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## ONTOLOGY

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The term *ontology* is used in a large number of diverse fields. An ontology is, in its broadest sense, a systematic or formalized description of accepted properties and characteristics that relies on distinct institutional, social, and technical conventions. In geography, it represents a nexus of intellectual activities, most significantly philosophy and computer science. Its significance comes in no small measure through its role in the facilitation of information exchange and sharing in computer networks (interoperability). Examples of geographic ontologies include public transportation, noise emissions, and map features. Through systematization and formalization, these examples help to facilitate the exchange of information about multiple activities often are stored in different computer systems. Different disciplinary understandings of the term have led, in geography and geographic information science (GIScience), to people distinguishing “big Ontology” from “little ontology.”

The general concept of ontology can be compared to a synopsis of a community’s language and understanding of the world around the community. Each community’s members pursue similar activities, but their environment influences how they conduct activities and what relationships they have with a variety of activities. An Arctic Inuit group understands the world its members experience in different ways from a Xhosa group in Southern Africa. Each group has an ontology that reflects the community’s shared set of knowledge. The specifics of fishing activities are different (e.g., needing to cut a hole in the ice), but the

systematization of the ontology leads to a clear definition of specific activities being part of fishing.

This “small *o*” concept of ontology has a practical orientation that accounts, to some degree, for different meanings of things but tends to describe functions. Functions offer much insight into what people do but make it hard to distinguish the means from the ends, especially means that are implicit such as the paper needed to write a letter and the sharpened stone needed to break through ice. For work with computers, this issue means that an ontology can oversimplify and possibly ignore key aspects of activities that give them significance. Rather than merely functions, small *o* ontologies should be taken as specification of a conceptualization. However, although this considers activities broadly, it remains limited to what is needed and desired for a particular conceptualization. Returning to the fishing example, an ontology of the Inuit conceptualization of fishing may be perfectly adequate for Inuit communities but not for Xhosa or other indigenous fishers dwelling in more temperate areas.

Philosophers have raised this question and focused on this “big *O*” issue, attempting to systematically, logically, and rationally describe the penultimate meaning of objects and activities. The philosophical concept of Ontology involves determining the essential characteristics and actions of fishing and describing the universal traits and activities of fishing. This concept originated with Plato’s view that the human mind is chained in a cave and can only perceive reflections of the world outside of the cave. Big *O* ontology aims to describe that world.

In spite of these differences, each approach requires the systematic and formal representation of

knowledge. In either approach, an ontology is independent of the agent's internal representation, for example, presented in a language and terms that a person outside of the agent's community can understand. Small *o* ontologies are called conceptualizations, which are abstract simplified views of world to represent for a purpose and are explicit.

Because small *o* ontologies are far more prevalent in geography and GIScience, some relevant details are in order. First, most ontologies use a joint terminology that can be used by a number of disciplines and applications. An ontology usually uses a representation language based on first-order predicate logic, that is, logic suitable for algebraic expression in which predicates take only individuals as arguments and quantifiers bind only individual variables. Because a domain can be manipulated algebraically, terms and relationships in a domain can be described as axioms and put into relationship with each other.

Ontologies rely on commitments, especially agreements to use the shared vocabulary. These agreements are crucial to the success of ontologies. Different knowledge of the same activities or environmental processes and characteristics is possible, and different answers to queries are possible. An example of such a problematic query is the question, "What are all the towns in the Chicago area?" For some people, the Chicago area may be limited by political affiliations to any regional governing associations. Other people may consider the Chicago area to be economically defined. Without more knowledge about the context, these queries can be impossible to answer—a substantial problem for ontologies developed for particular conceptualizations.

A number of XML-based representation languages, including Ontolingua, Loom, and Frame Logic, are used for describing artificial intelligence ontologies that can address these problems. Other languages provide resources for developing and supporting Web services by connecting representation language to particular approaches to model, access, and construct relationships with other ontologies. Examples of these languages include Simple HTML Ontology Extensions (SHOE), Ontology Exchange Language (XOL), Ontology Markup Language (OML and CKML), and Resource Description Framework Schema Language (RDFS).

As many uses of geographic information systems (GIS) move more toward Web services' models (e.g., when a visitor to a national park using a car navigation

system transparently loads map, road, and attraction information from separate Web servers), ontologies and these languages become critical to the successful combination of information. DAML Map is a sample application showing what is possible to do by merging different shareware or copyleft software packages and accessing different data sources.

In summary, ontologies define terms, query operations, and relationships. In networked environments with heterogeneous data sources, ontologies become crucial for the systematic and formalized description of geographic information. This makes it possible, using the Internet and semantic Web ideas and concepts, to access geographic information from multiple sources and to combine it as the need arises. Most ontologies are axiomatic frameworks for knowledge representation that require commitments and agreements to ensure that different groups use the ontologies' common vocabulary.

—Francis Harvey

*See also* Cartography; GIS; Humanistic GIScience; Spaces of Representation

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## OPEN SPACE

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Open space, a concept employed to offset or counterbalance unchecked urban expansion, refers to the conservation of landscapes retaining characteristics of presettlement environments, pastoral agricultural lands, or restored areas meant to recreate or mirror such landscapes. Open spaces typically are formed or

protected at the local level through the neglect of commons, the establishment of private land trusts, conservation planning, or active rehabilitation of abandoned or contaminated brownfields. The intent of advocates often is to keep these areas free of development in perpetuity.

Open spaces have been championed as having a wide array of benefits that not only accrue to the surrounding human population but also strengthen the integrity of local environmental and biotic systems. Keeping tracts of urbanized land undeveloped may allow for the preservation of environmental pockets reflective of the natural state of the environment or physical landscape. Ecologically, these areas have the potential to enhance biodiversity, aid in the conservation of endangered or threatened animal and plant species, and provide greenways or greenbelts that allow for the movement of larger, more mobile animal species. They are also valued for their ability to contribute to flood control, minimize erosion and mass movement, and provide protection from fire hazards. Open spaces often are used as hubs for recreation and sport by the nearby urban population as well.

Aesthetic considerations are also powerful motivating factors in the preservation of many open spaces. Open spaces are highly valued for their accessibility to the public, for their ability to provide a nearby “natural” experience in the middle of an otherwise concrete jungle, and as an important source of aesthetic beauty and scenic views that may provide affective and cognitive benefits to urban residents. Another valued asset of open spaces is their ability to buffer zones of dense development creating a patchwork or mosaic of urbanized landscapes interspersed with undeveloped areas. However, open spaces are not without their detractors. Critics claim that the removal of valuable urban land from development results in a weaker tax base and fragmentation of city services and also encourages higher density development elsewhere in the urban landscape.

Although open space may be naively construed as natural environments, especially in contrast to the exaggerated built environment of cities, this categorization becomes problematic when the ideologies with which such landscapes are invested are examined closely. Preservation of pastoral or agricultural landscapes has been recognized by geographers as being as much a part of the cultural heritage of a landscape as a reflection of the natural environment. Restored, rehabilitated, or neglected landscapes are also

invested with cultural meaning as their role, utility, and character are generated through interaction with the surrounding population. In this way, geographers may also view open spaces as unique urban places.

—Michael Urban

*See also* Conservation; Cultural Landscape; Nature and Culture; Political Ecology; Urban Sprawl; Wilderness

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## ORIENTALISM

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Orientalism has its origins in late literary theorist Edward Said's 1978 book by the same title. *Orientalism* is widely considered to be one of the most influential books of the 20th century, and its influences cross the humanities and social sciences. Said analyzed the writings and representations of Western European authorities on the region of the world they categorized as “The Orient”, with his particular interest focused on what most geography books would label Southwest Asia, the Middle East, and the Near East. Said's central claim was that this broad body of work had scripted a notion of the Orient as an exotic “other”, both repulsive and intriguing and unconnected to the long sweep of human cultural development that became—as a result of these Orientalists, Said argued—Europe's to claim.

What came to be referred to in this way as the Orientalizing of the Near East and its peoples was, Said contended, central to the imperialist projects of the West. By erasing the connectivity of civilizations and cultures of the region from the West's story and representing them as an exotic, bizarre, and inferior appendage, the Orientalists made colonial conquest a natural and logical extension of the rise of the West. Influenced by French philosopher Michel Foucault, Said sought to suggest that the Orientalists' discourse on the region had over time erased the real Orient or any alternative notion of regional identity.

*Orientalism* can be taken as one of the foundational texts of postcolonial studies, leading literary theorist Robert Young to consider Said to be one of the three

main scholars (with Gayatri Chakrovarty Spivak and Homi Bhabha) to shape that field's development. It has created many imitators and spawned a growth industry of applications of its basic notions to other parts of the world where European imperialism has, these works claim, Orientalized the people it has conquered or erased. Scholars have taken the concept well beyond its literary origins and into the critical rereading of the representations of places found in postcards, art, architecture, and maps, among other devices. These latter categories captivate geographers, perhaps for obvious reasons, and it is no surprise to see many geographers influenced by this idea. The central ideas of Orientalism have, for instance, been deployed in important geography scholarship such as Derek Gregory's *The Colonial Present*. Gregory sought to show how the Western powers have reproduced and extended the Orientalist scripting of the Middle East in three contemporary conflict settings: Afghanistan, Palestine, and Iraq.

*Orientalism* has hardly been without its critics. Some critics seek to discredit the work and all that has come in its wake because they do not separate it from the political project of Palestinian human rights that was, by virtue of his long and bitter exile from his homeland, Said's life work. Other critics argue that his book is notably absent of the possibilities for voices of resistance within Middle Eastern countries to this othering process. Bhabha prominently extended Said's claims, even while criticizing them. In demonstrating that the connections between imperialist or colonialist rhetoric or discourse and realities on the ground often could be found wanting, Bhabha provoked a storm of interest in the muddled places in between the colonizer and the colonized. Bhabha pointed a host of scholars to the ambivalence, hybridity, and mimicry found in colonial representations of Orientalized places and, at the same time, to the same phenomena in the self-representations of colonized peoples. The latter thought is the jumping off point for subaltern studies scholarship, commonly associated with Spivak. Subaltern studies scholars have problematized the question of the capacity for colonized peoples, such as those that the Orientalists critiqued by Said were writing about, to write back to the colonizers and subvert the discursive representations of them.

Although most of Said's work bears the profound influences not only of Foucault but also of cultural materialist theorists with strong Marxist credentials

such as Italian philosopher Antonio Gramsci, perhaps the harshest criticisms of *Orientalism* have come generally from Said's left, notably in the work of Aijaz Ahmad. Ahmad and other Marxist critics decry the work and the outpouring of scholarship it influenced for an alleged absence of grounded historical materialist class analysis. These critics bemoan the emphasis on deconstructing the discourse of texts rather than on the material consequences of European domination in the Middle East, alongside the sense that critics such as Ahmad have of Said's idealism about underlying causes in the region's subjugation.

Said himself replied to his critics through various expansions on the utility of the ideas he had crystallized in *Orientalism*. His responses are found in a number of publications, but *Culture and Imperialism*, published in 1993, is probably the most useful one for human geographers—in part because geography plays a crucial role in his arguments therein. Said acknowledged that the claims he made about the Middle East had now been extended to other parts of the world, even while he accepted that he had, in *Orientalism*, left out the whole story of the responses of colonized peoples to both the discursive and material tactics of imperialists. He defended the analysis of literature as a critical dimension of the materiality of imperialism, not only historically but also in contemporary times, because the discursive representations of Western outsiders, he argued, could be shown to have direct material links to policy outcomes such as the first Gulf War. Gregory's book has carried the claims of Said (now deceased) forward to the second Gulf War (the Iraq War).

—Garth Myers

*See also* Anticolonialism; Colonialism; Eurocentrism; Imperialism; Other/Otherness; Postcolonialism; Subaltern Studies

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## OTHER/OTHERNESS

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The ideas of the “other” and “otherness” have associations with psychoanalysis, structuralist and post-structuralist theory, and postcolonial studies. Many scholars of psychoanalysis take note of the work of the human brain, alongside its own internal divisions (often seen as the conscious mind and unconscious mind), in making some form of a basic distinction between the self and the beings outside. In what is termed *object relations theory*, it is posited that a person learns as a very young child to see herself or himself as unconnected to the mother—as a distinct being. The fears and terrors that this realization brings with it cause the child to displace her or his feelings onto others. Psychoanalytic theories suggest that the outside segment of the binaries—self/other and same/different—often is feared, loathed, or held as inferior. Thus, people often seek to expel, reject, abject, or exclude what is taken as other, outsider, or different, for instance, people who are out of place from where the mind’s prevailing order wants them. The term *othering* often is used for these exclusionary processes. These processes never quite succeed, according to many psychoanalysts, leading to a perpetual struggle for most selves between repulsion from otherness and desire for otherness.

Along with this inner world that in many ways remains geography’s last terrain for exploration, it seems to be a fairly basic step of taking this work of unsuccessful policing of separations between binaries of self/other or us/them outside of the head. Surely, one of human geography’s most fundamental reasons for existence lies in helping people to sort out areal difference—which places are the same or similar and which places are different or other. Societies often seek to separate same from other, whether the dividing lines be based on race, class, gender, or other categories. Like the processes in our heads, these social processes of separation have ambivalent outcomes. People in one place, of course, can be construed as different from people in another place; otherwise, human geographers would not have much work to do. The problems that keep human geographers employed hinge on how those differences are constructed, manipulated, and deployed at differing levels of a society’s power structure and on just how incomplete or unsuccessful the constructions, manipulations, or deployments are.

Cultural anthropology, like human geography, relies on the basic idea that people differ from one place to another for a significant portion of its *raison d’être*. Johannes Fabian’s study, *Time and the Other*, suggested that modern anthropology needed to contend with a considerable history of othering its objects of study by a pronounced focus on those who many Westerners conceive of as exotic or primitive. In Fabian’s view, the field, by essentializing culture—boiling down differences to these supposedly exotic or primitive traits—reinforced and extended stereotypes that debilitated efforts toward cultural understanding.

Postcolonial studies, however, has troubled any neat separation between self and other, or between us and them, common to conventional theories in cultural anthropology or earlier human geography. On the one hand, Edward Said’s *Orientalism* opened a whole field of analysis of how othering tactics served the interests of colonialism and imperialism; indeed, therein lies the impetus for Fabian’s work discussed previously. Similarly, the group of Indian historians known as the subaltern studies collective sought, in effect, to rewrite South Asian history from the point of view of the other, albeit articulated in their works as the subaltern or subordinate classes. For another example, in the work of Timothy Mitchell, it can be seen that colonial cities defined themselves by what they were not or what they excluded from their midst. There is an other side to every city in the colonial imagination. Yet things are not nearly so simple, post-colonial studies scholars suggest, and as Mitchell’s work shows, the exclusions seldom (if ever) produced the binaries that were intended. In particular, cultural studies scholar Homi Bhabha stressed the ambivalence of colonialism and mimicry that took place on both sides, leaving scars on either end of the encounter. The very otherness of the other often proves as desirable and alluring as it is alien and disgusting.

Poststructuralist or postmodern thought outside of the formerly colonized world also makes great use of the idea of the other or otherness. French philosopher and historian Michel Foucault helped to redirect a great deal of scholarly attention away from more conventional (i.e., elite) subjects of history toward marginalized groups in Western societies. Despite Foucault’s very diverse subjects for investigation, each of his works generally shared his fresh approach to ideas of power that suggested that power did not

flow in a neat top-down manner in societies but rather took diffuse capillary forms. Foucault and other post-structuralist French thinkers such as Jacques Derrida have been very influential in human geography, but these influences in this particular sphere of otherness have also been criticized. Notably, David Harvey worried that poststructuralism could lead to a kind of championing of difference that might take scholars down a thousand blind alleys on searches for power's diffusion—searches that would obscure what Harvey saw as the material sources of power located in the upper circuits of global capitalism. By focusing attention on inner worlds or the allure of difference, many critics (e.g., Harvey) charge, the power dynamics of political economy often can be shortchanged.

—Garth Myers

*See also* Postcolonialism; Subaltern Studies

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## OVERLAY

Overlay is, for most people, one of the most definitive operations of geographic information systems (GIS). Overlay makes it possible to combine vector and/or raster data for any areas based on a common coordinate system. The analytical capabilities of overlay make a critical contribution to geographic analysis in many fields.

However, overlay is a late arrival to geographic techniques and methods. The history of overlay prior to the late 1960s remains veiled in ambiguity. The technical and conceptual basis finds a parallel in the development of offset printing introduced during the early 20th century. The first published reference

to the technique is from a 1913 landscape architect's plan for Billerica, Massachusetts. The cost and complexity of conducting overlays by hand led to geographers using representative fractions to numerically indicate relationships. For the analytical integration of soil types and crops in Montfort, Wisconsin, the possibility of overlaying transparent maps of each property was discussed, but until GIS became widely available, the expense and cartographic complexity dissuaded the pursuit of overlay as a technique for geographic analysis.

Ian McHarg's presentation of overlay, published in *Design With Nature* in 1969, involves the use of overlay to superimpose transparent thematic maps drawn in darker colors as the value associated with the property changes over an area. Overlaying layers of natural features, social features, and engineering considerations for transportation planning produces a composite in which darker colors indicate higher values and more conflicts for planning. Lighter areas in the composite map show areas with lower values and fewer conflicts.

The concept of overlay remains complex. The collocation of two properties is invaluable for geographic analysis, but the significance of collocation is subject to many considerations. The ingenuity of McHarg's use of overlay masks problems with ensuring that measurements of properties can be meaningfully overlaid, which logical operations reflect geographic relationships, and reoccurring questions about how properties are valued. The accuracy of overlay is a constant concern.

Overlay techniques have been greatly advanced since McHarg's seminal work and are combined with logic selection operations to process geographic information. Raster overlay has become analytically richer, and vector overlay has been integrated into database systems. Overlay techniques remain an important interface metaphor operation for integration operations that now are processed entirely by database software with limited geometric intersection processing. For all of the advances in implementation, overlay still requires a substantial amount of interpretation. Geostatistical techniques have become important complements and alternatives to overlay.

—Francis Harvey

*See also* Cartography; GIS; Humanistic GIScience