband from entering into a particular country.

1. A Clear Link Between the Domain of Contraband Prevention and Geospatial Ontology

There is a dependence relationship which exists between the domain of contraband prevention and geospatial ontology, namely the former domain would not exist if there were not also entities that are subsumed under a geospatial ontology. In specific, the domain in question is dependent upon the existence of what Smith (1994) has called fiat boundaries. Fiat boundaries are demarcations which result from acts of human cognitive agency. Prime examples are political boundaries, such as the border which exists between Canada and the United States. The very essence of smuggling is dependent upon there being fiat boundaries which enclose political jurisdictions with different cultural norms and ways of living. It also deserves mention that bona fide boundaries play a role in detecting smuggling. Contraband is a physical existent and as such it has physical boundaries which separate it from the environment.

1.1 Contraband Prevention and SNAP and SPAN

Ad hoc categories are the link between entities which endure (for example: me, this bomb, or this knife) and entities which perdure (for example: my life, this explosion, or this threat). This role of linking Aristotlean substances to events or processes can be readily observed in the case of contraband prevention. Quite simply, preventing contraband is an event under which the act of forming the ad hoc category *things which could be smuggled into the country* is subsumed. However, the instances of the above category are substances in the Aristotlean substances. Ad hoc categories provide the

basis by which human agents negotiate through their environment and perform critical tasks, especially those related to homeland security.

2. Constraints Related to Ad Hoc Categorization

Acts of ad hoc categorization are purposeful in that they are specifically related to performing certain actions as the above example related to preventing smuggling proves. In other words, acts of ad hoc categorization are motivated by intentions on the side of the agents who perform them.

2.1 Ad Hoc Categories Within Geospatial Ontology

There may be specific ad hoc categories that relate to geospatial ontology along a specific dimension, for instance scale. For example, consider the category of *things which are big*. Such a category could include a wide variety of instances and it would be interesting to see to what extent there is an overlap between what humans would determine to belong to such a category and the entities that are considered to be included in a geospatial ontology. It is important to note that such a category would not violate the stipulation set forth above with respect to the intentionality of ad hoc categorization. This is because of another peculiar feature that ad hoc categories possess is that they have a taxonomic structure. Consider the relationship between the ad hoc categories *things which can be smuggled into the country* and *things which can be packed inside a suitcase*. Some instances of the latter are also instances of the former, but not all. The claim being made here is that the ad hoc category *things which are big* is not a special case of ad hoc categorization. Rather this latter category exists at a particular taxonomic level of ad hoc categorization and where the action it is related to is unspecified.

References

- Barsalou, L.W. (1983). Ad hoc categories. *Memory & Cognition*, 11 (3), 211-227.
- . (1991). Deriving categories to achieve goals. In Gordon H. Bower (Ed.) *The psychology of learning and motivation*, Vol. 27. San Diego, CA: Academic Press, Inc.
- Brooks, L. (1990). Concept formation and particularizing learning. In P. Hanson (Ed.), *Information, language and cognition*. Vancouver, BC: University of British Columbia Press.
- Collins, A.M.; and Loftus, E.F. (1975). A spreading activation theory of semantic Processing. *Psychological Review*, 82, 407-428.
- Das, S.; Shuster, K.; and Wu, C. (2002). Ontologies for agent-based information retrieval and sequence mining. From: *Proceedings of the workshop on ontologies in agent systems, 1st international joint conference on autonomous agents and multi-agent systems, Bologna, Italy*.
- Dipert, R.R. (1993). *Artifacts, art works, and agency*. Philadelphia: Temple University Press.
- Fonseca, F.T.; Egenhofer, M.J.; Davis, C.A.; and Camara, G. (2002). Semantic

- granularity in ontology-driven geographic information systems. *Annals of Mathematics and Artificial Intelligence* 36(1-2): 121-151.
- Garner, W.R. (1978). Aspects of a stimulus: Features, dimensions, and configurations. In E. Rosch and B.B. Lloyd (Eds.), *Cognition and categorization*. Hillsdale, NJ: Lawrence Erlbaum Associates.
- Guarino, N.; Carrara, M.; and Giaretta, P. (1994). An ontology of meta-level categories. In D. J. E. Sandewall and P. Torasso (eds.), *Principles of Knowledge Representation and Reasoning: Proceedings of the Fourth International Conference (KR94)*. Morgan Kaufmann, San Mateo, CA: 270-280.
- Guarino, N. (1994). The ontological level. In R. Casati, B. Smith and G. White (eds.), *Philosophy and the Cognitive Science*. Holder-Pivhler-Tempsky, Vienna: 443-456
- Husserl, E. (1970). *Logical investigations, Volumes I-II*. Translated by J.N. Findlay. London: Routledge and Kegan Paul. (Original work published in 1900/1901 as *Logische Untersuchungen*).
- Keil, F.C. (1989). *Concepts, kinds, and cognitive development*. Cambridge: MIT Press.
- Medin, D.L.; Lynch, E.B.; and Solomon, K.O. (2000). Are there kinds of concepts? *Annual Review of Psychology*, Annual 2000 p. 121.
- Mele, A.R. (1997). *The philosophy of action*. New York: Oxford University Press.
- Miller, G.A. (1956). The magical number seven plus or minus two: Some limits on our capacity for processing information. *Psychological Review*, 63, 81-97.
- Niles, I; and Pease, A. (2001). Towards a standard upper ontology. From *Formal ontology in information systems: Proceedings of the international conference on formal ontology in information systems - Volume 2001*. Ogunquit, Maine, USA. Pages: Pages: 2 – 9.
- Rosch, E. (1978). Principles of categorization. In E. Rosch and B.B. Lloyd (Eds.), *Cognition and categorization*. Hillsdale, NJ: Lawrence Erlbaum.
- Rosch, E.; Mervis, C.B.; Gray, W.; Johnson, D.; and Boyes-Braem, P. (1976). Basic objects in natural categories. *Cognitive Psychology*, 3, 382-439.
- Rosch, E. (1973). On the internal structure of perceptual and semantic categories. In T.E. Moore (Ed.), *Cognitive development and the acquisition of language*. New York: Academic Press.
- Smith, B. (1999). Truth and the visual field. In J. Petitot, F.J. Varela, B. Pachoud, and J.-M. Roy (Eds.), *Naturalizing phenomenology: Issues in contemporary Phenomenology and cognitive science*. Stanford: Stanford University Press.
- . (1998). The basic tools of formal ontology. In N. Guarino (Ed.), *Formal ontology in information systems*. Amsterdam, Oxford, Tokyo, Washington, DC: IOS Press (Frontiers in artificial intelligence and applications).
- . (1994). Fiat objects. From N. Guarino, L. Vieu and S. Pribbenow (eds.), *Parts and wholes: Conceptual part-whole relations and formal mereology, 11th European Conference on Artificial Intelligence, Amsterdam, 8 August 1994*, Amsterdam: European Coordinating Committee for Artificial Intelligence, 1994, 15-23.
- . (1989). Logic and formal ontology. In J. N. Mohanty and W. McKenna (Eds.), *Husserl's phenomenology: A textbook*. Lanham: University Press of America, pp. 29-67.
- Smith, B.; and Smith, D.W. (Eds.). (1995). *The Cambridge companion to Husserl*.

- Cambridge: Cambridge University Press.
- Smith, E.E.; and Medin, D.L. (1981). *Categories and concepts*. Cambridge: Harvard University Press.
- Stock, O. (Ed.). (1997). *Spatial and temporal reasoning*. Dordrecht; Boston: Kluwer Academic Publishers.
- Wason, P.C.; and Johnson-Laird, P.N. (1972). *Psychology of reasoning: Structure and content*. Cambridge: Harvard University Press.
- Wilkins, D.E. (1988). *Practical planning: Extending the classical AI planning paradigm*. San Mateo, CA: Morgan Kaufmann Publishers.