To the memory of

DENIS COSGROVE AND LESLIE HEPPLE

THE DICTIONARY OF

Human Geography

5th Edition

2009

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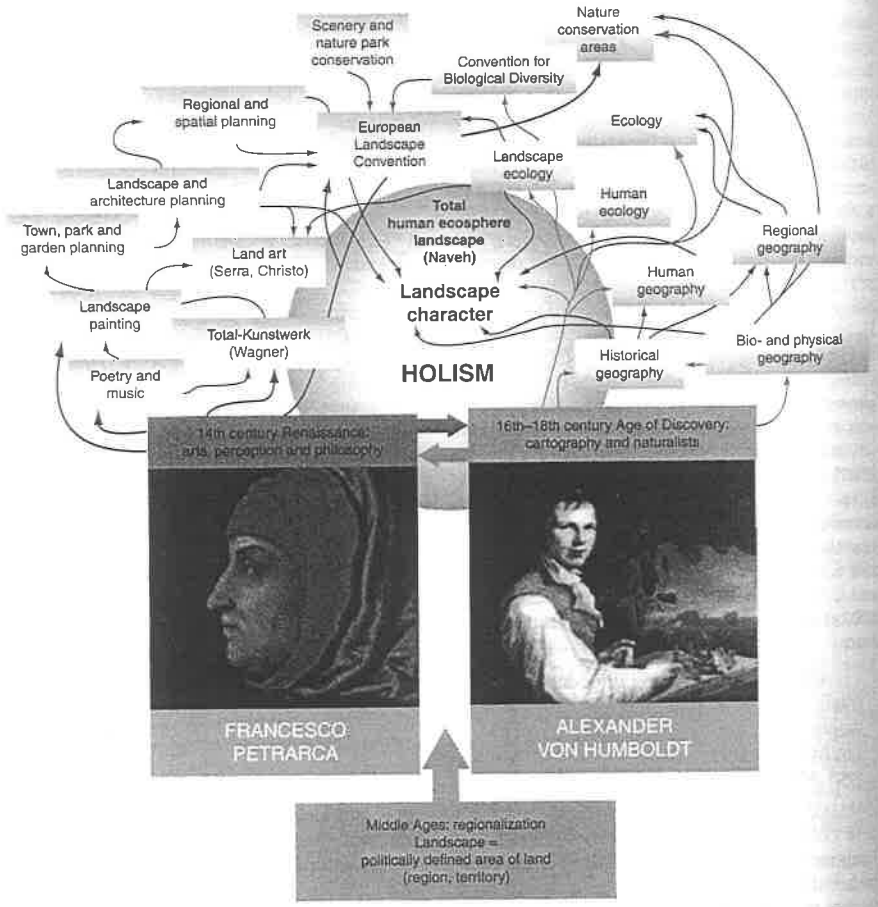
WILEY-BLACKWELL
A John Wiley & Sons, Ltd., Publication



physical geography *4: The relations between landscape, conservation, geography and landscape ecology* (Wascher, 2005)

Suggested reading
Chorley (1971); Fenneman (1919); Gregory (2005), which includes a reprint of Chorley (1971); Pitman (2005); Rhoads and Thorne (1996); Turner (2002) and subsequent discussions.

Pirenne thesis A MODEL of the relations between international TRADE and URBANIZATION in post-Roman and medieval EUROPE, proposed by the Belgian historian Henri Pirenne (1862–1935) (Pirenne, 1925, 2001 [1937]). The fall of the Roman Empire in AD 476 produced a politico-military crisis, but Pirenne argued that the major *economic* shock to the urban system came much later, from the Islamic conquest of the eastern Mediterranean and North Africa, Sicily and southern Spain (*al-Andalus*) in the eighth century. Long-distance Mediterranean trade was cut 'with the elemental force of a cosmic cataclysm', and the urban foundations of Europe crumbled as it was 'forced to live by its own resources'. Europe fractured into a series of cellular, insular regions. It was not until the tenth and eleventh centuries, so Pirenne claimed, after the Christian *Reconquista* in Spain and the military campaigns of the Crusades, that commercial recovery revived the fortunes of cities: 'Just as the trade of the west disappeared with the shutting off of its foreign markets, just so it was renewed when these markets were re-opened.' Merchants led the urban revival, spearheaded by cities in the south (especially Venice) and on the North Atlantic coast (Bruges), where they settled in grey zones close to but outside former, pre-urban fortified enclaves: the *faubourg* or *portus*.

Later work has used archaeological, numismatic and textual sources to show that the Mediterranean remained a practicable trade route throughout this period, however, though activity was concentrated in the more secure central zones, and that trade was also vigorous along the Atlantic and Baltic coasts. Still more arrestingly, McCormick (2001) argued that communications between the Frankish empire and the eastern Mediterranean surged in the final decades of the eight and ninth centuries, so that Islam did not so much 'apply the *coup de grâce* to a moribund late Roman system' as offer 'the wealth and markets which would fire the first rise of Europe' and its commercial economy (see also Hodges and Whitehouse, 1981). It is now also clear that towns 'of unambiguously commercial character' grew in north-west Europe from the seventh and multiplied in the eight and ninth centuries, with important implications for both geographies of local and long-distance trade and the role of merchants in shaping urban MORPHOLOGY (see Verhulst, 1999). DG

Suggested reading
Hodges and Whitehouse (1983); Verhulst (1989).

pixel The term 'pixel' is a corrupted abbreviation of picture element – the individual elements arranged in columns and rows to form a rectangular, composite image. For example, a 1980s VGA (Video Graphics Array) monitor had a maximum resolution of 640 × 480 pixels (with 16 colours), whereas a modern Super VGA monitor can have 1,024 × 768 pixels (and 16,777,216 colours!). Raising the number of pixels per fixed area increases the resolution of an image, but also the amount of information to be processed and stored. Consequently, RASTER images are often compressed, as are digital photographs (as JPEGs) and DVD frames (using MPEG2). RH

place In a generic sense, a place is a geographical locale of any size or configuration, comparable to equally generic meanings of AREA, REGION or LOCATION. In HUMAN GEOGRAPHY and the HUMANITIES more generally, however, place is often attributed with greater significance (cf. LANDSCAPE). It is sometimes defined as a human-wrought transformation of a part of the Earth's surface or of pre-existing, undifferentiated SPACE. It is usually distinguished by the cultural or subjective meanings through which it is constructed and differentiated, and is understood by most human geographers to be in an incessant state of 'becoming' (Pred, 1984). Place is a central concept in human geography in general and in CULTURAL GEOGRAPHY in particular, but there has also been renewed interest in the concept in ECONOMIC GEOGRAPHY, where it stands for the necessity of economic processes to be grounded in specific locales and for those locales to be proactive competitors within the global ECONOMY (Massey, 1984; Harvey, 1989b). For many geographers, place and the differences between places are the very stuff of GEOGRAPHY, the raw materials that give the discipline its warrant (cf. AREAL DIFFERENTIATION). But the potential interchangeability of place with other concepts is a sticking point. Place, region, area and so on all *can* denote a unit of space that has discrete boundaries, shared internal characteristics, and that changes over time and interacts with other similar units. What then makes place a distinctive concept? There are three arenas of discussion of special interest:

(1) *The idea that place, to be a place, necessarily has meaning.* Although there are glimmers of this idea throughout the HISTORY OF GEOGRAPHY, it grew in popularity in the modern discipline with the rise of HUMANISTIC GEOGRAPHY. Tuan (1977), Relph (1976) and a host of others approached place as a subjectively sensed and experienced phenomenon. Often taking their inspiration from PHENOMENOLOGY, humanistic geographers regarded place as not only the phenomenological ground for geography but also an irreducible component of human experience, without which human experience itself could not be constituted and interpreted. Such experiences included perceptions of place, senses of place and human dwelling in and memories of place (see ENVIRONMENTAL PERCEPTION; MEMORY). These were understood to be formative of the unique experiences of individuals, while also

being specific to different cultures. Places themselves were understood as unique, meaningful material constructions that reflected and articulated cultural perceptions and habits. With the rise of FEMINIST GEOGRAPHIES and a 'new' cultural geography in the 1980s, place was understood less through the notion of a self-adequate, intentional human SUBJECT and more through the lens of POWER-laden social relations through which human subjects were at once constituted and de-centred. That is, subjects were not understood as authors of their own intentions and meanings, but as bearers of social IDENTITIES that they did not themselves create. Place meanings came to be seen as specific to particular racial and gender-, sexual- and class-based identities (e.g. Keith and Pile, 1993; McDowell, 1997b). (This was part and parcel of the changing meanings of CULTURE in geography.) At the same time, meaning itself was cast in a new light, being viewed as much less self-evident than before. Particular attention was given to how places are represented in different cultural forms (e.g. ART, FILM, LITERATURE, MAPS), which themselves were given over to specific social uses within power-laden fields of activity (e.g. Duncan and Ley, 1993). But meaning was understood to be controlled neither by its producers nor by its consumers. Meaning had no ultimate locus: it was understood to be contestable and alterable at each point of dissemination. Another important stream of place as meaning-filled sees place as a concept that helps mark the distinction between social order/disorder, the proper/improper and so on. Place in this regard is inextricable from imposed/internalized social and cultural rules that dictate what belongs where. It denotes the (alterable) state of belonging versus exclusion, as suggested by the expression that something or someone is 'in place' or 'out of place' (Creswell, 2004) (see also HETEROTOPIA).

(2) *Place as becoming locale.* Temporal change as a constituent feature of place has long been accepted, particularly in cultural-historical geographies. It is an unexceptional (yet at times politically charged) statement that places do not remain the same. Instead, place is continually emergent. This has meant various things. It has meant that place involves a transformation of some kind; for example, the transformation of a non-human element (the physical environment) by human beings into a HYBRID of culture and nature (see CULTURAL LANDSCAPE). A different kind of transformation often spoken of is the transformation from space to place. The introduction of the notion of the PRODUCTION OF SPACE has made the space and place opposition difficult to sustain, however, as it seems to render place largely as a particular moment within produced space. More recently, the emergence of place has been understood as wrought through a process of immanence. In this sense, place is not derived from something else (as place from space); it is, rather, an always-already ongoing ASSEMBLAGE of geographically associated, ONTOLOGICALLY co-constitutive elements and relationships. (Space, one might say, is fully saturated with place.) This idea of place builds upon STRUCTURATION THEORY (e.g. Pred, 1984) and, later, on NON-REPRESENTATIONAL THEORY and on the monistic thought of Gilles Deleuze and other theorists of immanence (Hetherington, 1997a; Thrift, 1999a).

(3) *The de-centred, global sense of place.* Recently, geographers and others have taken up the question of whether GLOBALIZATION has eliminated place as a social-spatial reality (in much the same way that globalization is claimed to have brought about the 'death of distance' and, still more apocalyptically, 'the end of geography'), and whether places are degenerating into 'NON-PLACES' under the signs of late MODERNITY (see also PLACELESSNESS). There seems to be broad agreement that place does still matter, and that it would be wrong to see place and globalization as negating one another. For example, places/locales continue as salient features of a globalizing economy that is still marked by the production of differences through a constitutive process of UNEVEN DEVELOPMENT. Also interesting is the way in which some geographers, notably Massey (1991), have promulgated an idea of place that takes the notion of global interconnection as a *precondition* for place or sense of place. For Massey, place is not constituted by what is internal to it, but by its distinct lines of connection to other parts of the world. One place is different from another on the basis of its relations to the outside. This effectively renders the distinction between 'inside' and 'outside' moot. Massey's 'global sense of place' has the added virtue of a politics that looks towards the outside rather than towards a defensive localism on the basis of embattled, threatened traditions. Her sense of place nonetheless leaves open the question of whether to construe places as centres of some kind, even if only as meeting places of lines of global connectivity. Hetherington (1997), drawing upon ACTOR-NETWORK THEORY, advocates somewhat differently for place as an 'ordering process' of diffuse but connected *placings*, through which a NETWORK of potentially far flung sites are enrolled into relationship with each other. (See also CONTRAPUNTAL GEOGRAPHIES.)

GHe

Suggested reading

Cresswell (2004); Hetherington (1997a).

place-names Attaching a name to a PLACE is a way of differentiating one place from another, but place-names are more than markers in a system of differences: they are also ways of staking some sort of claim (often of rule, domination or possession) and, as such, are frequently sites of contestation. The two spatial registers, linguistic and social, are intimately connected (cf. Pred, 1990).

In HISTORICAL GEOGRAPHY, especially in EUROPE, the study of place-names or *toponyms* is a philological discipline based principally on written evidence revealing early spellings of names. Such studies have often been used to make inferences about settlement history and LANDSCAPE evolution, and have also attracted considerable controversy. Thus for Britain it was once claimed that pagan names and settlements with the element *-ingas* (e.g. Hastings) denoted the very earliest Anglo-Saxon settlement, while *-ingaham* (e.g. Birmingham) represented the next stage of settlement, and the numerous instances of *x's tun* names (e.g. Edgbaston: Ecgbald's *tun*) marked a later establishment (Gelling, 1997). Adherents to these views also believed in the so-called 'clean sweep' theory, which asserts that the Anglo-Saxons were the originators of English landscapes, since a wholesale disappearance of Celtic place-names in the eastern counties denoted a land area devoid of settlers and settlements (cf. SETTLEMENT CONTINUITY). Almost all of these claims have been rejected in the past 40 years. The main objection is that *-ingas* and *-ingaham* place-names coincide with early Anglo Saxon archaeological remains about as little as possible, given that both occur in substantial numbers in south and east England (Dodgson, 1966). Furthermore, there are great difficulties consistently distinguishing *ham* meaning 'village' from *hamm* meaning 'land in a river bend', probably dry ground in a marsh, which opens up the possibility of mistaking topographical and habitative meanings (Dodgson, 1973). However, it is recognized that if there is one nominative form more frequently associated with the early Anglo-Saxon settlers than any other it is the topographical name. It is now supposed that *-tun* is associated with manorialization, when society was organized in a more sophisticated manner with the establishment of the powerful institutions of kingship. A stronger continuity of Celtic populations is suggested by work charting the incidence of the word *walh*, which is supposed to establish the presence of substantial Welsh-speaking populations (Cameron, 1980). Studies of Scandinavian names have, however, produced greater consensus and led to some successful integrations of philological, archaeological and landscape history. These studies consistently suggest that the Danish-named villages were located in the least desirable locations from an ecological and agricultural perspective, and imply that the victorious Danes were a militarily smaller group than once claimed and did not take over or absorb pre-existing English settlements (Fellows-Jensen, 1975).

The modern world has by no means been insensitive to the histories carried in solution in place-names. Beyond Europe, and sometimes within, COLONIALISM and IMPERIALISM exercised the power to impose new names on the landscape: naming a place coincided with the taking of place. Although the practice continues – as in Israel's colonization and settlement of Gaza and the West Bank under its military occupation (see OCCUPATION, MILITARY: Cohen and Kliot, 1992) – subject populations do not passively adopt the new nomenclatures. Indeed, the POST-COLONIAL period has usually been marked by the recovery or invention of place-names that register a pre-colonial history and an indigenous culture (Herman, 1999; Nash, 1999). Thus, for example, Salisbury, the capital of the British colony of Rhodesia, was named after a British Prime Minister, but in 1981 it became Harare,

Agamben, who thought that the fate of the Jews in the HOLOCAUST ran counter to Foucault's theory. Instead, Agamben argued that at times individuals and groups may be classified in such a way that their life is deemed worthless rather than something to be regulated. For Agamben, the Nazis identified Jews as 'BARE LIFE' – life that warranted extermination. Agamben begins with the Romans, and their classification of *HOMO SACER* (from Roman law, an individual who may be killed but not sacrificed). *Homines sacri* may not be sacrificed as they are 'beyond the divine', and hence meaningless to the gods. They may be killed with impunity, however, because *homo sacer* is beyond juridical law, and hence has no value to the citizenry. While Foucault examined how power disciplined individuals to create a SUBJECT (a person behaving within imposed rules and norms), Agamben argued that sovereign power allows for the elimination of particular subjects. Foucault's biopolitics tries to define who can and should be included in a political community, while Agamben argues that sovereign power excludes individuals and groups not just from particular territorial political communities but from humanity itself.

Geographers have utilized the next logical step in Agamben's work, his identification of spaces of exception (see EXCEPTION, SPACE OF); the geographical construction of BORDERS outside which the rules and norms of established legal and political order do not apply. It is in these geographical zones that sovereign power allows and enacts the killing of *homo sacer* with impunity. The classification of territory in this way results, for Agamben, in a mapping of our world not into NATIONS, but into 'CAMPS'. In the context of the 'war on terror', Agamben's concept was used by geographers to explain the slaughter of fighters and civilians by the US military in Afghanistan and Iraq, the violence upon the Palestinians by Israeli forces, and the incarceration of 'terrorists' at the US Naval Station at Guantánamo Bay, Cuba, with no recourse to US or international LAW (Gregory, 2004b). CF

Suggested reading

Edkins (2000); Gregory (2004b).

sovereignty A claim to final and ultimate authority over a political community. The Treaty of Westphalia (1648) codified modern politics as a system of STATES: states have sovereignty over the land and people in their territories. The term implies that no external political entity has the authority to enact laws or exercise authority within a sovereign TERRITORY (Taylor, 1994c, 1995b). In reality, such a condition of sovereignty has never existed and has been particularly challenged by contemporary processes of GLOBALIZATION.

Sovereignty of states in an inter-state system is the result of two interrelated processes. First, *internal sovereignty* means that external powers are excluded from exercising authority within a state's territory, and that the state has authority over the whole of its territory. A distinction must be made between legal and effective sovereignty. A state may claim sovereignty over the whole of its territory but face strong opposition and resistance to its rule in particular regions to the extent that the STATE APPARATUS is ineffective and ignored. Second, *external sovereignty* means mutual recognition from other states in the system, ultimately requiring endorsement by, and membership of, the United Nations. For example, Israel's induction into the United Nations in 1947, despite protest from Arab countries, established the new state in the inter-state system.

The sub-discipline of POLITICAL GEOGRAPHY was initially focused upon issues of sovereignty, especially the precise location of the BORDERS that delimit states and their sovereignty, as well as the functional internal geography that facilitated the effective exercise of sovereignty. In addition, the fact that state sovereignty did not produce peace, as intended and expected, but has generated CONFLICTS has also provided topics for political geographers: inter-state conflicts, IMPERIALISM and SECESSION, for example. Furthermore, sovereignty over the sea and inner and outer space have emerged as important topics.

The most intriguing discussions of sovereignty have emerged in light of GLOBALIZATION, and the extreme argument, made by some, that we are facing the end of state sovereignty as it emerged in modern times (Ohmae, 1995). Before discussing globalization and sovereignty two points must be made. Sovereignty as per its definition has never existed; there have always been interdictions of external authority and challenges to internal sovereignty. Second, globalization is not an external force acting upon states, but a collection of economic, political, and cultural processes that are partially created and enacted by states. The undermining of state sovereignty by globalization is partly a result of the states themselves. This has led to the definition of 'quasi-states', those that have limited effective sovereignty, often an outcome of POSTCOLONIAL relationships (Jackson, 1990).

The inter-state, or even trans-state, character of globalization has weakened the ability of states to manage their own economic affairs. Currency values and interest rates within particular countries are partially set by the decisions made by international markets rather than through domestic policy, for example. In other words, external influence is felt within sovereign territory. The outcome is a geography of 'graduated sovereignty', in which state sovereignty is spatially differentiated within a sovereign territory (Park, 2005). For example, special economic zones of reduced taxes and tariffs are established within countries that reduce the fiscal authority of the state in order to promote TRADE and INVESTMENT (cf. ENTERPRISE ZONE).

Although states have ceded sovereignty over economic processes, others, reacting to public pressure, have focused upon social sovereignty (Rudolph, 2005), defined as the states' ability to define and control access to a political community. Political CITIZENSHIP has been understood as a feature of territorial sovereignty; citizenship was attached to a particular territorially-defined community, and citizens gained RIGHTS and received duties from the sovereign state. However, processes of globalization have led to increased calls for non-territorial forms of citizenship, in effect granting sovereignty to institutions that transcend states (Russell, 2005).

Sovereignty is in a state of flux, as SOCIETY becomes increasingly organized around NETWORKS rather than territories (Castells, 1996b). Consideration of graduated sovereignty is coupled to overlapping forms of sovereignty, akin to pre-modern times, whereby a territory may be subject to a number of sovereign claims. Some of these claims may be stronger and more appealing than others as the ability to exercise authority may decline with distance from a political centre (Lake, 2003). Currently, we live in a hybrid political geography of varying forms of sovereignty within territorial and network spaces. CF

Suggested reading

Holsti (2004); Sidaway (2002).

space The production of geographical knowledge has always involved claims to know 'space' in particular ways. Historically, special importance has been attached to the power to fix the locations of events, places, people and phenomena on the surface of the Earth and to represent these on MAPS. The extension of these capacities involved a series of instrumental, mathematical and graphical advances, but these innovations were also *political technologies* that were implicated in the production of particular constellations of POWER (Pickles, 2004; Short, 2004). As such, they carried within them particular conceptions of space that were always more than purely technical constructions (see also CARTOGRAPHY, HISTORY OF). This recognition of an intricate connection between power, knowledge and geography has transformed the ways in which contemporary HUMAN GEOGRAPHY has conceptualized space. A suite of theories and concepts has been assembled to address what Allen (2003) describes as both 'spatial vocabularies of power' (which trace the mobilizations and effects of power *over* space) and 'lost geographies of power' (which show how power is produced and performed *through* space). These elaborations have significant repercussions for concepts such as PLACE, REGION and TERRITORY, but in what follows attention is directed towards the more general, plenary concepts of space within which these more particular concepts may be convened.

These are matters of considerable importance. Many writers have argued that the nineteenth century was the epoch of TIME, the twentieth century the epoch of space, and that as 'the modern' yielded to 'the postmodern' so there has been a marked 'spatial turn' across the spectrum of the HUMANITIES and social sciences that describes much more than the play of spatial METAPHORS (e.g. Smith and Katz, 1993; Soja, 1989). But others have insisted on the imminent 'end of geography', 'the irrelevance of space' and the 'death of distance' in ostensibly the same late, liquid or postmodern world (e.g. Bauman, 2000a). It is not difficult to reconcile these competing claims: everything depends on how 'space' is conceptualized (cf. MODERNITY; POSTMODERNITY).

Hartshorne's once influential enquiry into *The nature of geography* (1939) occupies a strange position within the history of the discipline. His view of geography was Kantian – Geography was concerned with the organization of phenomena in space (see AREAL DIFFERENTIATION; KANTIANISM) – and yet Hartshorne provided no systematic discussion of the concept on which his prospectus depended. Even his subsequent account of geography as one of the 'spatial sciences' (with astronomy and geophysics) failed to elucidate the conceptual basis of his claim. What

preoccupied Hartshorne (1958) was the recovery of a line of descent from Kant through Humboldt to Hettner, and yet the ways in which these writers *conceptualized* space was never allowed to become a problem. Hartshorne simply took it for granted that space (like time) was a universal of human existence, an external coordinate, an empty grid of mutually exclusive points, 'an unchanging box' *within which objects exist and events occur*: all of which is to say that he privileged the concept of *absolute space* (Smith, 1984, pp. 67–8).

Many of Hartshorne's postwar critics fastened on the way in which he had taken a specific concept of space and elevated it to the single, supposedly universal concept of space. Although Schaefer objected to the EXCEPTIONALISM of Hartshorne's views, he nonetheless agreed that 'spatial relations are the ones that matter in geography and no others'. The difference was that spatial relations were now to be defined *between objects and events* (not between the fixed points of an external coordinate system) and thereby made relative to the objects and events that constituted a spatial system or spatial structure. This substituted a concept of *relative space* whose elucidation required a more complex geometry, and for this reason SPATIAL ANALYSIS – the preferred research METHODOLOGY of many of Hartshorne's critics – involved a process of ABSTRACTION in which 'physical space [was] superseded by mathematical space' (Smith, 1984, pp. 68–73). This intellectual project promised to turn geography into a formal SPATIAL SCIENCE, predicated on a key claim: 'That there is more order than appears at first sight is not discovered till that order is looked for' (Haggett, 1965, p. 2). This was used to demarcate a new research frontier – a 'new geography' – whose explorer–scientists believed that there was an intrinsically and essentially *spatial order* to the world: that spatial science made it possible to disclose (to make visible) the spatiality of the natural and the social in ways that were literally overlooked by the other sciences.

Yet many human geographers became increasingly uncomfortable at what they saw as both SPATIAL FETISHISM (treating social relations as purely spatial relations) and SPATIAL SEPARATISM (divorcing human geography from the humanities and social sciences). The critique of spatial science was many-stranded, but many of the original objections revolved around Olsson's (1974) insight that the statements of spatial science revealed more about the language that its protagonists were talking *in* than the world that they were talking *about*. The most general outcome was a movement towards a PROCESS-oriented human geography that explored the process-domains of POLITICAL ECONOMY and SOCIAL THEORY, and then traced the marks made by these processes and practices on the surface of the Earth. At the time, several influential writers insisted that concepts of space could not be adjudicated by appeals to the PHILOSOPHY of SCIENCE, but had to be articulated through the conduct of social practices: 'The question "what is space?" is therefore replaced by the question "How is it that different human practices create and make use of distinctive conceptualizations of space?"' (Harvey, 1973, p. 14). This introduced a *relational* concept in which space is 'folded into' social relations through practical activities. This allowed not only for the socialization of spatial analysis but also, crucially, for the spatialization of social analysis: like simultaneous equations, each was incomplete without the other (Gregory and Urry, 1985; Soja, 1989). The international journal *Society and Space* was founded in 1983 to foster the interdisciplinary conversations that were emerging in this new discursive arena.

Many of the first attempts to re-theorize 'society and space' were indebted to Harvey's re-readings of Marx. Harvey argued that Marx's critique of political economy implied a latent spatial structure that he never made explicit: CAPITALISM as a system of COMMODITY production also depends on the production of a SPACE-ECONOMY, and its spasmodic crises in turn require a precarious 'spatial fix' (Harvey, 1999 [1982]). Others preferred to explore the writings of later Marxist scholars, notably Henri Lefebvre and his suggestive yet enigmatic account of the PRODUCTION OF SPACE (Lefebvre, 1991b). Harvey had always acknowledged his interest in Lefebvre, and subsequently integrated his own work with some of Lefebvre's key propositions and, en route, diagrammed the implications of absolute, relative and relational spaces for a revitalized HISTORICAL MATERIALISM (Harvey, 2006a; see also Gregory, 1994, pp. 348–416).

Later contributions pursued the spatial implications of other thinkers with varying degrees of success (Crang and Thrift, 2000). Two diagnostics have repeatedly emerged. The first is an unwavering concern with ONTOLOGY: with grasping the significance of space not for the constitution and conduct of capitalism alone, but for being-in-the-world. Pickles (1985) was one of the first human geographers to provide a rigorous account of the implications of EXISTENTIALISM and PHENOMENOLOGY for understanding human SPATIALITY, and these themes have re-emerged in later thematizations of space (e.g. Strohmayer, 1998). The second is a persistent interest in concepts of space that are markedly less orderly than those of spatial science and its successor projects, sometimes through readings of outlaw Marxists such as Walter Benjamin (Latham, 1999; Dubow, 2004) and sometimes through POST-STRUCTURALISM: the most influential figures here have been Gilles Deleuze, Michel Foucault (Crampton and Elden, 2007) and Jacques Lacan.

Taken together, contemporary theorizations of space in human geography (and beyond) share the following features:

(1) *The integration of time and space.* Conventional social science privileged the first term (so that time was seen as change, movement and history) while marginalizing the second (so that space was seen as the site of stasis and stability). Human geography has abandoned the project of an autonomous science of the spatial, rejected conceptions of space as the fixed and frozen ground on which events take place or processes leave their marks, and is now exploring the mobile, processual fields of 'time–space' (May and Thrift, 2001; see TIME-GEOGRAPHY; TIME–SPACE COMPRESSION; TIME-SPACE EXPANSION).

(2) *The co-production of time and space.* Time and space are not neutral, canonical grids that exist 'on the outside', enframing and containing life on Earth, but are instead folded into the ongoing flows and forms of the world in which we find ourselves. Thus Thrift (1996; see also 2008) introduces the idea of *spatial formations* to figure a sensuous ONTOLOGY of practices and encounters between diverse, distributed bodies and things. This is a thoroughly MATERIALIST account, but it operates through an analytics of the surface rather than the 'depth models' of mainstream Marxism, and it refuses the oppositions between 'CULTURE' and 'NATURE' on which HISTORICAL MATERIALISM is predicated. Time–space emerges as a process of continual construction 'through the agency of things encountering each other in more or less organized circulations' (Thrift, 2003, p. 96). Similarly but differently, Rose (1999b) draws on feminist theory, and particularl work of Judith Butler, to insist that is not a pre-existent void or 'a terr be spanned or constructed': it is in 'a doing', a PERFORMANCE.

(3) *The unruliness of time–space.* Both s science and conventional social t made too much of pattern and sys ticity, labouring to solve what they 'the problem of order', without rec ing the multiple ways in which li Earth evades and exceeds those o The sense of partial ordering and ir pletion is focal to many contemp theorizations. To be sure, space infinitely plastic: 'certain forms of tend to recur, their repetition a si the power that saturates the sp (Rose, 1999). And yet, while mod of power often work to condense pa lar spatialities as 'natural' outc through architectures of SURVEIL and regulation, Massey (2005) that space is not a coherent syst discriminations and interconnecti grid of 'proper places'. She argue space necessarily entails plurality multiplicity. Hence spatial formatio volve (and invite) 'happenstance positions' and 'accidental separat so that time–space becomes a turb field of constellations and configura a world of structures and solidaritie ruptions and dislocations that pr for the emergence of genuine nc 'Emergence' is not necessarily pr sive or emancipatory, of course, ar argument may also be put in re contemporary spaces of exceptior EXCEPTION, SPACES OF) trade on par ical orderings of space whose very guity is used to foreclose possib for political action. Either way, hov far from space being 'the dead', as Foucault's astringent critics claimed, it is now theorized as fully involved in the modulations o sion and transformation.

(4) *The porousness of time–space.* Cons tions of power and knowledge are ally elaborated through a spatial sy of inclusions and exclusions, most g ally through the demarcation of a ' of the Same' from which 'the Oth supposedly excluded (cf. IMAGIN GEOGRAPHIES). A common critic sponse to these measures is to call b/ordering processes to account

denaturalize them by disclosing their constructedness – and to break open (literally to de-limit) the 'space of the Same'. This involves recognizing the presence of the Other within the space of the Same: the ways in which the geographical knowledges brought 'home' by European explorers relied on, appropriated and so smuggle in indigenous knowledges, for example, or the ways in which the racialized, gendered and 'pure' spaces of COLONIALISM were routinely disrupted and transgressed (cf. HYBRIDITY; TRANSCULTURATION).

Thinking about time–space in these ways invites critical readings of the ways in which LANDSCAPE, MAPS and other conceptual devices function as REPRESENTATIONS – as orderings – of space, redescribing their naturalization as the product of political technologies and cultural practices, and calling into question the discipline's claims to know the world by rendering it as a transparent space (cf. SITUATED KNOWLEDGE). But they also require other ways of grasping time–space, and there are signs of experiments with the performing, plastic and media arts to subvert our taken-for-granted methods of representation, and to open new political spaces for observant participation in the making of human geographies. DG

Suggested reading

Harvey (2006a); Thrift (2006).

space syntax An approach to studying the spatial structure of cities using mathematical tools to describe their complexity. For example, the street system may be analysed topologically by calculating the complexity distance for each street – that is, the minimum number of links needed (i.e. streets traversed) to reach all other streets in the city (see TOPOLOGY). The measures extend beyond three-dimensional descriptions of the elements of the built environment themselves to assessments of how they are integrated – as in the use of *isovists* to identify the area visible from any point, either at street level or, say, from a window on a building's fourth floor. (In GEOGRAPHIC INFORMATION SYSTEMS these are termed *viewsheds*.) Such representations, using MAPS and graphs as well as numerical indices, allow the city's 'navigability' to be assessed – how easy is it to move about and to get from one point to another? – with techniques that can be applied at any SCALE (how easy is it to get around an airport terminal, for example?).

Using their syntactical representations of the urban built environment, workers at the Space Syntax Laboratory at the Bartlett School of Architecture, University College London have studied COMMUTING and other movements, linking flows to the urban structure and thereby providing means for predicting future traffic patterns and transport system demands. RJ

Suggested reading

Hiller (1996); Hiller and Hanson (1984). See also http://www.spacesyntax.org/

space-economy The idea that economic processes extend across geographical SPACE, thereby influencing their operation and outcome. Walter Isard (1956) coined the term, using it as the basis for his new discipline of regional science. In his (much earlier) development of LOCATION THEORY, August Lösch (1954 [1940]) had already shown that economic competition in space does not have the same beneficial outcomes claimed in standard economic theory, because competition is monopolistic in spatially extensive MARKETS (see NEO-CLASSICAL ECONOMICS). Location theory and regional science developed a series of related claims showing how space makes a difference to economic theory, making the term popular in the 1950s and 1960s. Within this tradition, SPATIAL STRUCTURES, a consequence of rational economic DECISION-MAKING, drive equilibrium outcomes and social welfare implications that differ from those of mainstream, a-spatial economic theory. Since 1990, with a revival of this tradition of work in geographical economics, the term has regained its popularity (Fujita, Krugman and Venables, 1999; see also NEW ECONOMIC GEOGRAPHY).

A parallel usage can be found within geographical interventions in MARXISM and POLITICAL ECONOMY, particularly among theorists whose intellectual socialization was influenced by spatial science and location theory, and who subsequently became highly critical of these formulations. Thus Harvey (1999 [1982]) used the term to describe how the geographical organization of CAPITALISM shapes its dynamics and evolution, calling into question some core beliefs of the conventional a-spatial Marxist critique of capitalism, and Sheppard and Barnes (1990) took these arguments still further in their analysis of the capitalist space-economy. In this view, space qualitatively complicates the contradictions, CRISES and CLASS struggles that are characteristic of capitalism. The spaces and places produced through ACCUMULATION and competition dynamics become barriers for future accumulation; conflict between places can cut across and undermine class struggle; and individual agents find it all but impossible to undertake actions that are in their long-term as well as their immediate interests. Again, taking account of the spatial extension of economic processes requires adjustments to conventional, a-spatial political economy. In this case, however, in contradistinction to regional science and location theory, analysis focuses on the dynamical dialectical relation between economic processes and the SPATIALITY they shape and are in turn shaped by (see DIALECTIC), rather than on assumed spatial structures and their impact on spatial economic equilibria.

As economic geography has subsequently moved to a conception of economy that emphasizes the inseparability of the economic from other societal and biophysical processes, thereby calling into question any theory that seeks to separate or prioritize economic relative to these other processes, so once again the term 'space-economy' has fallen out of favour (see also CULTURAL TURN; INSTITUTIONAL ECONOMICS). ES

space–time forecasting models Statistical models that attempt to FORECAST the evolution of variables over both TIME and SPACE (e.g. sets of regions). These models are usually of the general REGRESSION form and forecast the future value of a variable and an observation unit in terms of (a) lagged exogenous or explanatory variables, (b) its own past values and (c) the lagged values for neighbouring or influencing spatial observation-units, thus capturing the impacts of spatial DIFFUSION. These models have been used to forecast both economic and demographic changes, and in studies of EPIDEMICS and the modelling of DISEASE. LWH

Suggested reading

Bennett (1979).

spatial analysis The application of QUANTITATIVE METHODS in LOCATIONAL ANALYSIS within HUMAN GEOGRAPHY and sometimes used as a synonym for that portion of the discipline that concentrates on the *geometry* of the LANDSCAPE (cf. SPATIAL SCIENCE). O'Sullivan and Unwin (2002) present spatial analysis as the study of the arrangements of points, lin areas and surfaces on a MAP, and of their int relationships. Analyses of those separate co ponents have deployed procedures adap from other sciences – nearest-neighb analysis and QUADRAT ANALYSIS, for PO PATTERN ANALYSIS; GRAPH THEORY for lin and TREND SURFACE ANALYSIS for surfaces, example. Whereas many geographers h undertaken analyses of the interrelationsl using techniques from within the GENE LINEAR MODEL, others have argued that spa analysis poses particular statistical probl because of the nature of spatial data SPATIAL AUTOCORRELATION), thus requi special techniques.

The development of GEOGRAPHIC INFOR TION SYSTEMS is rapidly facilitating advanc spatial analysis and the greater power of c puters, together with software developm has significantly increased geographers' at to work with large and complex spatial sets (cf. GEOCOMPUTATION).

Suggested reading

Bailey and Gatrell (1995); Haining (1990).

spatial autocorrelation The presenc spatial pattern in a mapped variable du geographical proximity. The most com form of spatial autocorrelation is where sir values for a variable (such as county inc levels) tend to cluster together in adja observation-units or REGIONS, so that on age across the map the values for neighb are more similar than would occur if the cation of values to observation-units wer result of a purely random mechanism. is positive spatial autocorrelation. Neg autocorrelation is where neighbouring re are significantly dissimilar; more general complicated forms of autocorrelation can be defined. The presence of spatial autoc lation is very widespread and indeed ma said to lie at the core of GEOGRAPHY expressed in Tobler's (1970) – light-hear First Law of Geography: 'everything is re to everything else, but near things are related than distant things'.

However, the presence of spatial correlation violates a basic assumptio independence in many standard stati MODELS. Thus for REGRESSION, there assumption that the residuals are not aut related. The issue of spatial autocorrel was recognized early in the history of ini tial statistics, but it was not until the wo Moran and Geary in the late 1940s and