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THE NATURE OF GEOGRAPHY

Geography is concerned with place. Understanding the nature and causes of aerial differentiation on the global surface has been the geographers task since people first noticed differences between places. Through geography we seek to understand these differences in patterns of human distribution, interrelationships between human society and the physical environment, peoples use of the Earth in time and space, and how these differences are related to peoples cultures and economies.

These, and other related themes, express major concerns of our time and reflect the consequences of spatial decisions. In geographys pursuit of this understanding the questions "where?," "why?," and "how?" are central. The first of these introduces the issues of location and spatial choice; the latter two signify that modern geography is not content merely to describe, but seeks to explain. Beyond these questions, geographers also ask a fourth"what if?"as a means of seeking alternatives and giving the subject an applied dimension that can assist decision makers in planning and development at a variety of geographical scales.

The idea of place is not an examinable objective but an ultimate goal, whose pursuit gives direction to geographical study. As a geographical concept it refers to the aerial context of events, objects, and actions; in other words, to the patterns resulting from human occupancy of the global surface over time. The areal context is set in space which, though

measurable, has by itself no meaning. Space becomes place when humans invest it with meaning, most commonly by giving it a name and all of the associations that that name evokes. The terms place and region may, therefore, be distinguished by spatial scale, rather than by inherent differences, for both involve space that has been invested with meaning. Two important implications flow from this understanding of place: First, geography is strongly influenced by the norms of the social sciences.

The complexity and changing nature of human society seldom permit the type of precision expected in the physical sciences. Instead, the social sciences offer a variety of perspectives and methods of study by which to examine the consequences of human behaviour on the global surface. In studying the idea of place from a spatial perspective, geographers inevitably encounter the problem of change through time; for them, landscape is document. Historians, too, are concerned with change through time as they document the consequences of human behaviour.

Thus, like geographers, historians are also concerned with place. Indeed, a common concern with place brings the work of geographers and historians close together. Second, physical geographers, no less than human geographers, contribute to an understanding of place; for the concept of sitethe physical characteristics of a placeis integral to understanding aerial differentiation on the global surface. Nevertheless, geographers focus on the patterns and interactions to be found on that surface, and not primarily on the natural processes that act on it from above or below.

They recognize that interaction between humans and their environment has always been mutual, and that the growth of technology has increased the human capacity to modify the environment. That growth in technology has greatly aided geographers in their traditional tasks. It has given them increasingly refined techniques for gathering and interpreting data, whether in the field by means of GPS or by aerial and satellite imagery. Spatial relationships are at the heart of geography. Using software to analyse spatial relationships

among objects being mapped, GIS, in particular, has greatly assisted geographers in depicting the character of place. Not only can they now process larger quantities of data more quickly and with greater refinement, but also they can manipulate variables and thus project alternatives that give geography an applied dimension. Finally, their work can be displayed using advanced techniques of computer-generated mapping.

The view of geography presented here is that of a core sharply focused on the concept of place one in which both physical and human elements play an important part. The subject has an applied dimension that can affect our daily lives. It can, therefore, be a powerful medium for the development of skills contributing to citizenship and cultural awareness.

THE LANGUAGE OF GEOGRAPHY

Geography is the study of Earth, its lands, features, and inhabitants. Just about every subject, from science to sports, has its own language. Geography has its own language too. In order to understand a subject, you need to understand the terms used by that subject. Geography has many different terms. Latitude and longitude are two such terms. Latitudes are imaginary lines that circle the earth and are parallel to the equator. The equator is the zero degree latitude line. Lines of latitude are measured my degrees.

These degrees represent the degree from the equator to the poles. The north pole is located at 90 degrees or 90 degrees North Latitude; the south pole is located at -90 degrees or 90 degrees South Latitude. Longitude lines are imaginary lines that run from the north pole to the south pole. These lines are further apart at the equator and get closer together as they near the poles. Longitude is usually referenced from Greenwich, England.

This is because the 0 degree lone of longitude passes through Greenwich. This line of 0 degrees longitude is known as the prime meridian. In this context, prime means first or most important. The prime meridian is the most important meridian because all distances east or west are measured from

this line. The location of the prime meridian was agreed upon by geographers from around the world. They met in 1884 in Washington, D.C. They could have chosen a different meridian to represent 0 degrees longitude, but they chose this line because it passed through the location of a famous observatory. Since many of the people were familiar with the location of Greenwich, it was chosen as the reference point for all other meridians.

There are 360 degrees around Earth, but generally, points are referenced as 180 degrees east of Greenwich (or +180 degrees) or 180 degrees west of Greenwich (or -180 degrees). Remember that latitude and longitude lines circle the earth. This means that if you were to follow the Prime Meridian (0 degrees) from Greenwich to a corresponding point on the other side of the globe, you would now be on a meridian that is 180 degrees from the Prime Meridian. Degrees can be further divided into minutes and seconds.

There are 60 seconds in a minute and 60 minutes in a degree. These additional divisions allow geographers to pinpoint a location more exactly. A hemisphere is a term that refers to half of the Earth. The hemispheres of Earth are the Western Hemisphere, the Eastern Hemisphere, the Northern Hemisphere, and the Southern Hemisphere. The Western Hemisphere is a term used to represent the half of Earth that lies to the west of the Prime Meridian.

The Eastern Hemisphere refers to the half of Earth that lies to the east of the Prime Meridian. The Northern Hemisphere refers to the half of Earth that lies north of the equator. The Southern Hemisphere refers to the half of Earth that lies south of the Equator.

These different terms provide a starting point for geographers to reference the same points by using the same terms and commonly accepted reference points. Without these agreed upon terms and reference points, geographers would have to spend a lot of time explaining the terms that they are using. These agreed upon terms allow geographers to spend more time on their studies and discussing their points instead of arguing over where a particular reference point is.

BRANCHES

PHYSICAL GEOGRAPHY

Physical geography (or physiography) focuses on geography as an Earth science. It aims to understand the physical lithosphere, hydrosphere, atmosphere, pedosphere, and global flora and fauna patterns (biosphere).

HUMAN GEOGRAPHY

Human geography is a branch of geography that focuses on the study of patterns and processes that shape human interaction with various environments. It encompasses human, political, cultural, social, and economic aspects. While the major focus of human geography is not the physical landscape of the Earth, it is hardly possible to discuss human geography without referring to the physical landscape on which human activities are being played out, and environmental geography is emerging as a link between the two. Human geography can be divided into many broad categories.

Various approaches to the study of human geography have also arisen through time and include:

- Behavioural geography
- Feminist geography
- Culture theory
- Geosophy

ENVIRONMENTAL GEOGRAPHY

Environmental geography is the branch of geography that describes the spatial aspects of interactions between humans and the natural world. It requires an understanding of the traditional aspects of physical and human geography, as well as the ways in which human societies conceptualize the environment.

Environmental geography has emerged as a bridge between human and physical geography as a result of the increasing specialisation of the two sub-fields. Furthermore, as human relationship with the environment has changed as a result of globalization and technological change a new

approach was needed to understand the changing and dynamic relationship. Examples of areas of research in environmental geography include emergency management, environmental management, sustainability, and political ecology.

GEOMATICS

Geomatics is a branch of geography that has emerged since the quantitative revolution in geography in the mid 1950s. Geomatics involves the use of traditional spatial techniques used in cartography and topography and their application to computers. Geomatics has become a widespread field with many other disciplines using techniques such as GIS and remote sensing. Geomatics has also led to a revitalization of some geography departments especially in Northern America where the subject had a declining status during the 1950s. Geomatics encompasses a large area of fields involved with spatial analysis, such as Cartography, Geographic information systems (GIS), Remote sensing, and Global positioning systems (GPS).

REGIONAL GEOGRAPHY

Regional geography is a branch of geography that studies the regions of all sizes across the Earth. It has a prevailing descriptive character. The main aim is to understand or define the uniqueness or character of a particular region which consists of natural as well as human elements. Attention is paid also to regionalization which covers the proper techniques of space delimitation into regions. Regional geography is also considered as a certain approach to study in geographical sciences.

RELATED FIELDS

- *Urban planning, regional planning and spatial planning*: use the science of geography to assist in determining how to develop (or not develop) the land to meet particular criteria, such as safety, beauty, economic opportunities, the preservation of the built or natural heritage, and so

on. The planning of towns, cities, and rural areas may be seen as applied geography.

- *Regional science*: In the 1950s the regional science movement led by Walter Isard arose, to provide a more quantitative and analytical base to geographical questions, in contrast to the descriptive tendencies of traditional geography programmes. Regional science comprises the body of knowledge in which the spatial dimension plays a fundamental role, such as regional economics, resource management, location theory, urban and regional planning, transport and communication, human geography, population distribution, landscape ecology, and environmental quality.
- *Interplanetary Sciences*: While the discipline of geography is normally concerned with the Earth, the term can also be informally used to describe the study of other worlds, such as the planets of the Solar System and even beyond. The study of systems larger than the earth itself usually forms part of Astronomy or Cosmology. The study of other planets is usually called planetary science. Alternative terms such as Areology (the study of Mars) have been proposed, but are not widely used.

TECHNIQUES

As spatial interrelationships are key to this synoptic science, maps are a key tool. Classical cartography has been joined by a more modern approach to geographical analysis, computer-based geographic information systems (GIS).

In their study, geographers use four interrelated approaches:

- *Systematic*: Groups geographical knowledge into categories that can be explored globally.
- *Regional*: Examines systematic relationships between categories for a specific region or location on the planet.
- *Descriptive*: Simply specifies the locations of features and populations.
- *Analytical*: Asks why we find features and populations in a specific geographic area.

CARTOGRAPHY

Cartography studies the representation of the Earth's surface with abstract symbols (map making). Although other subdisciplines of geography rely on maps for presenting their analyses, the actual making of maps is abstract enough to be regarded separately.

Cartography has grown from a collection of drafting techniques into an actual science. Cartographers must learn cognitive psychology and ergonomics to understand which symbols convey information about the Earth most effectively, and behavioural psychology to induce the readers of their maps to act on the information.

They must learn geodesy and fairly advanced mathematics to understand how the shape of the Earth affects the distortion of map symbols projected onto a flat surface for viewing. It can be said, without much controversy, that cartography is the seed from which the larger field of geography grew. Most geographers will cite a childhood fascination with maps as an early sign they would end up in the field.

GEOGRAPHIC INFORMATION SYSTEMS

Geographic information systems (GIS) deal with the storage of information about the Earth for automatic retrieval by a computer, in an accurate manner appropriate to the information's purpose. In addition to all of the other subdisciplines of geography, GIS specialists must understand computer science and database systems.

GIS has revolutionized the field of cartography; nearly all mapmaking is now done with the assistance of some form of GIS software. GIS also refers to the science of using GIS software and GIS techniques to represent, analyse and predict spatial relationships. In this context, GIS stands for Geographic Information Science.

REMOTE SENSING

Remote sensing is the science of obtaining information about Earth features from measurements made at a distance.

Remotely sensed data comes in many forms such as satellite imagery, aerial photography and data obtained from hand-held sensors.

Geographers increasingly use remotely sensed data to obtain information about the Earth's land surface, ocean and atmosphere because it:

- Supplies objective information at a variety of spatial scales (local to global),
- Provides a synoptic view of the area of interest,
- Allows access to distant and/or inaccessible sites,
- Provides spectral information outside the visible portion of the electromagnetic spectrum,
- Facilitates studies of how features/areas change over time.

Remotely sensed data may be analysed either independently of, or in conjunction with, other digital data layers (*e.g.*, in a Geographic Information System).

QUANTITATIVE METHODS

Geostatistics deal with quantitative data analysis, specifically the application of statistical methodology to the exploration of geographic phenomena. Geostatistics is used extensively in a variety of fields including: hydrology, geology, petroleum exploration, weather analysis, urban planning, logistics, and epidemiology.

The mathematical basis for geostatistics derives from cluster analysis, linear discriminant analysis and non-parametric statistical tests, and a variety of other subjects. Applications of geostatistics rely heavily on geographic information systems, particularly for the interpolation (estimate) of unmeasured points. Geographers are making notable contributions to the method of quantitative techniques.

QUALITATIVE METHODS

Geographic qualitative methods, or ethnographical; research techniques, are used by human geographers. In cultural geography there is a tradition of employing qualitative research techniques also used in anthropology and sociology.

Participant observation and in-depth interviews provide human geographers with qualitative data.

HISTORY

BABYLON

The oldest known world maps date back to ancient Babylon from the 9th century BC. The best known Babylonian world map, however, is the Imago Mundi of 600 BC. The map as reconstructed by Eckhard Unger shows Babylon on the Euphrates, surrounded by a circular landmass showing Assyria, Urartu and several cities, in turn surrounded by a "bitter river" (Oceanus), with seven islands arranged around it so as to form a seven-pointed star.

The accompanying text mentions seven outer regions beyond the encircling ocean. The descriptions of five of them have survived. In contrast to the Imago Mundi, an earlier Babylonian world map dating back to the 9th century BC depicted Babylon as being further north from the centre of the world, though it is not certain what that centre was supposed to represent.

GRECO-ROMAN WORLD

The ancient Greeks saw the poet Homer as the founder of geography. His works the Iliad and the Odyssey are works of literature, but both contain a great deal of geographical information. Homer describes a circular world ringed by a single massive ocean. The works show that the Greeks by the 8th century BC had considerable knowledge of the geography of the eastern Mediterranean.

The poems contain a large number of place names and descriptions, but for many of these it is uncertain what real location, if any, is actually being referred to. Thales of Miletus is one of the first known philosophers known to have wondered about the shape of the world. He proposed that the world was based on water, and that all things grew out of it. He also laid down many of the astronomical and mathematical rules that would allow geography to be studied scientifically.

His successor Anaximander is the first person known to have attempted to create a scale map of the known world and to have introduced the gnomon to Ancient Greece. Hecataeus of Miletus initiated a different form of geography, avoiding the mathematical calculations of Thales and Anaximander he learnt about the world by gathering previous works and speaking to the sailors who came through the busy port of Miletus. From these accounts he wrote a detailed prose account of what was known of the world. A similar work, and one that mostly survives today, is Herodotus' Histories.

While primarily a work of history, the book contains a wealth of geographic descriptions covering much of the known world. Egypt, Scythia, Persia, and Asia Minor are all described in great detail. Little is known about areas further a field, and descriptions of areas such as India are almost wholly fanciful. Herodotus also made important observations about geography. He is the first to have noted the process by which large rivers, such as the Nile, build up deltas, and is also the first recorded as observing that winds tend to blow from colder regions to warmer ones.

Pythagoras was perhaps the first to propose a spherical world, arguing that the sphere was the most perfect form. This idea was embraced by Plato and Aristotle presented empirical evidence to verify this. He noted that the Earth's shadow during an eclipse is curved, and also that stars increase in height as one moves north. Eudoxus of Cnidus used the idea of a sphere to explain how the sun created differing climatic zones based on latitude.

This led the Greeks to believe in a division of the world into five regions. At each of the poles was an uncharitably cold region. While extrapolating from the heat of the Sahara it was deduced that the area around the equator was unbearably hot. Between these extreme regions both the northern and southern hemispheres had a temperate belt suitable for human habitation.

Hellenistic Period

These theories clashed with the evidence of explorers,

however. Hanno the Navigator had traveled as far south as Sierra Leone, and it is possible other Phoenicians had circumnavigated Africa. In the 4th century BC the Greek explorer Pytheas traveled through northwest Europe, and circled the British Isles. He found that the region was considerably more habitable than theory expected, but his discoveries were largely dismissed as fanciful by his contemporaries because of this.

Conquerors also carried out exploration, for example, Caesar's invasions of Britain and Germany, expeditions/ invasions sent by Augustus to Arabia Felix and Ethiopia, and perhaps the greatest Ancient Greek explorer of all, Alexander the Great, who deliberately set out to learn more about the east through his military expeditions and so took a large number of geographers and writers with his army who recorded their observations as they moved east.

The ancient Greeks divided the world into three continents, Europe, Asia, and Libya (Africa). The Hellespont formed the border between Europe and Asia. The border between Asia and Libya was generally considered to be the Nile river, but some geographers, such as Herodotus objected to this. Herodotus argued that there was no difference between the people on the east and west sides of the Nile, and that the Red Sea was a better border.

The relatively narrow habitable band was considered to run from the Atlantic Ocean in the west to an unknown sea somewhere east of India in the east. The southern portion of Africa was unknown, as was the northern portion of Europe and Asia, so it was believed that they were circled by a sea. These areas were generally considered uninhabitable. The size of the Earth was an important question to the Ancient Greeks. Eratosthenes attempted to calculate its circumference by measuring the angle of the sun at two different locations.

While his numbers were problematic, most of the errors cancelled themselves out and he got quite an accurate figure. Since the distance from the Atlantic to India was roughly known, this raised the important question of what was in the vast region east of Asia and to the west of Europe. Crates of

Mallus proposed that there were in fact four inhabitable land masses, two in each hemisphere. In Rome a large globe was created depicting this world. That some of the figures Eratosthenes had used in his calculation were considerably in error became known, and Posidonius set out to get a more accurate measurement. This number actually was considerably smaller than the real one, but it became accepted that the eastern part of Asia was not a huge distance from Europe.

Roman Period

While the works of almost all earlier geographers have been lost, many of them are partially known through quotations found in Strabo. Strabo's seventeen volume work of geography is almost completely extant, and is one of the most important sources of information on classical geography. Strabo accepted the narrow band of habitation theory, and rejected the accounts of Hanno and Pytheas as fables.

None of Strabo's maps survive, but his detailed descriptions give a clear picture of the status of geographical knowledge of the time. A century after Strabo Ptolemy launched a similar undertaking. By this time the Roman Empire had expanded through much of Europe, and previously unknown areas such as the British Isles had been explored. The Silk Road was also in operation, and for the first time knowledge of the far east began to be known.

Ptolemy's Geographia opens with a theoretical discussion about the nature and techniques of geographical inquiry, and then moves to detailed descriptions of much the known world. Ptolemy lists a huge number of cities, tribes, and sites and places them in the world. It is uncertain what Ptolemy's names correspond to in the modern world, and a vast amount of scholarship has gone into trying to link Ptolemaic descriptions to know locations. Pliny the Elder's Natural History also has parts on geography.

For the most part Ancient Greek geography was an academic field. There is little evidence that maps or charts were used for navigation. It does, however, seem that at least in Athens the people were acquainted with maps and that several

were on public display. It was the Romans who made far more extensive practical use of geography and maps.

MEDIEVAL ISLAMIC WORLD

In the Middle East, Muslim geographers such as al-Idrisi, al-Yaqubi, al-Masudi, Ibn Khurdadhbih, Ibn al-Faqih, al-Istakhri, Ibn Battuta, Ibn Khaldun, etc. maintained the Greek and Roman techniques and developed new ones. The Islamic empire stretched from Spain to India, and Arab and Jewish traders (known as Radhanites) travelled throughout Eurasia, Africa and the Indian Ocean.

The Arabs added a great deal of knowledge to expand and correct the classical sources. There were some representatives of the West that produced geographical works of quality, such as the Syrian bishop Jacob of Edessa (633-708), but this paled in comparison to the virtual mountain of work published by Islamic writers of the Middle Ages (who were largely responsible for the foundations of knowledge present in later Western geography). During the Muslim conquests of the seventh and early 8th centuries, Arab armies established the Islamic Arab Empire, reaching from Central Asia to the Iberian Peninsula.

An early form of globalization began emerging during the Islamic Golden Age, when the knowledge, trade and economies from many previously isolated regions and civilizations began integrating due to contacts with Muslim explorers, sailors, scholars, traders, and travellers. Subhi Y. Labib has called this period the Pax Islamica, and John M. Hobson has called it the Afro-Asiatic age of discovery, in reference to the Muslim Southwest Asian and North African traders and explorers who travelled most of the Old World, and established an early global economy across most of Asia, Africa, and Europe, with their trade networks extending from the Atlantic Ocean and Mediterranean Sea in the west to the Indian Ocean and China Seas in the east, and even as far as Japan, Korea and the Bering Strait. Arabic silver dirham coins were also being circulated throughout the Afro-Eurasian landmass, as far as sub-Saharan Africa in the south and

northern Europe in the north, often in exchange for goods and slaves. In England, for example, the Anglo-Saxon king Offa of Mercia had coins minted with the Shahadah in Arabic.

These factors helped establish the Arab Empire (including the Rashidun, Umayyad, Abbasid and Fatimid caliphates) as the world's leading extensive economic power throughout the 7th–13th centuries. In the 9th century, Alkindus was the first to introduce experimentation into the Earth sciences.

An early adherent of environmental determinism was the medieval Afro-Arab writer al-Jahiz, who explained how the environment can determine the physical characteristics of the inhabitants of a certain community. He used his early theory of evolution to explain the origins of different human skin colours, particularly black skin, which he believed to be the result of the environment. He cited a stony region of black basalt in the northern Najd as evidence for his theory. In the early 10th century, Abû Zayd al-Balkhî, originally from Balkh, founded the "Balkhî school" of terrestrial mapping in Baghdad.

The geographers of this school also wrote extensively of the peoples, products, and customs of areas in the Muslim world, with little interest in the non-Muslim realms. Suhrâb, a late 10th century Muslim geographer, accompanied a book of geographical coordinates with instructions for making a rectangular world map, with equirectangular projection or cylindrical cylindrical equidistant projection. In the early 11th century, Avicenna hypothesized on the geological causes of mountains in The Book of Healing.

In mathematical geography, Abû Rayhân al-Bîrûnî, around 1025, was the first to describe a polar equi-azimuthal equidistant projection of the celestial sphere. He was also regarded as the most skilled when it came to mapping cities and measuring the distances between them, which he did for many cities in the Middle East and western Indian subcontinent. He often combined astronomical readings and mathematical equations, in order to develop methods of pin-pointing locations by recording degrees of latitude and longitude.

He also developed similar techniques when it came to measuring the heights of mountains, depths of valleys, and expanse of the horizon, in The Chronology of the Ancient Nations. He also discussed human geography and the planetary habitability of the Earth. He hypothesized that roughly a quarter of the Earth's surface is habitable by humans, and also argued that the shores of Asia and Europe were "separated by a vast sea, too dark and dense to navigate and too risky to try" in reference to the Atlantic Ocean and Pacific Ocean. At the age of 17, al-Biruni calculated the latitude of Kath, Khwarazm, using the maximum altitude of the Sun. Al-Biruni also solved a complex geodesic equation in order to accurately compute the Earth's circumference, which were close to modern values of the Earth's circumference. His estimate of 6,339.9 km for the Earth radius was only 16.8 km less than the modern value of 6,356.7 km.

In contrast to his predecessors who measured the Earth's circumference by sighting the Sun simultaneously from two different locations, al-Biruni developed a new method of using trigonometric calculations based on the angle between a plain and mountain top which yielded more accurate measurements of the Earth's circumference and made it possible for it to be measured by a single person from a single location.

By the age of 22, al-Biruni had written several short works, including a study of map projections, Cartography, which included a method for projecting a hemisphere on a plane. John J. O'Connor and Edmund F. Robertson write in the MacTutor History of Mathematics archive:

- "Important contributions to geodesy and geography were also made by al-Biruni. He introduced techniques to measure the earth and distances on it using triangulation. He found the radius of the earth to be 6339.6 km, a value not obtained in the West until the 16th century. His Masudic canon contains a table giving the coordinates of six hundred places, almost all of which he had direct knowledge."

The Arab geographer Al-Idrisi's Mappa Mundi incorporated the knowledge of Africa, the Indian Ocean and

the Far East gathered by Arab merchants and explorers with the information inherited from the classical geographers to create one of the most accurate maps of the world to date. The Tabula Rogeriana was drawn by Al-Idrisi in 1154 for the Norman King Roger II of Sicily, after a stay of eighteen years at his court, where he worked on the commentaries and illustrations of the map.

The map, written in Arabic, shows the Eurasian continent in its entirety, but only shows the northern part of the African continent. In the 14th century, Ibn Bamm ûm ah, a Moroccan, began his travels. He started as a pilgrim to Mecca, but continued his journeys for the next 30 years, covering some 73,000 miles (117,000 km).

Before returning home, he had visited most of the Muslim world and beyond, from Europe and southern Africa in the west to eastern Asia in the east. The universal use of Arabic in the Muslim world and his status as judge trained in law gave him access to royal courts at most locations he visited. Ibn Battuta (1304–1368) was a traveller and explorer, whose account documents his travels and excursions over a period of almost thirty years, covering some 73,000 miles (117,000 km).

These journeys covered most of the known Old World, extending from North Africa, West Africa, Southern Europe and Eastern Europe in the west, to the Middle East, Indian subcontinent, Central Asia, Southeast Asia and China (then the Mongol Yuan Empire) in the east, a distance readily surpassing that of his predecessors and his near-contemporary Marco Polo.

MEDIEVAL EUROPE

During the Early Middle Ages, geographical knowledge in Europe regressed (though it is a popular misconception that they thought the world was flat), and the simple T and O map became the standard depiction of the world. The trips of Venetian explorer Marco Polo in the 13th century, the Christian Crusades of the 12th and 13th centuries, and the Portuguese and Spanish voyages of exploration during the 15th and 16th centuries opened up new horizons and stimulated geographic

writings. During the 15th century, Henry the Navigator of Portugal supported explorations of the African coast and became a leader in the promotion of geographic studies. Among the most notable accounts of voyages and discoveries published during the 16th century were those by Giambattista Ramusio in Venice, by Richard Hakluyt in England, and by Theodore de Bry in what is now Belgium.

EARLY MODERN PERIOD

Following the journeys of Marco Polo, interest in geography spread throughout Europe. From around circa 1400, the writings of Ptolemy and his Islamic successors provided a systematic framework to tie together and portray geographical information. The great voyages of exploration in 16th and 17th centuries revived a desire for both accurate geographic detail, and more solid theoretical foundations. The Geographia Generalis by Bernhardus Varenius and Gerardus Mercator's world map are prime examples of the new breed of scientific geography. The Mongols also had wide ranging knowledge of the geography of Europe and Asia, based in their governance and ruling of much of this area and used this information for the undertaking of large military expeditions.

The evidence for this is found in historical resources such as The Secret History of Mongols and other Persian chronicles written in 13th and 14th centuries. For example, during the rule of the Great Yuan Dynasty a world map was created and is currently kept in South Korea. The Muslim Ottoman cartographer Piri Reis drawn navigational maps in his Kitab-ý Bahriye. The work includes an atlas of charts for small segments of the Mediterranean, accompanied by sailing instructions covering the sea. In the second version of the work, he included a map of the Americas. The Piri Reis map drawn by the Ottoman cartographer Piri Reis in 1513 is an early surviving map to show the Americas.

19TH CENTURY

By the 18th century, geography had become recognized as a discrete discipline and became part of a typical university

curriculum in Europe (especially Paris and Berlin), although not in the United Kingdom where geography was generally taught as a sub-discipline of other subjects. One of the great works of this time was Kosmos: a sketch of a physical description of the Universe, by Alexander von Humboldt, the first volume of which was published in German in 1845. Such was the power of this work that Dr Mary Somerville, of Cambridge University intended to scrap publication of her own Physical Geography on reading Kosmos.

Von Humboldt himself persuaded her to publish. In 1877, Thomas Henry Huxley published his Physiography with the philosophy of universality presented as an integrated approach in the study of the natural environment.

The philosophy of universality in geography was not a new one but can be seen as evolving from the works of Alexander von Humboldt and Immanuel Kant. The publication of Huxley physiography presented a new form of geography that analysed and classified cause and effect at the micro-level and then applied these to the macro-scale (due to the view that the micro was part of the macro and thus an understanding of all the micro-scales was need to understand the macro level). This approach emphasized the empirical collection of data over the theoretical. The same approach was also used by Halford John Mackinder in 1887.

However, the integration of the Geosphere, Atmosphere and Biosphere under physiography was soon over taken by Davisian geomorphology. Over the past two centuries the quantity of knowledge and the number of tools has exploded. There are strong links between geography and the sciences of geology and botany, as well as economics, sociology and demographics.

The Royal Geographical Society was founded in England in 1830, although the United Kingdom did not get its first full Chair of geography until 1917. The first real geographical intellect to emerge in United Kingdom geography was Halford John Mackinder, appointed reader at Oxford University in 1887. The National Geographic Society was founded in the USA in 1888 and began publication of the National Geographic

magazine which became and continues to be a great popularizer of geographic information. The society has long supported geographic research and education.

20TH CENTURY

In the West during the second half of the 19th and the 20th century, the discipline of geography went through four major phases: environmental determinism, regional geography, the quantitative revolution, and critical geography.

Environmental Determinism

Environmental determinism is the theory that a people's physical, mental and moral habits are directly due to the influence of their natural environment. Prominent environmental determinists included Carl Ritter, Ellen Churchill Semple, and Ellsworth Huntington.

Popular hypotheses included "heat makes inhabitants of the tropics lazy" and "frequent changes in barometric pressure make inhabitants of temperate latitudes more intellectually agile." Environmental determinist geographers attempted to make the study of such influences scientific.

Around the 1930s, this school of thought was widely repudiated as lacking any basis and being prone to (often bigoted) generalizations. Environmental determinism remains an embarrassment to many contemporary geographers, and leads to skepticism among many of them of claims of environmental influence on culture.

Regional Geography

Regional geography was coined by a group of geographers known as possibilists and represented a reaffirmation that the proper topic of geography was study of places (regions). Regional geographers focused on the collection of descriptive information about places, as well as the proper methods for dividing the earth up into regions. Well-known names from these period are Alfred Hettner in Germany and Paul Vidal de la Blache in France. The philosophical basis of this field in United States was laid out

by Richard Hartshorne, who defined geography as a study of areal differentiation, which later led to criticism of this approach as overly descriptive and unscientific.

The Quantitative Revolution

The quantitative revolution in geography began in the 1950s. Geographers formulated geographical theories and subjected the theories to empirical tests, usually using statistical methods (especially hypothesis testing). This quantitative revolution laid the groundwork for the development of geographic information systems. Well-known geographers from this period are Fred K. Schaefer, Waldo Tobler, William Garrison, Peter Haggett, Richard J. Chorley, William Bunge, and Torsten Hägerstrand.

Critical Geography

Though positivist approaches remain important in geography, critical geography arose as a critique of positivism. The first strain of critical geography to emerge was humanistic geography. Drawing on the philosophies of existentialism and phenomenology, humanistic geographers focused on people's sense of, and relationship with, places.

More influential was Marxist geography, which applied the social theories of Karl Marx and his followers to geographic phenomena. David Harvey and Richard Peet are well-known Marxist geographers. Feminist geography is, as the name suggests, the use of ideas from feminism in geographic contexts. The most recent strain of critical geography is postmodernist geography, which employs the ideas of postmodernist and poststructuralist theorists to explore the social construction of spatial relations.

2

Mapping

EARTH'S GRID SYSTEM

Topography, is the study of Earth's surface shape and features or those of planets, moons, and asteroids. It is also the description of such surface shapes and features. The topography of an area can also mean the surface shape and features themselves.

PLANETARY ENERGETIC GRID THEORY

Planetary Energetic Grid Theory falls under the heading of pseudoscience. It operates through geometric patterns called Sacred Geometry. Grids meet at various intersecting points forming a grid or matrix. This is equivalent to the acupressure points on our bodies. These grid points can be found at some of the strongest power places on the planet. Plato recognized grids and their patterns, devising a theory that the Earth's basic structure evolved from a simple geometric shapes to more complex ones.

These shapes became known as platonic solids: cube, tetrahedron, octahedron, dodecahedron, icosahedron. In Timeaus, Plato associated each shape with one of the elements, earth, fire, air, ether, and water. The Earth's energy grids, from the beginnings of its evolutionary course, has evolved through each of these shapes to what it is today.

Each shape, superimposed, one upon the other to create a kind of all encompassing energy field that is the very basis of Earth holding it all together. Bill Becker and Bethe Hagens discussed the code of the Platonic Solids' positions on Earth,

ascribing this discovery to the work of Ivan P. Sanderson, who was the first to make a case for the structure of the icosahedron at work in the Earth. He did this by locating what he referred to as Vile Vortices refer to a claim that there are twelve geometrically distributed geographic areas that are alleged to have the same mysterious qualities popularly associated with the Bermuda Triangle, the Devil's Sea near Japan, and the South Atlantic Anomaly.

Becker and Hagens' attention was drawn to this research through the work of Chris Bird, who punished "Planetary Grid" in the New Age Journal in May 1975. After meeting with Bird, they completed their Grid making it compatible with all the Platonic Solids, by inserting a creation from Buckminster Fuller's work. They proposed that the planetary grid map outlined by the Russian team Goncharov, Morozov and Makarov is essentially correct, with its overall organization anchored to the north and south axial poles and the Great Pyramid at Gizeh. They believed the Russian map lacked completeness, which led them to them overlaying a complex, icosahedrally-derived, spherical polyhedron developed by R. Buckminster Fuller.

In Synergetics, he called it the "Composite of Primary and Secondary Icosahedron Great Circle Sets." South America's grid triangle forms the continent around itself. In looking at the southernmost tip of South America, you can see how the force of node number 58 pushes the land away from its due south trend and towards the east. Then, if you look at node 49, on the middle of the East Coast of South America near Rio de Janeiro, you can clearly see how the force of the node has pushed the landmass of the continent into a rounded shape.

Looking at Australia, you can clearly see that the whole continent, and especially the northwest side, forms very precisely within the stretching forces of this area of the Global Grid. Here, if we look to the exact north and middle of Australia on point 27, we see a circular "node point" displacing the land around it and forming the Gulf of Carpenteria.

Again, the nodes themselves have shaped the land into circular "vortices," repelling the continental mass from

themselves and in this case, also shaping the outline of the island directly above Australia. Node 44 is precisely aligned with the bottom of Antarctica, and we see either edge "drooping" to the right or the left from this. Richard Lefors Clark, this is the "bowtie" energetic configuration showing itself in the Australian landmass, which he calls a "diamagnetic energy vortex." As suggested, examine how such a shape could be formed by the curved, spiraling energies that make up the grid below. Clark also shows us that the Gulf of Mexico follows this same curving energetic organization, as well as the two coastlines of the continental United States.

Africa shows the combined action of two larger triangles, one with the point facing downwards on the African continent and its neighbour pointing upwards, griding the Indian Sea. The downward-pointing triangle certainly describes Africa well, and the extra land on the western side can be explained by the pressure coming from the Mid-Atlantic Ridge, which is almost precisely the same as the Atlantic grid line formed by points 10, 19, 37, 38, 39 and 50. The east coast of Africa and Saudi Arabia follow the eastern side of the triangle very nicely, on the grid line from point 41 to point 12. Node point 22 gently pushes in on Africa's east coast, causing it to dip inwards as it travels and forming the Somalia Basin.

We can also assume that the "cracks" separating Africa and Saudi Arabia were caused by the expansion of the Grid, forcefully pulling the land into alignment. The "crack" to the immediate left of point 12 follows the grid line exactly. And finally, the upward-pointing triangle can be clearly seen to cut its way right into the land, with Africa's coast defining its left side and India's coast defining its right. Node point 22 gently pushes in on Africa's east coast, causing it to dip inwards as it travels and forming the Somalia Basin.

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side and India's coast defining its right. In this next illustration, we can see how point 21, in the centre of the African continent, works with its above-right partner point 20 in providing a framework for the bow-shaped energy vortex that shaped the northeast coast of Africa.

Point 20 is the only "vile vortex" that is significantly inland; 41, near South Africa, and 42, near India, are the only others that touch land at all! This is probably due to the incredible strength that they possess, which seems to repel landmasses. We can see how the northeast coast of Africa is indeed very circular, and point 20 is directly at the centre of this "bowtie" of energy. We see Dr. Lefors Clark's bow-shaped "diamagnetic energy vortex" shaping the land in a smooth curve. We can also see the same curving formation created by the east coast of India and the west coast of the China/Korea/ Vietnam area of Asia.

This vortex is balanced between points 24 and 13. We remind ourselves that these smooth curves show the spiraling nature of the superstrings that make up these geometric energy fields, here expressed as spiraling lines of magnetic force. Dr. Clark, the point at the centre of the "bowtie" becomes a magnetic null zone of zero gravity when appropriately triggered by the right geometric positions of the Sun, Moon and Planets to the Earth.

In those moments of conjunction, there is a "hyperdimensional bleed-through," and we then get time dilations. The circular grid energy formations surrounding the east coast of China and surrounding area: We have our straight grid map of China for comparison. Three circular vortexes in it. We have already discussed the bottom left vortex in India and China.

Then, the centre vortex shapes the East Coast of China, based off of and emanating from point 13. The uppermost and largest vortex shapes the entire Japanese and Russian archipelago, and is centred in and emanating from point 4. We have a vortex centred in Sanderson's "vile vortex" near Japan, the "Devil's Sea," here listed as point 14. This vortex is "equalized" by points 25 and 26, both of which are equidistant

from the edge of the circle. And obviously, Indonesia precisely traces the bottom left of the circle itself. This is obviously a very strong vortex to be able to shape the land of Indonesia from where it stands, just as to Becker and Hagens. Another area of continuing disappearances and mysterious time-warps is the Devil's Sea located east of Japan between Iwo Jima and Marcus Island. Here events have become so sinister that the Japanese government has officially designated the area a danger zone.

This area was significant enough to the work of Bermuda Triangle author Charles Berlitz that he wrote a whole book dedicated to it and the "bigger picture," entitled The Devil's Triangle. It is becoming more and more clear that our geometric shapes, expressed as the consciousness unit expanded to a planetary scale, are far more than abstract concepts of theoretical physics. What we have here are direct, quantifiable and measurable phenomena, and these geometry-based Grid patterns are simply the simplest, and therefore the best solution to the problem.

The "grid bands" on the Earth and how their effects shaped the Ring of Fire', the flowing of the Nile River, the "node point" of the Egyptian northern coast centred in 'Giza, and the vertical structure of the Yucatan Peninsula. Now, with the full map of the Becker-Hagens grid, we can see a great deal more from the effect of these straight longitudinal lines. By referring back to the main map, the reader can clearly see that the entire Eastern side of Hudson Bay in Canada precisely follows the line from 18 in Florida to 9 in the Bay to 61 at the North Pole. Furthermore, all of England is precisely within the line created by point 20 in Africa, through point 11 in England to point 61 at the North Pole.

So, there are a variety of ways to see this energy at work on Earth. One can begin to visualize this Grid energy as a living net of "wires" that are tightly stretched over a thin balloon. It is obvious to us that what we think of as randomly placed continents are actually conforming to this massive energy, disappearances, gravity loss, levitation and other related phenomena. Becker-Hagens explain how these grid points

seem to attract large population centres. Look at the South American landmass. Not only does it fit perfectly a Grid Triangle, but we can see a circular, bowtie-shaped energy at work in the actual shaping of the landmass itself. This "bowtie" is nearly centred within the diamond that is formed between points 18, 35, 37 and 49. The offset of the South American landmass from being precisely within this "diamond" again could be accounted for by the pushing of the Mid-Atlantic Ridge, which follows the lines of the Global Grid with amazing precision.

Looking back at the Becker-Hagens map, it is quite easy for us to see how this line clearly demarcates the separation between the continents, just as the Mid-Atlantic Ridge is the point of expansion between the two continental plates. An elliptical-shaped gravity field is clearly visible when the centre is placed directly in node 15. If we use any standard image editing programme and "drag out" an ellipse using point 15 as a centre, we can indeed align it precisely with the island formations to the far west of our diagram.

We can see the amazing connections of this energy formation as soon as we start looking at the diagram. We can try other centre points besides 15, but the ellipse will not fit anywhere else as precisely as it does right at that spot. This massive energy vortex seems to provide the clearest Grid counterpart for the existence of the Ring of Fire, which is a ring of volcanoes and tectonic activity surrounding the Pacific Ocean. When we look at this "grid ring" carefully, we can see that it represents the perfect fusion between the Earth's landmasses and the Global Grid.

Going clockwise from the 12:00 point, the ring will perfectly touch a "square" of grid points. We can also see that this ellipse is well defined by points 14 and 16, again Sanderson's incredibly powerful "vile vortices," the points of the icosahedron. We have already seen how the incredible gravitational force of these "vortices" was able to shape the entire upper Western half of Africa into an elegant, circular shape. Now, we are seeing two of these vortices working together to form an even larger shape. The ring forms part of

the East Coast of China, as well as a good part of the upper Russian coastline surrounding node 5. It also defines part of the southern coastline of Alaska. The grid points 14 and 16 would be akin to the two poles of the dividing cell. The grid lines provide us with a simplified depiction of the "spindle fibres" that form in cell mitosis. The actual ring of energy that is created forms a precise analog of the nuclear membrane of the cell, as it continues its expanding, elliptical process of division.

LEY LINES

Ley lines are alleged alignments of a number of places of geographical interest, such as ancient monuments and megaliths that are thought by certain adherents to dowsing and New Age beliefs to have spiritual power. Their existence was suggested in 1921 by the amateur archaeologist Alfred Watkins, *The Old Straight Track*.

The believers in ley lines think that the lines and their intersection points resonate a special psychic or mystical energy. Ascribing such characteristics to ley lines has led to the term being classified as pseudoscience. Ley lines can be the product of ancient surveying, property markings, or commonly traveled pathways. Many cultures use straight lines across the landscape. In South America, such lines often are directed towards mountain peaks; the Nazca lines are a famous example of lengthy lines made by ancient cultures.

Straight lines connect ancient pyramids in Mexico; today, modern roads built on the ancient roads deviate around the huge pyramids. The Chaco culture of Northwestern New Mexico cut stairs into sandstone cliffs to facilitate keeping roads straight. Additionally, chance alignments and coincidence are often cited as explanations that cannot be ruled out. The concept of ley lines was first proposed by Alfred Watkins.

On June 30, 1921 after Watkins visited Blackwardine in Herefordshire, and went riding a horse near some hills in the vicinity of Bredwardine. There he noted that many of the footpaths there seemed to connect one hilltop to another in a

straight line. He was studying a map when he noticed places in alignment. "The whole thing came to me in a flash", he later told his son.

However, in September 1870, William Henry Black gave to the British Archaeological Association, in Hereford, a talk titled Boundaries and Landmarks, in which he speculated that "Monuments exist marking grand geometrical lines which cover the whole of Western Europe". It is possible that Watkins's experience stemmed from faint memories of an account of that presentation.

Watkins believed that, in ancient times, when Britain was far more densely forested, the country was crisscrossed by a network of straight-line travel routes, with prominent features of the landscape being used as navigation points. This observation was made public at a meeting of the Woolhope Naturalists' Field Club of Hereford in September 1921. His work referred to G. H. Piper's paper presented to the Woolhope Club in 1882, which noted that: "A line drawn from the Skirrid-fawr mountain northwards to Arthur's Stone would pass over the camp and southern most point of Hatterall Hill, Oldcastle, Longtown Castle, and Urishay and Snodhill castles."

The ancient surveyors who supposedly made the lines were given the name "dodmen". Watkins published his ideas in the books Early British Trackways and The Old Straight Track. They generally met with skepticism from archaeologists, one of whom, O. G. S. Crawford, refused to accept advertisements for the latter book in the journal Antiquity. Most archaeologists since then have continued to reject Watkins's ideas. Despite the mostly negative reception to his ideas, some experts have made observations similar to Watkins's.

Megalithic researcher Alexander Thom offered a detailed analysis of megalithic alignments, proposing a standardization of measure by those who built megaliths, but avoided the term ley line. The discovery by Europeans of the Nazca lines, man-made lines on desert pavement in southern Peru, prompted study of their astronomical alignments. The existence of

alignments between sites is easily demonstrated. However, the causes of these alignments are disputed.

There are several major areas of interpretation:

- *Archaeological*: A new area of archaeological study, archaeogeodesy, examines geodesy as practiced in prehistoric time, and as evidenced by archaeological remains. One major aspect of modern geodesy is surveying. As interpreted by geodesy, the so-called ley lines can be the product of ancient surveying, property markings, or commonly travelled pathways. Numerous societies, ancient and modern, employ straight lines between points of use; archaeologists have documented these traditions. Modern surveying also results in placement of constructs in lines on the landscape. It is reasonable to expect human constructs and activity areas to reflect human use of lines.
- *Cultural*: Many cultures use straight lines across the landscape. In South America, such lines often are directed towards mountain peaks; the Nazca lines are a famous example of lengthy lines made by ancient cultures. Straight lines connect ancient pyramids in Mexico; today, modern roads built on the ancient roads deviate around the massive pyramids. The Chaco culture of Northeastern New Mexico cut stairs into sandstone cliffs to facilitate keeping roads straight.
- *New Age*: Some writers widely regarded as pseudoscientific have claimed that the ley lines and their intersection points resonate a special psychic or magical energy. These theories often include elements such as geomancy, dowsing or UFOs. Some similar believe these points on lines have electrical or magnetic forces associated with them.
- *Skeptical*: Skeptics of the actuality of ley lines often classify them as pseudoscience. Such skeptics tend to doubt that ley lines were planned or made by ancient cultures, and argue that apparent ley lines can be readily explained without resorting to extraordinary or pseudoscientific ideas.

Spiritual Significance of Ley Lines: Magical and Holy Lines

Watkins's theories have been adapted by later writers. Some of his ideas were taken up by the occultist Dion Fortune who featured them in her 1936 novel The Goat-footed God. Since then, ley lines have become the subject of a few magical and mystical theories. Two British dowsers, Captain Robert Boothby and Reginald A. Smith of the British Museum, have linked the appearance of ley lines with underground streams and magnetic currents.

Guy Underwood conducted various investigations and claimed that crossings of 'negative' water lines and positive aquastats explain why certain sites were chosen as holy. He found so many of these 'double lines' on sacred sites that he named them 'holy lines.' Separate from other spiritual theories of ley lines, two German Nazi researchers Wilhelm Teudt and Josef Heinsch have claimed that ancient Teutonic peoples contributed to the construction of a network of astronomical lines, called ³Holy lines², which could be mapped onto the geographical layout of ancient or sacred sites.

Teudt located the Teutoburger Wald district in Lower Saxony, centred around the dramatic rock formation called Die Externsteine as the centre of Germany. Nazism often employed ideation of superiority and associated Aryan descent with ancient higher cultures, often without regard for archaeological or historic fact.

CHANCE ALIGNMENTS

Watkins's discovery happened at a time when Ordnance Survey maps were being marketed for the leisure market, making them reasonably easy and cheap to obtain; this may have been a contributing factor to the popularity of ley line theories. Given the high density of historic and prehistoric sites in Britain and other parts of Europe, finding straight lines that "connect" sites is trivial, and ascribable to coincidence. The diagram to the right shows an example of lines that pass very near to a set of random points: for all practical purposes, they can be regarded as nearly "exact" alignments.

For a mathematical treatment of this topic. Since the existence of alignments themselves are not controversial, analysis can proceed by an attempted rejection of the null hypothesis that ley-line-like alignments are due to random chance. Statistical analysis by skeptics of this hypothesis shows that random chance is consistent with the evidence.

Some Chaos Magicians claim such results to be in accord with their generative view of chance, though such alternative null hypothesis explanations are usually deprecated on philosophical grounds in hypothesis testing due to considerations of falsifiability and Occam's razor. One study by David George Kendall used the techniques of shape analysis to examine the triangles formed by standing stones to deduce if these were often arranged in straight lines. The shape of a triangle can be represented as a point on the sphere, and the distribution of all shapes can be thought of as a distribution over the sphere.

The sample distribution from the standing stones was compared with the theoretical distribution to show that the occurrence of straight lines was no more than average. Archaeologist Richard Atkinson once demonstrated this by taking the positions of telephone boxes and pointing out the existence of "telephone box leys".

This, he thus argued, showed that the mere existence of such lines in a set of points does not prove that the lines are deliberate artifacts, especially since it is known that telephone boxes were not laid out in any such manner, and without any such intention. Straight lines also do not make ideal roads in many circumstances, particularly where they ignore topography and require users to march up and down hills or mountains, or to cross rivers at points where there is no portage or bridge.

Examples

Alfred Watkins identified St. Ann's Well in Worcestershire as what he believed to be the start of a ley line that passes along the ridge of the Malvern Hills through several springs including the Holy Well, Walms Well and St. Pewtress Well.

In the late 1970's Paul Devereux stated he had discovered the Malvern Ley which began at St Ann's Well and ended at Whiteleaved Oak. The alignment passes through St. Ann's Well, the Wyche Cutting, a part of the Shire Ditch, Midsummer hillfort and Whiteleaved Oak.

HARTMANN NET OR HARTMANN LINES

The Hartmann net consists of naturally occurring charged lines, running North-South and East-West. It is named after Dr. Ernst Hartmann, a well regarded German medical doctor, who first described it soon after the second world war. Alternate lines are usually positively and negatively charged, so where the lines intersect it is possible to have double positive charges and double negative charges, or one positive and one negative charge. It is the intersections that are seen to be a source of potential problems.

The Hartmann Net appears as a structure of radiations rising vertically from the ground like invisible, radioactive walls, each 21 centimetres wide. The grid is magnetically orientated, from North to South they are encountered at intervals of 2 metres, while from East to West they are 2.5 metres apart. Between these geometric lines lies a neutral zone, an unperturbed micro-climate. This network penetrates everywhere, whether over open ground or through dwellings.

The Hartmann net has been defined using the Chinese terms of Yin and Yang. The Yin is a cold energy which acts slowly, corresponds to winter, is related to cramps, humidity and all forms of rheumatism. The Yang is a hot, dry rapidly acting energy. It is related to fire and is linked to inflammations. The points formed by the intersection of these lines, whether positive or negative, are dynamic environments sensitive to the rhythms of the hours and the seasons.

It has been suggested that both the Curry grids and Hartmann Net are earthing grids for cosmic rays that constantly bombard the Earth, and that they can be distorted by other things, such as geological fault lines and underground mining. It is also possible to have spots where the Curry and Hartmann lines cross, causing further potential problems.

These spots are generally seen to be more detrimental than a single crossing within the Curry or Hartmann system.

CURRY LINES

Earth radiation is a hypothetical geophysical phenomenon described primarily by the German authors Manfred Curry and Ernst Hartmann. This is known as Curry Lines. Both men describe a mystic force field, similar to Odic force, Mana, and Qi, that covers the Earth at regular intervals and can be detected by dowsing using a divining rod.

It is not supposed to be detectable by common scientific instruments but some still connect it to telluric currents, which are actual phenomena, detectable by scientific instruments. Placing people or other living things in certain spots of the earth radiation knots is believed to be beneficial/harmful depending on radiation flow direction.

It connects to the Gaia philosophy and vitalist school and is very popular in certain New Age circles in Europe, especially in Germany. The radiation is described as a grid-like arrangement with lines at regular distances.

COMPARING CURRY LINES, HARTMANN LINES AND LEY LINES

Curry lines are approximately 3 meters apart, diagonally to the poles, east to west. Hartmann lines run both east-west and north-south forming a grid across the earths surface with a distance of circa 2 meters in the north-south direction and 2.5 meters in the east-west direction. Ley lines are man-made energy lines, created by stone formations such as stone ships or other ancient archaeological structures. The knowledge of creating Ley lines is supposed to be lost.

BLACK LINES

Black lines seem to be naturally generated, although quite how is not known. They may be localized and do not form a network in the same way as Hartmann and Curry lines. This could be similar in nature to the “sha”, or deadly energy lines of Chinese Feng-Shui.

They can be curved, straight, at ground level or higher, even found in the upper levels of buildings. There have been described 2 types of Black lines, one as “black and depressed”, the other as “shiny, black, hard and sharp.” They could possibly represent the flow lines of a negative type of “orgone-type” energy as described by Wilhelm Reich.

MAP PROJECTION AND PROPERTIES

A map projection is any method of representing the surface of a sphere or other three-dimensional body on a plane. Map projections are necessary for creating maps. All map projections distort the surface in some fashion. Depending on the purpose of the map, some distortions are acceptable and others are not; therefore different map projections exist in order to preserve some properties of the sphere-like body at the expense of other properties.

There is no limit to the number of possible map projections. For simplicity, this object usually assumes that the surface to be mapped is the surface of a sphere. However, the Earth and other sufficiently large celestial bodies are generally better modeled as oblate spheroids, and small objects such as asteroids may have irregular shapes. These other surfaces can be mapped as well. Therefore, more generally, a map projection is any method of “flattening” into a plane a continuous surface having curvature in all three spatial dimensions.

Projection as used here is not limited to perspective projections, such as those resulting from casting a shadow on a screen. Rather, any mathematical function transforming coordinates from the curved surface to the plane is a projection. Carl Friedrich Gauss’s Theorema Egregium proved that a sphere cannot be represented on a plane without distortion. Since any method of representing a sphere’s surface on a plane is a map projection, all map projections distort. Every distinct map projection distorts in a distinct way.

The study of map projections is the characterization of these distortions. A map of the earth is a representation of a curved surface on a plane. Therefore a map projection must

have been used to create the map, and, conversely, maps could not exist without map projections.

Maps can be more useful than globes in many situations: they are more compact and easier to store; they readily accommodate an enormous range of scales; they are viewed easily on computer displays; they can facilitate measuring properties of the terrain being mapped; they can show larger portions of the Earth's surface at once; and they are cheaper to produce and transport. These useful traits of maps motivate the development of map projections.

METRIC PROPERTIES OF MAPS

Many properties can be measured on the Earth's surface independently of its geography.

Some of these properties are:

- Area
- Shape
- Direction
- Bearing
- Distance
- Scale

Map projections can be constructed to preserve one or more of these properties, though not all of them simultaneously. Each projection preserves or compromises or approximates basic metric properties in different ways. The purpose of the map determines which projection should form the base for the map. Because many purposes exist for maps, many projections have been created to suit those purposes. Another major concern that drives the choice of a projection is the compatibility of data sets. Data sets are geographic information. As such, their collection depends on the chosen model of the Earth. Different models assign slightly different coordinates to the same location, so it is important that the model be known and that the chosen projection be compatible with that model.

On small areas data compatibility issues are more important since metric distortions are minimal at this level. In very large areas on the other hand, distortion is a more important factor to consider.

WHICH MAP IS BEST

Cartographers have long despaired over publishers' inappropriate use of the Mercator.

A 1943 New York Times editorial states:

- The time has come to discard [the Mercator] for something that represents the continents and directions less deceptively... Although its usage... has diminished... it is still highly popular as a wall map apparently in part because, as a rectangular map, it fills a rectangular wall space with more map, and clearly because its familiarity breeds more popularity.

The Peters map controversy motivated the American Cartographic Association to produce a series of booklets designed to educate the public about map projections and distortion in maps. In 1989 and 1990, after some internal debate, seven North American geographic organizations adopted the following resolution, which rejected all rectangular world maps, a category that includes both the Mercator and the Gall–Peters projections:

- Whereas, the earth is round with a coordinate system composed entirely of circles,
- Whereas, flat world maps are more useful than globe maps, but flattening the globe surface necessarily greatly changes the appearance of Earth's features and coordinate systems,
- Whereas, world maps have a powerful and lasting effect on people's impressions of the shapes and sizes of lands and seas, their arrangement, and the nature of the coordinate system,
- Whereas, frequently seeing a greatly distorted map tends to make it "look right,"
- Therefore, we strongly urge book and map publishers, the media and government agencies to cease using rectangular world maps for general purposes or artistic displays. Such maps promote serious, erroneous conceptions by severely distorting large parts of the world, by showing the round Earth as having straight edges and sharp corners, by representing most

distances and direct routes incorrectly, and by portraying the circular coordinate system as a squared grid. The most widely displayed rectangular world map is the Mercator but other rectangular world maps proposed as replacements for the Mercator also display a greatly distorted image of the spherical Earth.

CONSTRUCTION OF A MAP PROJECTION

The creation of a map projection involves two steps:

1. Selection of a model for the shape of the Earth or planetary body. Because the Earth's actual shape is irregular, information is lost in this step.
2. Transformation of geographic coordinates to Cartesian or polar plane coordinates. Cartesian coordinates normally have a simple relation to eastings and northings defined on a grid superimposed on the projection.

Some of the simplest map projections are literally projections, as obtained by placing a light source at some definite point relative to the globe and projecting its features onto a specified surface. This is not the case for most projections which are defined only in terms of mathematical formulae that have no direct physical interpretation.

CHOOSING A PROJECTION SURFACE

A surface that can be unfolded or unrolled into a plane or sheet without stretching, tearing or shrinking is called a developable surface. The cylinder, cone and of course the plane are all developable surfaces. The sphere and ellipsoid are not developable surfaces. As noted in the introduction, any projection of a sphere onto a plane will have to distort the image.

One way of describing a projection is first to project from the Earth's surface to a developable surface such as a cylinder or cone, and then to unroll the surface into a plane. While the first step inevitably distorts some properties of the globe, the developable surface can then be unfolded without further distortion.

ASPECTS OF THE PROJECTION

Once a choice is made between projecting onto a cylinder, cone, or plane, the aspect of the shape must be specified. The aspect describes how the developable surface is placed relative to the globe: it may be normal, transverse or oblique. The developable surface may also be either tangent or secant to the sphere or ellipsoid. Tangent means the surface touches but does not slice through the globe; secant means the surface does slice through the globe. Insofar as preserving metric properties goes, it is never advantageous to move the developable surface away from contact with the globe, so that possibility is not discussed here.

SCALE

A globe is the only way to represent the earth with constant scale throughout the entire map in all directions. A map cannot achieve that property for any area, no matter how small. It can, however, achieve constant scale along specific lines.

Some possible properties are:

- The scale depends on location, but not on direction. This is equivalent to preservation of angles, the defining characteristic of a conformal map.
- Scale is constant along any parallel in the direction of the parallel. This applies for any cylindrical or pseudocylindrical projection in normal aspect.
- Combination of the above: the scale depends on latitude only, not on longitude or direction. This applies for the Mercator projection in normal aspect.
- Scale is constant along all straight lines radiating from a particular geographic location. This is the defining characteristic of an equidistant projection such as the Azimuthal equidistant projection. There are also projections where true distances from two points are preserved.

CHOOSING A MODEL FOR THE SHAPE OF THE EARTH

Projection construction is also affected by how the shape of the Earth is approximated. However, the Earth is not exactly

spherical but is closer in shape to an oblate ellipsoid, a shape which bulges around the equator. Selecting a model for a shape of the Earth involves choosing between the advantages and disadvantages of a sphere versus an ellipsoid. Spherical models are useful for small-scale maps such as world atlases and globes, since the error at that scale is not usually noticeable or important enough to justify using the more complicated ellipsoid.

The ellipsoidal model is commonly used to construct topographic maps and for other large- and medium-scale maps that need to accurately depict the land surface. A third model of the shape of the Earth is the geoid, a complex and more accurate representation of the global mean sea level surface that is obtained through a combination of terrestrial and satellite gravity measurements.

This model is not used for mapping, because of its complexity, but is used for control purposes in the construction of geographic datums. A geoid is used to construct a datum by adding irregularities to the ellipsoid in order to better match the Earth's actual shape. It takes into account the large-scale features in the Earth's gravity field associated with mantle convection patterns, and the gravity signatures of very large geomorphic features such as mountain ranges, plateaus and plains.

Historically, datums have been based on ellipsoids that best represent the geoid within the region that the datum is intended to map. Each ellipsoid has a distinct major and minor axis. Different controls are added to the ellipsoid in order to construct the datum, which is specialized for a specific geographic region.

A few modern datums, such as WGS84 which is used in the Global Positioning System, are optimized to represent the entire earth as well as possible with a single ellipsoid, at the expense of accuracy in smaller regions.

CLASSIFICATION

A fundamental projection classification is based on the type of projection surface onto which the globe is conceptually

projected. The projections are described in terms of placing a gigantic surface in contact with the earth, followed by an implied scaling operation. These surfaces are cylindrical, conic, or azimuthal or plane. Many mathematical projections, however, do not neatly fit into any of these three conceptual projection methods.

Hence other peer categories have been described in the literature, such as pseudoconic, pseudocylindrical, pseudoazimuthal, retroazimuthal, and polyconic. Another way to classify projections is just as to properties of the model they preserve.

Some of the more common categories are:

- Preserving direction, a trait possible only from one or two points to every other point
- Preserving shape locally
- Preserving area
- Preserving distance, a trait possible only between one or two points and every other point
- Preserving shortest route, a trait preserved only by the gnomonic projection

Because the sphere is not a developable surface, it is impossible to construct a map projection that is both equal-area and conformal.

PROJECTIONS BY SURFACE

Cylindrical

The term "normal cylindrical projection" is used to refer to any projection in which meridians are mapped to equally spaced vertical lines and circles of latitude are mapped to horizontal lines. The mapping of meridians to vertical lines can be visualized by imagining a cylinder wrapped around the Earth and then projecting onto the cylinder, and subsequently unfolding the cylinder.

By the geometry of their construction, cylindrical projections stretch distances east-west. The amount of stretch is the same at any chosen latitude on all cylindrical projections, and is given by the secant of the latitude as a multiple of the equator's scale.

The various cylindrical projections are distinguished from each other solely by their north-south stretching:

- North-south stretching is equal to the east-west stretching: The east-west scale matches the north-south scale: conformal cylindrical or Mercator; this distorts areas excessively in high latitudes.
- North-south stretching growing rapidly with latitude, even faster than east-west stretching: The cylindric perspective projection; unsuitable because distortion is even worse than in the Mercator projection.
- North-south stretching grows with latitude, but less quickly than the east-west stretching: such as the Miller cylindrical projection.
- North-south distances neither stretched nor compressed: equidistant cylindrical or plate carrée.
- North-south compression precisely the reciprocal of east-west stretching: equal-area cylindrical. This divides north-south distances by a factor equal to the secant of the latitude, preserving area but heavily distorting shapes.

In the first case, the east-west scale always equals the north-south scale. In the second case, the north-south scale exceeds the east-west scale everywhere away from the equator. Each remaining case has a pair of identical latitudes of opposite sign at which the east-west scale matches the north-south-scale. Normal cylindrical projections map the whole Earth as a finite rectangle, except in the first two cases, where the rectangle stretches infinitely tall while retaining constant width.

Pseudocylindrical

Pseudocylindrical projections represent the central meridian and each parallel as a single straight line segment, but not the other meridians.

Each pseudocylindrical projection represents a point on the Earth along the straight line representing its parallel, at a distance which is a function of its difference in longitude from the central meridian.

- Sinusoidal: the north-south scale and the east-west scale

are the same throughout the map, creating an equal-area map. On the map, as in reality, the length of each parallel is proportional to the cosine of the latitude. Thus the shape of the map for the whole earth is the region between two symmetric rotated cosine curves

The true distance between two points on the same meridian corresponds to the distance on the map between the two parallels, which is smaller than the distance between the two points on the map. The true distance between two points on the same parallel–and the true area of shapes on the map–are not distorted. The meridians drawn on the map help the user to realise the shape distortion and mentally compensate for it.

- Collignon projection, which in its most common forms represents each meridian as 2 straight line segments, one from each pole to the equator
- Mollweide
- Goode homolosine
- Eckert IV
- Eckert VI
- Kavrayskiy VII
- Tobler hyperelliptical

Hybrid:

- The HEALPix projection combines an equal-area cylindrical projection in equatorial regions with the Collignon projection in polar areas

Conical:

- Equidistant conic
- Lambert conformal conic
- Albers conic

Pseudoconical:

- Bonne
- Werner cordiform designates a pole and a meridian; distances from the pole are preserved, as are distances from the meridian along the parallels
- Continuous American polyconic

AZIMUTHAL

Azimuthal projections have the property that directions

from a central point are preserved. Usually these projections also have radial symmetry in the scales and hence in the distortions: map distances from the central point are computed by a function r(d) of the true distance d, independent of the angle; correspondingly, circles with the central point as centre are mapped into circles which have as centre the central point on the map.

The mapping of radial lines can be visualized by imagining a plane tangent to the Earth, with the central point as tangent point. The radial scale is r'(d) and the transverse scale r(d)/(R sin(d/R)) where R is the radius of the Earth.

Some azimuthal projections are true perspective projections; that is, they can be constructed mechanically, projecting the surface of the Earth by extending lines from a point of perspective onto the plane:

- The gnomonic projection displays great circles as straight lines. Can be constructed by using a point of perspective at the centre of the Earth. r(d) = c tan(d/R); a hemisphere already requires an infinite map,
- The General Perspective Projection can be constructed by using a point of perspective outside the earth. Photographs of Earth give this perspective,
- The orthographic projection maps each point on the earth to the closest point on the plane. Can be constructed from a point of perspective an infinite distance from the tangent point; r(d) = c sin(d/R). Can display up to a hemisphere on a finite circle. Photographs of Earth from far enough away, such as the Moon, give this perspective,
- The azimuthal conformal projection, also known as the stereographic projection, can be constructed by using the tangent point's antipode as the point of perspective. r(d) = c tan(d/2R); the scale is c/(2R $\cos^2$(d/2R)). Can display nearly the entire sphere on a finite circle. The full sphere requires an infinite map,

Other azimuthal projections are not true perspective projections:

- Azimuthal equidistant: r(d) = cd; it is used by amateur radio operators to know the direction to point their

antennas towards a point and see the distance to it. Distance from the tangent point on the map is proportional to surface distance on the earth,
- Lambert azimuthal equal-area. Distance from the tangent point on the map is proportional to straight-line distance through the earth: $r(d) = c \sin(d/2R)$,
- Logarithmic azimuthal is constructed so that each point's distance from the centre of the map is the logarithm of its distance from the tangent point on the Earth. Works well with cognitive maps: $r(d) = c \ln(d/d_0)$; locations closer than at a distance equal to the constant d_0 are not shown.

PROJECTIONS BY PRESERVATION OF A METRIC PROPERTY

Conformal

Conformal map projections preserve angles locally:
- *Mercator*: Rhumb lines are represented by straight segments,
- *Stereographic*: Shape of circles is conserved,
- Roussilhe,
- Lambert conformal conic,
- Quincuncial map,
- Adams hemisphere-in-a-square projection,
- Guyou hemisphere-in-a-square projection.

Equal-area

These projections preserve area:
- Gall orthographic,
- Albers conic,
- Lambert azimuthal equal-area,
- Lambert cylindrical equal-area,
- Mollweide,
- Hammer,
- Briesemeister,
- Sinusoidal,
- Werner,
- Bonne,

- Bottomley,
- Goode's homolosine,
- Hobo-Dyer,
- Collignon,
- Tobler hyperelliptical.

Equidistant

These preserve distance from some standard point or line:

- *Equirectangular*: Distances along meridians are conserved,
- *Plate carree*: An Equirectangular projection centred at the equator,
- *Azimuthal equidistant*: Distances along great circles radiating from centre are conserved,
- Equidistant conic,
- *Sinusoidal*: Distances along parallels are conserved,
- Werner cordiform distances from the North Pole are correct as are the curved distance on parallels,
- Soldner,
- *Two-point equidistant*: Two "control points" are arbitrarily chosen by the map maker. Distance from any point on the map to each control point is proportional to surface distance on the earth.

Gnomonic

Great circles are displayed as straight lines:

- Gnomonic projection.

Retroazimuthal

Direction to a fixed location B corresponds to the direction on the map from A to B:

- *Littrow*: The only conformal retroazimuthal projection,
- *Hammer retroazimuthal*: Also preserves distance from the central point,
- *Craig retroazimuthal aka Mecca or Qibla*: Also has vertical meridians.

Compromise Projections

Compromise projections give up the idea of perfectly

preserving metric properties, seeking instead to strike a balance between distortions, or to simply make things "look right". Most of these types of projections distort shape in the polar regions more than at the equator:

- Robinson
- van der Grinten
- Miller cylindrical
- Winkel Tripel
- Buckminster Fuller's Dymaxion
- B.J.S. Cahill's Butterfly Map
- Kavrayskiy VII
- Wagner VI
- Chamberlin trimetric
- Oronce Fine's cordiform

TYPES OF PROJECTION

PARALLEL PROJECTION

In parallel projection, the lines of sight from the object to the projection plane are parallel to each other. Within parallel projection there is an ancillary category known as "pictorials". Pictorials show an image of an object as viewed from a skew direction in order to reveal all three directions of space in one picture. Because pictorial projections innately contain this distortion, in the rote, drawing instrument for pictorials, some liberties may be taken for economy of effort and best effect.

ORTHOGRAPHIC PROJECTION

The Orthographic projection is derived from the principles of descriptive geometry and is a two-dimensional representation of a three-dimensional object. It is a parallel projection. It is the projection type of choice for working drawings.

AXONOMETRIC PROJECTION

Within parallel projection there is an subcategory known as Pictorials. Pictorials show an image of an object as viewed from a skew direction in order to reveal all three directions of

space in one picture. Parallel projection pictorial instrument drawings are often used to approximate graphical perspective projections, but there is attendant distortion in the approximation. Because pictorial projections inherently have this distortion, in the instrument drawing of pictorials, great liberties may then be taken for economy of effort and best effect. Parallel projection pictorials rely on the technique of axonometric projection.

ISOMETRIC PROJECTION

In isometric pictorials, the direction of viewing is such that the three axes of space appear equally foreshortened, of which the displayed angles among them and also the scale of foreshortening are universally known. However in creating a final, isometric instrument drawing, in most cases a full-size scale, *i.e.*, without using a foreshortening factor, is employed to good effect because the resultant distortion is difficult to perceive.

DIMETRIC PROJECTION

In dimetric pictorials, the direction of viewing is such that two of the three axes of space appear equally foreshortened, of which the attendant scale and angles of presentation are determined just as to the angle of viewing; the scale of the third direction is determined separately. Approximations are common in dimetric drawings.

TRIMETRIC PROJECTION

In trimetric pictorials, the direction of viewing is such that all of the three axes of space appear unequally foreshortened. The scale along each of the three axes and the angles among them are determined separately as dictated by the angle of viewing. Approximations in Trimetric drawings are common.

OBLIQUE PROJECTION

In oblique projections the parallel projection rays are not perpendicular to the viewing plane as with orthographic projection, but strike the projection plane at an angle other than

ninety degrees. In both orthographic and oblique projection, parallel lines in space appear parallel on the projected image. Because of its simplicity, oblique projection is used exclusively for pictorial purposes rather than for formal, working drawings. In an oblique pictorial drawing, the displayed angles among the axes as well as the foreshortening factors are arbitrary. The distortion created thereby is usually attenuated by aligning one plane of the imaged object to be parallel with the plane of projection thereby creating a true shape, full-size image of the chosen plane. Special types of oblique projections are cavalier projection and cabinet projection.

PERSPECTIVE PROJECTION

Perspective projection is a type of projection where three dimensional objects are not projected along parallel lines, but along lines emerging from a single point. This has the effect that distant objects appear smaller than nearer objects. It also means that lines which are parallel in nature appear to intersect in the projected image, for example if railways are pictured with perspective projection, they appear to converge towards a single point, called vanishing point.

Photographic lenses and the human eye work in the same way, therefore perspective projection looks most realistic. Perspective projection is usually categorized into one-point, two-point and three-point perspective, depending on the orientation of the projection plane towards the axes of the depicted object.

SCALE OF MAP

The scale of a map is defined as the ratio of a distance on the map to the corresponding distance on the ground. If the region of the map is small enough for the curvature of the Earth to be neglected, then the scale may be taken as a constant ratio over the whole map. For maps covering larger areas, or the whole Earth, it is essential to use a map projection from the sphere to the plane.

Such projections inevitably involve distortion and the scale can no longer be considered as constant. It is then

necessary to introduce the concept of a variable point scale which is defined as the ratio of the length of a small line element emanating from a point on the map to the length of the corresponding line element on the surface of the Earth. In general the point scale will vary with the position of the point and also the direction of the line element.

Tissot's Indicatrix is often used to show the variation of point scale. In the study of point scale it is convenient to define the projection formulae in such a way that the scale is unity, or nearly so, on some lines of the resulting map projection. Clearly such a map projection must be comparable to the size of the Earth and, in order to represent it on a small sheet of paper, it must be scaled down by a constant ratio known as the representative fraction or principal scale. Thus we have to differentiate two uses of the word scale: the variable point scale inherent in the projection and the constant scale involved in the reduction to the printed map.

TOPOGRAPHIC MAP

A topographic map is a type of map characterized by large-scale detail and quantitative representation of relief, usually using contour lines in modern mapping, but historically using a variety of methods. Traditional definitions require a topographic map to show both natural and man-made features.

A topographic map is typically published as a map series, made up of two or more map sheets that combine to form the whole map. A contour line is a combination of two line segments that connect but do not intersect; these represent elevation on a topographic map. The Canadian Centre for Topographic Information provides this definition of a topographic map:

- A topographic map is a detailed and accurate graphic representation of cultural and natural features on the ground.

Other authors define topographic maps by contrasting them with another type of map; they are distinguished from smaller-scale "chorographic maps" that cover large regions,

"planimetric maps" that do not show elevations, and "thematic maps" that focus on specific topics. However, in the vernacular and day to day world, the representation of relief is popularly held to define the genre, such that even small-scale maps showing relief are commonly called "topographic". The study or discipline of topography, while interested in relief, is actually a much broader field of study which takes into account all natural and man made features of terrain.

Topographic maps are based on topographical surveys. Performed at large scales, these surveys are called topographical in the old sense of topography, showing a variety of elevations and landforms. This is in contrast to older cadastral surveys, which primarily show property and governmental boundaries.

The first multi-sheet topographic map series of an entire country, the Carte géométrique de la France, was completed in 1789. Topographic surveys were prepared by the military to assist in planning for battle and for defensive emplacements. As such, elevation information was of vital importance.

As they evolved, topographic map series became a national resource in modern nations in planning infrastructure and resource exploitation. In the United States, the national map-making function which had been shared by both the Army Corps of Engineers and the Department of the Interior migrated to the newly created United States Geological Survey in 1879, where it has remained since.

USES

Topographic maps have multiple uses in the present day: any type of geographic planning or large-scale architecture; earth sciences and many other geographic disciplines; mining and other earth-based endeavours; and recreational uses such as hiking or, in particular, orienteering, which uses highly detailed maps in its standard requirements.

MAP CONVENTIONS

The various features shown on the map are represented by conventional signs or symbols. For example, colours can

be used to indicate a classification of roads. These signs are usually explained in the margin of the map, or on a separately published characteristic sheet. Topographic maps are also commonly called contour maps or topo maps.

In the United States, where the primary national series is organized by a strict 7.5 minute grid, they are often called topo quads or quadrangles. Topographic maps conventionally show topography, or land contours, by means of contour lines. Contour lines are curves that connect contiguous points of the same altitude. In other words, every point on the marked line of 100 m elevation is 100 m above mean sea level.

These maps usually show not only the contours, but also any significant streams or other bodies of water, forest cover, built-up areas or individual buildings and other features and points of interest. Today, topographic maps are prepared using photogrammetric interpretation of aerial photography, LIDAR and other Remote sensing techniques. Older topographic maps were prepared using traditional surveying instruments.

THEMATIC MAPS

A thematic map is a map that emphasizes a particular theme or special topic such as the average distribution of rainfall in an area. They are different from general reference maps because they do not just show natural features like rivers, cities, political subdivisions and highways. Instead, if these items are on a thematic map, they are simply used as reference points to enhance one's understanding of the map's theme and purpose.

Normally however, all thematic maps use maps with coastlines, city locations and political boundaries as their base maps. The map's specific theme is then layered onto this base map via different mapping programmes and technologies like a geographic information system.

HISTORY OF THEMATIC MAPS

Thematic maps did not develop as a map type until the mid-17th Century because accurate base maps were not present prior to this time. Once they became accurate enough

to display coastlines, cities and other boundaries correctly, the first thematic maps were created. In 1686 for example, Edmond Halley, an astronomer from England, developed a star chart. In that same year, he published the first meteorological chart using base maps as his reference in an object he published about trade winds. In 1701, Halley also published the first chart to show lines of magnetic variation- a thematic map that later became useful in navigation.

Halley's maps were largely used for navigation and the study of the physical environment. In 1854, John Snow, a doctor from London created the first thematic map used for problem analysis when he mapped cholera's spread throughout the city. He began with a base map of London's neighbourhoods that included all streets and water pump locations. He then mapped the locations where people died from cholera on that base map and was able to find that the deaths clustered around one pump and determined that the water coming from the pump was the cause of cholera.

In addition to these maps, the first map of Paris showing population density was developed by a French engineer named Louis-Leger Vauthier. It used isolines to show population distribution throughout the city and was believed to be the first use of isolines to display a theme that did not have to do with physical geography.

THEMATIC MAP CONSIDERATIONS

When cartographers design thematic maps today, there are several important things to consider. The most significant though is the map's audience. This is important because it helps determine what items should be included on the thematic map as reference points in addition to the map's theme. A map being made for a political scientist for example would need to have political boundaries, whereas one for a biologist might instead need contours showing elevation.

The sources of a thematic map's data are also important and should be carefully considered. Cartographers must find accurate, recent and reliable sources of information in a wide range of subjects- from environmental features to demographic

data to make the best possible maps. In addition to making sure a thematic map's data is accurate, there are various ways to use that data and each must be considered with the map's theme. Univariate mapping for example is a map dealing with only one type of data and therefore looks at the occurrence of one type of event. This process would be good for mapping a location's rainfall. Bivariate data mapping shows the distribution of two data sets and models their correlations such as rainfall amounts relative to elevation. Multivariate data mapping is mapping with two or more data sets. A multivariate map could look at rainfall, elevation and the amount of vegetation relative to both for example.

TYPES OF THEMATIC MAPS

Although cartographers can use these datasets in many different ways to create thematic maps, there are five thematic mapping techniques that are used most often. The first and most commonly used of these is the choropleth map. This is a map that portrays quantitative data as a colour and can show density, per cent, average value or quantity of an event within a geographic area.

Sequential colours on these maps represent increasing or decreasing positive or negative data values. Normally, each colour also represents a range of values. Proportional or graduated symbols are the next type of map and represent data associated with point locations such as cities. Data is displayed on these maps with proportionally sized symbols to show differences in occurrences. Circles are most often used with these maps but squares and other geometric shapes are suitable as well. The most common way to size these symbols is to make their areas proportional to the values to be depicted with mapping or drawing software.

Another thematic map is the isarithmic or contour map and it uses isolines to depict continuous values like precipitation levels. These maps can also display three-dimensional values like elevation on topographic maps. Generally data for isarithmic maps is gathered via measureable points or is collected by area. Isarithmic maps also follow the

basic rule that there is a high and low side in relation to the isoline. For example in elevation if the isoline is 500 feet then one side must be higher than 500 feet and one side must be lower. A dot map is another type of thematic map and uses dots to show the presence of a theme and display a spatial pattern. On these maps, a dot can represent one unit or several, depending on what is being depicted with the map.

Finally, dasymetric mapping is the last type of thematic map. This map is a complex variation of the choropleth map and works by using statistics and extra information to combine areas with similar values instead of using the administrative boundaries common in a simple choropleth map.

REMOTE SENSING

Remote Sensing is the science and art of acquiring information about material objects, area, or phenomenon, without coming into physical contact with the objects, or area, or phenomenon under investigation. Without direct contact, some means of transferring information through space must be utilised. In remote sensing, information transfer is accomplished by use of electromagnetic radiation. EMR is a form of energy that reveals its presence by the observable effects it produces when it strikes the matter. EMR is considered to span the spectrum of wavelengths from 10-10 mm to cosmic rays up to 1010 mm, the broadcast wavelengths, which extend from 0.30-15 mm.

TYPES

- In respect to the type of Energy Resources: Passive Remote Sensing: Makes use of sensors that detect the reflected or emitted electro-magnetic radiation from natural sources. Active remote Sensing: Makes use of sensors that detect reflected responses from objects that are irradiated from artificially-generated energy sources, such as radar.
- In respect to Wavelength Regions: Remote Sensing is classified into three types in respect to the wavelength regions.

- Visible and Reflective Infrared Remote Sensing.
- Thermal Infrared Remote Sensing.
- Microwave Remote Sensing.

AERIAL PHOTOGRAPHY

Aerial photography is the art of taking photographs of the ground from an elevated position. The term usually refers to images in which the camera is not supported by a ground-based structure.

Cameras may be hand held or mounted, and photographs may be taken by a photographer, triggered remotely or triggered automatically. In many ways, aerial photography is both more or less complex than other kinds of photography. However, the skill and techniques needed to obtain good results are easily learned through careful observation and good judgment.

Arthus Bertrand is a premier Aerial Photographer whose works go beyond just amazement. Born in 1946, Yann Arthus-Bertrand has always been fond of nature and animals. At thirty years old, he settled in Kenya with his wife, Anne, to study the every day life of a pride of lions. The camera soon becomes necessary to relate his observations, and he understood that he had to tell the facts through images rather than words.

Photography became his vocation. Back to France in 1981, he published a book, “Lions” began a career as a reporter-photographer and became specialized in aerial photography. In 1994, under the patronage of UNESCO, he began the creation of an aerial image bank of the most beautiful places on earth. He created the ‘GoodPlanet Foundation’, a non-profit organization. His works have been a strong source of inspiration to many photographers in the world. In this object, I have showcased some of his brilliant works which are awe-inspiring at the least.

GEOGRAPHIC INFORMATION SYSTEM

A geographic information system, geographical information system, or geospatial information system is any system that captures, stores, analyses, manages, and presents

data that are linked to location. In the simplest terms, GIS is the merging of cartography, statistical analysis, and database technology. GIS may be used in archaeology, geography, cartography, remote sensing, land surveying, public utility management, natural resource management, precision agriculture, photogrammetry, urban planning, emergency management, landscape architecture, navigation, aerial video, and localized search engines.

As GIS can be thought of as a system, it digitally creates and "manipulates" spatial areas that may be jurisdictional, purpose or application oriented for which a specific GIS is developed. Hence, a GIS developed for an application, jurisdiction, enterprise, or purpose may not be necessarily interoperable or compatible with a GIS that has been developed for some other application, jurisdiction, enterprise, or purpose.

What goes beyond a GIS is a spatial data infrastructure, a concept that has no such restrictive boundaries. Therefore, in a general sense, the term describes any information system that integrates, stores, edits, analyses, shares, and displays geographic information for informing decision making. GIS applications are tools that allow users to create interactive queries, analyse spatial information, edit data, maps, and present the results of all these operations. Geographic information science is the science underlying the geographic concepts, applications and systems.

APPLICATIONS

GIS technology can be used for: earth surface based scientific investigations; resource management, reference, and projections of a geospatial nature—both manmade and natural; asset management and location planning; archaeology; environmental impact study; infrastructure assessment and development; urban planning; cartography, for a thematic and/or time based purpose; criminology; GIS data development geographic history; marketing; logistics; population and demographic studies; prospectivity mapping; location attributes applied statistical analysis; warfare assessments; and

other purposes. Examples of use are: GIS may allow emergency planners to easily calculate emergency response times and the movement of response resources in the case of a natural disaster; GIS might be used to find wetlands that need protection strategies regarding pollution; or GIS can be used by a company to site a new business location to take advantage of GIS data identified trends to respond to a previously under-served market. Most city and transportation systems planning offices have GIS parts.

GIS TECHNIQUES AND TECHNOLOGY

Modern GIS technologies use digital information, for which various digitized data creation methods are used. The most common method of data creation is digitization, where a hard copy map or survey plan is transferred into a digital medium through the use of a computer-aided design programme, and geo-referencing capabilities.

With the wide availability of ortho-rectified imagery, heads-up digitizing is becoming the main avenue through which geographic data is extracted. Heads-up digitizing involves the tracing of geographic data directly on top of the aerial imagery instead of by the traditional method of tracing the geographic form on a separate digitizing tablet.

Relating Information from Different Sources

GIS uses spatio-temporal location as the key index variable for all other information. Just as a relational database containing text or numbers can relate many different tables using common key index variables, GIS can relate otherwise unrelated information by using location as the key index variable. The key is the location and/or extent in space-time. Any variable that can be located spatially, and increasingly also temporally, can be referenced using a GIS. Locations or extents in Earth space-time may be recorded as dates/times of occurrence, and x, y, and z coordinates representing, longitude, latitude, and elevation, respectively. These GIS coordinates may represent other quantified systems of temporo-spatial reference. Units applied to recorded temporal-spatial data can

vary widely but all Earth-based spatial-temporal location and extent references should, ideally, be relatable to one another and ultimately to a "real" physical location or extent in space-time.

Related by accurate spatial information, an incredible variety of real-world and projected past or future data can be analysed, interpreted and represented to facilitate education and decision making. This key characteristic of GIS has begun to open new avenues of scientific inquiry into behaviours and patterns of previously considered unrelated real-world information.

GIS Uncertainties

GIS accuracy depends upon source data, and how it is encoded to be data referenced. Land Surveyors have been able to provide a high level of positional accuracy utilizing the GPS derived positions. The high-resolution digital terrain and aerial imagery, the powerful computers, Web technology, are changing the quality, utility, and expectations of GIS to serve society on a grand scale, but nevertheless there are other source data that has an impact on the overall GIS accuracy like: paper maps that are not found to be very suitable to achieve the desired accuracy since the aging of maps affects their dimensional stability. In developing a Digital Topographic Data Base for a GIS, topographical maps are the main source of data.

Aerial photography and satellite images are extra sources for collecting data and identifying attributes which can be mapped in layers over a location facsimile of scale. The scale of a map and geographical rendering area representation type are a very important aspects since the information content depends mainly on the scale set and resulting locatability of the map's representations.

In order to digitize a map, the map has to be checked within theoretical dimensions, then scanned into a raster format, and resulting raster data has to be given a theoretical dimension by a rubber sheeting/warping technology process. Uncertainty is a significant problem in designing a GIS because

spatial data tend to be used for purposes for which they were never intended. Some maps were made many decades ago, where at that time the computer industry was not even in its perspective establishments. This has led to historical reference maps without common norms. Map accuracy is a relative issue of minor importance in cartography.

All maps are established for communication ends. Maps use a historically constrained technology of pen and paper to communicate a view of the world to their users. Cartographers feel little need to communicate information based on accuracy, for when the same map is digitized and input into a GIS, the mode of use often changes. The new uses extend well beyond a determined domain for which the original map was intended and designed. A quantitative analysis of maps brings accuracy issues into focus. The electronic and other equipment used to make measurements for GIS is far more precise than the machines of conventional map analysis. The truth is that all geographical data are inherently inaccurate, and these inaccuracies will propagate through GIS operations in ways that are difficult to predict, yet have goals of conveyance in mind for original design.

Accuracy Standards for 1:24000 Scales Map: 1:24,000 ± 40.00 feet This means that when we see a point or attribute on a map, its "probable" location is within a +/- 40 foot area of its rendered reference, just as to area representations and scale. A GIS can also convert existing digital information, which may not yet be in map form, into forms it can recognize, employ for its data analysis processes, and use in forming mapping output. For example, digital satellite images generated through remote sensing can be analysed to produce a map-like layer of digital information about vegetative covers on land locations. Another fairly recently developed resource for naming GIS location objects is the Getty Thesaurus of Geographic Names which is a structured vocabulary containing about 1,000,000 names and other information about places. Likewise, researched census or hydrological tabular data can be displayed in map-like form, serving as layers of thematic information for forming a GIS map.

Data Representation

GIS data represents real objects with digital data determining the mix. Real objects can be divided into two abstractions: discrete objects and continuous fields. Traditionally, there are two broad methods used to store data in a GIS for both kinds of abstractions mapping references: raster images and vector. Points, lines, and polygons are the stuff of mapped location attribute references. A new hybrid method of storing data is that of identifying point clouds, which combine three-dimensional points with RGB information at each point, returning a “3D colour image”. GIS Thematic maps then are becoming more and more realistically visually descriptive of what they set out to show or determine.

Raster

A raster data type is, in essence, any type of digital image represented by reducible and enlargeable grids. Anyone who is familiar with digital photography will recognize the Raster graphics pixel as the smallest individual grid unit building block of an image, usually not readily identified as an artifact shape until an image is produced on a very large scale. A combination of the pixels making up an image colour formation scheme will compose details of an image, as is distinct from the commonly used points, lines, and polygon area location symbols of scalable vector graphics as the basis of the vector model of area attribute rendering.

While a digital image is concerned with its output blending together its grid based details as an identifiable representation of reality, in a photograph or art image transferred into a computer, the raster data type will reflect a digitized abstraction of reality dealt with by grid populating tones or objects, quantities, cojoined or open boundaries, and map relief schemas. Aerial photos are one commonly used form of raster data, with one primary purpose in mind: to display a detailed image on a map area, or for the purposes of rendering its identifiable objects by digitization. Additional raster data sets used by a GIS will contain information regarding elevation, a digital elevation model, or reflectance

of a particular wavelength of light, Landsat, or other electromagnetic spectrum indicators. Raster data type consists of rows and columns of cells, with each cell storing a single value.

Raster data can be images with each pixel containing a colour value. Additional values recorded for each cell may be a discrete value, such as land use, a continuous value, such as temperature, or a null value if no data is available. While a raster cell stores a single value, it can be extended by using raster bands to represent RGB colours, colourmaps or an extended attribute table with one row for each unique cell value.

The resolution of the raster data set is its cell width in ground units. Raster data is stored in various formats; from a standard file-based structure of TIF, JPEG, etc. to binary large object data stored directly in a relational database management system similar to other vector-based feature classes. Database storage, when properly indexed, typically allows for quicker retrieval of the raster data but can require storage of millions of significantly sized records.

Vector

In a GIS, geographical features are often expressed as vectors, by considering those features as geometrical shapes.

Different geographical features are expressed by different types of geometry:

- *Points*: Zero-dimensional points are used for geographical features that can best be expressed by a single point reference—in other words, by simple location. Examples include wells, peaks, features of interest, and trailheads. Points convey the least amount of information of these file types. Points can also be used to represent areas when displayed at a small scale. For example, cities on a map of the world might be represented by points rather than polygons. No measurements are possible with point features.
- *Lines or polylines*: One-dimensional lines or polylines are used for linear features such as rivers, roads, railroads,

trails, and topographic lines. Again, as with point features, linear features displayed at a small scale will be represented as linear features rather than as a polygon. Line features can measure distance.

- *Polygons*: Two-dimensional polygons are used for geographical features that cover a particular area of the earth's surface. Such features may include lakes, park boundaries, buildings, city boundaries, or land uses. Polygons convey the most amount of information of the file types. Polygon features can measure perimeter and area.

Each of these geometries are linked to a row in a database that describes their attributes. For example, a database that describes lakes may contain a lake's depth, water quality, pollution level.

This information can be used to make a map to describe a particular attribute of the dataset. For example, lakes could be coloured depending on level of pollution. Different geometries can also be compared. For example, the GIS could be used to identify all wells that are within one kilometre of a lake that has a high level of pollution.

Vector features can be made to respect spatial integrity through the application of topology rules such as 'polygons must not overlap'. Vector data can also be used to represent continuously varying phenomena. Contour lines and triangulated irregular networks are used to represent elevation or other continuously changing values. TINs record values at point locations, which are connected by lines to form an irregular mesh of triangles. The face of the triangles represent the terrain surface.

Advantages and Disadvantages

There are some important advantages and disadvantages to using a raster or vector data model to represent reality:

- Raster datasets record a value for all points in the area covered which may require more storage space than representing data in a vector format that can store data only where needed.

- Raster data allows easy implementation of overlay operations, which are more difficult with vector data.
- Vector data can be displayed as vector graphics used on traditional maps, whereas raster data will appear as an image that may have a blocky appearance for object boundaries.
- Vector data can be easier to register, scale, and re-project, which can simplify combining vector layers from different sources.
- Vector data is more compatible with relational database environments, where they can be part of a relational table as a normal column and processed using a multitude of operators.
- Vector file sizes are usually smaller than raster data, which can be 10 to 100 times larger than vector data.
- Vector data is simpler to update and maintain, whereas a raster image will have to be completely reproduced.
- Vector data allows much more analysis capability, especially for "networks" such as roads, power, rail, telecommunications, etc. Raster data will not have all the characteristics of the features it displays.

Non-spatial Data

Additional non-spatial data can also be stored along with the spatial data represented by the coordinates of a vector geometry or the position of a raster cell. In vector data, the additional data contains attributes of the feature. For example, a forest inventory polygon may also have an identifier value and information about tree species. In raster data the cell value can store attribute information, but it can also be used as an identifier that can relate to records in another table.

Software is currently being developed to support spatial and non-spatial decision-making, with the solutions to spatial problems being integrated with solutions to non-spatial problems. The end result with these Flexible Spatial Decision-Making Support Systems is expected to be that non-experts will be able to use GIS, along with spatial criteria, and simply integrate their non-spatial criteria to view solutions to multi-

criteria problems. This system is intended to assist decision-making.

Data Capture

Data capture—entering information into the system—consumes much of the time of GIS practitioners. There are a variety of methods used to enter data into a GIS where it is stored in a digital format. Existing data printed on paper or PET film maps can be digitized or scanned to produce digital data. A digitizer produces vector data as an operator traces points, lines, and polygon boundaries from a map. Scanning a map results in raster data that could be further processed to produce vector data. Survey data can be directly entered into a GIS from digital data collection systems on survey instruments using a technique called Coordinate Geometry.

Positions from a Global Navigation Satellite System like Global Positioning System, another survey tool, can also be directly entered into a GIS. Current trend is data collection and field mapping carried out directly with field computers. New technologies allow to create maps as well as analysis directly in the field, projects are more efficient and mapping is more accurate. Remotely sensed data also plays an important role in data collection and consist of sensors attached to a platform. Sensors include cameras, digital scanners and LIDAR, while platforms usually consist of aircraft and satellites.

The majority of digital data currently comes from photo interpretation of aerial photographs. Soft copy workstations are used to digitize features directly from stereo pairs of digital photographs. These systems allow data to be captured in two and three dimensions, with elevations measured directly from a stereo pair using principles of photogrammetry. Currently, analog aerial photos are scanned before being entered into a soft copy system, but as high quality digital cameras become cheaper this step will be skipped.

Satellite remote sensing provides another important source of spatial data. Here satellites use different sensor packages to passively measure the reflectance from parts of

the electromagnetic spectrum or radio waves that were sent out from an active sensor such as radar. Remote sensing collects raster data that can be further processed using different bands to identify objects and classes of interest, such as land cover.

When data is captured, the user should consider if the data should be captured with either a relative accuracy or absolute accuracy, since this could not only influence how information will be interpreted but also the cost of data capture. In addition to collecting and entering spatial data, attribute data is also entered into a GIS. For vector data, this includes additional information about the objects represented in the system. After entering data into a GIS, the data usually requires editing, to remove errors, or further processing.

For vector data it must be made "topologically correct" before it can be used for some advanced analysis. For example, in a road network, lines must connect with nodes at an intersection. Errors such as undershoots and overshoots must also be removed. For scanned maps, blemishes on the source map may need to be removed from the resulting raster. For example, a fleck of dirt might connect two lines that should not be connected.

Raster-to-vector Translation

Data restructuring can be performed by a GIS to convert data into different formats. For example, a GIS may be used to convert a satellite image map to a vector structure by generating lines around all cells with the same classification, while determining the cell spatial relationships, such as adjacency or inclusion.

More advanced data processing can occur with image processing, a technique developed in the late 1960s by NASA and the private sector to provide contrast enhancement, false colour rendering and a variety of other techniques including use of two dimensional Fourier transforms. Since digital data is collected and stored in various ways, the two data sources may not be entirely compatible. So a GIS must be able to convert geographic data from one structure to another.

Projections, Coordinate Systems and Registration

A property ownership map and a soils map might show data at different scales. Map information in a GIS must be manipulated so that it registers, or fits, with information gathered from other maps. Before the digital data can be analysed, they may have to undergo other manipulations—projection and coordinate conversions, for example—that integrate them into a GIS.

The earth can be represented by various models, each of which may provide a different set of coordinates for any given point on the Earth's surface. The simplest model is to assume the earth is a perfect sphere. As more measurements of the earth have accumulated, the models of the earth have become more sophisticated and more accurate. In fact, there are models that apply to different areas of the earth to provide increased accuracy.

Projection is a fundamental component of map making. A projection is a mathematical means of transferring information from a model of the Earth, which represents a three-dimensional curved surface, to a two-dimensional medium—paper or a computer screen. Different projections are used for different types of maps because each projection particularly suits specific uses.

For example, a projection that accurately represents the shapes of the continents will distort their relative sizes. Since much of the information in a GIS comes from existing maps, a GIS uses the processing power of the computer to transform digital information, gathered from sources with different projections and/or different coordinate systems, to a common projection and coordinate system.

Spatial Analysis with GIS

Given the vast range of spatial analysis techniques that have been developed over the past half century, any summary or review can only cover the subject to a limited depth. This is a rapidly changing field, and GIS packages are increasingly including analytical tools as standard built-in facilities or as optional toolsets, add-ins or 'analysts'.

In many instances such facilities are provided by the original software suppliers, whilst in other cases facilities have been developed and are provided by third parties. Furthermore, many products offer software development kits, programmeming languages and language support, scripting facilities and/or special interfaces for developing one's own analytical tools or variants.

The website Geospatial Analysis and associated book/ ebook attempt to provide a reasonably comprehensive guide to the subject. The impact of these myriad paths to perform spatial analysis create a new dimension to business intelligence termed "spatial intelligence" which, when delivered via intranet, democratizes access to operational sorts not usually privy to this type of information.

3

Geography of Landforms

AGE OF EARTH

The earth has an absolute age of approximately 4.6 billion years old. The Big Bang Theory there was a massive explosion that sent forth, at great speed, a huge amount of heat and matter that consisted almost exclusively of hydrogen and helium. The essential result of this explosion was our solar system's development. The earth had its first life forms some 4.0 billion years ago.

The oldest rock discovered is 4.1 billion years old. Scientist learn the age of the rock by measuring the amount of radioactive substance in them. Comparitive studies have been done to meteorite parts which have impacted on earth they to date to the time of the planets first forming about 4.3 billion years. Humans evolved about 50,000-100,000 years ago. The exact date has still not been determined. Our human existence is but a fraction of a second on a 24-hour clock in geologic time. The earth has gone through many stages and mankind is only a small part of this history.

TECTONIC FORCES

Plate tectonic is the idea that plates carry the continents and are great slabs of solid material that make up the ocean floor. Plate tectonics comes from the Greek word,"tektonikos" meaning "builder." It has been determined that there are about 20 rigid plates that are in slow, continuous motion. Some continents move at a rate of 1/2 to 4 inches per year which is directed by heat driven convection cells in the molten rock

deep below the crust. As they move, they carry the continents and ocean floor. In the late 1800's, Alfred Wegener, a German physical geographer, used spatial analysis to propose the continental drift hypothesis. Wegener studied the outlines of the continents and suggested that the existing land masses had been united at one point in the earths early history. He called his theory"die Verschiebung der Continent" meaning "continental displacement." His idea stated that these stable, immovable continents were mobile with the help of the tectonic plates. With further research his theory was accepted, but not until 60 to 70 years later.

The Earth is made up of three layers: the crust, the mantle and the core. The crust is a thin (15 mile) layer covering the outside part of the earth. The second layer is the mantle which is 1,800 miles thick. The crust and the upper mantle make up what is called the lithosphere. This lithosphere is 60-90 miles below the continents and 40-50 miles below the oceans. The plates in the plate tectonic theory are the lithosphere. The continental crust is less dense or lighter than the oceanic crust and "floats" above it. The base of the lithosphere is called the asthenosphere.

Here is where the lithosphere is unattached from the mantle and moves around, mostly by gravity and thermal differences in the mantle. The core, the third layer, is 1,000 miles thick. The core and the mantle are made of hot molten rocks, but the core is much hotter than the mantle. Below the 15 mile crust there is an increased amount of heat. It is believed that this heat is 'left over' from the formation of the earth and decaying radioactive material is fueling the fire. In fact, it is a possibility we could use the energy from this heat to fuel our lives if we were to run out of oil.

How does this heat cause the plates to move? The earth's crust is cold, the mantle is hot and the core is even hotter, thus providing us with the explanation. In order to equalize these temperatures, convection cells are formed. Two types of rotation are produced by these convection cells. Propelled by these heat convection cells, these plates move very slowly; one to four inches per year. (A couple of inches per year isn't much,

since the earth's history is measured in millions of years). 225 million years ago, it is postulated that a giant continent called Pangaea ('all-earth') existed. This giant continent remained until about 135 million years ago, when it began to break up during the Mesozoic time. The break up consisted of India detaching itself from Africa and Antarctica and headed into the Indian Ocean. A giant mountain range is formed where the Australian-Indian Plate is pushing into the heart of Asia.

Additional evidence supporting the continental drift theory is supplied by the amphibian and reptile fossils that are spread out among the widely separated continents. And the evidence of polar wandering and evidence of magnetic field reversals locked into oceanic basalt samples. There are only three ways plates can interact while moving. This, in turn, causes there to be only three types of boundaries which are produced by different stress fields. The first boundary is called divergent.

This is a tension or a stress that pulls the plates apart. Divergent boundaries cause mid oceanic ridges. Some other common characteristics are high heat flow, mild volcanic activity, and shallow earthquakes. The second boundary is called convergent and this is a compression, or a stress that can shorten or compresses the plates. Convergent boundaries cause mountain ranges to develop. The Himalayas for example, were formed when the plate carrying India collided with the plate carrying Eurasia.

This continental collision is still active and moving at a rate of 3 to 4 inches per year as the India plate is pushed under the Asian plate and the mountain continue to grow. Strong earthquake activity is very common with areas of convergent boundaries as well. The third type of boundary is a transform boundary and this is when the plates slide past each other along faults causing mid-oceanic ridges and trenches. One plate may be forced down into the mantle under the other plate.

When this occurs, a deep oceans trench forms. The largest ocean form is the Mariana Trench in the Pacific Ocean southwest of Guam. Another example is the San Andreas Fault

with is between the North American plate and the Pacific plate. Here, earthquakes are common but not volcanoes, and the earthquakes tend to outline the major plates. The earth is constantly being shaped by the dynamics of the tectonicactivity and plates motion. Some of the present day's biggest mountains and ocean trenches are examples of the great power of these plates in motion.

'Hot Spots' is a generally accepted term used to explain the formation of islands in the middle of the Pacific such as the Hawaiian Islands, the Line Islands, and the Tuamotus. The Galapagos Islands are similar in fashion, though not as aligned, but are located off the coast of Ecuador. A Hot Spot is caused by the magma that rises or plumes from the core to the surface causing volcanoes by penetrating the mantle. As the plate moves, it carries along the volcano that was formed. In it's place, a new one begins to form from the sea floor, while the hot spot stays in one place.

Islands form in a "chain" as a result. The Hawaiian Islands get younger from east to west in the chain. On the island of Hawaii, which is still over the hot spot, volcanoes remain very active. Other events related to this activity include earthquakes, volcanoes, and geothermic activity. Earthquakes are caused by abrupt easing of strains that have been built up along geologic faults and by volcanic action.

The result of this is movement in the earth's surface. These vibrations can be felt in the locally affected areas and measured by scientific devices around the world. These plate cycles may also form volcanic activity. For example, the Pacific Ocean is surrounded by a nearly continuous plate-collision zone, called the 'Ring of Fire', here Volcanoes are the results of the instability of this zone. Japan lies near the colliding edges of three plates, hence, earthquakes and volcanoes are a constant threat to the islands population.

GRADATIONAL FORCES

Weathering is the physical disintegration and chemical decomposition of earth materials at or near the earth's surface. There are different types of weathering; mechanical, physical,

and chemical. Water is a mechanical weathering force or erosional force (gradational force). Evidence shows that water molds the earth's surface through chemical weathering, rivers, waves, glaciation, and deposition. One of the largest examples of water as a weathering force is the Grand Canyon. Mainly the work of one river, the Colorado River, has molded and shaped the canyon over the last 5 million years and continues to do so today.

Physical weathering breaks rocks into pieces. Animals, insects, worms, and burrowing mammals all work to loosen the soil by aeration and by mixing loose materials. Another main causes of physical weathering is the formation of ice in rocks. First, the water soaks into the cracks. Then, when the temperature falls low enough, the water in the cracks freeze. The expansion of the water in the cracks pushes hard enough to split the rock.

Chemical weathering is very complex, but basically it is the reactions between earth materials and atmospheric components such as water, Oxygen, and Carbon Dioxide. The end products are new minerals and/or dissolved minerals. Rain, streams, and seawater dissolve some substances from rock and may cause the remaining substances from the rock to crumble. The main causes of chemical weathering is the dissolving action of water. There are other factors that may cause weathering such as humidity, pollution, acid rain, and wind. There are monuments in Luxor, Egypt that have remained visible for over 3500 years, but when the same ruins are sent to New York as a gift from the government in Egypt, the monument quickly is worn away and is no longer legible.

All in all, the rate of chemical weathering is controlled by the surface environment, grain size, and the climate. Rivers (especially fast-moving) erodes the land by carrying sediment away from one location and depositing it in another. Alluvium is all the sediment that is deposited by running water. Deltas are formed where running water moves into standing water. The Missouri River Valley has been formed by this slow-moving erosional force. Tributaries are bodies of water which flow into a larger river. These form valleys within a larger

valley, leaving hills on each side. Fluvial landscape is the landscape formed by rivers. "Bird's foot" deltas get their name from their appearance on a map. Rivers move back and forth in a snake-like pattern causing erosion and deposition. This may cause the river to become so tightly curved that the river may take a short cut across the corners and create a loop or an oxbow lake. An oxbow lake is the explanation for the creation of Lake Manawa and Carter Lake.

Deposition is the process of eroding materials into sediments then depositing them elsewhere. Deltas are areas of built up from soil dumped when a river empties into a lake or ocean. Sand bars are offshore shoals of sand deposited with slower moving water. Waves are formed when wind blows over calm waters and ripples are created. These ripples enlarge with time and form larger wind waves. These Ocean waves then crash into continents and are considered to be a very powerful gradational force.

They wear away the sides of continents. There have been islands that were formed by volcanic action and were worn away by waves erosion in a few short years. Beaches and coastal land fronts are continually being changed by the wave action. These environment are semi fragile and can be created and destroyed quite simply by long shore drift, waves action and storms as these landmasses under go continuous change. The Earth periodically under goes the event of glaciation.This is a time during which global temperatures drop and environments change.

Glaciers,or large masses of ice, are gigantic erosional forces. There are many different types of glaciers and most contain a large portion of the earth's fresh water resources. During the Ice Age, ten-thousand years ago, glaciers covered large areas of land, wore away the surface, and disrupted the drainage system. The glaciers can create large U-shaped glacial valleys and cut through large mountains. The Missouri Valley was created by a glacier years and years ago, as well as the Kern Canyon in Sequoia-Kings Canyon National Park, California. Large boulders have been moved and deposited in the most unusual locations and the only explanation for

these displacements are the glaciers. Glacial landscapes vary widely and are distinguished in forms as they carve mountains and valleys. One such feature are areas in which a lake may been formed without a river to carry water to or from the existing lakes. Moraines are another feature of this glacial sculpting, formed by the upward force of materiels in front of the glaciers path. Why did glaciers occur?

The earth had a cooling period again before the ice which had formed years before had a chance to melt. This is viewed as a cyclical event. We are presently in an Interglacial Period. Today, glaciers cover all of Antarctica and most of Greenland. The volume of the Antarctic ice contains 2% of the earth's water and about 90% of the world's fresh water. If global warming continues, the glaciers will begin to melt and causing a rise in the levels of the oceans.

If the global temperature increases just three degrees by the year 2050, the sea levels will rise 8 inches from the alpine glaciers alone. This would cause flooded beaches every where. Aside from the sea level rising, the global temperatures and weather patterns would also change.

EROSION AND DEPOSITION

7Erosion is defined as the removal of soil, sediment, regolith, and rock fragments from the landscape. Most landscapes show obvious evidence of erosion. Erosion is responsible for the creation of hills and valleys. It removes sediments from areas that were once glaciated, shapes the shorelines of lakes and coastlines, and transports material downslope from elevated sites. In order for erosion to occur three processes must take place: detachment, entrainment and transport. Erosion also requires a medium to move material. Wind, water, and ice are the mediums primarily responsible for erosion. Finally, the process of erosion stops when the transported particles fall out of the transporting medium and settle on a surface. This process is called deposition.

ENERGY OF EROSION

The energy for erosion comes from several sources.

Mountain building creates a disequilibrium within the Earth's landscape because of the creation of relief. Gravity acts to vertically move materials of higher relief to lower elevations to produce an equilibrium. Gravity also acts on the mediums of erosion to cause them to flow to base level. Solar radiation and its influence on atmospheric processes is another source of energy for erosion.

Rainwater has a kinetic energy imparted to it when it falls from the atmosphere. Snow has potential energy when it is deposited in higher elevations. This potential energy can be converted into the energy of motion when the snow is converted into flowing glacial ice. Likewise, the motion of air because of differences in atmospheric pressure can erode surface material when velocities are high enough to cause particle entrainment.

THE EROSION SEQUENCE

Erosion can be seen as a sequence of three events: detachment, entrainment, and transport. These three processes are often closely related and sometimes not easy distinguished between each other. A single particle may undergo detachment, entrainment, and transport many times.

DETACHMENT

Erosion begins with the detachment of a particle from surrounding material. Sometimes detachment requires the breaking of bonds which hold particles together. Many different types of bonds exist each with different levels of particle cohesion. Some of the strongest bonds exist between the particles found within igneous rocks. In these materials, bonds are derived from the growth of mineral crystals during cooling. In sedimentary rocks, bonds are weaker and are mainly caused by the cementing effect of compounds such as iron oxides, silica, or calcium.

The particles found in soils are held together by even weaker bonds which result from the cohesion effects of water and the electro-chemical bonds found in clay and particles of organic matter. Physical, chemical, and biological weathering

act to weaken the particle bonds found in rock materials. As a result, weathered materials are normally more susceptible than unaltered rock to the forces of detachment. The agents of erosion can also exert their own forces of detachment upon the surface rocks and soil through the following mechanisms:

- *Plucking*: Ice freezes onto the surface, particularly in cracks and crevices, and pulls fragments out from the surface of the rock.
- Cavitation: intense erosion due to the surface collapse of air bubbles found in rapid flows of water. In the implosion of the bubble, a micro-jet of water is created that travels with high speeds and great pressure producing extreme stress on a very small area of a surface. Cavitation only occurs when water has a very high velocity, and therefore its effects in nature are limited to phenomenon like high waterfalls.
- *Raindrop impact*: The force of a raindrop falling onto a soil or weathered rock surface is often sufficient to break weaker particle bonds. The amount of force exerted by a raindrop is a function of the terminal velocity and mass of the raindrop.
- *Abrasion*: The excavation of surface particles by material carried by the erosion agent. The effectiveness of this process is related to the velocity of the moving particles, their mass, and their concentration at the eroding surface. Abrasion is very active in glaciers where the particles are firmly held by ice. Abrasion can also occur from the particles held in the erosional mediums of wind and water.

ENTRAINMENT

Entrainment is the process of particle lifting by the agent of erosion. In many circumstances, it is hard to distinguish between entrainment and detachment. There are several forces that provide particles with a resistance to this process. The most important force is frictional resistance. Frictional resistance develops from the interaction between the particle to its surroundings. A number of factors increase frictional

resistance, including: gravity, particle slope angle relative to the flow direction of eroding medium, particle mass, and surface roughness. Entrainment also has to overcome the resistance that occurs because of particle cohesive bonds. These bonds are weakened by weathering or forces created by the erosion agent (abrasion, plucking, raindrop impact, and cavitation).

ENTRAINMENT FORCES

The main force reponsible for entrainment is fluid drag. The strength of fluid drag varies with the mass of the eroding medium (water is 9000 times more dense than air) and its velocity. Fluid drag causes the particle to move because of horizontal force and vertical lift.

Within a medium of erosion, both of these forces are controlled by velocity. Horizontal force occurs from the push of the agent against the particle. If this push is sufficient to overcome friction and the resistance of cohesive bonds, the particle moves horizontally. The vertical lift is produced by turbulence or eddies within the flow that push the particle upward. Once the particle is lifted the only force resisting its transport is gravity as the forces of friction, slope angle, and cohesion are now non-existent.

The particle can also be transported at velocities lower than the entrainment velocities because of the reduction in forces acting on it. Many hydrologists and geomorphologists require a mathematical model to predict levels of entrainment, especially in stream environments. In these highly generalized models, the level of particle entrainment is relative to particle size and the velocity of the medium of erosion. These quantitative models can be represented graphically. On these graphs, the x-axis represents the log of particle diameter, and the y-axis the log of velocity.

The relationship between these two variables to the entrainment of particles is described by a curve, and not by a straight line. The critical entrainment velocity curve suggests that particles below a certain size are just as resistant to entrainment as particles with larger sizes and masses. Fine silt

and clay particles tend to have higher resistance to entrainment because of the strong cohesive bonds between particles. These forces are far stronger than the forces of friction and gravity.

TRANSPORT

Once a particle is entrained, it tends to move as long as the velocity of the medium is high enough to transport the particle horizontally.

Within the medium, transport can occur in four different ways:

- Suspension is where the particles are carried by the medium without touching the surface of their origin. This can occur in air, water, and ice.
- Saltation is where the particle moves from the surface to the medium in quick continuous repeated cycles. The action of returning to the surface usually has enough force to cause the entrainment of new particles. This process is only active in air and water.
- Traction is the movement of particles by rolling, sliding, and shuffling along the eroded surface. This occurs in all erosional mediums.
- Solution is a transport mechanism that occurs only in aqueous environments. Solution involves the eroded material being dissolve and carried along in water as individual ions.

Particle weight, size, shape, surface configuration, and medium type are the main factors that determine which of these processes operate.

DEPOSITION

The erosional transport of material through the landscape is rarely continuous. Instead, we find that particles may undergo repeated cycles of entrainment, transport, and deposition. Transport depends on an appropriate balance of forces within the transporting medium.

A reduction in the velocity of the medium, or an increase in the resistance of the particles may upset this balance and cause deposition. Reductions in competence can occur in a variety of ways. Velocity can be reduced locally by the

sheltering effect of large rocks, hills, stands of vegetation or other obstructions. Normally, competence changes occur because of large scale reductions in the velocity of flowing medium. For wind, reductions in velocity can be related to variations in spatial heating and cooling which create pressure gradients and wind. In water, lower velocities can be caused by reductions in discharge or a change in the grade of the stream.

Glacial flows of ice can become slower if precipitation input is reduced or when the ice encounters melting. Deposition can also be caused by particle precipitation and flocculation. Both of these processes are active only in water. Precipitation is a process where dissolved ions become solid because of changes in the temperature or chemistry of the water. Flocculation is a chemical process where salt causes the aggregation of minute clay particles into larger masses that are too heavy to remain suspended.

LANDFORM REGION

A landform region describes the distinct characteristics of a geographic area, in which some physical characteristics are dominant, almost to the exclusion of others. A landform comprises a geomorphological unit. Landforms are categorized by characteristics such as elevation, slope, orientation, stratification, rock exposure, and soil type. Landforms by name include berms, mounds, hills, cliffs, valleys, and so forth.

Oceans and continents exemplify highest-order landforms. Landform elements are parts of a landform that can be further identified. Landform elements, such as hill-top, shoulder, backslope etc, can be observed on many various geomorphological landforms. The generic landform elements are: pits, peaks, channels, ridges, passes, pools, planes etc, and can be often extracted from a digital elevation model using some automated or semi-automated techniques. Elementary landforms (segments, facets, relief units) are the smallest homogeneous divisions of the land surface, at the given scale/ resolution. These are areas with relatively homogenuous

morphometric properties, bounded by lines of discontinuity. A plateau or a hill can be observed at various scales ranging from few hundred meters to hundreds of kilometers. Hence, the spatial distribution of landforms is often fuzzy and scale-dependent as is the case for soils and geological strata. A number of factors, ranging from plate tectonics to erosion and deposition can generate and affect landforms.

Biological factors can also influence landforms and the work of corals and algae in the formation of coral reefs. Many of the terms are not restricted to refer to features of the planet Earth, and can be used to describe surface features of other planets and similar objects in the Universe.

4

Weather and Climate

BASIC DEFINITIONS

WEATHER

Weather is the state of the atmosphere, to the degree that it is hot or cold, wet or dry, calm or stormy, clear or cloudy. Most weather phenomena occur in the troposphere, just below the stratosphere. Weather refers, generally, to day-to-day temperature and precipitation activity, whereas climate is the term for the average atmospheric conditions over longer periods of time. When used without qualification, "weather" is understood to be the weather of Earth. Weather is driven by density (temperature and moisture) differences between one place and another.

These differences can occur due to the sun angle at any particular spot, which varies by latitude from the tropics.The strong temperature contrast between polar and tropical air gives rise to the jet stream. Weather systems in the mid-latitudes, such as extratropical cyclones, are caused by instabilities of the jet stream flow. Because the Earth's axis is tilted relative to its orbital plane, sunlight is incident at different angles at different times of the year. On Earth's surface, temperatures usually range ±40 °C (100 °F to "40 °F) annually.

Over thousands of years, changes in Earth's orbit affect the amount and distribution of solar energy received by the Earth and influence long-term climate and global climate change. Surface temperature differences in turn cause pressure

differences. Higher altitudes are cooler than lower altitudes due to differences in compressional heating. Weather forecasting is the application of science and technology to predict the state of the atmosphere for a future time and a given location.

The atmosphere is a chaotic system,so small changes to one part of the system can grow to have large effects on the system as a whole. Human attempts to control the weather have occurred throughout human history, and there is evidence that human activity such as agriculture and industry has inadvertently modified weather patterns.

Studying how the weather works on other planets has been helpful in understanding how weather works on Earth. A famous landmark in the Solar System, Jupiter's Great Red Spot, is an anticyclonic storm known to have existed for at least 300 years. However, weather is not limited to planetary bodies. A star's corona is constantly being lost to space, creating what is essentially a very thin atmosphere throughout the Solar System. The movement of mass ejected from the Sun is known as the solar wind.

CLIMATE

Climate encompasses the statistics of temperature, humidity, atmospheric pressure, wind, rainfall, atmospheric particle count and other meteorological elements in a given region over a long period of time. Climate can be contrasted to weather, which is the present condition of these same elements and their variations over shorter time periods. The climate of a location is affected by its latitude, terrain, and altitude, as well as nearby water bodies and their currents. Climates can be classified just as to the average and the typical ranges of different variables, most commonly temperature and precipitation.

The most commonly used classification scheme was originally developed by Wladimir Köppen. The Thornthwaite system, in use since 1948, incorporates evapotranspiration in addition to temperature and precipitation information and is used in studying animal species diversity and potential

impacts of climate changes. The Bergeron and Spatial Synoptic Classification systems focus on the origin of air masses that define the climate of a region. Paleoclimatology is the study of ancient climates. Since direct observations of climate are not available before the 19th century, paleoclimates are inferred from proxy variables that include non-biotic evidence such as sediments found in lake beds and ice cores, and biotic evidence such as tree rings and coral. Climate models are mathematical models of past, present and future climates.

Climate change may occur over long and short timescales from a variety of factors; recent warming is discussed in global warming. Climate is commonly defined as the weather averaged over a long period of time. The standard averaging period is 30 years, but other periods may be used depending on the purpose. Climate also includes statistics other than the average, such as the magnitudes of day-to-day or year-to-year variations.

The Intergovernmental Panel on Climate Change (IPCC) definition is:

- Climate in a narrow sense is usually defined as the "average weather," or more rigorously, as the statistical description in terms of the mean and variability of relevant quantities over a period of time ranging from months to thousands or millions of years. The classical period is 30 years, as defined by the World Meteorological Organization (WMO). These quantities are most often surface variables such as temperature, precipitation, and wind. Climate in a wider sense is the state, including a statistical description, of the climate system.

The difference between climate and weather is usefully summarized by the popular phrase "Climate is what you expect, weather is what you get." Over historical time spans there are a number of nearly constant variables that determine climate, including latitude, altitude, proportion of land to water, and proximity to oceans and mountains. These change only over periods of millions of years due to processes such as plate tectonics. Other climate determinants are more

dynamic: for example, the thermohaline circulation of the ocean leads to a 5 °C (9 °F) warming of the northern Atlantic ocean compared to other ocean basins. Other ocean currents redistribute heat between land and water on a more regional scale. The density and type of vegetation coverage affects solar heat absorption, water retention, and rainfall on a regional level. Alterations in the quantity of atmospheric greenhouse gases determines the amount of solar energy retained by the planet, leading to global warming or global cooling.

The variables which determine climate are numerous and the interactions complex, but there is general agreement that the broad outlines are understood, at least insofar as the determinants of historical climate change are concerned.

AIR TEMPERATURE

- Temperature is a measure of the level of sensible heat (temperature measured by a thermometer) of matter, whether it is gaseous (air), liquid (water), or solid (rock or dry soil).
- Air temperature is the intensity aspect of sun's energy that strikes the earth's surface.
- Because the amount of energy from the sun reaching the earth varies from day to day, from season to season, and from latitude to latitude, temperatures also vary.
- The earth as a whole receives a constant flow of radiant short-wave energy from the sun. The earth also radiates long-wave energy to space.
- During the day, the flow of short-wave radiation absorbed exceeds long -wave energy emitted, and the surface temperature increases.
- At no short-wave radiation strikes the darkened side of the earth. But, long-wave energy is still emitted from the surface. Therefore, surface temperatures decrease.

AIR PRESSURE AND WIND

The wind blows because of differences in air pressure from one location to another. Wind blows from areas of high pressure towards areas of low pressure. If the high pressure

area is very close to the low pressure area, or if the pressure difference is very great, the wind can blow very fast.

WHAT IS AIR PRESSURE

Imagine a group of acrobats at the circus. One climbs up and stands on another's shoulders. The weight of the acrobat on top puts more pressure on the one below. Then another acrobat climbs up and stands on the second acrobat's shoulders. Now there's even more pressure on the acrobat on the bottom because he is under the weight of the two acrobats above him. It's the same with air.

Yes, air has weight, and probably more than you think. In fact, the weight of the air on your desk at school weighs about 11,000 pounds. That's about the same weight as a school bus! Since air pressure pushes in all directions, the air pressure pushing up from under your desk balances out the air pushing down on it, so the desk doesn't collapse under the weight. Just like an acrobat with two people stacked on his shoulders would want to move to where there wasn't so much pressure on him, air moves from areas where the pressure is higher to where it is lower.

CAUSES OF AIR PRESSURE

Air pressure depends on the density of the air, or how close together its molecules are. You know that a hard rubber ball is more dense than a Styrofoam ball and that ice cream is more dense than whipped cream.

Air lower in the atmosphere is more dense than air above, so air pressure down low is greater than air pressure higher up. Temperature also makes changes in air pressure. In cold air, the molecules are more closely packed together than in warm air, so cold air is more dense than warm air.

RISING AND SINKING AIR

Since warm air is less dense and creates less air pressure, it will rise; cold air is denser and creates greater air pressure, and so it will sink. When warm air rises, cooler air will often move in to replace it, so wind often moves from areas where

it's colder to areas where it's warmer. The greater the difference between the high and low pressure or the shorter the distance between the high and low pressure areas, the faster the wind will blow. Wind also blows faster if there's nothing in its way, so winds are usually stronger over oceans or flat ground. Meteorologists can forecast the speed and direction of wind by measuring air pressure with a barometer.

WIND DIRECTION

Although wind blows from areas of high pressure to areas of low pressure, it doesn't blow in a straight line. That's because the earth is rotating. In the northern hemisphere, the spin of the earth causes winds to curve to the right (to the left in the southern hemisphere). This is called the coriolis effect. So in the northern hemisphere, winds blow clockwise around an area of high pressure and counter-clockwise around low pressure.

OCEAN CURRENTS

DEFINITIONS

The movement of ocean water is one of the two principal sources of discrepancy between dead reckoned and actual positions of vessels. Water in motion is called a current; the direction towards which it moves is called set, and its speed is called drift. Modern shipping speeds have lessened the impact of currents on a typical voyage, and since electronic navigation allows continuous adjustment of course, there is less need to estimate current set and drift before setting the course to be steered. Nevertheless, a knowledge of ocean currents can be used in cruise planning to reduce transit times.

Ocean current models are an integral part of ship routing systems. Oceanographers have developed a number of methods of classifying currents in order to facilitate descriptions of their physics and geography. Currents may be referred to just as to their forcing mechanism as either wind driven or thermohaline. Alternatively, they may be classified just as to their depth (surface, intermediate, deep or bottom).

The surface circulation of the world ocean is mostly wind driven. Thermohaline currents are driven by differences in heat and salt and are associated with the sinking of dense water at high latitudes; the currents driven by thermohaline forcing are typically subsurface.

Note that this classification scheme is not unambiguous; the circumpolar current, which is wind driven, extends from the surface to the bottom. A periodic current is one for which the speed or direction changes cyclically at somewhat regular intervals, such as a tidal current. A seasonal current is one which changes in speed or direction due to seasonal winds.

The mean circulation of the ocean consists of semi-permanent currents which experience relatively little periodic or seasonal change. A coastal current flows roughly parallel to a coast, outside the surf zone, while a longshore current is one parallel to a shore, inside the surf zone, generated by waves striking the beach at an angle. Any current some distance from the shore may be called an offshore current, and one close to the shore an inshore current.

CAUSES OF OCEAN CURRENTS

The primary generating forces are wind and differences in density of the water caused by variations in heat and salt. Currents generated by these forces are modified by such factors as depth of water, underwater topography including shape of the basin in which the current is running, extent and location of land, and deflection by the rotation of the earth.

WIND DRIVEN CURRENTS

The stress of wind blowing across the sea causes a surface layer of water to move. Due to the low viscosity of water, this stress is not directly communicated to the ocean interior, but is balanced by the Coriolis force within a relatively thin surface layer, 10-200m thick. This layer is called the Ekman layer and the motion of this layer is called the Ekman transport. Because of the deflection by the Coriolis force, the Ekman transport is not in the direction of the wind, but is 90° to the right in the Northern Hemisphere and 90° towards the left in the Southern

Hemisphere. The amount of water flowing in this layer depends only upon the wind and the Coriolis force and is independent of the depth of the Ekman layer and the viscosity of the water. The large scale convergence or divergence of Ekman transport serves to drive the general ocean circulation. Consider the case of the Northern Hemisphere subtropics. To the south lie easterly winds with associated northward Ekman transport. To the north lie westerly winds with southward Ekman transport.

The convergence of these Ekman transports is called Ekman pumping and results in a thickening of the upper ocean and a increase in the depth of the thermocline. The resulting subsurface pressure gradients, balanced by the Coriolis force, give rise to the anticyclonic subtropical gyres found at mid latitudes in each ocean basin. In subpolar regions, Ekman suction produces cyclonic gyres.

These wind driven gyres are not symmetrical. Along the western boundary of the oceans, currents are narrower, stronger, and deeper, often following a meandering course. These currents are sometimes called a stream. In contrast, currents in mid-ocean and at the eastern boundary, are often broad, shallow and slow-moving. Sometimes these are called drift currents. Within the Ekman layer, the currents actually form a spiral. At the surface, the difference between wind direction and surface wind-current direction varies from about 15° along shallow coastal areas to a maximum of 45° in the deep oceans.

As the motion is transmitted to successively deep layers, the Coriolis force continues to deflect the current. At the bottom of the Ekman layer, the current flows in the opposite direction to the surface current. This shift of current directions with depth, combined with the decrease in velocity with depth, is called the Ekman spiral. The velocity of the surface current is the sum of the velocities of the Ekman, geostrophic, tidal, and other currents.

The Ekman surface current or wind drift current depends upon the speed of the wind, its constancy, the length of time it has blown, and other factors. In general, however, wind drift

current is about 2 per cent of the wind speed, or a little less, in deep water where the wind has been blowing steadily for at least 12 hours.

CURRENTS RELATED TO DENSITY DIFFERENCES

The density of water varies with salinity, temperature, and pressure. At any given depth, the differences in density are due only to differences in temperature and salinity. With sufficient data, maps showing geographical density distribution at a certain depth can be drawn, with lines connecting points of equal density.

These lines would be similar to isobars on a weather map and serve an analogous purpose, showing areas of high density and those of low density. In an area of high density, the water surface is lower than in an area of low density, the maximum difference in height being about 1 meter in 100 km. Because of this difference, water tends to flow from an area of higher water (low density) to one of lower water (high density).

But due to rotation of the earth, it is deflected by the Coriolis force or towards the right in the Northern Hemisphere, and towards the left in the Southern Hemisphere. This balance, between subsurface pressure fields and the Coriolis force, is called geostrophic equilibrium. At a given latitude, the greater the density gradient (rate of change with distance), the faster the geostrophic current.

OCEANIC CIRCULATION

A number of ocean currents flow with great persistence, setting up a circulation that continues with relatively little change throughout the year. Because of the influence of wind in creating current, there is a relationship between this oceanic circulation and the general circulation of the atmosphere. Some differences in opinion exist regarding the names and limits of some of the currents, but those shown are representative. Speed may vary somewhat with the season. This is particularly noticeable in the Indian Ocean and along the South China coast, where currents are influenced to a marked degree by the monsoons.

Southern Ocean Currents

The Southern Ocean has no meridional boundaries and its waters are free to circulate around the world. It serves as a conveyor belt for the other oceans, exchanging waters between them. The northern boundary of the Southern Ocean is marked by the Subtropical Convergence zone. This zone marks the transition from the temperate region of the ocean to the polar region and is associated with the surfacing of the main thermocline.

This zone is typically found at 40°S but varies with longitude and season. In the Antarctic, the circulation is generally from west to east in a broad, slow-moving current extending completely around Antarctica. This is called the Antarctic Circumpolar Current or the West Wind Drift, and it is formed partly by the strong westerly wind in this area, and partly by density differences. This current is augmented by the Brazil and Falkland Currents in the Atlantic, the East Australia Current in the Pacific, and the Agulhas Current in the Indian Ocean.

In return, part of it curves northward to form the Cape Horn, Falkland, and most of the Benguela Currents in the Atlantic, and the Peru Current in the Pacific. In a narrow zone next to the Antarctic continent, a westward flowing coastal current is usually found. This current is called the East Wind Drift because it is attributed to the prevailing easterly winds which occur there.

Atlantic Ocean Currents

The trade winds set up a system of equatorial currents which at times extends over as much as 50° of latitude or more. There are two westerly flowing currents conforming generally with the areas of trade winds, separated by a weaker, easterly flowing countercurrent. The North Equatorial Current originates to the northward of the Cape Verde Islands and flows almost due west at an average speed of about 0.7 knot. The South Equatorial Current is more extensive. It starts off the west coast of Africa, south of the Gulf of Guinea, and flows in a generally westerly direction at an average speed of about

0.6 knot. However, the speed gradually increases until it may reach a value of 2.5 knots, or more, off the east coast of South America. As the current approaches Cabo de Sao Roque, the eastern extremity of South America, it divides, the southern part curving towards the south along the coast of Brazil, and the northern part being deflected northward by the continent of South America.

Between the North and South Equatorial Currents, the weaker North Equatorial Countercurrent sets towards the east in the general vicinity of the doldrums. This is fed by water from the two westerly flowing equatorial currents, particularly the South Equatorial Current. The extent and strength of the Equatorial Countercurrent changes with the seasonal variations of the wind. It reaches a maximum during July and August, when it extends from about 50° west longitude to the Gulf of Guinea. During its minimum, in December and January, it is of very limited extent, the western portion disappearing altogether.

That part of the South Equatorial Current flowing along the northern coast of South America which does not feed the Equatorial Countercurrent unites with the North Equatorial Current at a point west of the Equatorial Countercurrent. A large part of the combined current flows through various passages between the Windward Islands and into the Caribbean Sea. It sets towards the west, and then somewhat north of west, finally arriving off the Yucatan peninsula. From there, the water enters the Gulf of Mexico and forms the Loop Current; the path of the Loop Current is variable with a 13-month period.

It begins by flowing directly from Yucatan to the Florida Straits, but gradually grows to flow anticyclonically around the entire Eastern Gulf; it then collapses, again following the direct path from Yucatan to the Florida Straits, with the loop in the Eastern Gulf becoming a separate eddy which slowly flows into the Western Gulf. Within the Straits of Florida, the Loop Current feeds the beginnings of the most remarkable of American ocean currents, the Gulf Stream. Off the southeast coast of Florida this current is augmented by the Antilles

Current which flows along the northern coasts of Puerto Rico, Hispaniola, and Cuba. Another current flowing eastward of the Bahamas joins the stream north of these islands. The Gulf Stream follows generally along the east coast of North America, flowing around Florida, northward and then northeastward towards Cape Hatteras, and then curving towards the east and becoming broader and slower.

After passing the Grand Banks, it turns more towards the north and becomes a broad drift current flowing across the North Atlantic. The part in the Straits of Florida is sometimes called the Florida Current. A tremendous volume of water flows northward in the Gulf Stream. It can be distinguished by its deep indigo-blue colour, which contrasts sharply with the dull green of the surrounding water. It is accompanied by frequent squalls. When the Gulf Stream encounters the cold water of the Labrador Current, principally in the vicinity of the Grand Banks, there is little mixing of the waters.

Instead, the junction is marked by a sharp change in temperature. The line or surface along which this occurs is called the cold wall. When the warm Gulf Stream water encounters cold air, evaporation is so rapid that the rising vapour may be visible as frost smoke. Investigations have shown that the current itself is much narrower and faster than previously supposed, and considerably more variable in its position and speed. The maximum current off Florida ranges from about 2 to 4 knots. Northward, the speed is generally less, and it decreases further after the current passes Cape Hatteras.

As the stream meanders and shifts position, eddies sometimes break off and continue as separate, circular flows until they dissipate. Boats in the Newport-Bermuda sailing yacht race have been known to be within sight of each other and be carried in opposite directions by different parts of the same current.

This race is generally won by the boat which catches an eddy just right. As the current shifts position, its extent does not always coincide with the area of warm, blue water. When the sea is relatively smooth, the edges of the current are

marked by ripples. A recirculation region exists adjacent to and southwest of the Gulf Stream. The flow of water in the recirculation region is opposite to that in the Gulf Stream and surface currents are much weaker, generally less than half a knot. As the Gulf Stream continues eastward and northeastward beyond the Grand Banks, it gradually widens and decreases speed until it becomes a vast, slow-moving current known as the North Atlantic Current, in the general vicinity of the prevailing westerlies.

In the eastern part of the Atlantic it divides into the Northeast Drift Current and the Southeast Drift Current. The Northeast Drift Current continues in a generally northeasterly direction towards the Norwegian Sea. As it does so, it continues to widen and decrease speed. South of Iceland it branches to form the Irminger Current and the Norway Current. The Irminger Current curves towards the north and northwest to join the East Greenland Current southwest of Iceland.

The Norway Current continues in a northeasterly direction along the coast of Norway. Part of it, the North Cape Current, rounds North Cape into the Barents Sea. The other part curves towards the north and becomes known as the Spitsbergen Current. Before reaching Svalbard (Spitsbergen), it curves towards the west and joins the cold East Greenland Current flowing southward in the Greenland Sea.

As this current flows past Iceland, it is further augmented by the Irminger Current. Off Kap Farvel, at the southern tip of Greenland, the East Greenland Current curves sharply to the northwest following the coastline. As it does so, it becomes known as the West Greenland Current, and its character changes from that of an intense western boundary current to a weaker eastern boundary current. This current continues along the west coast of Greenland, through Davis Strait, and into Baffin Bay.

In Baffin Bay the West Greenland Current generally follows the coast, curving westward off Kap York to form the southerly flowing Labrador Current. This cold current flows southward off the coast of Baffin Island, through Davis Strait,

along the coast of Labrador and Newfoundland, to the Grand Banks, carrying with it large quantities of ice. Here it encounters the warm water of the Gulf Stream, creating the cold wall. Some of the cold water flows southward along the east coast of North America, inshore of the Gulf Stream, as far as Cape Hatteras. The remainder curves towards the east and flows along the northern edge of the North Atlantic and Northeast Drift Currents, gradually merging with them. The Southeast Drift Current curves towards the east, southeast, and then south as it is deflected by the coast of Europe.

It flows past the Bay of Biscay, towards southeastern Europe and the Canary Islands, where it continues as the Canary Current. In the vicinity of the Cape Verde Islands, this current divides, part of it curving towards the west to help form the North Equatorial Current, and part of it curving towards the east to follow the coast of Africa into the Gulf of Guinea, where it is known as the Guinea Current. This current is augmented by the North Equatorial Countercurrent and, in summer, it is strengthened by monsoon winds. It flows in close proximity to the South Equatorial Current, but in the opposite direction.

As it curves towards the south, still following the African coast, it merges with the South Equatorial Current. The clockwise circulation of the North Atlantic leaves a large central area between the recirculation region and the Canary Current which has no well-defined currents. This area is known as the Sargasso Sea, from the large quantities of sargasso or gulfweed encountered there. That branch of the South Equatorial Current which curves towards the south off the east coast of South America, follows the coast as the warm, highly-saline Brazil Current, which in some respects resembles a weak Gulf Stream.

Off Uruguay it encounters the colder, less-salty Falkland or Malvinas Current forming a sharp meandering front in which eddies may form. The two currents curve towards the east to form the broad, slow-moving, South Atlantic Current in the general vicinity of the prevailing westerlies and the front dissipates somewhat. This current flows eastward to a point

west of the Cape of Good Hope, where it curves northward to follow the west coast of Africa as the strong Benguela Current, augmented somewhat by part of the Agulhas Current flowing around the southern part of Africa from the Indian Ocean.

As it continues northward, the current gradually widens and slows. At a point east of St. Helena Island it curves westward to continue as part of the South Equatorial Current, thus completing the counterclockwise circulation of the South Atlantic.

The Benguela Current is also augmented somewhat by the West Wind Drift, a current which flows easterly around Antarctica. As the West Wind Drift flows past Cape Horn, that part in the immediate vicinity of the cape is called the Cape Horn Current. This current rounds the cape and flows in a northerly and northeasterly direction along the coast of South America as the Falkland or Malvinas Current.

Pacific Ocean Currents

Pacific Ocean currents follow the general pattern of those in the Atlantic. The North Equatorial Current flows westward in the general area of the northeast trades, and the South Equatorial Current follows a similar path in the region of the southeast trades. Between these two, the weaker North Equatorial Countercurrent sets towards the east, just north of the equator. After passing the Mariana Islands, the major part of the North Equatorial Current curves somewhat towards the northwest, past the Philippines and Taiwan.

Here it is deflected further towards the north, where it becomes known as the Kuroshio, and then towards the northeast past the Nansei Shoto and Japan, and on in a more easterly direction. Part of the Kuroshio, called the Tsushima Current, flows through Tsushima Strait, between Japan and Korea, and the Sea of Japan, following generally the northwest coast of Japan. North of Japan it curves eastward and then southeastward to rejoin the main part of the Kuroshio. The limits and volume of the Kuroshio are influenced by the monsoons, being augmented during the season of southwesterly winds, and diminished when the northeasterly

winds are prevalent. The Kuroshio (Japanese for "Black Stream") is so named because of the dark colour of its water. It is sometimes called the Japan Current. In many respects it is similar to the Gulf Stream of the Atlantic.

Like that current, it carries large quantities of warm tropical water to higher latitudes, and then curves towards the east as a major part of the general clockwise circulation in the Northern Hemisphere. As it does so, it widens and slows, continuing on between the Aleutians and the Hawaiian Islands, where it becomes known as the North Pacific Current. As this current approaches the North American continent, most of it is deflected towards the right to form a clockwise circulation between the west coast of North America and the Hawaiian Islands called the California Current. This part of the current has become so broad that the circulation is generally weak.

Near the coast, the southeastward flow intensifies and average speeds are about 0.8 knot. But the flow pattern is complex, with offshore directed jets often found near more prominent capes, and poleward flow often found over the upper slope and outer continental shelf. It is strongest near land. Near the southern end of Baja California, this current curves sharply to the west and broadens to form the major portion of the North Equatorial Current. During the winter, a weak countercurrent flows northwestward, inshore of the southeastward flowing California Current, along the west coast of North America from Baja California to Vancouver Island.

This is called the Davidson Current. Off the west coast of Mexico, south of Baja California the current flows southeastward during the winter as a continuation of part of the California Current. During the summer, the current in this area is northwestward as a continuation of the North Equatorial Countercurrent. As in the Atlantic, there is in the Pacific a counterclockwise circulation to the north of the clockwise circulation.

Cold water flowing southward through the western part of Bering Strait between Alaska and Siberia, is joined by water

circulating counterclockwise in the Bering Sea to form the Oyashio. As the current leaves the strait, it curves towards the right and flows southwesterly along the coast of Siberia and the Kuril Islands. This current brings quantities of sea ice, but no icebergs. When it encounters the Kuroshio, the Oyashio curves southward and then eastward, the greater portion joining the Kuroshio and North Pacific Current. The northern branch of the North Pacific Current curves in a counterclockwise direction to form the Alaska Current, which generally follows the coast of Canada and Alaska. When the Alaska Current turns to the southwest and flows along the Kodiak Island and the Alaska Peninsula, its character changes to that of a western boundary current and it is called the Alaska Stream. When this westward flow arrives off the Aleutian Islands, it is less intense and becomes known as the Aleutian Current. Part of it flows along the southern side of these islands to about the 180th meridian, where it curves in a counter-clockwise direction and becomes an easterly flowing current, being augmented by the northern part of the Oyashio.

The other part of the Aleutian Current flows through various openings between the Aleutian Islands, into the Bering Sea. Here it flows in a general counterclockwise direction. The southward flow along the Kamchatka peninsula is called the Kamchatka Current which feeds the southerly flowing Oyashio. Some water flows northward from the Bering Sea through the eastern side of the Bering Strait, into the Arctic Ocean. The South Equatorial Current, extending in width between about 4°N latitude and 10°S, flows westward from South America to the western Pacific.

After this current crosses the 180th meridian, the major part curves in a counterclockwise direction, entering the Coral Sea, and then curving more sharply towards the south along the east coast of Australia, where it is known as the East Australian Current. The East Australian Current is the weakest of the subtropical western boundary currents and separates from the Australian coast near 34°S. The path of the current from Australia to New Zealand is known as the Tasman Front, which marks the boundary between the warm water of the

Coral Sea and the colder water of the Tasman Sea. The continuation of the East Australian Current east of New Zealand is the East Auckland Current. The East Auckland Current varies seasonally: in winter, it separates from the shelf and flows eastward, merging with the West Wind Drift, while in winter it follows the New Zealand shelf southward as the East Cape Current until it reaches Chatham Rise where it turns eastward, thence merging with the West Wind Drift. Near the southern extremity of South America, most of this current flows eastward into the Atlantic, but part of it curves towards the left and flows generally northward along the west coast of South America as the Peru Current or Humboldt Current. Occasionally a set directly towards land is encountered.

At about Cabo Blanco, where the coast falls away to the right, the current curves towards the left, past the Galapagos Islands, where it takes a westerly set and constitutes the major portion of the South Equatorial Current, thus completing the counterclockwise circulation of the South Pacific. During the northern hemisphere summer, a weak northern branch of the South Equatorial Current, known as the New Guinea Coastal Current, continues on towards the west and northwest along both the southern and northeastern coasts of New Guinea. The southern part flows through Torres Strait, between New Guinea and Australia, into the Arafura Sea. Here, it gradually loses its identity, part of it flowing on towards the west as part of the South Equatorial Current of the Indian Ocean, and part of it following the coast of Australia and finally joining the easterly flowing West Wind Drift. The northern part of New Guinea Coastal Current both curves in a clockwise direction to help form the Pacific Equatorial Countercurrent and off Mindanao turns southward to form a southward flowing boundary current called the Mindanao Current. During the northern hemisphere winter, the New Guinea Coastal Current may reverse direction for a few months.

Indian Ocean Currents

Indian Ocean currents follow generally the pattern of the Atlantic and Pacific but with differences caused principally

by the monsoons, the more limited extent of water in the Northern Hemisphere, and by limited communication with the Pacific Ocean along the eastern boundary. During the northern hemisphere winter, the North Equatorial Current and South Equatorial Current flow towards the west, with the weaker, eastward Equatorial Countercurrent flowing between them, as in the Atlantic and Pacific (but somewhat south of the equator). But during the northern hemisphere summer, both the North Equatorial Current and the Equatorial Counter current are replaced by the Southwest Monsoon Current, which flows eastward and southeastward across the Arabian Sea and the Bay of Bengal.

Near Sumatra, this current curves in a clockwise direction and flows westward, augmenting the South Equatorial Current, and setting up a clockwise circulation in the northern part of the Indian Ocean. Off the coast of Somalia, the Somali Current reverses direction during the northern hemisphere summer with northward currents reaching speeds of 5 knots or more. Twice a year, around May and November, westerly winds along the equator result in an eastward Equatorial Jet which feeds warm water towards Sumatra. As the South Equatorial Current approaches the coast of Africa, it curves towards the southwest, part of it flowing through the Mozambique Channel between Madagascar and the mainland, and part flowing along the east coast of Madagascar. At the southern end of this island the two join to form the strong Agulhas Current, which is analogous to the Gulf Stream.

This current, when opposed by strong winds from Southern Ocean storms, creates dangerously large seas. South of South Africa, the Agulhas Current retroflects, and most of the flow curves sharply southward and then eastward to join the West Wind Drift; this junction is often marked by a broken and confused sea, made much worse by westerly storms. A small part of the Agulhas Current rounds the southern end of Africa and helps form the Benguela Current; occasionally, strong eddies are formed in the retroflection region and these too move into the Southeastern Atlantic. The eastern boundary currents in the Indian Ocean are quite different from those

found in the Atlantic and Pacific. The seasonally reversing South Java Current has strongest westward flow during August when monsoon winds are easterly and the Equatorial jet is inactive. Along the coast of Australia, a vigourous poleward flow, the Leeuwin Current, runs against the prevailing winds.

Arctic Currents

The waters of the North Atlantic enter the Arctic Ocean between Norway and Svalbard. The currents flow easterly, north of Siberia, to the region of the Novosibirskiye Ostrova, where they turn northerly across the North Pole, and continue down the Greenland coast to form the East Greenland Current. On the American side of the Arctic basin, there is a weak, continuous clockwise flow centred in the vicinity of 80°N, 150°W. A current north through Bering Strait along the American coast is balanced by an outward southerly flow along the Siberian coast, which eventually becomes part of the Kamchatka Current. Each of the main islands or island groups in the Arctic, as far as is known, seems to have a clockwise nearshore circulation around it. The Barents Sea, Kara Sea, and Laptev Sea each have a weak counterclockwise circulation. A similar but weaker counterclockwise current system appears to exist in the East Siberian Sea.

OCEAN CURRENT PHENOMENA

Ocean Eddies And Rings

Eddies with horizontal diameters varying from 50-150 km have their own pattern of surface currents. These features may have either a warm or a cold core and currents flow around this core, either cyclonically for cold cores or anticyclonically for warm cores. The most intense of these features are called rings and are formed by the pinching off of meanders of western boundary currents such as the Gulf Stream. Maximum speed associated with these features is about 2 knots. Rings have also been observed to pinch off from the Agulhas retroflexion and to then drift to the northwest into the South

Atlantic. Similarly, strong anticyclonic eddies are occasionally spawned by the loop current into the Western Gulf Mexico. In general, mesoscale variability is strongest in the region of western boundary currents and in the Circumpolar Current. The strength of mesoscale eddies is greatly reduced at distances of 200-400 km from these strong boundary currents, because mean currents are generally weaker in these regions. The eddies may be sufficiently strong to reverse the direction of the surface currents.

Undercurrents

At the equator and along some ocean boundaries, shallow undercurrents exist, flowing in a direction counter to that at the surface. These currents may affect the operation of submarines or trawlers. The most intense of these flows, called the Pacific Equatorial Undercurrent, is found at the equator in the Pacific. It is centred at a depth of 150m to the west of the Galapagos, is about 4 km wide, and eastward speeds of up to 1.5 m/s have been observed.

Equatorial Undercurrents are also observed in the Atlantic and Indian Ocean, but they are somewhat weaker. In the Atlantic, the Equatorial Undercurrent is found to the east of 24°W and in the Indian Ocean, it appears to be seasonal. Undercurrents also exist along ocean boundaries. They seem to be most ubiquitous at the eastern boundary of oceans. Here they are found at depths of 100-200m, may be 100 km wide, and have maximum speeds of 0.5 m/s.

OCEAN CURRENTS AND CLIMATE

Many of the ocean currents exert a marked influence upon the climate of the coastal regions along which they flow. Thus, warm water from the Gulf Stream, continuing as the North Atlantic, Northeast Drift, and Irminger Currents, arrives off the southwest coast of Iceland, warming it to the extent that Reykjavik has a higher average winter temperature than New York City, far to the south. Great Britain and Labrador are about the same latitude, but the climate of Great Britain is much milder because of the relatively warm currents. The west

coast of the United States is cooled in the summer by the California Current, and warmed in the winter by the Davidson Current. Partly as a result of this circulation, the range of monthly average temperature is comparatively small. Currents exercise other influences besides those on temperature. The pressure pattern is affected materially, as air over a cold current contracts as it is cooled, and that over a warm current expands. As air cools above a cold ocean current, fog is likely to form. Frost smoke occurs over a warm current which flows into a colder region. Evaporation is greater from warm water than from cold water, adding to atmospheric moisture.

OCEAN CURRENT OBSERVATIONS

Historically, our views of the surface circulation of the ocean have been shaped by reports of ocean currents provided by mariners. These observations consist of reports of the difference between the dead reckoning and the observed position of the vessel. These observations were routinely collected until the start of World War II. Two observation systems are generally used for surface current studies. The first utilizes autonomous free-drifting buoys which are tracked by satellite or relay their position via satellite.

These buoys consist of either a spherical or cylindrical surface float which is about 0.5m in diameter with a drogue at a depth of about 35m. The second system utilizes acoustic Doppler current profilers. These profilers utilize hull mounted transducers, operate at a frequency of 150 kHz, and have pulse repetition rates of about 1 second. They can penetrate to about 300m, and, where water is shallower than this depth, track the bottom. Merchant and naval vessels are increasingly being outfitted with acoustic Doppler current profilers which, when operated with the Global Positioning System, provide accurate observations of currents.

MOISTURE IN THE ATMOSPHERE

The troposphere is also known as the weather sphere. This is due to the water vapour in the air. After the tropopause, water vapour doesn't exist in the atmosphere.

MEASUREMENT OF WATER IN THE AIR

The amount of water in the air can be measured in different ways. The specific humidity of air is a measure of how much water is in the air.

Warmer air can hold more water than colder air. When the air reaches its capacity, it is saturated. This capacity doubles for about every 11°C rise in temperature. The term more often used is relative humidity. This is the measure of how much water is in the air divided by how much it can hold. The relative humidity reading is given as a per cent. The relative humidity for saturated air is 100 per cent.

FINDING RELATIVE HUMIDITY

The relative humidity can be found by two different methods. One involves the use of a hygrometer. This is a pointer attached to a piece of hair. As the humidity increases, the hair stretches out. This is your typical "bad-hair day." When the humidity drops, the hair shrinks, causing the needle to point in a different direction. The other method requires the use of two thermometers and a chart. The thermometers and chart all use the Celsius scale.

If you are getting the readings from a station model and need to find the relative humidity, you need to convert the temperature readings from Fahrenheit to Celsius. Station models show the surface observations and weather data for a specific city. One of the thermometers measures the air temperature. This is the dry-bulb reading.

The other thermometer has a wet wick on the bottom of the bulb. Water evaporating from the wick into the air takes energy with it, cooling off the thermometer. As the relative humidity increases, less water can evaporate into the air. This makes the temperature readings between the two thermometers closer. If the air is much drier, the thermometers have readings that are much farther apart.

The difference between the wet and dry-bulb temperatures is called the wet-bulb depression. The wet-bulb temperature is always lower or the same as the dry-bulb temperature. If the temperatures are the same, the relative

humidity is 100 per cent. The wet-bulb depression is used with the dry-bulb temperature and a chart to determine the relative humidity. The instrument with the wet and dry-bulb thermometers is called a psychrometer. A sling psychrometer is a handheld device with the two thermometers that spins around.

DEW POINT

The temperature at which water vapour condenses into liquid water is called the dew point. If the dew point is below 0°C, it is called the frost point. These are important numbers in helping to determine where to post frost and freeze warnings. The dew-point temperature is found in a similar manner to that of relative humidity.

The dry-bulb and wet-bulb temperatures are determined. If the water vapour comes in direct contact with the cooler surface, it can condense onto it. Fog can occur when warm air moves into an area that has a cold surface temperature. An advected fog forms in this situation. This also can be a reverse situation, where cooler air moves over a warmer surface. Ground fog forms by radiational cooling at night. These are common in humid valleys and near rivers and lakes.

CLOUDS

A cloud is formed when air is cooled to its dew-point temperature. The air cools as it rises away from the Earth's surface. If that temperature is above 0°C, the cloud is made of water droplets. If the cloud forms below 0°C, the cloud is made from ice and snow crystals and supercooled water. Cloud formations fall into three categories. Cirrus clouds are very high clouds that are made from ice crystals. They are the thin, feathery clouds you see on a nice day. Stratus clouds are the layered, sheet-like clouds. They are found at lower altitudes. Cumulus clouds are the puffy, cottonlike clouds formed by vertical rising of air. Other clouds are made from combinations and variations of these clouds. The name of a cloud may also contain a prefix or suffix that tells you more about the cloud. Alto (high) and nimbus (rain) are some examples of these.

CLOUD DEVELOPMENT

As a parcel of air rises upward, it cools. The air expands and cools because of the decreasing pressure. The rate at which it cools depends on the amount of moisture in the air. If dry air rises, it cools at a rate of 1°C/100 m. This is the dry adiabatic lapse rate. By adding moisture, this rate changes to 0.6°C/100 m. This is the moist adiabatic lapse rate. The high specific heat of the water is the reason for the difference in the rates. When air at the surface is heated, it rises upward. The air is warmer than the air surrounding it and is less dense, which makes it buoyant.

This is why clouds appear to "float" in the sky. The clouds can continue to develop vertically. Eventually, a cumulonimbus cloud may form. These are thunderstorm clouds that can be associated with heavy rain, hail, strong winds, and tornadoes. These clouds form in an unstable air mass that has air that is moving due to density differences. A cloud can form in a stable air mass, but it rises for other reasons. These are layered clouds that form from air that is forced upward by the land (mountains) or by radiational cooling as the air mixes with a cooler layer of air. Some clouds that form have a flat base and billow out on top. The bottom of the cloud is the place where the air temperature is the same as the dew-point temperature.

This is the point known as the condensation level. The height of the cloud base can be found with a simple formula or a chart. To use the formula, take the difference between the temperature and dew point at the surface and divide it by 0.8°C (the amount that the dew-point temperature gets closer to the air temperature in 100 m).

The result is multiplied by 100, which gives you the lifting condensation level or the height that a cloud can form at. Cloud base altitude can also be found by using the air temperature and the dew point temperature. When the lines meet, read along the side that is labeled "Altitude." This is the height of the cloud base in kilometers. Eventually the cloud and air temperatures become equal. The cloud isn't buoyant at this

point and begins to spread out. This creates the classic anvil-shaped tops that are seen at cloud tops.

PRECIPITATION

In order for water vapour to condense, certain conditions are needed. The air must cool down. This can occur in several different ways. It can come in contact with a colder surface; it can radiate heat; it can mix with colder air; or it can expand as it rises upward. The other ingredient that is needed is condensation nuclei. This provides a surface for condensation to occur.

These particles can be dust, salt, sulfate, or nitrate particles (these form acid rain) in the air. Scientists have seeded clouds to enhance nucleation and produce needed rain. Silver iodide crystals are put into clouds to provide a surface for condensation to occur. In some instances, water vapour can condense and form water droplets (homogenous nucleation), but this is rare. The type of precipitation that forms depends on the air temperature. If this is above the freezing point, rain forms.

If the air temperature is below 0°C, snow forms. Updrafts in a cloud move rain droplets around. As they collide, they collect and get larger. When the drop gets too heavy to stay in up the cloud, it falls to the Earth. Small droplets of rain (less than.02 cm in diameter) are called drizzle. Drops larger than these are called rain. When much larger drops of rain fall, they fall apart into smaller drops by vibrations caused by friction with the air.

Hail forms in a tall cloud with strong updrafts. An ice crystal or frozen raindrop moves though the cloud collecting water droplets. As the hailstone rises up in the cloud, the outer layer freezes. When it falls downward, it gathers more water droplets. This circulation process continues until the hailstone falls to the ground. When you cut a hailstone in half, you can see rings. Like rings in a tree, they can tell the hailstone's history of formation. Some hailstones can reach the size of a softball. These can be very damaging to crops, animals, cars, and other property.

5

Natural Resources

NON-RENEWABLE RESOURCE

A non-renewable resource is a natural resource which cannot be produced, grown, generated, or used on a scale which can sustain its consumption rate. These resources often exist in a fixed amount, or are consumed much faster than nature can create them. Fossil fuels and nuclear power are examples. In contrast, resources such as timber or metals are considered renewable resources.

FOSSIL FUEL

Natural resources such as coal, petroleum, oil and natural gas take thousands of years to form naturally and cannot be replaced as fast as they are being consumed. Eventually natural resources will become too costly to harvest and humanity will need to find other sources of energy. At present, the main energy sources used by humans are non-renewable as they are cheap to produce.

RENEWABLE ALTERNATIVES

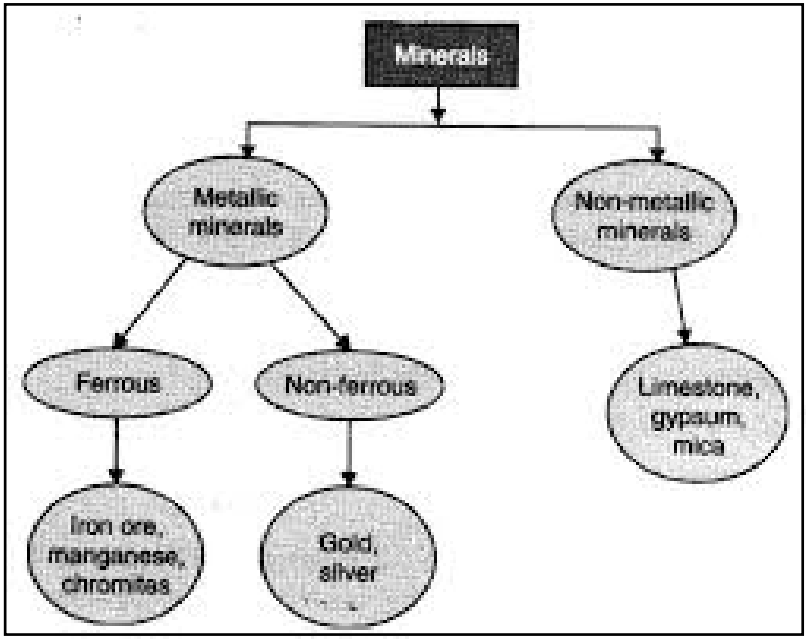
Natural resources, called renewable resources, are replaced by natural processes given a reasonable amount of time. Soil, water, forests, plants, and animals are all renewable resources as long as they are properly conserved. Solar, wind, wave, and geothermal energies are based on renewable resources. Renewable resources such as the movement of water, wind, geothermal heat; and radiant energy are practically infinite and cannot be depleted, unlike their non-renewable counterparts, which are likely to run out if not used wisely.

ECONOMIC MODELS

Hotelling's rule is a 1931 economic model of non-renewle resource management by Harold Hotelling. It shows that efficient exploitation of a nonrenewable and nonaugmentable resource would, under otherwise stable conditions, lead to a depletion of the resource. The rule states that this would lead to a net price or "Hotelling rent" for it that rose annually at a rate equal to the rate of interest, reflecting the increasing scarcity of the resources. The Hartwick's rule provides an important result about the sustainability of welfare in an economy that uses non-renewable source.

NON-FUEL MINERAL RESOURCES

In 1997 was a good year for the New Mexico mining industry in general, with small to modest gains in production for coal, copper, gold, and potash, and major increases for molybdenum and uranium. Industrial mineral production including gypsum, mica, perlite, pumice, aggregate resources was steady with no major fluctuations.



Silver was the only production category significantly down during the year. Total industry production value was $848.9 million. For the second consecutive year, New Mexico ranked 12th among the 50 states in total non-fuel mineral production value.

Information on the location of non-fuel mineral resources in the state; the Overview provides summary information. The Fence Lake coal mine permit was approved in 1997 by the New Mexico Mining and Minerals Division, but is under appeal in State District Court.

Permitting and development of copper operations in southwestern New Mexico continued at Copper Flat and near Tyrone, and Federal- State-Indian jurisdictional issues connected with in-situ leach uranium development at Church Rock and Crownpoint in McKinley County continued to be addressed.

A new pumice operation began production in Sandoval County. The Continental Mines, operated by Cobre Mining Company, was purchased by Phelps Dodge in February 1998. Although exploration for precious metals was limited, permitting for renewed gold mining continued in the Steeple Rock mining district in Grant County. Permits were issued for uranium exploration in McKinley and Bernalillo Counties.

Total mining industry employment was 7,850 in 1997 compared to approximately 8,300 in 1996, a 5% decline for the industry as a whole.

A drop-off in coal employment accounted for most of the decline with other sectors of the industry holding steady. Total reported industry payroll topped $300 million. Revenues generated through production taxes totaled almost $43 million during 1997. Mining industry production, U. S. production rank, production value, employment, payroll and revenue generated. For data and statistics related to coal mining.

COPPER

Copper recovery totaled some 573.6 million pounds in 1997 or 286,800 short tons up 2% over 1996. The 5 year production trend for copper. Copper production was valued at $598.8 million, up 4%. The average producer price for copper in New Mexico increased by $0.02 per lb in 1997 to $1.04 per lb compared to $1.02 per lb in 1996, however copper was at or below $0.80 per lb during the first half of 1998 and by late 1998 had slipped to below $0.75 per lb.

Employment totaled 2,707 people at all mines, mills and smelters during 1997. Out of the total, direct employees numbered 2,543, about 50 less than in 1996. Payroll amounted to $106.8 million in 1997 compared with $104 million in 1996. Four mines and two smelters were active and included Phelps Dodge's Tyrone mine, Playas smelter and Burro Chief operations, Chino Mines Company's Chino mine and Hurley smelter, and Cobre Mining Company's Continental mines. In addition to copper, some 1.1 million tons of coproduct sulfuric acid was produced at the two copper smelters.

Permitting continued for two mines during the year including the Copper Flat mine near Hillsboro and the Little Rock mine near Tyrone. The copper and base metals industry is located principally in Grant and Hidalgo Counties. The state ranks third nationally in copper production after Arizona and Utah. New Mexico copper is used chiefly in the manufacture of electrical wire.

Nationally, copper supply remained tight for the first half of 1997 with prices trending upward. During this period the U.S. producer price averaged about $1.16 per pound. By July, however, commodity exchange inventories began to rise and prices declined. By the end of September exchange inventories had more than doubled from December 1996 levels and the price per lb had fallen to below $1.00.

Recovery of copper from old and new scrap responded accordingly, increasing during the first half of the year and falling during the second half. This market trend of decreasing copper prices that developed in mid- 1997 and intensified during 1998 as the Asian economic depression deepened has

seriously impacted demand for copper and presents a serious situation for the state's largest non-fuel mining sector. Presents a serious situation for the state's largest non-fuel mining sector.

GOLD AND SILVER

Gold, a coproduct of copper processing, improved by 2% in 1997 compared to 1996. ome 28,709 troy ounces of gold were recovered compared with 28,083 in 1996. Five year production trends for both gold and silver, respectively. Gold recovery value was $10.5 million for an average New Mexico producer price of $368.35 per tr oz. Silver recovery fell by 6% with only 468,742 tr oz compared with 501,623 tr oz in 1996. The value of recovered silver was $2.5 million for an average New Mexico producer value of $5.29 per tr oz. Employment and payroll information for precious metals is included in copper industry totals. Permitting for existing gold-mining operations continued at the Centre and Carlisle mines in the Steeple Rock mining district of western Grant County.

Precious metals exploration in the state is currently slow. Precious metals are recovered from copper operations primarily in Grant County. New Mexico ranks last among all gold and silver producing states. Gold and silver are used in coinage, jewelry, computers and other electronic devices. Magnetite and manganiferous ores were produced in southwestern NM but production and value are withheld due to confidentiality. Because gold and silver are primarily coproducts of copper production, decreased copper prices and production will effect the quantity of these precious metals produced in 1998.

MOLYBDENUM

Molybdenum recovery surged during 1997 as Molycorp, the state's only primary molybdenum producer began its second year of renewed operations at its Questa mine and mill in Taos County. Molybdenum is also recovered as a byproduct from copper operations in Grant County. Molybdenum disulfide recovery amounted to 8.3 million lbs in 1997 compared with 1.5 million lbs in 1996. Production value was

$25.1 million, averaging $3.00 per lb. Total employment was 309. Industry payroll amounted to $14.5 million. Molycorp is permitting its Questa tailings facility in Taos County under the New Mexico Mining Act and the New Mexico Water Quality Act. New Mexico is a major molybdenum producing state ranking number 6 in the U. S. Molybdenum is necessary for stainless steel and wear-resistant steel alloy production.

POTASH

Domestic potash production is from three states with the majority of the production from southeastern New Mexico in Eddy and Lea Counties, where three companies operated five mines at the beginning of the year.

These five mines are conventional underground mines of bedded deposits, which have projected lifetimes that range from 1 year to more than 100 years at present prices. Potash ore in the state is beneficiated by flotation, heavy media separation, dissolutionrecrystallization and washing. Potash ore from the state in 1997 provided about 80% of the U.S. producer sales making New Mexico the largest producer of potash in the country. The state also has the nation's largest remaining reserves of potash.

Potash ore mine production decreased in 1997 to 1.64 million short tons compared to 1.78 million tons in 1996. Sales of potassium salts increased from 1.27 to 1.67 million st. Sales value in 1997 was estimated at $179 million down from $225 million in 1996. 1997 average potash industry employment was 1,519 compared to 1,539 in 1996. Industry payroll totaled $72 million for the year.

In September 1997 IMC Global Inc., parent company of IMC Kalium, completed its acquisition of Western Ag-Minerals. Western Ag-Minerals mine and processing plant are located near Carlsbad and adjacent to an existing IMC Kalium potash mining and processing operation.

The existing 1.1 million ton per year facility has ore deposits of three types:

1. Sylvinite, a mixture of potassium chloride and sodium chloride;

2. Langbeinite, a double sulphate of potassium and magnesium;
3. A mixed ore containing both potassium chloride and langbeinite.

In December 1997 only sylvinite and langbeinite ores were being mined. Three types of potash are produced at the potash refinery: muriate of potash which is the primary source of potassium for the crop industry nutrient industry; double sulphate of potash magnesia containing significant amounts of sulphur, potassium and magnesium; and sulphate of potash supplying sulpher and a high concentration of potassium.

Mississippi Potash, Inc. purchased Eddy Potash in 1996 and now has two mines and related facilities near Carlsbad. Prior to the acquisition the company operated only the West Facility which consisted of a mine and refinery located approximately 25 miles east of Carlsbad. The company's potash is mined from subterranean salt deposits containing a mixture of potassium chloride and sodium chloride. These potash deposits are located approximately 800 to 1200 feet below the surface.

INDUSTRIAL MINERALS

Industrial minerals include perlite, pumice, gypsum, salt, mica, aggregates, zeolite, calcite, both silica and chemical limestone flux, Portland cement, mineral dessicants, feldspar, clay, humate and semi-precious gemstones. Information on selected industrial minerals, including employment and U.S. production rank. The industrial minerals industry employed 550 people in 1997 and had a total payroll of 14.9 million. The industry produced 2.4 million st of materials valued at $72.5 million.

New Mexico led the nation in production of perlite, however, production is withheld due to confidentiality. Active operations include Dicaperl, Harborlite, and US Gypsum in Socorro, Taos, and Cibola Counties. 131 employees were reported for the perlite industry. Perlite is used chiefly in construction, filters, and agricultural applications. Production and value statistics for other industrial minerals are withheld

due to confidentiality. In early 1998, Copar Pumice began production at its El Cajete pumice mine in the Jemez Mountains, Sandoval County. Pumice is used in building blocks and by the clothing industry. Franklin Industrial Minerals produces mica at its mine near Penasco in Taos County. Humate is discussed in the Extractive Energy Resources. The sand, gravel and stone mining industry comprised 89 of 139 active mining operations in New Mexico during 1997.

Aggregate resources produced include sand, gravel, base course, caliche, crushed rock, riprap, scoria, fill dirt, and top soil. Total combined production was 13.1 million st valued at $52.7 million. The sand, gravel and stone industry employed 968 people during 1997 representing about 13% of the total mining industry employment.

Aggregate resources are used chiefly in the construction and road building industries. A new turquoise mine opened in May 1997-the Lost Mine of Enchantment, near Ruidoso in Lincoln County. The turquoise is green, mottled with brownish streaks, and is being sold for $3 to $15 a carat.

CARBON DIOXIDE

New Mexico continued to be a national leader in both reserves and production of carbon dioxide during 1997. Carbon dioxide, a heavy, colourless and odorless gas at normal pressure and temperature, has been produced commercially in New Mexico since the early 1930's. Historically, it has enjoyed a wide variety of uses. Yet not until the discover of CO_2 flooding as an enhanced oil recovery technique did demand for CO_2 increase significantly from previous levels.

This, in turn, stimulated the rapid growth of our state's CO_2 industry. Based in the northeast quadrant of New Mexico, the industry is developing what is believed to be the largest deposit of carbon dioxide in the United States. The Bueyeros field, better know as the Bravo Dome, encompasses 1.2 million acres in Harding, Union and Quay Counties. It is estimated to contain over 16 trillion cubic feet of CO_2 reserves. Approximately half of these in-place reserves are considered

to be recoverable using currently available technology. A map showing CO_2 gas fields is provided in the "Who is EMNRD" part at the beginning of this report. Total 1997 CO_2 production was 143 billion cubic feet valued at over $52 million. Virtually all CO_2 marketed in the state is transported to oilfields in the Permian Basin of Texas and New Mexico for use in enhanced oil recovery projects.

RENEWABLE RESOURCE

A natural resource is a renewable resource if it is replaced by natural processes and if replenished with the passage of time. Renewable resources are parts of our natural environment and form our eco-system. In 1962, within a report to the committee on natural resources which was forwarded to the President of the United States, Paul Weiss defined Renewable Resources as: "The total range of living organisms providing man with food, fibres, drugs, etc...". Renewable resources are endangered by industrial developments and growth.

They must be carefully managed to avoid exceeding the natural world's capacity to replenish them. A life cycle assessment provides a systematic means of evaluating renewability. This is a matter of sustainability in the natural environment. Solar radiation, tides, winds and other natural elements are renewable resources of energy now called renewable energies. Gasoline, coal, natural gas, diesel, and other commodities derived from fossil fuels are non-renewable. Unlike fossil fuels, a renewable resource can have a sustainable yield.

RENEWABLE ENERGY

Solar energy is the energy derived directly from the Sun. Along with nuclear energy, it is the most abundant source of energy on Earth. The fastest growing type of alternative energy, increasing at 50 per cent a year, is the photovoltaic cell, which converts sunlight directly into electricity. The Sun yearly delivers more than 10,000 times the energy that humans currently use. Wind power is derived from uneven heating of

the Earth's surface from the Sun and the warm core. Most modern wind power is generated in the form of electricity by converting the rotation of turbine blades into electrical current by means of an electrical generator. In windmills wind energy is used to turn mechanical machinery to do physical work, like crushing grain or pumping water. Hydropower is energy derived from the movement of water in rivers and oceans can likewise be used to generate electricity using turbines, or can be used mechanically to do useful work. It is a very common resource. Geothermal power directly harnesses the natural flow of heat from the ground.

The available energy from natural decay of radioactive elements in the Earth's crust and mantle is approximately equal to that of incoming solar energy. Alcohol derived from corn, sugar cane, switchgrass, etc. is also a renewable source of energy. Similarly, oils from plants and seeds can be used as a substitute for non-renewable diesel. Methane is also considered as a renewable source of energy.

RENEWABLE MATERIALS

Agricultural Products

Techniques in agriculture which allow for minimal or controlled environmental damage qualify as sustainable agriculture. Products from this type of agriculture may be considered "sustainable" when processing, logistics, etc. also have sustainable characteristics.

Biomass

Similarly, forest products such as lumber, plywood, paper, can be renewable resources when produced by sustainable forestry techniques.

Water

Water can be considered a renewable material when carefully controlled usage, treatment, and release are followed. If not, it would become a non-renewable resource at that location. For example, groundwater could be removed from

an aquifer at a rate greater than the sustainable recharge. Removal of water from the pore spaces may cause permanent compaction that cannot be renewed.

LAND RESOURCES

Land, a critically important national resource, supports all living organisms including plants as well as every primary production system such as roads, industries, communication and storage for surface and ground water,among others. The soil profile of land determines its ability to serve socio-economic needs. It has been estimated that more than 5,000 million tonnes of top soil is eroded annually alongwith about 5 million tonnes of nutrients.

About a third of this is lost to the sea, while the rest builds the silt load in reservoirs and river beds leading to floods. About 38% of the area in India suffers from moderate to high degree of water-based erosion, most of which needs suitable soil and water conservation measures such as Watershed Development. Arid areas suffering from moderate or high degree of soil loss comprise upto 4% of the geographical area. Therefore, about 42% of the country's area requires soil and water conservation efforts on a priority basis.

The efficient management of land is vital for economic growth and development of rural areas. The integrated thinking about the need for a land use policy started only in 1972 when a paper entitled "A Charter for the Land" was circulated by Shri B.B. Vohra.

The paper highlighted the dependence of majority of our people on land for their livelihood and pleaded that care for this resource must rank high in our priorities notwithstanding that the Constitution has placed the subject in the State List. It is in this context that the Prime Minister in 1972 had given a challenge to the nation for working out a viable land use policy as follows:

- "We can no longer afford to neglect our most important natural resource. This is not simply an environmental problem but one which is basic to the future of our country. The stark question before us is whether our

soil will be productive enough to sustain a population of one billion by the end of the century at a higher standard of living than now prevails. We must have long term plans to meet this contingency."

The per capita availability of land in the country has declined from 1.37 hectare in 1901 to 0.33 hectare in 2000. Moreover, all the land cannot be made available for agricultural purposes.Some land would be required for other activities and would be located in centre of economic grouth. However, effective steps are required to be taken for preventing diversion of land suitable for sustainable farming to non-farm uses.

Simultaneously, degraded lands and wastelands would require to be improved through efficient adoption of principles of ecological restoration. The Department of Land Resources was set up in April 1999 in the Ministry of Rural Development to act as a Nodal Agency for Land Resource Management. All the land-based programmes/schemes, which earlier were with different Departments of the Ministry, were brought within the purview of the DoLR.

The Area Development Programmes as well as the Wastelands Development Programme are now being implemented through the Watershed Development Approach in accordance with the Guidelines for Watershed Development formulated on the recommendations of the Hanumantha Rao Committee since April, 1995. For achieving comprehensive area development, instructions have also been issued for convergence of all rural development programmes in the areas where watershed development is taken up. The Department comprises two Divisions, namely the Wastelands Development Division and the Land Reforms Division.

Secretary, Ministry of Rural Development heads the Department. He is assisted by one Addl. Secretary, two Joint Secretaries and other officers and officials. The Wastelands Development Division has been implementing various programmes for the development of wastelands/degraded lands. The programmes include the Integrated Wastelands Development Programme, the Drought Prone Areas

Programme, the Desert Development Programme and other allied matters. The Land Reforms Divisioin has been monitoring the progress of implementation of various land reform measures such as abolition of Zamindari System, distribution of ceiling surplus lands, consolidation of land holdings and implementation of tenancy laws etc. In addition, it has been administering the Land Acquisition Act, 1894. The land Reforms Division has also prepared the draft National Policy on Resettlement and Rehabilitation of Project Affected Persons/Families.

The plan allocation for the Department of Land Resources has been increased from `324 crore in 1999-2000 to `900 crore for 2001-2002. Presently 971 Blocks of 183 Districts in 16 States are covered under the Drought Prone Areas Programme. Similarly, 232 Blocks of 40 Districts in 7 States are covered under the Desert Development Programme. The coverage under Integrated Wastelands Development Programme extends generally to the remaining Blocks in the Country. Projects covering an area of 114.69 lac hectares have been taken up from 1.4.1995 to 31.3.2001 under the three programmes namely DPAP, DDP and IWDP. In addition, an area of 63.50 lakh hectares has been taken up for development prior to 31.3.99 under the Employment Assurance Scheme.

Besides the schemes, the Wastelands Development Division also implements Technology Development, Extension and Training Scheme and Investment Promotional Scheme. In the area of Land Reforms, the task of abolition of intermediary tenures has been completed all over the country. Besides, an area of 5.26 million acres of ceiling surplus land, 14.74 million acres of Government wastelands and 2.18 million acres of Bhoodan land has been distributed among the eligible rural poor. Similarly, 0.43 million acres of alienated land has been restored to Scheduled Tribes.

Consolidation of land holdings has taken place in an area of 161.53 million acres. 569 districts have been brought under the scheme of Computerisation of Land Records and its operationalisation has been extended to 2509 talukas/tehsils/ blocks. For the purpose of strengthening of Survey and

Settlement Operations for updation of land records and other allied matters, a scheme for Strengthening of Revenue Administration and Updating of Land Records is under implementation in collaboration with the State Governments. Besides, amendment of the Land Acquisition Act, 1894, and draft National Policy on Resettlement and Rehabilitation of Project Affected Persons/Families are presently under consideration. With the formation of a separate Department of Land Resources, all the Watershed Development Programmes of the Ministry of Rural Development have already been brought within its purview.

However, the programmes relating to conservation, development and management of land resources remain scattered in different Ministries and Departments. At the Joint Session of Parliament in February, 2000, the President of India had made the following announcement:

- "There is an imperative need to put in place an integrated mechanism capable of responding effectively to the challenges of managing our scarce land resources-especially those arising from globalization, liberalization and privatization. The Government will, therefore, bring all the programmes and schemes as well as the institutional infrastructure relating to land in rural areas, under the control of the newly created Department of Land Resources in the Ministry of Rural Development."

The Department of Land Resources had initiated suitable action for implementation of the above announcement. However, final decision on the matter is still awaited.

RESOURCE MANAGEMENT

In organizational studies, resource management is the efficient and effective deployment for an organization's resources when they are needed. Such resources may include financial resources, inventory, human skills, production resources, or information technology. In the realm of project management, processes, techniques and philosophies as to the best approach for allocating resources have been developed.

These include discussions on functional vs. cross-functional resource allocation as well as processes espoused by organizations like the Project Management Institute through their Project Management Body of Knowledge methodology to project management. Resource management is a key element to activity resource estimating and project human resource management.

Both are essential components of a comprehensive project management plan to execute and monitor a project successfully. As is the case with the larger discipline of project management, there are resource management software tools available that automate and assist the process of resource allocation to projects and portfolio resource visibility including supply and demand of resources.

HR MANAGEMENT

This is the science of allocating human resources among various projects or business units, maximizing the utilization of available personnel resources to achieve business goals; and performing the activities that are necessary in the maintenance of that workforce through identification of staffing requirements, planning and oversight of payroll and benefits, education and professional development, and administering their work-life needs. The efficient and effective deployment of an organization's personnel resources where and when they are needed, and in possession of the tools, training and skills required by the work.

CORPORATE RESOURCE MANAGEMENT PROCESS

Large organizations usually have a defined corporate resource management process which mainly guarantees that resources are never over-allocated across multiple projects.

TECHNIQUES

One resource management technique is resource leveling. It aims at smoothing the stock of resources on hand, reducing both excess inventories and shortages. The required data are: the demands for various resources, forecast by time period into

the future as far as is reasonable, as well as the resources' configurations required in those demands, and the supply of the resources, again forecast by time period into the future as far as is reasonable. The goal is to achieve 100% utilization but that is very unlikely, when weighted by important metrics and subject to constraints, for example: meeting a minimum service level, but otherwise minimizing cost. The principle is to invest in resources as stored capabilities, then unleash the capabilities as demanded.

A dimension of resource development is included in resource management by which investment in resources can be retained by a smaller additional investment to develop a new capability that is demanded, at a lower investment than disposing of the current resource and replacing it with another that has the demanded capability. In conservation, resource management is a set of practices pertaining to maintaining natural systems integrity.

Examples of this form of management are air resource management, soil conservation, forestry, wildlife management and water resource management. The broad term for this type of resource management is natural resource management.

6

Population Geography

INTRODUCTION

Human beings evolved under conditions of high mortality due to famines, accidents, illnesses, infections and war and therefore the relatively high fertility rates were essential for species survival.

In spite of the relatively high fertility rates it took all the time from evolution of mankind to the middle of the 19th century for the global population to reach one billion. The twentieth century witnessed an unprecedented rapid improvement in health care technologies and access to health care all over the world; as a result there was a steep fall in the mortality and steep increase in longevity.

The population realised these changes and took steps to reduce their fertility but the decline in fertility was not so steep. As a result the global population has undergone a fourfold increase in a hundred years and has reached 6 billion.

DEMOGRAPHIC TRANSITION

Demographers refer to these changes from stable population with high fertility and mortality to a new stability in population due to low fertility and mortality patterns as demographic transition. Demographic transition occurs in four phases; of these the first three phases are characterized by population growth. In the first phase there is a fall in death rate and improvement in longevity; this leads to population growth. In the second phase there is a fall in birth rate but fall is less steep than fall in death rates and consequently there is

population growth. In the third phase death rates plateau and replacement level of fertility is attained but the population growth continues because of the large size of population in reproductive age group.

The fourth phase is characterized by fall in birth rate to below replacement level and reduction in the proportion of the population in reproductive age group; as a result of these changes population growth ceases and population stabilizes. Experience in some of the developed countries suggest that in some societies even after attainment of stable population there may be a further decline in fertility so that there is a further reduction in the population- so called negative population growth phase of the demographic transition.

Different countries in the world have entered the demographic transition at different periods of time; there are also substantial differences in the rate of demographic transition and time taken to achieve population stabilization.

GLOBAL POPULATION SCENARIO

In 1901 the world population was 1.6 billion. By 1960, it became 3 billion, and by 1987, 5 billion and in 1999, 6 billion. Currently, one billion people are added every 12-13 years. During the last decade there has been substantial decline in birth rate. The reasons for decline vary from society to society; urbanization, rising educational attainment, increasing employment among women, lower infant mortality are some major factors responsible for growing desire for smaller families; increasing awareness and improved access to contraception have made it possible for the majority of the couple to achieve the desired family size.

In some countries slowing of the population growth has been due to an increase in mortality. As a result of all these the decline in the global population growth during the nineties is steeper than the earlier predictions.

Currently, the annual increment is about 80 million. It is expected to decrease to about 64 million by 2020 -25 and to 33 million by 2045 -50; 95% of the growth of population occurs in developing countries. Most demographers believe that the

current accelerated decline in population growth will continue for the next few decades and the medium projections of Population Division of United Nations, that the global population will grow to 8.9 billion by 2050 is likely to be achieved.

CHANGING AGE STRUCTURE OF THE POPULATION

During demographic transition along with the growth in number there are changes in the population age structure. While the importance of the population growth as a determinant of quality of life is universally understood, the profoundly serious consequences of changing age structure especially if it occurs too rapidly is not understood by many.

Population pyramids graphically represent complex changes in age structure of the population so that it can be readily understood and interpreted. The population pyramids for the global population, developed and developing countries. Currently nearly half of the global population is below 25 years of age and one sixth are in the age group 15-24. Their choices, efforts and lifestyles will determine not only the population growth but also future improvement in the quality of life in harmony with global ecology. In developed countries the reproductive age group population is relatively small; their fertility is low and the longevity at birth is high.

Population profiles of these countries resemble a cylinder and not a pyramid.These countries have the advantages of having achieved a stable population but have to face the problems of having a relatively small productive workforce to support the large aged population with substantial non-communicable disease burden. Some of the developing countries have undergone a very rapid decline in the birth rates within a short period.

This enabled them to quickly achieve population stabilization but they do face the problems of rapid changes in the age structure and workforce which may be inadequate to meet their manpower requirements. In contrast the population in most of the developing countries consist of a very large proportion of children and persons in reproductive

age. Because of the large reproductive age group the population will continue to grow even when replacement level of fertility is reached. It is imperative that these countries should generate enough employment opportunities for this work force and utilise the human resources and accelerate their economic growth.

Planners and policy makers in developing countries like India have to take into account the ongoing demographic changes so that available human resources are optimally utilised as agents of change and development to achieve improvement in quality of life.

DEMOGRAPHIC TRANSITION IN INDIA

Over the last four decades there has been rapid fall in Crude Death Rate from 25.1 in 1951 to 9.8 in 1991 and less steep decline in the Crude Birth Rate from 40.8 in 1951 to 29.5 in 1991. The annual exponential population growth rate has been over 2% in the period 1961-90. During the nineties the decline in CBR has been steeper than that in the and consequently, the annual population growth rate has fallen below 2%. The rate of decline in population growth is likely to be further accelerated during the next decade.

The changes in the population growth rates have been relatively slow, steady and sustained. As a result the country was able to achieve a relatively gradual change in the population numbers and age structure. The short and long term adverse consequences of too rapid decline in birth rates and change in age structure on the social and economic development were avoided and the country was able to adapt to these changes without massive disruptions of developmental efforts. In spite of the uniform national norms set under the 100% Centrally Funded and Centrally Sponsored Scheme of Family Welfare, there are substantial differences in the performance between States as assessed by IMR and CBR.

Though the decline in CBR and IMR has occurred in all States, the rate of decline is slower in some States. At one end of the spectrum is Kerala with mortality and fertility rates nearly similar to those in some of the developed countries. At

the other end, there are four large northern States with high Infant Mortality Rate and Fertility Rates. Though the decline in CBR, IMR and CDR has occurred in all States, the rate of decline was slower in some States like U.P. and Bihar.

There are substantial differences in CBR and IMR not only between States but also between the districts in the same state. In view of these findings, the NDC Committee on Population recommended that efforts should be made to provide reproductive and child health services at district level and undertake decentralized area-specific micro planning and implementation of appropriate interventions.

In response to this recommendation Dept of Family Welfare has abolished the practice of fixing targets for individual contraceptives by the Central Government from April 1996 and had initiated decentralized district based, planning, implementation, monitoring and midcourse corrections of FW programme. The experience of states with district based planning, implementation and the impact are being closely monitored.

ENVIRONMENTAL AND ECOLOGICAL CONSEQUENCES

The already densely populated developing countries contribute to over 95% of the population growth and rapid population growth could lead to environmental deterioration. Developed countries are less densely populated and contribute very little to population growth; however, they cause massive ecological damage by the wasteful, unnecessary and unbalanced consumption the consequences of which could adversely affect both the developed and the developing countries.

The review on "Promotion of sustainable development: challenges for environmental policies" in the Economic Survey 1998-99 had covered in detail the major environmental problems, and policy options for improvement; the present review will only briefly touch upon some of the important ecological consequences of demographic transition. In many developing countries continued population growth has resulted in pressure on land, fragmentation of land holding,

collapsing fisheries, shrinking forests, rising temperatures, loss of plant and animal species. Global warming due to increasing use of fossil fuels could have serious effects on the populous coastal regions in developing countries, their food production and essential water supplies.

The Intergovernmental Panel on Climate Change has projected that, if current greenhouse gas emission trends continue, the mean global surface temperature will rise from 1 to 3.5 degrees Celsius in the next century. The panel's best estimate scenario projects a sea-level rise of 15 to 95 centimeters by 2100. The ecological impact of rising oceans would include increased flooding, coastal erosion, salination of aquifers and coastal crop land and displacement of millions of people living near the coast.

Patterns of precipitation are also likely to change, which combined with increased average temperatures, could substantially alter the relative agricultural productivity of different regions. Greenhouse gas emissions are closely linked to both population growth and development. Slower population growth in developing countries and ecologically sustainable lifestyles in developed countries would make reduction in green house gas emission easier to achieve and provide more time and options for adaptation to climate change. Rapid population growth, developmental activities either to meet the growing population or the growing needs of the population as well as changing lifestyles and consumption patterns pose major challenge to preservation and promotion of ecological balance in India.

Some of the major ecological adverse effects reported in India include:

- Severe pressure on the forests due to both the rate of resource use and the nature of use. The per capita forest biomass in the country is only about 6 tons as against the global average of 82 tons.
- Adverse effect on species diversity:
- Conversion of habitat to some other land use such as agriculture, urban development, forestry operation. Some 70-80% of fresh water marshes and lakes in the Gangetic flood plains has been lost in the last 50 years.

- Tropical deforestation and destruction of mangroves for commercial needs and fuel wood. The country's mangrove areas have reduced from 700,000 ha to 453,000 ha in the last 50 years.
- Intense grazing by domestic livestock Poaching and illegal harvesting of wildlife.
- Increase in agricultural area, high use of chemical fertilizers pesticides and weedicides; water stagnation, soil erosion, soil salinity and low productivity.
- High level of biomass burning causing large-scale indoor pollution.
- Encroachment on habitat for rail and road construction thereby fragmenting the habitat. increase in commercial activities such as mining and unsustainable resource extraction.
- Degradation of coastal and other aquatic ecosystems from domestic sewage, pesticides, fertilizers and industrial effluents.
- Over fishing in water bodies and introduction of weeds and exotic species.
- Diversion of water for domestic, industrial and agricultural uses leading to increased river pollution and decrease in self-cleaning properties of rivers.
- Increasing water requirement leading to tapping deeper aquifers which have high content of arsenic or fluoride resulting health problems.
- Disturbance from increased recreational activity and tourism causing pollution of natural ecosystems with wastes left behind by people.

The United Nations Conference on Environment and Development acknowledged population growth, rising income levels, changing technologies, increasing consumption pattern will all have adverse impact on environment. Ensuring that there is no further deterioration depends on choices made by the population about family size, life styles, environmental protection and equity. Availability of appropriate technology and commitment towards ensuring sustainable development

is increasing throughout the world. Because of these, it might be possible to initiate steps to see that the natural carrying capacity of the environment is not damaged beyond recovery and ecological balance is to a large extent maintained. It is imperative that the environmental sustainability of all developmental projects is taken care of by appropriate inputs at the planning, implementation, monitoring and evaluation stages.

URBANIZATION

The proportion of people in developing countries who live in cities has almost doubled since 1960, while in more developed regions the urban share has grown from 61 per cent to 76 per cent. Urbanization is projected to continue well into the next century. By 2030, it is expected that nearly 5 billion of the world's 8.1 billion people will live in cities. India shares this global trend towards urbanisation.

Globally, the number of cities with 10 million or more inhabitants is increasing rapidly, and most of these new "megacities" are in developing regions. In 1960, only New York and Tokyo had more than 10 million people. By 1999, the number of megacities had grown to 17. It is projected that there will be 26 megacities by 2015; more than 10 per cent of the world's population will live in these cities. India's urban population has doubled from 109 million to 218 million during the last two decades and is estimated to reach 300 million by 2000 AD.

As a consequence cities are facing the problem of expanding urban slums. Like many other demographic changes, urbanization has both positive and negative effects. Cities and towns have become the engines of social change and rapid economic development.

Urbanisation is associated with improved access to education, employment, health care; these result in increase in age at marriage, reduction in family size and improvement in health indices. As people have moved towards and into cities, information has flowed outward. Better communication and transportation now link urban and rural areas both

economically and socially creating an urban-rural continuum of communities with improvement in some aspects of lifestyle of both. The ever increasing reach of mass media communicate new ideas, points of reference, and available options are becoming more widely recognized, appreciated and sought. This phenomenon has affected health care, including reproductive health, in many ways.

For instance, radio and television programmes that discuss gender equity, family size preference and family planning options are now reaching formerly isolated rural populations. This can create demand for services for mothers and children, higher contraceptive use, and fewer unwanted pregnancies, smaller healthier families and lead to more rapid population stabilisation. But the rapid growth of urban population also poses some serious challenges.

Urban population growth has outpaced the development of basic minimum services; housing, water supply, sewerage and solid waste disposal are far from adequate; increasing waste generation at home, offices and industries, coupled with poor waste disposal facilities result in rapid environmental deterioration. Increasing automobiles add to air pollution. All these have adverse effect on ecology and health. Poverty persists in urban and peri-urban areas; awareness about the glaring inequities in close urban setting may lead to social unrest.

RURAL POPULATION AND THEIR DEVELOPMENT

Over seventy per cent of India's population still lives in rural areas. There are substantial differences between the states in the proportion of rural and urban population. Agriculture is the largest and one of the most important sector of the rural economy and contributes both to economic growth and employment.

Its contribution to the Gross Domestic Product has declined over the last five decades but agriculture still remains the source of livelihood for over 70 per cent of the country's population. A large proportion of the rural work force is small and consists of marginal farmers and landless agricultural

labourers. There is substantial under employment among these people; both wages and productivity are low. These in turn result in poverty; it is estimated that 320 million people are still living below the poverty line in rural India.

Though poverty has declined over the last three decades, the number of rural poor has in fact increased due to the population growth. Poor tend to have larger families which puts enormous burden on their meagre resources, and prevent them from breaking out of the shackles of poverty. In States like Tamil Nadu where replacement level of fertility has been attained, population growth rates are much lower than in many other States; but the population density is high and so there is a pressure on land. In States like Rajasthan, Uttar Pradesh, Bihar and Madhya Pradesh population is growing rapidly, resulting in increasing pressure on land and resulting land fragmentation. Low productivity of small land holders leads to poverty, low energy intake and under nutrition, and this, in turn, prevents the development thus creating a vicious circle.

In most of the states non-farm employment in rural areas has not grown very much and cannot absorb the growing labour force. Those who are getting educated specially beyond the primary level, may not wish to do manual agricultural work. They would like better opportunities and more remunerative employment. In this context, it is imperative that programmes for skill development, vocational training and technical education are taken up on a large scale in order to generate productive employment in rural areas.

The entire gamut of existing poverty alleviation and employment generation programmes may have to be restructured to meet the newly emerging types of demand for employment. Rural poor have inadequate access to basic minimum services, because of poor connectivity, lack of awareness, inadequate and poorly functional infrastructure. There are ongoing efforts to improve these, but with the growing aspirations of the younger, educated population these efforts may prove to be inadequate to meet the increasing needs both in terms of type and quality of services. Greater

education, awareness and better standard of living among the growing younger age group population would create the required consciousness among them that smaller families are desirable; if all the felt needs for health and family welfare services are fully met, it will be possible to enable them to attain their reproductive goals, achieve substantial decline in the family size and improve quality of life.

WATER SUPPLY

In many parts of developed and developing world, water demand substantially exceeds sustainable water supply. It is estimated that currently 430 millions are living in countries affected by water stress; by 2020 about one fourth of the global population may be facing chronic and recurring shortage of fresh water. In India, water withdrawal is estimated to be twice the rate of aquifer recharge; as a result water tables are falling by one to three meters every year; tapping deeper aquifers have resulted in larger population groups being exposed to newer health hazards such as high fluoride or arsenic content in drinking water.

At the other end of the spectrum, excessive use of water has led to water logging and increasing salinity in some parts of the country. Eventually, both lack of water and water logging could have adverse impact on India's food production. There is very little arable agricultural land which remains unexploited and in many areas, agricultural technology improvement may not be able to ensure further increase in yield per hectare.

It is, therefore, imperative that research in biotechnology for improving development of foodgrains strains that would tolerate salinity and those which would require less water gets high priority. Simultaneously, a movement towards making water harvesting, storage and its need based use part of every citizens life should be taken up.

FOOD SECURITY

Technological innovations in agriculture and increase in area under cultivation have ensured that so far, food

production has kept pace with the population growth. Evolution of global and national food security systems have improved access to food. It is estimated that the global population will grow to 9 billion by 2050 and the food production will double; improvement in purchasing power and changing dietary habits may further add to the requirement of food grains.

Thus, in the next five decades, the food and nutrition security could become critical in many parts of the world especially in the developing countries and pockets of poverty in the developed countries. In India one of the major achievements in the last fifty years has been the green revolution and selfsufficiency in food production. Food grain production has increased from 50.82 in 1950-51 to 200.88 million tons in 1998-99.

It is a matter of concern that while the cereal production has been growing steadily at a rate higher than the population growth rates, the coarse grain and pulse production has not shown a similar increase. Consequently there has been a reduction in the per capita availability of pulses and coarse grains. Over the last five decades there has been a decline in the per capita availability of pulses.

During the last few years the country has imported pulses to meet the requirement. There has been a sharp and sustained increase in cost of pulses, so there is substantial decline in per capita pulses consumption among poorer segment of population. This in turn could have an adverse impact on their protein intake. The pulse component of the "Pulses and Oil Seeds Mission" need to receive a major thrust in terms of R&D and other inputs, so that essential pulse requirement of growing population is fully met. Rising cost of pulses had a beneficial effect also.

Till eighties in central India wages of landless labourers were given in the form Kesari Dal which was cheaper than cereals or coarse grains. Consumption of staple diet of Kesari Dal led to crippling disease of neuro lathyrism. Over the last three decades the rising cost of pulses has made Kesari Dal more expensive than wheat or rice and hence it is no longer

given to labourers as wages for work done; as a result the disease has virtually disappeared from Central India. Over years the coarse grain production has remained stagnant and per capita availability of coarse grain has under gone substantial reduction; there has been a shift away from coarse grains to rice and wheat consumption even among poorer segment of population. One of the benefits of this change is virtual elimination of pellagra which was widely prevalent among low income group population in Deccan Plateau whose staple food was sorghum.

Coarse grains are less expensive than rice and wheat; they can thus provide higher calories for the same cost as compared to rice and wheat. Coarse grains which are locally produced and procured if made available through TPDS at subsidised rate, may not only substantially bring down the subsidy cost without any reduction in calories provided but also improve "targetting"-as only the most needy are likely to access these coarse grains. Another area of concern is the lack of sufficient focus and thrust in horticulture; because of this, availability of vegetables especially green leafy vegetables and yellow/red vegetables throughout the year at affordable cost both in urban and rural areas has remained an unfulfilled dream.

Health and nutrition education emphasizing the importance of consuming these inexpensive rich sources of micronutrients will not result in any change in food habits unless there is harnessing and effective management of horticultural resources in the country to meet the growing needs of the people at affordable cost. States like Tamil Nadu and Himachal Pradesh have initiated some efforts in this direction; similar efforts need be taken up in other states also.

NUTRITION

At the time of independence the country faced two major nutritional problems; one was the threat of famine and acute starvation due to low agricultural production and lack of appropriate food distribution system.

The other was chronic energy deficiency due to poverty, low-literacy, poor access to safe-drinking water, sanitation and

health care; these factors led to wide spread prevalence of infections and ill health in children and adults. Kwashiorkor, marasmus, goitre, beri beri, blindness due to Vitamin-A deficiency and anaemia were major public health problems. The country adopted multi-sectoral, multi-pronged strategy to combat the major nutritional problems and to improve nutritional status of the population. During the last 50 years considerable progress has been achieved. Famines no longer stalk the country.

There has been substantial reduction in moderate and severe undernutrition in children and some improvement in nutritional status of all segments of population. Kwashiorkor, marasmus, pellagra, lathyrism, beri beri and blindness due to severe Vitamin-A deficiency have become rare. However, it is a matter of concern that milder forms of Chronic Energy Deficiency and micronutrient deficiencies continue to be widely prevalent in adults and children. In view of the fact that population growth in India will continue for the next few decades, it is essential that appropriate strategies are devised to improve food and nutrition security of families, identify individuals/families with severe forms of CED and provide them assistance to over come these problem.

Operational strategy to improve the dietary intake of the family and improve nutritional status of the rapidly growing adult population would include:

- Ensuring adequate agricultural production of cereals, pulses, vegetables and other foodstuffs needed to fully meet the requirement of growing population.
- Improving in purchasing power through employment generation and employment assurance schemes.
- Providing subsidised food grains through TPDS to the families below poverty line.
- Exploring feasibility of providing subsidized coarse grains to families Below Poverty Line.

Operational strategies to improve health and nutritional status of the growing numbers of women and children include:

- Pregnant and lactating women-screening to identify women with weight below 40 Kgs and ensuring that

they/their preschool children receive food supplements through Integrated Child Development Services Scheme; adequate antenatal intrapartum and neonatal care.

- 0-6 months infants-Nutrition education for early initiation of lactation protection and promotion of universal breast feeding exclusive breast feeding for the first six months; unless there is specific reason supplementation should not be introduced before 6 months immunisation, growth monitoring and health care.
- Well planned nutrition education to ensure that the infants and children do a) continue to get breasted; b) get appropriate cereal pulse-vegetable based supplement fed to them at least 3-4 times a day– appropriate help in ensuring this through family/ community/work place support; c) immunisation and health care.
- Children in the 0-5 age group; a) screen by weighment to identify children with moderate and severe undernutrition b) provide double quantity supplements through ICDS; c) screening for nutrition and health problems and appropriate intervention.
- Primary school children: a) weigh and identify those with moderate and severe chronic energy deficiency; b) improve dietary intake to these children through the mid-day meal.
- Monitor for improvement in the identified undernourished infants, children and mothers; if no improvement after 2 months refer to physician for identification and treatment of factors that might be responsible for lack of improvement.
- Nutrition education on varying dietary needs of different members of the family and how they can be met by minor modifications from the family meals. Intensive health education for improving the life style of the population coupled with active screening and management of the health problems associated with obesity.

POPULATION PROJECTIONS FOR INDIA AND THEIR IMPLICATIONS

Right from 1958 the Planning Commission has been constituting an Expert Group on Population Projections prior to the preparation of each of the Five Year Plans so that the information on the population status at the time of initiation of the Plan and population projections for future are available during the preparation of the Plan. Population projections have been utilised not only for planning to ensure provision of essentials necessities such as food, shelter and clothing but also prerequisites for human development such as education, employment and health care.

Over the years there has been considerable refinement in the methodology used for population projections and substantial improvement in the accuracy of predictions. The projections made by the Standing Committee on Population Projection in 1988 for the year 1991 was 843.6 million; this figure was within 0.3% of the 846.3 million reported in the Census 1991. In 1996, Technical Group on Population Projections, had work out the population projections for the country and the states for the period 1996 to 2016 on the basis of census 1991 and other available demographic data. Population pyramids for the period 1971 to 2016.

Economic Implications

Population growth and its relation to economic growth has been a matter of debate for over a century. The early Malthusian view was that population growth is likely to impede economic growth because it will put pressure on the available resources, result in reduction in per capita income and resources; this, in turn, will result in deterioration in quality of life.

Contrary to the Malthusian predictions, several of the East Asian countries have been able to achieve economic prosperity and improvement in quality of life inspite of population growth. This has been attributed to the increase in productivity due to development and utilisation of innovative technologies by the young educated population who formed the majority

of the growing population. These countries have been able to exploit the dynamics of demographic transition to achieve economic growth by using the human resources as the engine driving the economic development; improved employment with adequate emoluments has promoted saving and investment which in turn stimulated economic growth.

However, not all countries, which have undergone demographic transition, have been able to transform their economies. Sri Lanka in South Asia underwent demographic transition at the same time as South East Asian countries but has not achieved the economic transition. It is now realised that population growth or demographic transition can have favourable impact on economic growth only when there are optimal interventions aimed at human resource development and appropriate utilisation of available human resources. For India the current phase of demographic transition with low dependency ratio and high working age group population, represents both a challenge and an opportunity.

The challenge is to develop these human resources through appropriate education and skill development and utilise them fully by giving them appropriate jobs with adequate emoluments; if this challenge is met through well planned schemes for HRD and employment generation which are implemented effectively, there will be improved national productivity and personal savings rates; appropriate investment of these savings will help the country to achieve the economic transition from low economic growth-low per capita income to high economic growth-high per capita income.

It is imperative to make the best use of this opportunity so as to enable the country and its citizens to vault to the high income- high economic growth status and stabilize at that level.

INTERSTATE DIFFERENCES

The projected values for the total population in different regions. There are marked differences between States in size of the population and population growth rates, the time by

which replacement level of fertility is to be achieved and age structure of the population. If the present trend continues, most of the Southern and the Western States are likely to achieve TFR of 2.1 by 2010.

Urgent energetic steps to assess and fully meet the unmet needs for maternal and child health care and contraception through improvement in availability and access to family welfare services are needed in the States of UP, MP, Rajasthan and Bihar in order to achieve a faster decline in their mortality and fertility rates. The five states of Bihar, Uttar Pradesh, Madhya Pradesh, Rajasthan and Orissa, which constitute 44% of the total population of India in 1996, will constitute 48% of the total population of India in 2016.

These states will contribute 55% of the total increase in population of the country during the period 1996-2016. In all the states performance in the social and economic sector has been poor. The poor performance is the outcome of poverty, illiteracy and poor development which co-exist and reinforce each other.

The quality and coverage under health services is poor and the unmet need for FW services is about 30%. Urgent energetic steps are required to be initiated to assess and fully meet the unmet needs for maternal and child health care and contraception through improvement in availability and access to family welfare services in the states of UP, MP, Rajasthan and Bihar in order to achieve a faster decline in their mortality and fertility rates.

The performance of these states would determine the year and size of the population at which the country achieves population stabilisation. There are also marked differences between States in socio-economic development. Increasing investments and rapid economic development are likely to occur in the States where literacy rates are high; there is ready availability of skilled work force and adequate infrastructure. In these States, population growth rates are low. If equitable distribution of the income and benefits generated by development is ensured, substantial increase in per capita income and improvement in quality of life could occur in these

States in a relatively short time. In majority of States with high population growth rates, the performance in the social and economic sector has been poor. The poor performance could be the outcome of a variety of factors including paucity of natural, financial or human resources.

Poverty, illiteracy and poor development co-exist and aggravate each other. In order to promote equity and reduce disparity between States, special assistance has been provided to the poorly performing States.

The benefits accrued from such assistance has to a large extent depended upon:

- The States' ability to utilise the available funds; improve quality and coverage of services and facilities, increase efficiency and improve performance
- Community awareness and ability to utilise the available services

In spite of the additional assistance provided, improvement in infrastructure, agriculture and industry have been sub-optimal and the per capita income continues to be low in most of the poorly performing States. These States also have high birth rates and relatively low literacy rates. It is imperative that special efforts are made during the next two decades to break this vicious self perpetuating cycle of poor performance, poor per capita income, poverty, low literacy and high birth rate so that the further widening of disparities between States in terms of per capita income and quality of life is prevented.

The higher population growth rates and low per capita income in poorly performing States are likely to have a major impact on several social sector programmes. The health status of the population in these States is poor; the health sector programme will require inputs not only for improving infrastructure and manpower, but also increasing efficiency and improving performance. The Family Welfare Programme has to address the massive task of meeting all the unmet needs for MCH and contraception so that there is a rapid decline in mortality and fertility rates. Due to high birth rate, the number of children requiring schooling will be large. The emphasis in

the education sector on primary education is essential to ensure that the resource constraints do not result in an increase in either proportion or number of illiterates. Emphasis on prevocational and vocational training in schools will enable these children to acquire skills through which they will find gainful employment later.

Migration

The available data from census shows that until 1991 both internal and international migration has been negligible. The Technical Group while computing the population projection upto 2016, has assumed that the component of migration between major States and from India will be negligible. This assumption may not be valid if there is further widening of the disparity between States in terms of economic growth and employment opportunity.

Given the combination of high population growth, low literacy and lack of employment opportunities in the poorly performing States, there may be increasing rural to urban migration as well as interstate migration especially of unskilled workers. Such migration may in the short run assist the migrants in overcoming economic problems associated with unemployment.

However, the migrant workers and their families may face problems in securing shelter, education and health care. It is essential to build up a mechanism for monitoring these changes. Steps will have to be taken to provide for the minimum essential needs of the vulnerable migrant population.

Labour, Employment and Manpower

Population, which is engaged in any economic activity and population seeking work constitute Labour Force. India has the second largest labour force in the world. Projection of labour force is pre-requisite ensuring optimal utilisation of available human resources. Manpower development is then taken up to provide adequate labour force, of appropriate skills and quality to different sectors so that there is rapid

socioeconomic development and there is no mismatch between skills required and skills available. Planning also attempts to provide enabling environment for employment generation in public, private and voluntary sectors in urban and rural areas. Labour force in India will be increasing by more than 10 million per annum during 1997-2012. It will be imperative to plan for and achieve adequate agricultural and industrial growth to absorb this work force. Most of the persons entering the labour force will be educated and have some skills.

Increasing literacy and decreasing birth rates may result in more women seeking economically productive work outside home. It will be important to generate appropriate and renumerative employment at places where labour force are available so as to reduce interstate and urban migration in search of employment. Attempts should be made to eliminate bonded labour, employment of children and women in hazardous industries and minimising occupational health hazards.

Planners face the challenge to have sustained high economic growth rate in sectors that are labour-intensive to ensure adequate employment generation for productively utilising this massive work force. If the massive work force of literate, skilled, aware men and women in age-group 20-60 years get fully employed and adequately paid they could trigger off a period of rapid economic development. As they have very few dependant children and elders there will be increased savings and investments at household level; this in turn will improve the availability of resources for accelerating economic growth. The current stage of demographic transition thus provides the country with the opportunity window for using human resources as the engine to power economic development and improving the quality of life of all the citizens.

Sex Ratio

The reported decline in the sex ratio during the current century has been a cause for concern. The factors responsible for this continued decline are as yet not clearly identified.

However, it is well recognised that the adverse sex ratio is a reflection of the gender disparity. Higher childhood mortality in girl children is yet another facet of the existing gender disparities and consequent adverse effect on survival. In the reproductive age group the mortality rates among women are higher than those among men.

The continued high maternal mortality is one of the major factors responsible for this. Effective implementation of the Reproductive and Child Health Programme is expected to result in a substantial reduction in maternal mortality. At the moment, the longevity at birth among women is only marginally higher than that among men. However over the next decade life expectancy among women will progressively increase. Once the reproductive age group is crossed, the mortality rates among women are lower as women outlive and outnumber men in the age group 65 and above.

The needs especially of the widowed women have to be met so that quality of life does not deteriorate. The census 2001 will collect and report vital data on sex disaggregated basis; this will be of help in identifying and taking up appropriate interventions in correcting gender disparity; continued collection, collation, analysis and reporting of sex disaggregated data from all social sectors will also provide a mechanism to monitor whether girls and women have equal access to services. There are substantial differences in sex ratio at birth and in different age groups between states.

The SRS based estimates of average sex ratio at birth for the period 1981-90 for the major States. The observed sex ratio of 110 is higher than the internationally accepted sex ratio at birth of 106. There are substantial differences among states in the reported sex ratio at birth. There had been speculations whether female infanticide, sex determination and selective female foeticide are at least in part responsible for this. The Government of India has enacted a legislation banning the prenatal sex determination and selective abortion. Intensive community education efforts are under way to combat these practices, especially in pockets from where female infanticide and foeticide have been reported.

INCREASING LONGEVITY

The projected populations of India in the three major age groups. Over the coming decades the country will be facing a progressive increase both in the proportion and number of persons beyond 60 years of age. Over the next 20 years the population of more than 60 years will grow form 62.3 million to 112.9 million; the subsequent decades will witness massive increase in this age group. Increasing longevity will inevitably bring in its wake increase in the prevalence of non-communicable diseases.

The growing number of senior citizens in the country poses a major challenge and the cost of providing socio-economic security and health care to this population has to be met. Currently several region and culture specific innovative interventions to provide needed care to this population are underway; among these are efforts to reverse the trend of break up of joint families. If these efforts succeed, it will be possible to provide necessary care for rapidly increasing population of senior citizens in the subsequent two decades within the resources of the family and the country. Majority of the people in their sixties will be physically and psychologically fit and would like to participate both in economic and social activities.

They should be encouraged and supported to lead a productive life and contribute to the national development. Senior citizens in their seventies and beyond and those with health problems would require assistance. So far, the families have borne major share in caring for the elderly. This will remain the ideal method; however, there are growing number of elderly without family support; for them, alternate modes for caring may have to be evolved and implemented. Improved health care has “added years to life”. The social sectors have to make the necessary provisions for improving the quality of life of these senior citizens so that they truly “ add life to years.”

HEALTH IMPLICATION OF THE DEMOGRAPHIC TRANSITION

It was earlier assumed that population growth during demographic transition will lead to overcrowding, poverty,

undernutrition, environmental deterioration, poor quality of life and increase in disease burden. Experience in the last few decades have shown that this may not always be correct. India is currently in the phase of demographic transition when the increase in population is mainly among younger, better educated and healthy population with low morbidity and mortality rate. The challenge for the health sector is to promote healthy life styles, improve access to and utilisation of health care so that the country can achieve substantial reduction in mortality and morbidity.

Occupational health and environmental health programme need be augmented to ensure that working population remain healthy and productive. If these challenges are fully met, it is possible to accelerate reduction in morbidity and mortality rate in this age group and improve health indices of the country. With growing number of senior citizens there may be substantial increase in health care needs especially for management of non-communicable diseases. Increasing availability and awareness about technological advances for management of these problems, rising expectations of the population and the ever escalating cost of health care are some of the problems that the health care system has to cope with. Health care delivery systems will have to gear up to taking up necessary preventive, promotive, curative and rehabilitative care for growing population of senior citizens.

POPULATION PROJECTIONS AND THEIR IMPLICATIONS FOR THE FW PROGRAMME

There will be a marginal decline in the population less than 15 years of age. The health care infrastructure will therefore be not grappling with ever increasing number of children for providing care and they will be able to concentrate on:

- Improving quality of care;
- Focus on antenatal, intranatal and neonatal care aimed at reducing neonatal morbidity and mortality;
- Improve coverage and quality of health care to vulnerable and underserved adolescents;

- Promote intersectoral coordination especially with ICDS programme so that there is improvement in health and nutritional status;
- Improve coverage for immunization against vaccine preventable diseases.

The economic challenge is to provide needed funds so that these children have access to nutrition, education and skill development. The challenge faced by the health sector is to achieve reduction in morbidity and mortality rate in infancy and childhood, to improve nutritional status and eliminate ill-effects of gender bias. There will be a massive increase of population in the 15-59 age group. The persons in this age group will be more literate and have greater access to information; they will therefore have greater awareness and expectation regarding both the access to a wide spectrum of health care related services and the quality of these services.

Under the Reproductive and child health care programme efforts are underway to provide:

- Needed services for this rapid growing population;
- To broaden the spectrum of services available;
- To improve quality and coverage of health care to women, children and adolescents, so that their felt needs for health care are fully met;
- To improve the participation of men in the planned parenthood movement.

The components of the comprehensive RCH services are given in the text box. While providing the package of services, efforts will have to be made to improve the quality of services, make services more responsive to users' needs, ensure that health workers and health care providers have the necessary skills and supplies they need and there is a strong and effective referral system to manage all the risk cases.

Family welfare Programme is attempting to improve the logistics of supply of drugs and vaccine to make sure good quality drugs are available at appropriate time.

Simultaneously the IEC efforts are being directed to:

- Ensure responsible reproductive/sexual behaviour;
- Improve awareness about reproductive health needs;

- Promote community participation and optimal utilisation of available services.

ESSENTIAL REPRODUCTIVE AND CHILD HEALTH SERVICES

Though it is desirable that the entire package of services indicated under comprehensive RCH care is made available to all those who need it, it will not be possible to immediately implement such a comprehensive package at primary health care level on a nationwide basis. After consultation with experts a package of essential reproductive health services for nationwide implementation at primary health care settings has been identified.

Essential components recommended for nationwide implementation include:

- Prevention and management of unwanted pregnancy;
- Services to provide antenatal, intra-natal and post-natal, and neo-natal care;
- Services to promote child health and survival;
- Prevention and treatment of RTI/STD.

Most of these services are already being delivered under the Family Welfare Programme. However, there are wide variations in the quality and coverage of services not only between states but also between districts in the same state.

The focus under RCH Programme is therefore on the improvement in the quality and coverage of the services over and above the existing level in all districts/states in an incremental manner so that there is over all improvement maternal and child health indices.

7

Culture Geography

INTRODUCTION

Cultural geography is a sub-field within human geography. Cultural geography is the study of cultural products and norms and their variations across and relations to spaces and places. It focuses on describing and analysing the ways language, religion, economy, government and other cultural phenomena vary or remain constant, from one place to another and on explaining how humans function spatially.

AREAS OF STUDY

The areas of study of cultural geography are very broad. *Among many applicable topics within the field of study are*:

- Globalization has been theorised as an explanation for cultural convergence.
- Westernization or other similar processes such as modernization, americanization, islamization and others.
- Theories of cultural hegemony or cultural assimilation via cultural imperialism.
- Cultural areal differentiation, as a study of differences in way of life encompassing ideas, attitudes, languages, practices, institutions and structures of power and whole range of cultural practices in geographical areas.
- Study of cultural landscapes.
- Other topics include spirit of place, colonialism, post-colonialism, internationalism, immigration, emigration and ecotourism.

HISTORY

Though the first traces of the study of different nations and cultures on Earth can be dated back to ancient geographers such as Ptolemy or Strabo, cultural geography as academic study firstly emerged as an alternative to the environmental determinist theories of the early Twentieth century, which had believed that people and societies are controlled by the environment in which they develop.

Rather than studying pre-determined regions based upon environmental classifications, cultural geography became interested in cultural landscapes. This was led by Carl O. Sauer, at the University of California, Berkeley. As a result, cultural geography was long dominated by American writers. Sauer defined the landscape as the defining unit of geographic study. He saw that cultures and societies both developed out of their landscape, but also shaped them too.

This interaction between the 'natural' landscape and humans creates the 'cultural landscape'. Sauer's work was highly qualitative and descriptive and was surpassed in the 1930s by the regional geography of Richard Hartshorne, followed by the quantitative revolution.

Cultural geography was generally sidelined, though writers such as David Lowenthal continued to work on the concept of landscape. In the 1970s, the critique of positivism in geography caused geographers to look beyond the quantitative geography for its ideas. One of these re-assessed areas was also cultural geography.

NEW CULTURAL GEOGRAPHY

Since the 1980s, a "new cultural geography" has emerged, drawing on a diverse set of theoretical traditions, including Marxist political-economic models, feminist theory, post-colonial theory, post-structuralism and psychoanalysis.

Drawing particularly from the theories of Michel Foucault and performativity in western academia, and the more diverse influences of postcolonial theory, there has been a concerted effort to deconstruct the cultural in order to make apparent the various power relations.

A particular area of interest is that of identity politics and construction of identity.

Examples of areas of study include:

- Feminist geography
- Children's geographies
- Some parts of Tourism geography
- Behavioural geography
- Sexuality and space
- Some more recent developments in Political geography

Some within the 'new cultural geography' have turned their attention to critiquing some of its ideas, seeing its views on identity and space as static. It has followed the critiques of Foucault made by other 'poststructuralist' theorists such as Michel de Certeau and Gilles Deleuze. In this area, non-representational geography and population mobility research have dominated. Others have attempted to incorporate these critiques back into the new cultural geography.

AUTO-SEGREGATION

Auto-segregation is the separation of a religious or ethnic group from the rest of society in a state by the group itself. Through auto-segregation, the members of the separate group can establish their own services, and maintain their own traditions and customs. For example, some world tribes have preferred to stay in reservations and not to integrate with the rest of the state's population. By remaining in a reservation or on their original lands, they can preserve their language and beliefs. On the other hand, some supremacist groups self-segregate to avoid integrating with other groups that they consider inferior. Racists, radical Islamists, Orthodox Jews, ultranationalists, different Hindu castes and other supremacist or ethno-centric groups commonly segregate themselves from other communities through various practices like endogamy. The apartheid system in South Africa is an extreme example of this trend.

ENDOGAMY AS SELF-SEGREGATION

Endogamy encourages group affiliation and bonding. It

is a common practice among displanted cultures attempting to make roots in new countries whilst still resisting complete integration, as it encourages group solidarity and ensures greater control over group resources. However endogamy can also serve as a form of self-segregation and helps a community to resist integrating with surrounding populations. It thus helps minorities to survive as separate communities over a long time, in societies with other practices and beliefs. Ethno-religious groups which have successfully resisted complete integration for the longest, for example the Romany gypsies, the Ashkenazi Jews of Europe and the white people of South Africa, practise a higher level of endogamy.

Islam typically enforces a limited form of endogamy, Muslim men can take wives from neighbouring non-muslim populations but Muslim women are normally forbidden to marry outside of the Muslim community. This may be to ensure that Islam spreads into surrounding populations and is not diluted through integration with them.

CHILDREN'S STREET CULTURE

Children's street culture refers to the cumulative culture created by young children. Collectively, this body of knowledge is passed down from one generation of urban children to the next, and can also be passed between different groups of children. It is most common in children between the ages of seven and twelve. It is strongest in urban working class industrial districts where children are traditionally free to "play out" in the streets for long periods without supervision.

DIFFERENCE FROM MASS MEDIA CULTURE

Children's street culture is invented and largely sustained by children themselves, although it may come to incorporate fragments of media culture and toys in its activities. It is not to be confused with the commercial media-culture produced for children, although it may overlap.

LOCATION AND PLAY MATERIALS

Young children's street culture usually takes place on

quiet backstreets and sidewalks, and along routes that venture out into local parks, playgrounds, scrub and wasteland, and to local shops. It can often incorporate many found and scavenged materials such as old car seats, tyres, planks, bricks, etc. Sometimes found materials will be combined to create objects. Play will often incorporate crazes.

It also imposes imaginative status on certain parts of the urban realm. In summer children may use scavenged materials to create a temporary and semi-hidden 'den' or 'hideout' or 'HQ' in a marginal area near their homes, that serves as an informal meeting and relaxation place during the summer. An urban area that looks faceless or neglected to an adult may have deep 'spirit of place' meanings in children's street culture.

HISTORY AND RESEARCH

Although it varies from place to place, research shows that it appears to share many commonalities across many cultures. It is a traditional phenomenon that has been closely investigated and documented in the western world during the 20th century by anthropologists and folklorists such as Iona Opie; street photographers such as Roger Mayne, Helen Levitt, David Trainer, Humphrey Spender and Robert Doisneau; urbanists such as Colin Ward and Robin Moore, as well as being described in countless novels of childhood. The research of Robin Moore stresses children's need for 'marginal' unsupervised areas 'within running distance' of homes.

There are now two academic journals devoted to this area, the Journal of Children's Geographies and Play and Folklore. It has occasionally been central to feature films, such as the Our Gang series, Ealing's Hue and Cry and some Children's Film Foundation films. Since the advent of distractions such as video games, and television, concerns have been expressed about the vitality-or even the survival-of children's street culture.

CHILDREN'S URBAN LEGENDS

Many informal groups of small children will develop some level of superstitious beliefs about their local area. For

instance:- they will believe that there are certain places that are 'unlucky' to step on or touch or that an old woman is a 'witch', or that an abandoned house is 'haunted'. But in some extreme circumstances a consistent mythos may emerge among young children, and across a large area.

One example dates from 1997, The Miami New Times published Lynda Edwards' report "Myths Over Miami", which describes a huge consistent mythology spreading among young homeless children in the American South. The story has been picked up and reprinted many times on internet blogs and websites.

There is no known verification or confirmation that the mythology she describes actually exists, but these "secret stories" are clearly based on known elements of street culture, such as labeling certain places "haunted" or recycling legends of dangerous spirits such as Mary Worth. The object was the basis for Mercedes Lackey's novel Mad Maudlin, co-written with Rosemary Edghill.

CIVILIZATION

Civilization is a sometimes controversial term which has been used in several related ways. Primarily, the term has been used to refer to human cultures which are complex in terms of technology, science, politics and division of labour. Such civilizations are generally urbanized.

In classical contexts civilized peoples were called this in contrast to "barbarian" peoples, while in modern contexts civilized peoples have been contrasted to "primitive" peoples. In modern academic discussions however, there is a tendency to use the term in a more neutral way to mean approximately the same thing as "culture" and can refer to any human society associated with any particular geographical location at a particular time, historical or current.

Still, even when used in this second sense, the word is often restricted to apply only to societies that have attained a particular level of advancement, especially the founding of cities, with the word "city" defined in various ways. The level of advancement of a civilization is often measured by its

progress in agriculture, long-distance trade, occupational specialization, and urbanism. Aside from these core elements, civilization is often marked by any combination of a number of secondary elements, including a developed transportation system, writing, standards of measurement, contract and tort-based legal systems, characteristic art styles, monumental architecture, mathematics, science, sophisticated metallurgy, politics, and astronomy.

COLONIALISM

Colonialism is the establishment, maintenance, acquisition and expansion of colonies in one territory by people from another territory. Colonialism is a process whereby sovereignty over the colony is claimed by the metropole and the social structure, government, and economics of the colony are changed by colonists-people from the metropole. Colonialism is a set of unequal relationships: between the metropole and the colony, and between the colonists and the indigenous population.

The term colonialism normally refers to a period of history from the late 15th to the 20th century when European nation states established colonies on other continents. In this period, the justifications for colonialism included various factors such as the profits to be made, the expansion of the power of the metropole and various religious and political beliefs. Colonialism and imperialism were ideologically linked with mercantilism. Collins English Dictionary defines colonialism as "the policy of acquiring and maintaining colonies, especially for exploitation."

The Merriam-Webster Dictionary offers four definitions, including "something characteristic of a colony" and "control by one power over a dependent area or people." The Stanford Encyclopedia of Philosophy "uses the term 'colonialism' to describe the process of European settlement and political control over the rest of the world, including Americas, Australia, and parts of Africa and Asia." It discusses the distinction between colonialism and imperialism and states that "[g]iven the difficulty of consistently distinguishing

between the two terms, this entry will use colonialism as a broad concept that refers to the project of European political domination from the sixteenth to the twentieth centuries that ended with the national liberation movements of the 1960s."

In his preface to Jürgen Osterhammel's Colonialism: A Theoretical Overview, Roger Tignor says, "For Osterhammel, the essence of colonialism is the existence of colonies, which are by definition governed differently from other territories such as protectorates or informal spheres of influence." In the book, Osterhammel asks, "How can 'colonialism' be defined independently from 'colony?'"

He settles on a three-sentence definition:

- Colonialism is a relationship between an indigenous majority and a minority of foreign invaders. The fundamental decisions affecting the lives of the colonized people are made and implemented by the colonial rulers in pursuit of interests that are often defined in a distant metropolis. Rejecting cultural compromises with the colonized population, the colonisers are convinced of their own superiority and their ordained mandate to rule.

COSMOPOLITANISM

Cosmopolitanism is the belief that everyone exists in a globally constructed ethical-political order. The purpose of this paper is to unpack this definition. Such a definition, I believe, strikes at the core of many iterations of cosmopolitanism today. But it is not my intention to provide an intellectual history of the term here. Rather, I will seek to explicate my own understanding of the term in relation to our contemporary epoch.

Many forms of cosmopolitanism today come from a Kantian liberal perspective, basing their conceptions of cosmopolitanism on Kant's articulation of the term. Alternatively, I will seek to provide an interpretation of cosmopolitanism through going to the roots of the word in its first articulations in ancient Greek discourse. Cosmopolitanism has meet with much criticism and skepticism in some circles.

And such a concept is indeed frightening if it is not critically evaluated in terms of the global era in which we live. This is why I will discuss the global context in which the term "cosmopolitanism" gains meaning today.

After examining this context, I shall begin to unpack my own understanding of the term through looking back at the term's etymological origins. And finally, I will complete the explication of my definition through applying the arguments of the previous part to the global context and laying out some of its normative implications.

THE GLOBAL ERA, OR, WHY SHOULD WE CARE

The increased interconnection of people on a global scale has problematized the ethical-political boundaries associated with the nation-state. Such boundaries are by no means obsolete. But as processes of globalization bring people into new relationships with those beyond their national borders, those borders have increasingly become points of reflection and contention.

Undoubtedly, people have been closely interconnected for thousands of years. And each era has struggled to construct economic, moral, and political frameworks to mediate such interconnections. During the modern era, the international state system was devised in Europe to contain economic and political decision-making under a sovereign authority. Such developments generated struggles to create and sustain ethical-political attitudes framed in terms of national solidarity. Sometimes these ethical-national characteristics were "pre-political," as in the case of Germany; others, such as France, were actively constructed in service of political unification. But in each case, they served to create normative ideals for ethical-political unity.

International laws, customs, and treaties, served as the framework to adjudicate relations with other sovereign nations. Thus with the onset of modernity, the international state system became the primary normative institutional framework to contain ethical-political relationships. And despite it's imperfect realization at times, this system has

become global in scope. The international state system was conceived over three hundred years ago against the existing socio-political context in Europe. Yet, it has been argued that, today, globalization has significantly altered the ways in which people interact across these political boundaries. The globalization of organized violence, global economic trade and finance, multinational/transnational corporate organization, increased migrations and cultural transmissions across borders, and the potential for global environmental catastrophe have called into question the constructed boundaries of the nation-state and have raised normative questions for ethical and political relationships in an increasingly global age.

Issues of human rights and the decision-making and regulative capacities of supranational governance structures only generated further reflection. Cosmopolitans have responded to this context with a variety of claims. These claims can be roughly divided into moral and political categories. Moral claims examine what moral or ethical responsibilities result from our shared humanity as it is experienced in a global age. Political cosmopolitanism outlines proposals for legal or political solutions to global problems.

These claims can be broken down as follows:

- Moral
  - Global poverty requires a moral dedication to redistributive efforts across boundaries.
  - The pursuit of national-self interest or unilateral political action should be balanced by concerns for the effect of such actions on the broader global community.
  - Nations have a duty to uphold morally grounded human rights and a responsibility to protect violations of such human rights.
- Political
  - Processes of globalization have threatened the autonomy of nationally based decisionmaking and, in particular, the popular sovereignty of democratic states.

- People have become subject to an increasing number of decision-making bodies beyond the state without any corresponding rights to participate in their decision-making processes.
- A number of issues of global or regional concern have emerged that require action beyond the level of the nation-state.

Within the literature on cosmopolitanism, these claims are espoused and contested on both theoretical and empirical grounds. It is not my intention to outline the depths of these debates here, but only to explicate the claims made about the current era in which we live and their importance for understanding the cosmopolitan position.

These arguments are not always made in ways that are compatible with one another. Moral cosmopolitans frequently do not posit political solutions to moral problems, and sometimes argue against them. Some political cosmopolitans deliberately avoid making moral arguments, while others critique them as being metaphysical, imperialist, or incapable of being enforced without proper institutional support. The guiding principle for moral cosmopolitanism is a global moral order based on shared humanity.

For political cosmopolitanism, the guiding principle is a global political order based on shared subjection to political power. Despite their differences, both the moral and political cosmopolitans assume that such problems create certain obligations that are universally binding across national boundaries. The global era creates conditions whereby people exist in ethical and/or political relationships with one another on a global scale. The arguments of both moral and political cosmopolitans serve to posit a normative order that recognizes such a condition.

CONSTRUCTING COSMOPOLITANISM: COSMOPOLITANISM IN A GLOBAL ERA

So what does such an investigation into the ancient Greek roots of the term “cosmopolitanism” offer us in terms of the contemporary global era? We no longer look up into the sky

and base an understanding of our ethical-political world on imaginative intimations of cosmos. We now live in a post-metaphysical context where such speculations are viewed as irrelevant with respect to demystified, modern scientific worldviews.

And we no longer live in the tight community of the polis where ethics and politics are loath to be separated. The nation state, in many respects, was envisaged as an ethical-political relationship; however, in the contemporary world of pluralism and multiculturalism, ethics and politics are more easily separated and are often considered irrespective of one another. Also, theories of ethical-political relationships beyond the nation-state have come under criticism for being irreconcilable with the nation-state system. Despite their continued problems, the democratic nation-state has been the preeminent normative framework for ethical political order in the modern era. And the nation-state system has provided the foundations for adjudicating relationships between states under the normative order of sovereign equality.

Law and legalistic forms of justice are widely administered just as to such a framework. But it is my argument that cosmopolitanism, as it is articulated above, is even more salient today than when it was first articulated nearly twenty-five hundred years ago. The claims of moral and political cosmopolitans portray a global era in which the contemporary practices of people, groups, and institutions, have deepened human interactions on a global level. Such actions construct a global context where ethical and political concerns can no longer, if they ever did, be contained solely within the frame of the nation-state.

People's participation in such a context constructs a world in which individuals and groups are increasingly engaged in ethical and/or political relationships with others beyond their national boundaries. However, corresponding rights and duties have not emerged in order to meet these new conditions. It is within this context that we can apply the cosmopolitan principles articulated above. Many of us no longer share Timaeus or Diogenes' views of the kosmos. However, their

discourses were articulated, not in the service of scientifically explaining the natural world, but as a means to investigate and provide normative principles for order in human ethical-political relationships.

Such principles are important for analysing the global era for four reasons:

1. For in a global era, cosmopolitanism suggests that it is necessary to view ethical-political life from a global standpoint. Interrelations on local, national, transnational, regional, and supranational levels require a global frame of analysis. Although globalization might affect different regions disproportionately, it constructs and intensifies human relations on a global scale. An analysis of people's ethical-political relations must take this into account.
2. The nation-state emerged in a distinctive historical context, and political actors of the time participated—often disproportionately—in forming ethical-political relations to realise state-bound national political orders. As such, in an era of shifting forms of governance on a global scale, it is necessary to assess principles of ethical-political relationships in terms of the contemporary exercise of social and political power.
3. As globalization brings people closer together beyond the frame of the nation-state, people from diverse backgrounds are being brought together in ever widening and deepening relationships. Today, incredibly diverse individuals are increasingly unified around the world. It is crucial now to analyse the ways in which such a unity is constituted and, normatively, how to preserve difference in the face of ever-closer unions.
4. And in a changing context of mounting exercises of power on a global scale, it has become important to evaluate the status and prospects of freedom, particularly the freedom to critically participate in public discourse around the exercise of power on a global scale, in terms of the global era.

The polis, or political association, is currently conceived in terms of the nation-state as it is realised in the international state system. Such a context creates a dualistic political and legal system where formal politics either occurs a) within the framework of the state, or b) between states as political actors themselves. Law is either a) internal to a polity, concerned with citizens, or b) formed through agreements and customs realised between states as the subjects of international law. Some have argued that this necessarily limits the field of political relations to the political within and between nation-states. In other words, because the formal political institutions are state-based, the normative frame for political action must be limited to national institutions.

In another respect, legalistic conceptions of justice based on national identity, have framed the scope of ethical responsibility either primarily within a national framework. Such an outlook reflects a particular interpretation of the concept of politês. Such positions begin from the context of established political institutions as they are distinct from their members. This means that political institutions—often, today, state bureaucracies—exist separately from their members. Politics occurs within these formal political channels by virtue of membership in them. And in that, for some, the membership boundaries of the politeia designate ethical-national relationships, ethical relationships should exist at their strongest within the national community.

Cosmopolitan perspectives would view the issue of the ethical-political association from a different perspective. As I have sought to demonstrate in my reflection of politês above, the polity is constructed by the actions of those who are a part of it. People come together to form political associations in order to engage in public opinion- and will-formation around governing their lives. This means that ethical-political membership need not be limited to the existing forms of political institutions but should reflect conditions of political action around the globe. Cosmopolitan perspectives suggest that new ethical and political standards might be required to meet the needs of ethical and/or political relationships in the

global era where new modes of ethical and political associations are under formation. Such positions are based on the current distribution of governance structures around the globe, the rise of transnational social movements, and the increased intensity of relationships between people beyond formal political boundaries.

Rather than beginning from the given national framework for normatively assessing ethical responsibility and distributing political power, cosmopolitanism would seek to evaluate the current ethical and political practices of individuals, groups, and institutions in the global era.

From this perspective, it is:

- Necessary to reevaluate the current boundaries of ethical and political relationships and determine who are a part of such relationships.
- To articulate what rights, duties and responsibilities people owe one another based on such relationships. Such a position is based on the assumption that.
- If people are subject to ethical and/or political relationships with others beyond the state, they should have ethical or political standing in that relationship. And thus, this position.
- Presupposes the constitutive nature of ethical and political relationships beyond the frame of the nation-state in forming post-national ethical and political communities.

In sum, the cosmopolitan perspective takes the interrelations between people around the globe as the constitutive basis for a global ethical-political order of ethical. Cosmopolitanism assumes that the actions of people across the globe in an increasingly globalized era constructs ethical and political relationships that can no longer be bound to the frame of the nation-state. There is, of course, no one articulation of cosmopolitanism today. And the concerns articulated above generate a wide array of empirical analysis, theoretical reflection, and normative postulating. But it is not within the scope of this thesis for me to investigate different articulations of cosmopolitanism today. I have sought only to explicate the

principles of cosmopolitanism through interpreting its origins in ancient Greek discourse and applying such an interpretation to the global era.

CULTURAL AREA

A cultural area or culture area is a region with one relatively homogeneous human activity or complex of activities. These areas are primarily geographical, not historical and they are not considered equivalent to Kulturkreis. A culture area is a concept in cultural anthropology where a geographic region and time sequence is characterized by substantially uniform environment and culture.

The concept of culture areas was originated by museum curators and ethnologists during the late 1800s as means of arranging exhibits. Clark Wissler and Alfred Kroeber further developed the concept on the premise that they represent long-standing cultural divisions.

The concept is criticized by some, who argue that the basis for classification is arbitrary. But other researchers disagree and the organization of human communities into cultural areas remains a common practice throughout the social sciences. The definition of culture areas is enjoying a resurgence of practical and theoretical interest as social scientists conduct more research on processes of cultural globalization.

CULTURAL ASSIMILATION

Cultural assimilation is a socio-political response to demographic multi-ethnicity that supports or promotes the assimilation of ethnic minorities into the dominant culture. It is opposed to affirmative philosophy which recognizes and works to maintain differences.

The term assimilation is often used with regard to immigrants and various ethnic groups who have settled in a new land. New customs and attitudes are acquired through contact and communication.

The transfer of customs is not simply a one-way process. Each group of immigrants contributes some of its own cultural traits to its new society. Assimilation usually involves a

gradual change and takes place in varying degrees; full assimilation occurs when new members of a society become indistinguishable from older members.

CULTURAL INFLUENCE

A group can spontaneously adopt a different culture due to its political relevance, or to its perceived superiority. The first is the case of the Latin language and culture, that were gradually adopted by most of the subjugated people.

The second is the case of subjugated, but older and richer culture, which see itself imitated by the new masters, *e.g.* the victorious Roman Republic adopted more from the Hellenistic cultures than it imposed in most domains, except such Roman specialties as law and the military.

ASSIMILATION OF IMMIGRANTS

Immigrant assimilation is a complex process in which an immigrant fully integrates themselves into a new country. Social scientists rely on four primary benchmarks to assess immigrant assimilation: socioeconomic status, geographic distribution, second language attainment, and intermarriage. William A.V. Clark defines immigrant assimilation "as a way of understanding the social dynamics of American society and that it is the process that occurs spontaneously and often unintended in the course of interaction between majority and minority groups".

It has been found that between 1880 and 1920, the United States took in roughly 24 million immigrants. This increase in immigration can be attributed to many historical changes. Later, during the cold war from the 1960s through the 1980s and the disintegration of the Soviet Union in the late 1980s, over 1.8 million Jews (including some non-Jewish family members) emigrated from the former Soviet Union.

The major destination countries were Israel (about 1.1 million), the United States (over 400,000), Germany (about 130,000), and Canada (about 30,000). The beginning of the twenty-first century has also marked a massive era of immigration, and sociologists are once again trying to make

sense of the impact that immigration has on society and the impact it has on immigrants themselves.

Theoretical Explanations

Researchers have attempted to explain the assimilation rate for post 1965 immigrants in the United States with experiences of immigrants who entered the United States between 1880 and 1920. Many of the methods and theories that are used to assess immigrant assimilation today are derived from earlier immigrant studies.

One of the leading theories in understanding immigrant assimilation came from William I. Thomas and Florian Znaniecki whom published "The Polish Peasant in Europe and America". William I. Thomas and Florian Znaniecki's study on Polish immigrants (1880–1910) assessed how these immigrants built an institutional community in the United States during the Napoleonic War. Another influence on immigrant assimilation came from Robert Park, Ernest Burgess, and William I.

Thomas, in which they trained graduate students to study the experiences of immigrants in Chicago. Robert Park, Ernest Burgess, and William I. Thomas provided these graduate students with theoretical tools such as Park's theory on collective behaviour.

The third theory on immigrant assimilation comes from Gordon's book, Assimilation in American life. Gordon highlighted the generational change in immigrant groups, it states that the first generation or foreign born were less assimilated and less exposed to American life than their American-born children (the second generation), and their grandchildren (third-generation) were more like the American mainstream than their parents.

Theoretical Models to Immigrant Assimilation

The first, classic and new assimilation model sees immigrants and native-born people following a "straight-line" or a convergence. This theory sees immigrants becoming more similar over time in norms, values, behaviours, and

characteristics. This theory also expects those immigrants residing the longest in the host population, as well as the members of later generations, to show greater similarities with the majority group than immigrants who have spent less time in the host society. The second, racial or ethnic disadvantage model states that immigrant's chances to assimilate are "blocked". An example of this model would be discrimination and institutional barriers to employment and other opportunities.

The third, the segmented assimilation model theorizes that structural barriers, such as poor urban schools, cut off access to employment and other opportunities—obstacles that often are particularly severe in the case of the most disadvantaged members of immigrant groups, and such impediments can lead to stagnant or downward mobility, even as the children of other immigrants follow divergent paths towards classic straight-line assimilation.

Core Measurements to Immigrant Assimilation

Researchers have assessed that assimilation exists among immigrants because we can measure assimilation on four primary benchmarks. These core measurable aspects of immigrant assimilation that were formulated to study European immigrants to the United States are still the starting points for understanding current immigrant assimilation. These measurable aspects of assimilation are socioeconomic status, spatial concentration, language attainment, and intermarriage.

- Socioeconomic Status is defined by educational attainment, occupation, and income. By measuring socioeconomic status researchers want to find out if immigrants eventually catch up to native-born people in terms of human capital characteristics.
- Spatial Concentration is defined by geography or residential patterns. The spatial residential model (based on theories of Park) proposed by Massey states that increasing socioeconomic attainment, longer residence in the U.S, and higher generational status lead

to decreasing residential concentration for a particular ethnic group.

- Language Attainment is defined as the ability to speak English and the loss of the individual's mother tongue. The three-generation model of language assimilation states that the first generation makes some progress in language assimilation but remains dominant in their native tongue, the second generation is bilingual, and the third-generation only speaks English.
- Intermarriage is defined by race or ethnicity and occasionally by generation. High rates of intermarriage are considered to be an indication of social integration because it reveals intimate and profound relations between people of different groups, intermarriage reduces the ability of families to pass on to their children a consistent ethnic culture and thus is an agent of assimilation.

Intermarriage came under particular scrutiny by the Jewish community in the early-mid 20th century as Jewish leaders more and more often turned to social scientists to explain why Judaism was a typically endogamic religion. Although intermarriage was viewed as a firm base from which to begin an argument for assimilation, it was also seen as a way to gradually ease the transition into their new culture. Julius Draschler, a graduate student at Columbia University, believed that as long as people are allowed to maintain some differences, such as the Jewish practice of only marrying another Jew, they will delay the inevitable while simultaneously enriching the nation in the process of their slow assimilation.

While Draschler acknowledged that assimilation was the ultimate endpoint for all American groups, he hoped to prove through his intermarriage studies that, the more gradual the process, the better. Such need to justify (or vilify) the intermarriage practice became increasingly important after the 1950s as Jews (as well as other typically endogamic cultures, such as African-Americans) began to engage in more exogamic relationships.

Immigrant Name Changing as a Form of Assimilation

While the changing of immigrant names is not one of the 4 measurable benchmarks for assimilation outlined by early sociologists, it nonetheless represents a clear abandonment of the old as new immigrants are absorbed into the fabric of society. It is often believed that, due to language barriers, or the lack of training and sensitivity by government officials, names were often changed, without consent, by inspectors on Ellis Island. This general misconstruction of the facts is refuted in an object released by the Immigration and Naturalization Service, claiming that inspectors did not personally take names, instead inventorying the passengers using manifestos created by the shipping companies themselves.

As a matter of fact, many immigrants changed their names willingly. It's suggested by the Immigration and Naturalization Service that most name blunders were likely the fault of the origin, and not the destination. Donna Przecha, a published and well-known expert in genealogy, suggests a number of alternative explanations for name changing, one of which was a need for employment. A huge surplus of labour began to immigrate to the United States, many of whom were unskilled, with names that were often difficult to pronounce. Employers were not bound by the same anti-discriminatory legislature that they are now, and tended to gravitate towards individuals with more American names.

Comfort and fitting in was also a heavy motivator behind the changing of names. Many, if not most, US immigrants in the mid 1900's planned to make the United States their new home, permanently. Given this fact, it should come as no surprise that many immigrants welcomed the impending assimilation brought on by their host country. Eager to begin their new lives, many did as much as they could to become "American" as quickly as possible, particularly children. Of course, simplicity was yet another factor in the abandonment of old titles. As immigrants poured in from various European countries, many found their names to be difficult to pronounce and/or spell for many Americans, such as those names with many syllables, or with a large number of Z's.

Policies on Immigrant Assimilation

When considering immigrant assimilation it is important to consider why immigrants migrate. One reason immigrants migrated was the 1986 Immigration Reform and Control Act (IRCA), which legalized 2.3 million formerly undocumented Mexican Immigrants. This Act freed these newly legalized immigrants from the fear of being apprehended, and many of these immigrants moved to states beyond the nearest U.S-Mexican border.

Modifications for Assessing Immigrant Assimilation

Studies on immigrant assimilation in the 19th century and 20th century conclude that immigrants had a hard time catching up to the same human capital characteristics as native-born people in the 19th century, but studies in the 20th century suggest that immigrants eventually catch up to native born people. Timothy J. Hatton explains this puzzle on immigrant assimilation in the 19th century and in the 20th century. He explores how recent studies have been producing misleading results between the two. Hatton focuses his research on the specification of the earnings function.Hatton argues that that specification of the earnings function should be improved in two ways.

First, immigrants who arrived as children should be treated separately from those who arrived as adults.

Second, specification of the earnings function should be better approximate to the true shape of age-earnings profiles. Hatton points out that with these modifications, the patterns of immigrant earnings which have emerged make more sense with those of the 20th century and with traditional views on immigrant assimilation in the 19th century.

Owning a Home and Immigrant Assimilation

Owning a home can be seen as a step into assimilation. William A.V. Clark explores this link in his book “Immigrants and the American Dream Remarking the Middle Class”. Clark is aware that the process of assimilation is more than just being able to purchase a home. He argues that “homeownership” is

one of the steps of assimilation, it is becoming part of the community and a neighbourhood, and being a part of the daily activities that take place in a community.

Naturalization and Immigrant Assimilation

Other than marriage, Citizenship is one of the most significant factors in assimilation. The immigration debate focuses not only the number of immigrants, who should be admitted, and who should be allowed to be admitted but also the processes of incorporation and, most importantly, how citizenship should be extended and to whom. For example, should it be extended to those who arrive illegally? Allowing for naturalization of immigrants can create tension in assimilation. On one hand, those who favour the admission of immigrants input that these new residents will help build and enrich the American democratic process. However, others argue that the nature and legitimacy of the nation may be challenged and perhaps even threatened.

New Immigrant Gateways and Immigrant Assimilation

Although it is changing, the overwhelming majority of immigrants still settle in traditional gateway states such as Florida, New York, California, Illinois, Texas, and Massachusetts. It has found that immigrants settle in traditional gateways where there are large populations of foreign-born people. Walters and Jimenez have illustrated the changes in the geographic distribution and the rates of growth of immigration in the United States.

They show the number of foreign-born individuals in states where the foreign-born population grew by a factor of two or more between 1990 and 2000. Walters and Jimenez found that the largest percentage growth in the foreign-born population, was found in either the Midwest or the South in additional none of the traditional gateways were included in this large percentage growth. Walters and Jimenez noted that a reason these traditional gateways did not have an increase at the same rate of the new gateways was because, new gateways did not have many immigrants to begin with.

Walters and Jimenez have argued that this new change in geography could possibly change the way researchers assess immigrant assimilation. They argue that these new gateways are unique and they propose that immigrant assimilation may be different from the experiences of immigrants in more traditional gateways in at least three ways.

First, the long history of immigration in these established gateways means that the place of immigrants in terms of class, racial, and ethnic hierarchies in these traditional gateways are more structured or established on the other hand these new gateways do not have much immigration history therefore the place of immigrants in terms of class, racial, and ethnic hierarchies is less defined and immigrants may have more influence to define their position.

Second, the size of new gateways may influence immigrant assimilation. Having a smaller gateway may influence the level of segregation among immigrants and native-born people.

Third, the difference in institutional arrangements may influence immigrant assimilation. Traditional gateways unlike new gateways have many institutions set up to help immigrants which include legal-aid, bureaus, social organizations. Finally, Walters and Jimenez have only speculated that these differences may influence immigrant assimilation and the way researchers should assess immigrant assimilation.

CULTURAL DIVERSITY

Ethnic origins, religions, and languages are the major sources of cultural diversity. India is a country incredible for its diversity, biological and cultural. It is the natural resources that attracted to the subcontinent many streams of people at different times, from different directions; bringing together a great diversity of human genes and human cultures. Thus the bulk of the Indian population represents racial admixture in varying degrees. Unlike several other lands where the dominant human cultures have tended to absorb or eliminate others, in India the tendency has been to nurture diversity,

which has been favoured by the diversity of the country's ecological regimes. Powerful kingdoms and enumerable dynasties, contributed to the shaping of India's cultural regions. An important source of diversity among the people of India is the cultural identity of particular communities and regions.

Despite maintaining distinct identities several jatis, sects, and communities have organic links with other segments of the population of the region, which develops a cultural persona over time. Indian civilization has had a pluralistic character from the start. The pluralistic and composite ethos of Indian civilization, which began evolving during the Vedic period, was supplemented by the rise of Buddhism and Jainism, and was further reinforced during the early medieval period, which witnessed the early zenith in the Bhakti Movement. This composite tradition attained primacy during the late medieval period.

Linguistic and philological evidences demonstrate the incorporation and adaptation of regional features into the mainstream of Sanskritic culture distinctly. Certain kinds of echo formations, which are characteristic of the Austric family of languages, found their way into the Indo-Aryan speeches. The presence of non-Aryan elements, especially Proto-Dravidian, in vocabulary, syntax and phoenetics in Vedic Sanskrit is now fairly well established. The later Vedic texts indicate an even greater admixture of non-Aryan words. The Vedic society was internally differentiated and it was pluralistic. It was a synthesis of Aryan and non-Aryan, including tribal elements.

Since its very beginning Hinduism has been a "mosaic of distinct cults, deities, sects and ideas". Most records reveal that totemic deities such as fish, tortoise and boar were made into incarnations of Vishnu. Shiva was formed by a fusion of the Vedic Rudra with some non-Aryan deity. Shiva in its tribal and folk form is observable in several parts of peninsular India, including plains of northeast India, particularly in Assam - north-Bengal regions. Enough material exists which confirm the fact that Brahmanism immersed the deities of tribespeople

and 'low-castes'. The popularity of the saga of Jagannath cult in Orissa and that of Viththala in Maharashtra testify this. Similarly, serpent worship and phallus worship, which later found their way into classical Hinduism, were taken over from local communities.

Unorthodox sects and cults, such as Shakta and the Tantric tradition, incorporated several esoteric features from indigenous, including tribal cultures. Thus, some interrelated critical foundations of unity may be delineated at the pan-Indian level. We may categorize them first as the Sanskritic Hinduism at the social structural levels and through a system of pilgrimage centres. Then we may consider a composite cultural tradition born out of the protracted interaction and exchange between Hindus and Muslims and adherents of other faiths through the length and breadth of the country.

In this context one may notice social reforms and humanistic tendency as exemplified in the Sufi and Bhakti Movements. The secular-democratic philosophy, which is enshrined in the Constitution of the country and a Gandhian vision of Indianness, which was well founded during freedom movement, are manifestation and demonstration of our composite culture in modern India. Since the late medieval period India witnessed a creative synthesis of Hindu and Islamic civilizations and thus grew a composite tradition, a pluralistic synthesis of the Indo-Islamic tradition including inter-faith convergence. There are two interrelated dimensions of the Indo-Islamic tradition.

On the one hand, it manifested itself in syncretistic traditions of music, art, literature and architecture, and on the other, it found expression in folklore, dress patterns, food habits, names and surnames. If we turn to rural landscape we discover the distribution of material traits at the regional level indicating a certain complementarities in that it is marked by both local differentiation and interpenetration. Not only that a cluster or complex of material traits at the regional level unites different parts and communities, different communities have brought with them often innovations into regions of their adoption and internalized them effectively, though a proper

mapping of same is unlikely to be accomplished shortly. This phenomenon is seldom subjected to a critical examination in a diachronic framework anywhere. Language is an important attribute of a population, and has great relevance and significance in a multi-lingual and multi-ethnic country like India. The language literature generated by census over the last more than one hundred years has thrown much light on the ethnic and the linguistic characteristics of the population. The total number of mother tongues returned in 1961 and 1971 censuses was around 3,000, in 1981 around 7,000 and in 1991, it was more than 10,000. Tribal languages cannot be dismissed as dialects; many of them have a growing literature and at least two have their own scripts. Their multiplicity is baffling. Consider the case of Nagaland, formerly a district but now a State. It has as many as twenty different languages.

The Kohima station of All India Radio used to broadcast in twenty-five languages, besides Nagamese, the lingua-franka. The pan-Indian, civilizational dimension of cultural pluralism and syncretism encompasses ethnic diversity and admixture, linguistic heterogeneity as well as fusion, and variations as well as synthesis in customs, behavioural patterns, beliefs and rituals. The process of synthesis and integration has been extensively at work at the regional level. Though each group or community has a distinctive identity and ethos of its own, it does not exist in a social vacuum.

Rather, it forms part of an extended and dynamic network. Often, interaction, exchange and integration characterize inter-community relations. The sharing of space, regional ethos and cultural traits cut across religions and sectarian differences and bind the local people together. It is now revealed and established more vividly those cultural and religious practices in diverse eco-cultural zones of India have historically converged and people shared common traditions extensively. Thus, we witness a fine balancing between pluralism and syncretism pervading the base of Indian culture. While enough literature exists on this aspect of cultural manifestation in historical writings, not much is known about the religious syncretism and its stretch in contemporary India.

CULTURAL DIVERSITY IS OUR EVERYDAY REALITY

The international migration rate is growing fast every year. The "International Migration Report 2002" of the United Nations Department of Economic and Social Affairs, the number of migrants has doubled since the 1970s. The report also says that around 175 million persons are residing away from the country of their birth and one in every 10 persons in the developed regions is a migrant. Also, more migrants are coming from countries ever farther away. While the reasons for migration vary, one thing is sure: we live in an increasingly heterogeneous society.

CULTURAL DIVERSITY REFLECTS THE RESPECT OF FUNDAMENTAL RIGHTS

Culture is a set of distinctive spiritual, material, intellectual and emotional features of society or a social group. It encompasses, in addition to art and literature, lifestyles, ways of living together, values systems, traditions and beliefs. Respecting and safeguarding culture is a matter of Human Rights.

Cultural Diversity presupposes respect of fundamental freedoms, namely freedom of thought, conscience and religion, freedom of opinion and expression, and freedom to participate in the cultural life of one's choice.

CULTURAL DIVERSITY IS OUR COLLECTIVE STRENGTH

The Johannesburg Declaration on Sustainable Development acknowledges that our rich diversity, which is our collective strength, should be used to ensure sustainable development. Cultural Diversity, indeed, is not just a natural fact that we need simply recognize and respect. It is about plurality of knowledge, wisdom and energy which all contribute to improving and moving the World forward.

CULTURAL IDENTITY

Culture refers to the customs, practices, languages, values and world views that define social groups such as those based on nationality, ethnicity, region or common interests. Cultural

identity is important for people's sense of self and how they relate to others. A strong cultural identity can contribute to people's overall wellbeing. Cultural identity based on ethnicity is not necessarily exclusive. People may identify themselves as New Zealanders in some circumstances and as part of a particular culture in other circumstances.

They may also identify with more than one culture. The desired outcomes recognise the importance of a shared national identity and sense of belonging, and the value of cultural, social and ethnic diversity. They recognise New Zealand is a multicultural society, while also acknowledging that Mâori culture has a unique place. For example, under the Treaty of Waitangi, the Crown has an obligation to protect the Mâori language.

Defining a national identity is not simple. New Zealand is a diverse nation, made up of many cultural groups, with many different customs and traditions. While people may describe themselves as "New Zealanders", how they define their "New Zealand-ness" will vary from person to person. For example, some people might see a New Zealand identity in aspects of New Zealand's history or in New Zealander's achievements in sporting, artistic or other endeavours, while others might see it through a sense of national characteristics or traits, or through national symbols and icons.

Mâori culture may form one aspect of national identity, since it is both unique to New Zealand and a part of our identity in the outside world. Cultural identity is an important contributor to people's wellbeing. Identifying with a particular culture helps people feel they belong and gives them a sense of security.

An established cultural identity has also been linked with positive outcomes in areas such as health and education. It provides access to social networks, which provide support and shared values and aspirations. Social networks can help to break down barriers and build a sense of trust between people, a phenomenon sometimes referred to as social capital. However, strong cultural identity expressed in the wrong way can contribute to barriers between groups. And members of

smaller cultural groups can feel excluded from society if others obstruct, or are intolerant of, their cultural practices.

CULTURAL IMPERIALISM

Cultural imperialism is the act of a nation imposing it's cultural values onto another, usually weaker, nation. Cultural imperialism can take the form of an active, formal policy or a general attitude. A metaphor of colonialism is employed: the cultural products of the first world "invade" the third-world and "conquer" local culture. In the stronger variants of the term, world domination is the explicit goal of the nation-states or corporations that export the culture. The term is usually used in a pejorative sense, usually in conjunction with a call to reject foreign influence.

The term appears to have emerged in the 1960s. and has been a focus of research since at least the 1970s. Terms such as "media imperialism", "structural imperialism", "cultural dependency and domination", "cultural synchronization", "electronic colonialism", "ideological imperialism", and "economic imperialism" have all been used to describe the same basic notion of cultural imperialism. Various academics give various definitions of the term. American media critic Herbert Schiller wrote: "The concept of cultural imperialism today best describes the sum of the processes by which a society is brought into the modern world system and how its dominating stratum is attracted, pressured, forced, and sometimes bribed into shaping social institutions to correspond to, or even promote, the values and structures of the dominating centre of the system.

The public media are the foremost example of operating enterprises that are used in the penetrative process. For penetration on a significant scale the media themselves must be captured by the dominating/penetrating power. This occurs largely through the commercialization of broadcasting." Tom McPhail defined "Electronic colonialism as the dependency relationship established by the importation of communication hardware, foreign-produced software, along with engineers, technicians, and related information protocols, that vicariously

establish a set of foreign norms, values, and expectations which, in varying degrees, may alter the domestic cultures and socialization processes." Sui-Nam Lee observed that "communication imperialism can be defined as the process in which the ownership and control over the hardware and software of mass media as well as other major forms of communication in one country are singly or together subjugated to the domination of another country with deleterious effects on the indigenous values, norms and culture."

Ogan saw "media imperialism often described as a process whereby the United States and Western Europe produce most of the media products, make the first profits from domestic sales, and then market the products in Third World countries at costs considerably lower than those the countries would have to bear to produce similar products at home."

Downing and Sreberny-Mohammadi state: "Imperialism is the conquest and control of one country by a more powerful one. Cultural imperialism signifies the dimensions of the process that go beyond economic exploitation or military force. In the history of colonialism, the educational and media systems of many Third World countries have been set up as replicas of those in Britain, France, or the United States and carry their values. Western advertising has made further inroads, as have architectural and fashion styles. Subtly but powerfully, the message has often been insinuated that Western cultures are superior to the cultures of the Third World."

The issue of cultural imperialism emerged largely from communication studies. However, cultural imperialism has been used as a framework by scholars to explain phenomena in the areas of international relations, anthropology, education, science, history, literature, and sports. It can refer to either the forced acculturation of a subject population, or to the voluntary embracing of a foreign culture by individuals who do so of their own free will. Since these are two very different referents, the validity of the term has been called into question. Cultural

influence can be seen by the "receiving" culture as either a threat to or an enrichment of its cultural identity. It seems therefore useful to distinguish between cultural imperialism as an (active or passive) attitude of superiority, and the position of a culture or group that seeks to complement its own cultural production, considered partly deficient, with imported products. The imported products or services can themselves represent, or be associated with, certain values.

The "receiving" culture does not necessarily perceive this link, but instead absorbs the foreign culture passively through the use of the foreign goods and services. Due to its somewhat concealed, but very potent nature, this hypothetical idea is described by some experts as "banal imperialism." Some believe that the newly globalised economy of the late 20th and early 21st century has facilitated this process through the use of new information technology. This kind of cultural imperialism is derived from what is called "soft power". The theory of electronic colonialism extends the issue to global cultural issues and the impact of major multi-media conglomerates, ranging from Viacom, Time-Warner, Disney, News Corp, Sony, to Google and Microsoft with the focus on the hegemonic power of these mainly US-based communication giants.

One of the reasons often given for opposing any form of cultural imperialism, voluntary or otherwise, is the preservation of cultural diversity, a goal seen by some as analogous to the preservation of ecological diversity. Proponents of this idea argue either that such diversity is valuable in itself, or instrumentally valuable because it makes available more ways of solving problems and responding to catastrophes, natural or otherwise.Palestinian writer, philosopher, and literary theorist, Edward Said, who was one of the founders of the field of post-colonial study, wrote extensively on the subject of cultural imperialism.

His work attempts to highlight the inaccuracies of many assumptions about cultures and societies, and is largely informed by Michel Foucault's concepts of discourse and power. The relatively new academic field of post-colonial

theory has been the source for most of the in-depth work on the idea of discursive and other non-military mechanisms of imperialism, and its validity is disputed by those who deny that these forms are genuinely imperialistic. David Rothkopf, managing director of Kissinger Associates and an adjunct professor of international affairs at Columbia University (who also served as a senior US Commerce Department official in the Clinton Administration), wrote about cultural imperialism in his provocatively titled In Praise of Cultural Imperialism? in the summer 1997 issue of Foreign Policy magazine.

Rothkopf says that the US should embrace "cultural imperialism" as in its self interest. But his definition of cultural imperialism stresses spreading the values of tolerance and openness to cultural change in order to avoid war and conflict between cultures as well as expanding accepted technological and legal standards to provide free traders with enough security to do business with more countries. Rothkopf's definition almost exclusively involves allowing individuals in other nations to accept or reject foreign cultural influences.

He also mentions, but only in passing, the use of the English language and consumption of news and popular music and film as cultural dominance that he supports. Rothkopf additionally makes the point that globalization and the Internet are accelerating the process of cultural influence. Culture is sometimes used by the organizers of society—politicians, theologians, academics, and families—to impose and ensure order, the rudiments of which change over time as need dictates. One need only look at the 20th century's genocides. In each one, leaders used culture as a political front to fuel the passions of their armies and other minions and to justify their actions among their people.

Rothkopf then cites genocide and massacres in Armenia, Russia, the Holocaust, Cambodia, Bosnia and Herzegovina, Rwanda and East Timor as examples of culture (in some cases expressed in the ideology of "political culture" or religion) being misused to justify violence. He also acknowledges that cultural imperialism in the past has been guilty of forcefully eliminating the cultures of natives in the Americas and in

Africa, or through use of the Inquisition, "and during the expansion of virtually every empire." The most important way to deal with cultural influence in any nation, just as to Rothkopf, is to promote tolerance and allow, or even promote, cultural diversities that are compatible with tolerance and to eliminate those cultural differences that cause violent conflict:

- "Multicultural societies, be they nations, federations, or other conglomerations of closely interrelated states, discern those aspects of culture that do not threaten union, stability, or prosperity (such as food, holidays, rituals, and music) and allow them to flourish. But they counteract or eradicate the more subversive elements of culture (exclusionary aspects of religion, language, and political/ideological beliefs). History shows that bridging cultural gaps successfully and serving as a home to diverse peoples requires certain social structures, laws, and institutions that transcend culture. Furthermore, the history of a number of ongoing experiments in multiculturalism, such as in the European Union, India, South Africa, Canada and the United States, suggests that workable, if not perfected, integrative models exist. Each is built on the idea that tolerance is crucial to social well-being, and each at times has been threatened by both intolerance and a heightened emphasis on cultural distinctions. The greater public good warrants eliminating those cultural characteristics that promote conflict or prevent harmony, even as less-divisive, more personally observed cultural distinctions are celebrated and preserved."

CULTURAL LANDSCAPE

The cultural landscape is the environment around us which has been shaped by our interactions with all the constituent parts of that environment—the trees, plants, weather, houses, cars, other people, bugs, and a rather large number of other elements. In the twenty-first century, we are made quite aware of some of the problems involved in our

relationship with our environments—many people are also in a position to enjoy their environmental interactions considerably. Although the study of the cultural landscape has many social and political goals, at a most basic level, it is an attempt to understand the processes by which we engage our environments, with the most obvious goals of adding insight to these processes so that we might better understand both the possibilities and problems involved. I find the cultural landscape fascinating for a number of reasons.

The record that our creative interactions with the circumstances of everyday life leaves around us interests me aesthetically, morally, and practically: I read in the landscape a tremendous number of stories about what people have done in the past and what they have hoped for the future; I am continually delighted by the complexity and beauty of cultural and natural systems; and I find a great sense of equanimity in the ongoing adaptation and resiliance of both these natural and cultural systems in the face of disruption, change and stresses that serve as constant reminders that the unknown is always much larger than the known. Ongoing, active involvement with the processes of the cultural landscape around me seems to me one of the best ways I have to remain engaged with both the culture and the environment of which I am a part.

The modernization of the built environment has brought problems which our culture has often responded to with an attitude of escape; I find in my interest and interaction with the cultural landscape a compelling way to engage these problems at a scale appropriate to what is plausibly achieved in everydaylife. Many of the most pressing issues of culture and environment at the turn of the twenty-first century are themselves products of or exacerbated by our sense of the natural environment as a medium for escape—and our sense of culture as something from which we need escape! Attention to the cultural landscape not only allows us to gain insights into the way we do and might behave in our environments, but also provides us access to an understanding of our environments that includes us as part of the landscape, and

that helps us to understand the natural environment not only as something apart from us which our modernization has exploited furiously, but also as a series of processes of which we are part, and within which we have had a long history. This rich sense of our constant participation in the processes which surrounds us not only helps us see continuity along with change in the context of modernization and globalization, but it also helps us to get a sense of the profoundly social nature of our environmental experience.

CULTURAL REGION

Cultural Region –places and regions provide the essence of geography. A culture region is a geographical unit based on characteristics and functions of culture. Three types of culture regions are recognized by geographers: formal, functional, and vernacular.

FORMAL CULTURE REGION

Formal Culture Region- an area inhabited by people who have one or more cultural traits in common, such as language, religion or system of livelihood. It is an area that is relatively homogeneous with regard to one or more cultural traits. The geographer who identifies a formal culture region must locate cultural borders. Because cultures overlap and mix, such boundaries are rarely sharp, even if only a single cultural trait is mapped.

For this reason, we find cultural border zones rather than lines. These zones broaden with each additional cultural trait that is considered, because no two traits have the same spatial distribution. As a result, instead of having clear borders, formal culture regions reveal a centre or core where the defining traits are all present. Away from the central core, the characteristics weaken and disappear. Thus, many formal culture regions display a core-periphery pattern.

FUNCTIONAL CULTURE REGIONS

Functional Culture Regions- the hallmark of a formal culture region is cultural homogeneity. It is abstract rather than

concrete. By contrast, a functional culture region need not be culturally homogeneous; instead, it is an area that has been organized to function politically, socially, or economically as one unit. A city, an independent state, a precinct, a church diocese or parish, a trade area or a farm. Functional culture regions have nodes, or central points where the functions are coordinated and directed.

Example: City halls, national capitals, precinct voting places, parish churches, factories, and banks. In this sense, functional regions also possess a core-periphery configuration, in common with formal culture regions. Many functional regions have clearly defined borders that include all land under the jurisdiction of a particular urban government; clearly delineated on a regional map by a line distinguishing between one jurisdiction and another.

VERNACULAR CULTURE REGIONS

Vernacular Culture Regions- is one that is perceived to exist by its inhabitants, as evidenced by the widespread acceptance and use of a special regional name. Some vernacular regions are based on physical environmental features; others find their basis in economic, political, or historical characteristics. Vernacular regions, like most culture regions, generally lack sharp borders, and the inhabitants of any given area may claim residence in more than one such region.

It grows out of people's sense of belonging and identification with a particular region. Ex: one popular region in the US "Dixie". They often lack the organization necessary for functional regions, although they may be centred around a single urban node, and they frequently do not display the cultural homogeneity that characterizes formal regions.

CULTURAL LEVELING

Cultural leveling is the process by which different cultures approach each other as a result of travel and communication. Cultural leveling within the United States has been driven by mass market media such as radio and television broadcasting

and nation wide distribution of magazines and catalogs. Some of these means and effects are considered artifacts of the Machine Age of the 1920s and 1930s.

CULTURAL MAPPING

"Cultural mapping" (also known as cultural resource mapping or cultural landscape mapping) is the label organisations and peoples (including UNESCO) concerned about safeguarding cultural diversity give to a wide range of research techniques and tools used to 'map' distinct peoples' tangible and intangible cultural assets within local landscapes around the world.

- In its Universal Declaration on Cultural Diversity, UNESCO notes the importance of States adopting inclusive ways of encouraging cultural diversity.

The term 'cultural mapping' is also used to describe the use of 'cultural mapping' type research methods, tools, and techniques to identify, describe, portray, promote, and plan future use of particular region's or cities combined cultural assets and resources:

- A broadly-based mapping exercise for purposes of investigating or creating an identity profile of the community is enriching, informative and useful [...] The process of mapping by itself draws attention to the existence and importance of cultural resources. The results point out problems to be solved or strengths to build upon.

CULTURAL PRACTICE

Cultural practice generally refers to the manifestation of a culture or sub-culture, especially in regard to the traditional and customary practices of a particular ethnic or other cultural group. In the broadest sense, this term can apply to any person manifesting any aspect of any culture at any time. However, in practical usage it commonly refers to the traditional practices developed within specific ethnic cultures, especially those aspects of culture that have been practiced since ancient times. The term is gaining in importance due to the increased

controversy over "rights of cultural practice", which are protected in many jurisdictions for indigenous peoples and sometimes ethnic minorities. It is also a major component of the field of cultural studies, and is a primary focus of international works such as the United Nations declaration of the rights of indigenous Peoples.

Cultural practice is also a subject of discussion in questions of cultural survival. If an ethnic group retains its formal ethnic identity but loses its core cultural practices or the knowledge, resources, or ability to continue them, questions arise as to whether the culture is able to actually survive at all. International bodies such as the United Nations Permanent Forum on Indigenous Issues continually work on these issues, which are increasingly at the forefront of globalization questions.

INTERCULTURAL COMPETENCE

Intercultural competence is the ability of successful communication with people of other cultures. A person who is interculturally competent captures and understands, in interaction with people from foreign cultures, their specific concepts in perception, thinking, feeling and acting. Earlier experiences are considered, free from prejudices; there is an interest and motivation to continue learning.

CROSS-CULTURAL COMPETENCE

Cross-cultural competence, another term for inter-cultural competence, has generated its own share of contradictory and confusing definitions, due to the wide variety of academic approaches and professional fields attempting to achieve it for their own ends. One author identified no fewer than eleven different terms with some equivalence to 3C: cultural savvy, astuteness, appreciation, literacy or fluency, adaptability, terrain, expertise, competency, awareness, intelligence, and understanding.

Organizations from fields as diverse as business, health care, government security and developmental aid agencies, academia, and non-governmental organizations have all

sought to leverage 3C in one guise or another, often with poor results due to a lack of rigorous study of the phenomenon and reliance on "common sense" approaches based on the culture developing the 3C models in the first place. The U.S. Army Research Institute, which is currently engaged in a study of the phenomenon, defines 3C as: "A set of cognitive, behavioural, and affective/motivational components that enable individuals to adapt effectively in intercultural environments".

Cross-cultural competence does not operate in a vacuum, however. One theoretical construct posits that 3C, language proficiency, and regional knowledge are distinct skills that are inextricably linked, but to varying degrees depending on the context in which they are employed. In educational settings, Bloom's affective and cognitive taxonomies serve as an effective framework to describe the overlap area between the three disciplines: at the receiving and knowledge levels 3C can operate with near independence from language proficiency or regional knowledge, but as one approaches the internalizing and evaluation levels the required overlap area approaches totality.

The development of intercultural competence is mostly based on experiences one comes across while communicating with different cultures. While interacting with people from other cultures they face certain obstacles which are caused due to differences in the cultural understanding between the two people in question. Such experiences motivate people to work on skills that can help them put forward their point of view in front of an audience belonging to a completely different cultural ethnicity and background.

An issue that comes forward, especially for people who live in countries which is not their country of origin is that of which culture they should follow. Should they try to fit in and adapt to the culture surrounding them, or should they hold on to their culture and try to avoid interacting with the culture surrounding them? This issue is one faced by most people today. Globalization has caused the immigration rates to sky rocket for most of the developed and developing countries,

and hence people come to these countries in order to find employment and settle down in such countries where they are constantly surrounded by a culture which does not belong to them. International students are another part of the population that faces this dilemma. They have to make a choice about whether they are willing to modify their cultural boundaries in order to adapt to the culture around them or whether they hold on to their culture and surround themselves by people from their own country.

The people who decide to live by the latter rule are the students which face most problems in their university life and face constant culture shocks, while the students who live by the former rule face less problems and interact more with the domestic students. They end up increasing their knowledge about the culture which is followed by the domestic students and modify their own culture to inculcate certain aspects from the culture surrounding them in order to help them blend successfully in the society.

EARTH IN CULTURE

The cultural perspective on the Earth, or world, varies by society and time period. Religious beliefs often include a creation belief as well as personification in the form of a deity. The exploration of the world has modified many of the perceptions of the planet, resulting in a viewpoint of a globally-integrated ecosystem. Unlike the remainder of the planets in the Solar System, mankind didn't perceive the Earth as a planet until the sixteenth century.

ETYMOLOGY

Unlike the other planets in the Solar System, in English, Earth does not directly share a name with an ancient Roman deity. The name Earth derives from the eighth century Anglo-Saxon word erda, which means ground or soil. It became eorthe later, and then erthe in Middle English. These words are all cognates of Jörð, the name of the giantess of Norse myth. Earth was first used as the name of the sphere of the Earth in the early fifteenth century. The planet's name in Latin, used

academically and scientifically in the West during the Renaissance, is the same as that of Terra Mater, the Roman goddess, which translates to English as Mother Earth.

PLANETARY SYMBOL

The standard astronomical symbol of the Earth consists of a cross circumscribed by a circle. This symbol is known as the wheel cross, sun cross, Odin's cross or Woden's cross. Although it has been used in various cultures for different purposes, it came to represent the compass points, earth and the land.

Another version of the symbol is a cross on top of a circle; a stylized globus cruciger that was also used as an early astronomical symbol for the planet Earth.

RELIGIOUS BELIEFS

Earth has often been personified as a deity, in particular a goddess. In many cultures the mother goddess is also portrayed as a fertility deity. To the Aztec, Earth was called Tonantzin-"our mother"; to the Incas, Earth was called Pachamama-"mother earth".

The Chinese Earth goddess Hou Tu is similar to Gaia, the Greek goddess personifying the Earth. To Hindus it is called Bhuma Devi, the Goddess of Earth. In Norse mythology, the Earth giantess Jörð was the mother of Thor and the daughter of Annar. Ancient Egyptian mythology is different from that of other cultures because Earth is male, Geb, and sky is female, Nut. Creation myths in many religions recall a story involving the creation of the world by a supernatural deity or deities. A variety of religious groups, often associated with fundamentalist branches of Protestantism or Islam, assert that their interpretations of the accounts of creation in sacred texts are literal truth and should be considered alongside or replace conventional scientific accounts of the formation of the Earth and the origin and development of life.

Such assertions are opposed by the scientific community as well as other religious groups. A prominent example is the creation-evolution controversy.

PHYSICAL FORM

In the ancient past there were varying levels of belief in a flat Earth, with the Mesopotamian culture portraying the world as a flat disk afloat in an ocean. The spherical form of the Earth was suggested by early Greek philosophers; a belief espoused by Pythagoras. By the Middle Ages-as evidenced by thinkers such as Thomas Aquinas-European belief in a spherical Earth was widespread.

Prior to circumnavigation of the planet and the introduction of space flight, belief in a spherical Earth was based on observations of the secondary effects of the Earth's shape and parallels drawn with the shape of other planets.

MODERN PERSPECTIVE

The technological developments of the latter half of the 20th century are widely considered to have altered the public's perception of the Earth. Before space flight, the popular image of Earth was of a green world. Science fiction artist Frank R. Paul provided perhaps the first image of a cloudless blue planet on the back cover of the July 1940 issue of Amazing Stories, a common depiction for several decades thereafter. Earth was first photographed from space by Explorer 6 in 1959. Yuri Gagarin became the first human to view Earth from space in 1961.

The crew of the Apollo 8 was the first to view an Earth-rise from lunar orbit in 1968. In 1972 the crew of the Apollo 17 produced the famous "Blue Marble" photograph of the planet Earth from cislunar space. This became an iconic image of the planet as a marble of cloud-swirled blue ocean broken by green-brown continents. NASA archivist Mike Gentry has speculated that "The Blue Marble" is the most widely distributed image in human history. A photo taken of a distant Earth by Voyager 1 in 1990 inspired Carl Sagan to describe the planet as a "Pale Blue Dot." Since the 1960s, Earth has also been described as a massive "Spaceship Earth," with a life support system that requires maintenance, or, in the Gaia hypothesis, as having a biosphere that forms one large organism. Over the past two centuries a growing enviro-

nmental movement has emerged that is concerned about humankind's effects on the Earth. The key issues of this socio-political movement are the conservation of natural resources, elimination of pollution, and the usage of land. Although diverse in interests and goals, environmentalists as a group tend to advocate sustainable management of resources and stewardship of the environment through changes in public policy and individual behaviour. Of particular concern is the large-scale exploitation of non-renewable resources. Changes sought by the environmental movements are sometimes in conflict with commercial interests due to the additional costs associated with managing the environmental impact of those interests.

CULTURAL TRAVEL

Cultural Travel is a type of travel that emphasizes experiencing life within a foreign culture, rather than from the outside as a temporary visitor. Cultural travellers leave their home environment at home, bringing only themselves and a desire to become part of the culture they visit. Cultural travel goes beyond cultural exploration or discovery; it involves a transformation in way of life. This definition was first used by Gary Langer "Travel to Learn".

Transitions Abroad. A way of describing travel that requires a "transition" to a new level of understanding of and appreciation for a foreign culture. The term is often distorted and misused by travel agents, tour operators and international tourism organizations. Culture primarily has to do with people and less with places or things. So visiting museums, touring ancient structures, attending festivals, and eating local food does not provide the same experience as becoming a member of the culture itself. The antithesis of cultural travel is tourism, where people bring their home environment with them wherever they go and apply it to whatever they see.

CULTURAL TOURISM

'Cultural tourism' is the subset of tourism concerned with a country or region's culture, specifically the lifestyle of the

people in those geographical areas, the history of those peoples, their art, architecture, religion(s), and other elements that helped shape their way of life. Cultural tourism includes tourism in urban areas, particularly historic or large cities and their cultural facilities such as museums and theatres. It can also include tourism in rural areas showcasing the traditions of indigenous cultural communities, and their values and lifestyle. It is generally agreed that cultural tourists spend substantially more than standard tourists do. This form of tourism is also becoming generally more popular throughout the world, and a recent OECD report has highlighted the role that cultural tourism can play in regional development in different world regions.

Cultural tourism has been defined as 'the movement of persons to cultural attractions away from their normal place of residence, with the intention to gather new information and experiences to satisfy their cultural needs'.

DESTINATIONS

One type of cultural tourism destination is living cultural areas. For an indigenous culture that has stayed largely separated from the surrounding majority, tourism can present both advantages and problems. On the positive side are the unique cultural practices and arts that attract the curiosity of tourists and provide opportunities for tourism and economic development.

On the negative side is the issue of how to control tourism so that those same cultural amenities are not destroyed and the people do not feel violated. Other destinations include historical sites, modern urban districts, theme parks and country clubs, coastal or island ecosystems, and inland natural areas. Only a handful of people take part in these holiday trips each year as opposed to the thousands of people who go on package holidays.

8

Economic Geography

INTRODUCTION

This stage will introduce economic geography as a sub-discipline of geography that uses a geographical approach to study the economy. The stage will stress that an economic-geographical approach to studying economies is very different from the approach used by mainstream economics. In this stage as suggested, explore some of the key differences between the approaches used by geographers and economists. The stage will suggest that the field of economic geography offers some unique insights and is well placed to analyse and understand the contemporary world economy in all its complexity. One of the key features and strengths of the economic-geographical approach is the use of the concepts of space, place and scale and these will be introduced in turn.

The stage will also point out that economic geography itself represents a dynamic, evolving and diverse body of knowledge. However, this diversity also allows economic geography to engage with a number of issues in contemporary societies and economies. Indeed, despite the claims that economic globalisation will inevitably bring about 'the end of geography', geography matters more than ever and economic geography provides us with useful tools to analyse and understand economic processes that shape our world.

WHAT IS ECONOMIC GEOGRAPHY

Economic geography is a sub-discipline that uses a geographical approach to study the economy. It is a vibrant

and exciting branch of geography. Its name would suggest that economic geography lies somewhere between, or at the overlap of, the disciplines of geography and economics. This is true to some extent. In fact, both geographers and economists use the term 'economic geography'. However, they mean different things by it. Indeed, it is important to stress from the outset that the approach that geographers are using to study the economy is very different from that used by most economists. A Contemporary Introduction written by Neil Coe and his colleagues, this subject guide uses the term economic geography and economic-geographical approach to describe the approach used by geographers.

On the other hand, the type of 'economic geography' that economists are using, can be best described as 'geographical economics' or 'spatial economics'. More generally, this distinction between 'economic geography' and 'geographical economics' reflects fundamental differences between the way the economy is treated by geographers on the one hand, and economists on the other. In other words, an economic-geographical approach to studying the economy is very different from the one used by mainstream economics.

KEY DIFFERENCES BETWEEN ECONOMIC GEOGRAPHY AND ECONOMICS' APPROACHES

The key difference is that mainstream economists usually pay little attention to the geographical dimensions of economic processes while economic geographers consider geography as being essential for the understanding of the ways economies work. From this, two completely different views of the economy, and the way it operates, emerge. Most mainstream economists see the economy as a machine that works just as to certain principles and whose behaviour can be predicted using modelling techniques. Mathematics is therefore the main 'language' economists 'speak'. The body of thought that underpins such a conceptualisation of the economy can be referred to as 'economic orthodoxy'. Let us first explore the key components of economic orthodoxy before introducing the key concepts of an economic-geographical perspective.

MAINSTREAM ECONOMICS

Key components of economic orthodoxy could be simply summarised as follows.

- One of the key assumptions of the economic orthodoxy is that all people are behaving in a rational, self-interested and economising, profit-maximising manner. This type of rational individual is sometimes referred to as 'economic man' or homo economicus.
- Economic orthodoxy assumes that these rational individuals are competing against each other on the market. Mainstream economists believe that the market is the best mechanism to ensure economic efficiency since, they believe, perfect competition on the market guarantees that supply will meet demand at a particular price and the economy will be in equilibrium. The notion of equilibrium is one of the central assumptions of mainstream economic thought and shapes the way in which economists see the world around them.
- Mainstream economists believe that the market economy operates just as to certain laws and principles that could be studied as a 'science'. One of the main concerns of this economic 'science' is to predict the behaviour of the economy using mathematical models and equations. The achievement of the aforementioned equilibrium is one of the key concerns of such modelling.
- Mainstream economists believe that these laws and principles work everywhere and therefore economic models are applicable to them in every context. In other words, economic orthodoxy believes in certain universalism.

Some would argue that such a portrayal of economic orthodoxy is somewhat simplistic, a caricature of an increasingly diverse body of economics. However, a tendency among economists to assume some sort of universal applicability of basic economic 'laws' is rather pervasive. Within this world of universal laws there is a little room for local differences and geography in general. Indeed, geography

rarely enters economists' equations. The use of geography by economists is somewhat limited. There are some important exceptions, however. Among them is Paul Krugman, US economist and the Nobel Prize winner for economics in 2008. Over the years, Krugman has made an important contribution in terms of bringing geography into economics and is seen as a leading figure of the so-called 'New Economic Geography'. However, his notion of geography is still somewhat limited and narrow, especially when compared with the conceptualisation of geography used by the economic geographical perspective discussed below. Indeed, there are stark differences between the 'New Economic Geography' used by economists and the 'new economic geography' used by geographers.

AN ECONOMIC-GEOGRAPHICAL PERSPECTIVE

In contrast to a rather limited appreciation of geography by most economists, geographers emphasise the fact that no economy can function at the head of a pin. In other words, 'all economies must take place'. Geography, therefore, is always intrinsically present in all economic processes. One could therefore argue that, in fact, there are 'no economies, only economic geographies'. It follows then, that the kind of universalism that mainstream economics assumes is somewhat problematic.

Indeed, if all economic processes have a geographical dimension, then it is difficult to imagine that economic rules can apply equally to all places. Another major difference between an economic-geographical perspective and the assumptions of economic orthodoxy concerns the notion of a 'rational man'—homo economicus.

Mainstream economists assume that people are always behaving as rational, profitmaximising individuals responding to market signals. However, life is more complex than that and people's behaviour is not always the outcome of rational decision-making. Rather, it can be influenced and conditioned by their gender, race, age, class, religion, culture, health or disability. Geographers are keen to take these aspects on board

when studying economies. A 'geographical man/woman'–or what I will call here homo geographicus–can behave very differently from the way they are supposed to behave just as to economic orthodoxy. This has important implications for the remaining assumptions of economic orthodoxy. Indeed, if people are not behaving in a predictable way, than it is hard to expect that the entire economy will behave just as to some predictable laws and principles.

However sophisticated, mathematical models may not be able to capture all the complexity of economic processes happening in the real world. Worse still, mathematical models are not very helpful in elucidating the ways people relate to each other within societies and economies. In other words, 'the language of mathematics limits the ways in which economists can think about questions of power and social relations'. However, the questions of power and social relations are crucial in understanding economies because people do not live and work in isolation.

We are connected to each other in complex ways and economic geography helps us to explore these connections and relations. This exploration becomes more important in the age of globalisation. Further to this, it could be argued that these connections and relations are not limited to market exchanges and transactions. Indeed, there is a wide range of economic processes happening outside the scope of the market. The diversity of forms of economic processes, both within and outside the scope of the market, means that many economic geographers are not talking about 'the economy' but about 'economies'.

In recent years, the notion of 'diverse' or 'alternative' economies attracted much interest among geographers. The notion of 'diverse economies' further undermines the universalism of economic orthodoxy and paves the way for alternative explanations of what the economy is and how it works. Thus, one way or another, geographers in general, and economic geographers in particular, help to build a much richer, and perhaps more accurate, picture of the contemporary globalising economy. Coe and his colleagues go as far as to

suggest that 'the set of approaches offered by the field of economic geography is best placed to help us appreciate and understand the modern economic world in all its complexity'. They identify the following key concepts that form part of the economic-geographical approach: space, place and scale.

KEY CONCEPTS OF ECONOMIC GEOGRAPHY: SPACE, PLACE AND SCALE

An economic-geographical approach puts spatial concepts such as space, place and scale at the centre of the analysis. These concepts form part of the common language that is shared among professional geographers.

It is therefore essential that you familiarise yourself with these concepts right at the start:

- *Space*: The concept of space refers to physical distance and area. The concept of space allows us to ask simple questions such as where a particular process is happening.

  Four interrelated elements of the concept of space can be identified:

  1. Territoriality and form
  2. Location
  3. Flows across space
  4. The concept of uneven space as a necessary condition of a capitalist system
- *Place*: The concept of place aims to capture the specificity or uniqueness of particular places that are carved out of space. Through the notion of place, geographers are able to explore the richness and complexity of particular places and economic processes which are always embedded in environmental, social, cultural, institutional and political contexts. The idea of being embedded is very important because environmental, social, cultural, institutional and political contexts influence economic processes. Many Western values, for instance, may be alien to many other cultures, societies or nations. Therefore, the way economies are constructed and performed may be very different in

different places. Despite its importance for geographical research, the notion of place is somewhat vague because it can take various shapes and sizes

- *Scale*: The concept of scale therefore helps us to organise places through a typology of spatial scales
  Spatial scales that are commonly used by economic geographers include:
  - Global scale
  - Macro-regional scale
  - National scale
  - Regional scale
  - Local scale
  - Lived places

It is worth noting that the precise typology is sometimes problematic. The terms 'local' and 'regional', for instance, are often used rather loosely. In some cases, it is difficult to establish whether we are looking at a national, regional or local scale. When reading economic geography literature, you should always pay attention to what definition of scale a particular author is using.

Further to this, it is important to realise that the above three key concepts are not simply neutral tools for describing the world–they can also be seen as representations of the world. Indeed, the way these concepts are used by academics, the media or politicians influences the way we look at the world and how we understand its problems.

MAJOR THEORETICAL PERSPECTIVES IN ECONOMIC GEOGRAPHY

While most geographers would recognise and use the concepts of space, place and scale, it is important to realise that concepts of space, place and scale are themselves subject to debate and alternative interpretations in geography. For instance, some geographers use the term space to describe absolute geographical space, while others are using the term to describe relative space or relational space. You need to keep this in mind when reading some geography texts. More generally, you need to be aware of the fact that economic

geography is a vibrant, dynamic and continuously evolving sub-discipline composed of a diverse set of approaches and concepts. This subject guide will help you to learn about the key approaches and concepts that contemporary economic geography has to offer.

These approaches and concepts will be explained in some detail in subsequent stages. However, already at this point, it is useful to highlight the various intellectual traditions within which these approaches and concepts are anchored.

Four main theoretical perspectives in economic geography are:

- *Neo-classical location theory*: Location theory flourished in the 1950s and the 1960s and was primarily interested in establishing and explaining patterns in the distribution of economic activities across space. This type of economic geography was firmly anchored in a neoclassical economics theory and used a model-based approach to study the location of economic activities in space. This period in the development of economic geography is often called a 'quantitative revolution' which provided foundations for 'regional science', 'geographical economics' and 'spatial economics'. However, many economic geographers became dissatisfied with this approach and started exploring alternatives. More recently, the interest in regional science and geographical economics has been revived through the work of economist Paul Krugman and his 'New Economic Geography'.
- *Behavioural approach*: A behavioural approach emerged in the late 1960s as one of the reactions to the 'quantitative revolution'. It moved away from a simple neo-classical assumption of homo economicus and explored a wider range of factors that influence economic decisionmaking of human actors in various situations. The problem with this approach, however, is that it fails to explore fully the relationships between individuals and society.
- *Structuralist approach/Marxist political economy*: By contrast, a Marxist political economy approach, places

social relations at the centre of its analysis, with an emphasis on class. Since the 1970s Marxist views started to influence geography and still have a significant influence on economic geography today. Importantly, Marxist-inspired economic geography moved the attention from spatial patterns and locational issues to questions of social relations and economic structures of capitalist economies.

- *Post-structuralist approaches/New economic geography/ Cultural turn*: However, since the mid-1990s, a new type of economic geography has started to emerge from post-structuralist ideas. An important contribution of the new economic geography is its insistence that economic process cannot be seen in isolation from social, cultural and political contexts. In fact, new economic geography argues that social, cultural and/or institutional factors are central to the functioning of the economy/ economies. Thus the emphasis on the notion of class has been replaced by the interest in categories such as gender, race, age, religion and culture. This change of emphasis is often referred to as the 'cultural turn'. This emphasis on cultural factors also represents one of the key differences between the 'new economic geography' used by geographers and the one used by economists. Furthermore, the cultural turn brought with it a change of focus away from structural features towards more particular features of societies and economies.

You will familiarise yourself with these major theoretical perspectives step by step of this subject guide. The important thing to remember is that economic geographers do not always agree which approach is best and concepts they are working with are continually tested and contested. None of the theoretical perspectives is perfect; each of them has its strengths and weaknesses. However, collectively, they provide critical insights into the ways in which societies and economies work. The importance of economic geography for understanding the economic world around us will be explored in the subsequent part. However, before moving on to the next

part, let me reiterate the difference between the 'new economic geography' described by geographers and the 'New Economic Geography' described by economists. The difference between the two reflects a fundamental difference of understanding concerning what economic geography is about. Paul Krugman, the key proponent of NEG, economic geography is about 'the location of production in space'; in other words, it is a 'branch of economics that worries about where things happen in relation to one another'. In investigating the patterns of location of production in space, Krugman uses complex economic models in which geography is inserted as an important factor. In this way, Krugman's NEG has much in common with neo-classical location theory. This subject guide will not explore Krugman's theory in any detail. However, by learning about neoclassical location theory you will gain a good understanding of the basic principles on which Krugman's theory builds. This, in turn, will help you to study Krugman's work in the future should you choose to do so. In contrast to NEG, the 'new economic geography' described by geographers as part of the 'cultural turn' is not represented by one single theory. Rather it is very much a diverse set of approaches. More importantly, the new economic geography of the cultural turn represents a dramatically different view of economies and their geographies. While there have been attempts to foster a dialogue between geographers and economists the gap between the two types of new economic geographies is rather noticeable.

IMPORTANCE OF ECONOMIC GEOGRAPHY

Issues for Economic Geography

We highlighted the fact that economic geography can be seen as a diverse set of approaches and concepts that economic geographers use to study economic processes. In turn, this diversity of economic geography approaches allows economic geographers to engage with a diverse set of questions about the economy and society. Concrete questions often depend on a theoretical standpoint.

Peter Dicken and Peter Lloyd in their textbook Location in Space argue that:

- 'Fundamentally, the economic geographer is concerned with the spatial organisation of economic systems: with where the various elements of the system are located, how they are connected together in space, and the spatial impact of economic processes.'

On the basis of this, they argue that economic geographers are interested in three interconnected questions.

- In what ways are economic activities organised spatially on the earth's surface, and how do such spatial forms or patterns change over time?
- Why are economic activities organised spatially in particular ways; that is, what are the underlying processes at work?
- How does the spatial organisation of economic activities itself influence economic and other social processes?

On the other hand, Roger Lee suggests that economic geography is 'a geography of people's struggle to make a living' and should therefore concern itself with 'the sustainable and humane production, use and reproduction of the social, natural and material conditions of human existence'.

On the basis of this, Lee argues that an 'inclusive economic geography' should include the study of:

- The cultural and environmental origins of economic activity, articulated through socially constructed gender and kinship relations; and the struggle to establish a particular set of social relations of production and their geographical extent.
- The conceptualisation of nature.
- The forms of calculation and measurement of value.
- The processes and forms of production and consumption generated by such relations and value systems.
- The division of labour.
- The conditions of development within a particular set of social relations.
- The forms of state and politics which support and

legitimise particular social relations and processes of production and consumption.
- The construction of cultural and ideological forms which shape the basis of discourse within a particular value system.
- The structuring of relationships within and between different sets of social relations.
- The conditions of transformation from one set of social relations of production to another.

This is a long list indeed–it reflects the view discussed earlier that there are 'no economies, only economic geographies'. Put differently, given that all economic processes are inherently spatial, economic geographers should be concerned about all the processes related to the people's struggle to make a living. However, an important question arises about whether such an approach is still needed in the era of globalisation in which space is apparently being dissolved by modern information and communication technologies.

AGE OF GLOBALISATION: THE END OF GEOGRAPHY

Powerful arguments have been put forward about the impact of globalisation in general, and the effects of the ICT revolution in particular, on economic activities. Some observers have come to the conclusion that electronic communications have 'space-shrinking' effects and will bring about the 'death of distance' and thus, ultimately, the 'end of geography'.

The 'death of distance' thesis has been expressed by Cairncross as follows:

- 'Distance will no longer determine the cost of communicating electronically. Companies will organize certain types of work in three shifts just as to the world's three main time zones: the Americas, East Asia/ Australia, and Europe…No longer will location be key to most business decisions. Companies will locate any screen-based activity anywhere on earth, wherever they can find the best bargain of skills and productivity.'

A similar argument has been put forward by O'Brien who argued that ICTs will allow money to be moved around the globe without constraints, thus spelling the 'end of geography':

- 'The end of geography, as a concept applied to international financial relationships, refers to a state of economic development where geographical location no longer matters, or matters less than hitherto. In this state, financial market regulators no longer hold sway over their regulatory territory; that is rules no longer apply to specific geographical frameworks, such as the nation-state or other typical regulatory/jurisdictional territories. For financial firms, this means that the choice of geographical location can be greatly widened… Stock exchanges can no longer expect to monopolize trading in the shares of companies in their country or region… For the consumer of financial services, the end of geography means a wider range of services will be offered, outside the traditional services offered by local banks.'

Both the authors of these statements attempt to convince their readers that, thanks to ICTs, space and place no longer matter or at least they matter much less than before. Indeed, they both seem to suggest that location in space is no longer an issue for firms as they can locate 'anywhere on earth'. Also, the role of place is apparently greatly diminished. Cairncross, for instance, suggests that the only place characteristics that firms may be interested in can be reduced to 'the best bargain of skills and productivity'.

O'Brien, in the meantime, does not seem to recognise any role that places may play in the globalised financial markets. But, interestingly, both Cairncross and O'Brien seem to imply that the national scale is increasingly irrelevant in the global economy. Indeed, O'Brien specifically points out that financial market regulators 'no longer hold sway' and that rules no longer apply to nation-states, because financial flows are spilling over traditional national boundaries. Similarly, Cairncross seems to suggest that the time zone is the only geographical scale that holds any relevance in the new era of

global electronic communications. What is interesting about the above statements of Cairncross and O'Brien is that they both see globalisation as something positive.

Note, for instance, Cairncross's suggestion that companies will benefit from the new locational freedom by allowing them to find and exploit 'the best bargain of skills and productivity'. O'Brien, meanwhile, suggests that the 'end of geography' will be beneficial for both financial firms and their customers.

Views such as these can be labelled as 'hyperglobalist'. Some of them go as far as to suggest that freeing economic activities from their traditional geographical constraints will bring benefits to all people in all corners of the globe. However, this, manifestly, does not seem to be the case. Today's world is ridden with sharp inequalities both within and between countries and geography plays an important role in understanding economic and social processes and their uneven manifestations in the age of globalisation.

IMPORTANCE OF ECONOMIC GEOGRAPHY IN THE ERA OF GLOBALIZATION

Despite the hyperglobalist views, the role of space, place and scale do not diminish in the globalising world. Quite the opposite perhaps. Indeed, as economic activities are increasingly internationalised, interconnections between various places increase, competition between them intensifies and inequalities are on the rise, so geography becomes more important than ever. And as we have pointed out earlier, an economic-geographical approach is perhaps 'best placed to help us appreciate and understand the modern economic world in all its complexity'.

This conviction is based on the knowledge that economic geography offers powerful tools for analysing and understanding contemporary economies and societies. Economic geography, for instance, can help us to understand that, despite years and decades of economic globalisation, the pattern of investment, production, trade and consumption is highly uneven. Economic geography can also help us to understand that even footloose multi-national corporations

have to be 'grounded' in specific locations and often 'embedded' in places and their socio-political, institutional and cultural contexts. Economic geography also helps to elucidate the ways in which MNCs and other economic activities are 'governed' at various geographical scales from local and regional to national, macro-regional and global levels. Economic geography also helps us to understand that despite the widespread use of ICTs, trading places for global financial capital remain stubbornly located in a small number of global cities and these global cities, in turn, influence economic processes around the world.

Thanks to these and other insights, economic geography can thus contribute to our understanding of inequalities at various geographical scales from poverty in urban areas to global uneven development. No other discipline can claim such a wide scope of interest and relevance to today's rapidly changing world. By following this subject guide, you will gain solid foundations in economic geography approaches, concepts and theories and their applicability to the contemporary world and policy-making.

APPROACHES IN ECONOMIC GEOGRAPHY

We introduced economic geography as a subdiscipline of geography which uses a geographical approach to study economies. We have highlighted the fact that the economic-geographical approach of studying economies is very different from the one used by mainstream economics. We have also noted that economic geographers see the economy through the prism of space, place and scale.

What we have not done is to explore the question of what 'the economy' actually is. However, this is a fundamental question. Indeed, the way in which we define what 'the economy' is influences our understanding of how 'the economy' works and what can be done about it. Importantly, the definition of 'the economy' and 'the economic' has an important bearing on our understanding of the way economic processes work over space, across scales and in particular places. In other words, the way in which we define 'the

economy' has profound implications for our understanding of economic geographies. This stage thus aims to address this issue by exploring the different theoretical perspectives on 'the economy' and their geographical implications. The point here is not to provide a detailed description of the various economic geography concepts.

Rather the aim here is to allow the reader to grasp and recognise the key differences in the theoretical foundations on which various economic geography concepts have been developed. Economic geography is not a monolithic sub-discipline. Rather it is a sub-discipline which draws on various intellectual traditions.

This stage will consider three broad perspectives on the economy:

- The mainstream economic perspective.
- The Marxist perspective.
- Alternative approaches.

These three perspectives represent contrasting views on how the economy works and in turn offer three quite different ways of approaching economic geographies. But first, let us explore the question of what the economy is.

WHAT IS THE ECONOMY?

Defining the Economy

Let us start with a definition of 'the economy'. The term is used in everyday life with such frequency that we rarely pause to think what the economy actually is. Most people take the notion of the economy for granted. In fact, many economics dictionaries and textbooks take it for granted too and do not even bother defining it. The term 'economy' had not featured in the original version of Raymond Williams' Keywords either. So what is 'the economy'?

The Concise Oxford English Dictionary suggests that the word 'economy' is in fact of Greek origin. The Greek term 'oikonomia' basically means 'household management'–from oikos 'house' and nomos 'managing' from nemein 'manage'. The hint of this original meaning still survives today and 'economy' can mean 'careful management of available

resources'. In travel this can mean that you buy the cheapest air or rail ticket and travel 'economy class'. However, since about the eighteenth century the term economy also began to gain a new meaning and now can refer to economic affairs at a much larger geographical scale, namely that of a nation.

Nowadays, the notion of 'the economy' is perhaps still most commonly used to describe the economic processes of a country. The Concise Oxford English Dictionary defines the economy as 'the state of a country or area in terms of the production and consumption of goods and services and the supply of money'. However, as it will become apparent below, even this latter definition is somewhat problematic.

Measuring the Economy

Perhaps the most common way of measuring 'the state in which a country is in terms of the production and consumption of goods and services' is an indicator called Gross Domestic Product. GDP measures, in money terms, the total market value of production in a particular economy in a given year. It is usually calculated as a sum of expenditures by households, firms and the government plus net exports.

By household expenditure we mean the total amount spent by individuals in a given year including their expenditure on food, fuel, housing, clothing, household appliances, leisure, etc. Expenditure by firms is measured as investment expenditure by which we mean the amount invested by businesses in future productive capacity. Government expenditure is the amount spent by the government to build infrastructure or provide services. Finally, net exports represent the value of goods and services sold to other countries minus the value of goods and services imported from abroad.

Problematising and Re-defining the Economy

GDP represents a fairly standard way of measuring the economy. It captures three key economic agents–namely households, firms and the government–all of which play important roles in the economy. Yet measuring the economy

in this way can be highly problematic. One of the key problems is that GDP measurement is derived from a definition of the economy that is rather narrow–it includes certain things and processes but excludes others.

Coe offer a very good example of this problem. If you have taken a bus or drive a car to your place of work or study then you have engaged in an economic act. Your bus fare or your fuel bills and parking costs would be included in your individual consumption and therefore included in the conventional definition of the economy. But if you decide to cycle or walk instead, no money will change hands and, therefore, oddly, you have not engaged in an economic act! Another good example is unpaid work. Since no wages are paid, unpaid work occurs outside the formal monetary economy and therefore is not included in the consideration of the state of the economy.

This way, not only is the economy miscounted, but also the work of certain people is discounted. A similar problem arises with the 'black economy'. In the 'black economy', money can indeed change hands, but because these monetary transactions are not recorded by the government, they are not included in what counts as 'the economy'. Yet, the livelihoods of millions of people around the world may be dependent on such transactions. Thinking about what constitutes an economic act or process is crucial for our understanding of the economy and is, therefore, a point of contention.

The way in which cultural, social, political and environmental processes are related to the economic processes is another contentious issue. A conventional definition of the economy supports the impression that the economy is somewhat separated from other dimensions of our lives. This in turn helps to create the impression that the economy is something 'out there', which affects our lives, but which we, as individuals, cannot control.

This impression is often reinforced by the way the economy is represented in everyday use and policy documents. Indeed, the economy is often represented by metaphors such as a 'machine', an 'organism' or a 'body'; that

presumably has a life of its own. However, it could be argued that the economy is inseparable from cultural, social, political and environmental processes.

Ray Hudson, for instance, understands 'the economy' as referring to:

- those simultaneously discursive and material processes and practices of production, distribution and consumption, through which people seek to create wealth, prosperity and wellbeing and so construct economies; to circuits of production, circulation, realisation, appropriation and distribution of value.

However, he is quick to add that value is 'always culturally constituted and defined' and that '[w]hat counts as "the economy" is, therefore, always cultural, constituted in and distributed over space, linked by flows of values, monies, things and people that conjoin a diverse heterogeneity of people and things'. He further argues that '[e]qually importantly, the social processes that constitute the economy always involve biological, chemical or physical transformation via human labour of elements of the natural world'.

This also means that thinking about 'the economy' in terms of evergrowing GDP, for instance, may not be a universally shared, nor necessarily desirable, concept. Indeed as Hodder and Lee have argued several decades ago, that it is 'all too easy, for instance, to assume that the dream of each less-developed country is to become developed'. Indeed, 'such a view can easily disregard highly developed local cultures'. They add that 'self-respect is at least as important a measure of social and economic progress as are increases in… material wealth'.

Similarly, studying 'the economy' without considering the environmental dimension of economic processes is problematic, not least because 'economic activities are taking an increasing toll of balanced interactions within the life-giving ecosystem'. Another way to approach a definition of 'the economy' is to remind ourselves of the notion introduced in that there are 'no economies, only economic geographies'. In turn, economic geographies can be defined as 'geographies of

people's struggle to make a living'. Importantly, this struggle to make a living is framed in both material and social processes. In other words, 'all economies and economic geographies are both material and social constructs'. What is more, in the construction of economic geographies the relations between the material and the social are 'inseparable and mutually formative'. The recognition of this further undermines the notion of the economy as simply being 'the state of production and consumption of goods and service and the supply of money' or as being measurable by GDP.

HOW DOES THE ECONOMY WORK

We have attempted to answer the question 'what is the economy?' The process of defining the economy can be problematic. What should and should not be included in the notion of 'the economy' remains a contentious issue. In this part as suggested, attempt to address an issue which is even more contentious: 'How does the economy work?' As already pointed out in the introductory part, the answer to this question is in part influenced by the way we define the economy. However, even people who would share the view about what the economy is can disagree profoundly on the question of how it works. Large numbers of economists and social scientists work on this question every day and we have no space here to review all of their theories. Instead, what as suggested, attempt to do in this is to identify three basic theoretical perspectives on the economy.

First, as suggested, examine the mainstream economic perspective, which sees the functioning of the economy through the lens of market forces and which maintains that individual self-interest mediated by the 'invisible hand' of the market leads to equilibrium and prosperity.

Second, as suggested, introduce the Marxist perspective which, in contrast, argues that the capitalist market economy is ridden by internal contradictions and produces both inequality and instability. Finally, as suggested, have a look at the alternative approaches, especially those associated with evolutionary and institutionalist economics, which try to go

beyond the boundaries of market-based processes and which pay attention to wider social, cultural and institutional contexts in order to explain how economies function.

Mainstream Economic Views

The mainstream economic perspective is mainly associated with neoclassical economic theory. The neo-classical school of thought has been developing since the late nineteenth-century and currently represents the dominant way of looking at the economy. Neo-classical economics is rooted in the belief that the market is the most efficient mechanism for the allocation of resources and hence the creation of prosperity.

The neo-classical school of economic thought has been built on the foundations laid down by Adam Smith, a Scottish economist and the founder of the classical political economy. Back in the eighteenth century, Smith devised an economic theory, the features of which remain with us today. This includes his concepts of rational self-interest and the 'invisible hand' of the market, concepts that underpin much of contemporary mainstream economic thinking. In seeking to identify how wealth is created, Adam Smith argued that the main cause of prosperity is the division of labour.

Smith expressed his arguments in his famous work titled An Inquiry into the Nature and Causes of the Wealth of Nations published in 1776. In it, Smith used an example of a factory making pins to explain the power of the division of labour and the productivity that can be achieved from this. He argued that a single worker working alone at home would be lucky to produce even one pin per day and certainly not 20. However, he observed that in a pin-making factory 10 workers can engage in the production of pins by dividing 18 specialised pin-making tasks between them:

- One man draws out the wire, another straights it, a third cuts it, a fourth points it, a fifth grinds it at the top for receiving the head; to make the head requires two or three distinct operations; to put it on, is a peculiar business, to whiten the pins is another; it is even a trade

> by itself to put them into the paper; and the important business of making a pin is, in this manner, divided into about eighteen distinct operations, which, in some manufactories, are all performed by distinct hands, though in others the same man will sometimes perform two or three of them Smith.

By dividing the work between them in this way, Smith argued, 10 workers can together produce about 48,000 pins per day. That is 4,800 pins per worker per day, representing a massive improvement of productivity when compared to the output achievable without the division of labour. The above improvement of productivity in the pin-making factory is impressive indeed.

But how does the pin-making factory know how many pins to produce and at what price to sell them? The mainstream economists, this problem will be solved by what Smith called the 'invisible hand' of the market. The market will determine both the quantity of goods produced and the price at which these goods will be sold, by matching supply with demand. This is how it works. From a producer's point of view, the higher the price customers are prepared to pay for a product the more the producer will be prepared to produce.

However, the higher the price, the less the goods will be in demand by the customers. Under perfect market conditions, supply and demand curves will intersect in the middle, thus fixing both the quantity of goods to be produced and the price under which they will be sold. In other words, the markets will achieve equilibrium. However, is based on the expectation that both producers and consumers are acting in a rational, economising or profit-maximising way.

In other words, they are behaving as homo economicus. Adam Smith argued that such behaviour is motivated by 'self-interest'. He further argued that by pursuing their own self-interests, individuals, led by the 'invisible hand' of the market, are unintentionally contributing to a greater societal good, a win–win situation, from which everybody will benefit. If pin-makers, shoe-makers, butchers and bakers all pursue their individual self-interest, the market will ensure that everybody

will be better off. Since the times of Adam Smith, economic theory has developed a lot, but the key principles he introduced are still with us. The analysis of the workings of the economy through the lens of rational profit-making agents and the belief that markets are capable of delivering both equilibrium and efficiency, is central to neo-classical economic theory. However, such an understanding of the economy has been challenged by Marxist and other alternative approaches which as suggested, examine in turn.

The Marxist Approach

The Marxist perspective on the economy is derived from the work of Karl Marx and Friedrich Engels, two German philosophers of the late nineteenth-century. Like Adam Smith, Karl Marx was interested in the question of how wealth is created in the economy and how wealth is distributed among members of society.

However, in stark contrast to the win–win situation alluded to by Smith, Marx pointed out that wealth will increasingly concentrate in the hands of the few. How so? To answer this question, Marx devised his labour theory of value. In order to explain the basics of the labour theory of value as devised by Marx, let us go back to the pin-making factory described earlier. As we have seen, the productivity gains from organising pin production in the pin factory were substantial. But who reaps the benefits? If the factory was jointly owned by the 10 workers who work there, it is possible to imagine a situation in which they could split the benefits of their production between themselves.

However, in the capitalist market economy, the factory is likely to be privately owned. The owner, the capitalist, would own the land on which the factory is built, the factory building itself, the raw materials needed to produce the pins and all the machinery and tools used by the workers. In other words, he or she would own the means of production. Workers, on the other hand, do not own the means of production and the only way they can sustain themselves is to sell their own work to capitalists. Thus, in the capitalist market economy, labour

itself becomes a commodity–labour power can be bought and sold like any other commodity. So, workers sell their labour and receive wages in exchange for their work and that looks fine on the surface. However, the question arises as to what capitalists do to sustain themselves? They have to engage in the circuit of capital and make profit.

The way Marx described how the circuit of capital works. Imagine a capitalist who has capital in the form of money–money capital (M)–to invest. He or she can turn this money capital into productive capital (P) by purchasing two commodities–the labour power (LP; *e.g.* labour of 10 workers) and the means of production (MP; *e.g.* pin-making factory, raw materials, machinery, tools, etc., needed to produce pins). The labour power and the means of production are then combined in the process of production to produce 48,000 pins a day–representing another form of capital–commodity capital (C).

Commodity capital can be turned back into money capital when the factory owner sells pins on the market at a certain price (and this price represents what Marxists call exchange value). For the capitalist to survive, he or she has to make a profit. This means that the money he or she receives in exchange for the commodities produced must be greater than the money originally invested in the enterprise (M' > M). The search for profit is the motivating force of the capitalist economy. The crucial point in the Marxist analysis is a recognition that, ultimately, all value comes from human labour and the only way for a capitalist to make profit is to appropriate surplus value (s).

Surplus value is the difference between the wages the factory owner pays workers for their labour and the value these workers produce for him or her in the factory while making pins. To frame it differently, workers add value to the commodities they produce by applying their labour, and this value is greater than the reward they get in exchange for their efforts in the form of wages.

This is the basis of exploitation in the capitalist economy. However, capitalists have to engage in it, if they are to survive the cut-throat competition from other capitalists, who have to

do exactly the same. Those capitalists who fail to generate profit (or enough profit) go out of business. The effort to maximise profit is therefore an imperative of the capitalist economy. All capitalists, individually, have to act in a profit-maximising manner, which echoes the self-interested behaviour described by Adam Smith. Such behaviour, in turn, further exacerbates competition and so it could be argued that one of the key features of capitalism is that it is inherently competitive. However, Marx argued that such individual action will not lead to the equilibrium and win–win situation envisaged by Smith–far from it.

Marx argued that capitalism (the system based on capital) is both unequal and unstable. He argued that inequalities within society will increase as capitalists try to increase their profits and squeeze workers' wages, by introducing machines, intensifying labour processes or simply by forcing workers to work longer hours, for example. Capitalists can also endeavour to replace workers by machines and by doing so, they create a growing pool of the unemployed, which in turn will push wages down further still.

The result of this process will be an increasing concentration of wealth in the hands of a few (the capitalist class) and the impoverishment of the working class masses (proletariat). Simply put, the capitalist system will ensure that the rich will become richer and the poor will become poorer. Ethical issues aside, Marx argued that such a system is unlikely to reach an equilibrium of the kind envisaged by Adam Smith, because sooner or later the fundamental economic contradiction arises: too many commodities (*e.g.* pins) will be produced, but there will be too few people able to buy them.

Marxists call this situation an overaccumulation. Overaccumulation can take various forms, but overaccumulation of capital in the form of unsold commodities is one of the most striking symptoms. Ian Craib offers a very good illustration of how such a crisis of overaccumulation can happen, using a crucial distinction in Marxist theory between use value and exchange value:

- 'If I am a worker and I produce £50 worth of goods in a

day (the use value of my labour to my employer), and I receive £10 a day in wages (the exchange value of my labour power), then I do not receive in wages sufficient to buy back the value of goods I have produced. This applies right across the system, so that if stocks of unsold goods build up, workers have to be laid off, and the economy enters a crisis, a depression, or slump, until the stock of goods are used up and firms go back into production. There is a cycle of growth and slump, something that capitalist economies have been trying to deal with for over a century and a half.'

This is then one of the possible causes of the familiar boom-and-bust cycle. Each boom is followed by a crisis in which devaluation must take place to kickstart the accumulation process all over again. For Marx then, the capitalist economy is neither equal nor stable–it is inherently unequal and crisisprone. The profit-making imperative that drives the capitalist economy and makes it dynamic, is also a source of its fundamental contradiction. Marxist conceptualisation of the economy therefore represents a stark contrast to the equilibrium-prone and win–win expectations of mainstream economics. Importantly, Marx also argued that in the long run, the capitalist system is unsustainable, because the increasing contradictions will reach a tipping point at which the system will eventually collapse.

This, Just as to Marx will happen in the most advanced capitalist countries, where the contradictions between labour and capital will be the greatest. The collapse of capitalism will pave a way (via a socialist revolution led by the working class) for a new social and economic order (communism). Marx said very little about how such a new system would operate. However, for a system to be freed from exploitation, both private property and class relations based on property rights would have to be abolished.

While Marxism provides a powerful analysis of the way the economy works, it also leaves us with a number of important issues. Indeed, the economy does not always work as predicted by Marx and, so far, the socialist revolution has

failed to materialise in the most advanced capitalist countries. One of the key questions therefore is how can we account for the fact that the capitalist system manages to survive despite its contradictions? Economic geographers have made an important contribution to the debate on this question. But for now, let's turn to the alternative approaches.

Alternative Approaches

It is clear from the above two sub-sections that mainstream economic and Marxist perspectives differ dramatically in their analysis of the workings of the economy. However, despite the differences, these two perspectives also share one common feature-they both focus on formal market transactions. Indeed, as we have seen, mainstream economics is concerned with the relationship between the demand and supply of goods or services as expressed by a price fixed through the market mechanism.

The Marxist analysis, meanwhile, focuses on the difference between the price of labour (exchange value of labour power) and the exchange value of the commodities produced by the labour. However, what constitutes 'the economy' and 'the economic' is a contentious issue. Echoing these concerns, a number of alternative economic approaches have emerged. These approaches usually fall within a category of heterodox economics since they are providing a counterbalance to the established mainstream (orthodox) economic views. One of the leading heterodox approaches is associated with evolutionary and institutional economics.

Evolutionary and institutional economics is in itself a diverse set of approaches, but there are some key shared characteristics that clearly distinguish these approaches from both the mainstream economics and Marxist perspectives. The starting point of evolutionary/institutional and other alternative approaches is their insistence that the economy cannot be reduced to market transactions only.

Instead, they argue that wider social, cultural and institutional contexts need to be taken into consideration if one is to explain how economies work. Institutional contexts are

defined broadly here and may include both formal institutions (*e.g.* laws, regulations, formal procedures) and informal institutions (*e.g.* habits, customs, conventions, cultural norms, etc.) at various scales-from the level of the firm to the institutional landscapes underpinning the whole economy. The inclusion of the wider social, cultural and institutional considerations has profound implications for the understanding of the ways economies work.

Importantly, such an inclusion challenges the neo-classical notion of the rational behaviour of 'economic man' guided by the 'invisible hand' of the market. Instead, it emphasises the way in which social institutions play an essential role in guiding the action of economic agents. (This also differs from the Marxist view that the role of economic agents is structured by the prevailing social relations of production). In the evolutionary/institutionalist view, firms, for instance, are not seen as atomistic units competing against each other on the free market. Rather, firms are perceived as being embedded within wider socio-economic relations and networks.

These networks may include various formal and informal links with suppliers, customers and competitors. Importantly, transactions within these networks are not simply guided by market competition. Rather they often involve valuable elements of coordination and cooperation. This is important because such cooperative networks are often crucial for fostering innovation which is seen as vital for economic development or economic evolution. In turn, this raises the question whether the 'pure market' is the best mechanism for ensuring economic progress.

Evolutionary and institutionalist economists would argue that successful economies are neither pure markets nor pure hierarchies. Instead, successful economies are 'mixed economies' with important roles for the public sector and for different kinds of policy. Mixed economic systems are also seen as capable of producing a diversity of economic forms which contributes to the adaptability and longterm survival of economic systems. Another line of argument advanced by alternative approaches relates to the claim that successful

economies are increasingly knowledge-intensive or knowledge-based. The knowledge-based economy can be simply defined as an economy in which knowledge becomes the key economic resource. While all economies can be seen as knowledge-based, there is a perception that we witness a major shift in the relative importance of land, physical capital and knowledge capital, in favour of the latter. For some observers, the shift towards the knowledge-based economy represents an epochal transformation.

As Burton-Jones vividly put it:

- 'Since ancient times, wealth and power have been associated with the ownership of physical resources. The traditional factors of production, materials, labour, and money, have been largely physical in nature. Historically the need for knowledge has been limited, and access to it largely controlled by those owning the means of production. Steam power, physical labour, and money capital largely facilitated the Industrial Revolution... In contrast, future wealth and power will be derived mainly from intangible, intellectual resources: knowledge capital. This transformation from a world largely dominated by physical resources, to a world dominated by knowledge, implies a shift in the locus of economic power as profound as that which occurred at the time of the Industrial Revolution. We are in the early stages of a "Knowledge Revolution."'

The notion that the economy is moving towards a post-industrial, knowledge-intensive phase, in turn, opens up a whole set of questions. Both mainstream economics and Marxist approaches have been devised in the context of an industrial era. But will the same principles apply to the new knowledge economy? Evolutionary and institutionalist economists have devised their own approaches to account for the ways knowledge economies work.

One of the most influential concepts is that of the 'learning economy' introduced by Lundvall and Johnson. The starting point of the 'learning economy' concept is the argument that if knowledge is the most fundamental resource in our

contemporary economy, then learning is 'the most important process'. Although Lundvall and Johnson admit that knowledge always has been a 'crucial resource' for the economy, and was in the past 'layered in traditions and routines', they argue that knowledge and learning have more recently become much more fundamental resources than before. They argue that the economy is now characterised by 'new constellations of knowledge and learning in the economy' mainly through the development of ICTs, flexible specialisation and, finally, changes in the process of innovation.

These changes are bringing challenges that firms have responded to by changing organisational forms and by building alliances in order to gain access to a more diversified knowledge base. This implies 'broader participation in learning processes' to include all layers within the firm, the development of 'multiskilling and networking skills' and enhancing the 'capacity to learn and to apply learning to the processes of production and sales'. This is why Lundvall and Johnson 'regard… capitalist economies not only as knowledge-based economies but also as "learning economies"'.

They offer the following definition of the 'learning economy':

- 'The learning economy is a dynamic concept; it involves the capacity to learn and to expand the knowledge base. It refers not only to the importance of the science and technology systems-universities, research organisations, in-house RandD departments and so on-but also to the learning implications of the economic structure, the organisational forms and the institutional set-up.'

At the core of the 'learning economy' are apparently firms that 'start to learn how to learn' and which are able to handle various types of knowledge. Lundvall and Johnson distinguish at least four categories of knowledge: know-what, know-why, know-who and know-how. The first category, know-what, represents knowledge about 'facts'. The meaning of this is probably close to that of 'information'. The, second category, know-why, refers to scientific knowledge of principles and laws of motion in nature and in society. This kind of knowledge, Lundvall and Johnson argue, is extremely

important for technological development. The third term, know-who, is already a more complex construction that reaches a sphere of specific social relations and time-space dimension. A simple example of know-who can be a situation when, for a successful innovation, it is more important to know key persons than to know basic scientific principles.

Know-when and know-where refers to economically useful knowledge about markets with their temporal and spatial dimensions, for instance. Finally, knowhow refers to practical skills in production or other spheres of economic activity. Lundvall and Johnson also address different aspects of learning. Importantly, they do not understand learning as a simple absorption of science and technical knowledge. Rather, they define it more broadly as learning changes in economic structures, organisational and institutional forms. Learning is presented as a dynamic and interactive process aimed at the accumulation of knowledge at the level of the firm and the economy as a whole.

Learning is present in both production and consumption processes and is expressed through 'learning by doing' and 'learning by using'. From the point of view of permanent renewal and adaptation of economic and organisational structures, Lundvall and Johnson have also introduced an innovative term 'forgetting'. They argue that the 'learning economy' should not only preserve and store its pool of knowledge, but also should be able to 'forget'. 'Forgetting' at the level of individual workers refers to their ability to abandon obsolete skills and professional expertise. An example of 'forgetting' at the level of the firm or economy includes closing down ailing branches or whole sectors.

Thus, the 'learning economy' is supposed to intelligently manage continuous self-organised learning. The work of Lundvall and Johnson and other evolutionary/institutionalists has proved highly influential in framing the discussion on contemporary economic geographies, despite the fact that there remain questions about the precise nature of the supposed transformation of the economy towards the 'knowledge-based economy' or 'learning economy'. One

contentious issue relates to the question of whether the transformation beyond an old industrial economy also signifies a move beyond a capitalist economy. Geoffrey Hodgson-one of the prominent evolutionary/institutionalist economists-contributed to the debate by offering his own definitions of the 'knowledge-intensive economy' and 'learning economy'.

Hodgson has argued that the 'knowledge-intensive economy' would still be a capitalist one, but it would be an economy in which an 'enlightened group of business leaders' is 'aware of the kind of democratic culture and participatory industrial relations that facilitate productivity'. Alongside 'collaborative and co-operative relationships between firms... against the neo-liberal insistence on fierce, price driven, market competition', Hodgson suggests that:

- 'Such a progressive movement of business people could find valuable allies among trade unionists and the population as a whole'. However, for Hodgson, the 'learning economy' or 'market cognitism', in contrast, is a scenario clearly 'beyond capitalism' where the 'degree of control by the employer over the employee is minimal'. Hodgson has argued that such an economy, 'would not be socialist, in any common sense of the word', but nevertheless, 'it is not capitalism' presumably because the means of production are effectively controlled by the workers themselves, not by the employers. Such a benign view of the emerging new 'knowledge era' thus implies that the contradictions identified by Marx as inherent to the capitalist economy may be waning. This point is hotly debated but if proven true, it can have potentially important implications for the way we conceptualise economic geographies of the 'new era'.

HOW DOES THE ECONOMY WORK OVER SPACE

The perspectives on the economy presented offer a good starting point to explore the question of what the economy is and how it works. However, the problem is that all views presented above could be seen as 'aspatial'. Indeed, they do

not tell us much about how the economy or economies work over space. Economic and geographical considerations are, in other words, impossible to separate. The question of how the economy work(s) over space, across scales and in particular places, is the key question of economic geography.

This is an important question economic processes are enfolding in space in a highly uneven way and are engaged in producing and reproducing inequalities at various spatial scales. How can we explain this uneven and unequal development? The three perspectives on the economy presented in the previous part provide three very different ways of approaching this question. In other words, different perspectives on 'the economy' have profound implications for the theoretical conceptualisation of economic geographies.

NEO-CLASSICAL APPROACH, LOCATION THEORY AND BEYOND

Let us start with the neo-classical approach. The application of the neoclassical model for the understanding of the ways in which the economy works over space looks straightforward enough. Echoing the view that the 'invisible hand' of the market will ensure equilibrium between demand and supply, neo-classical theory of spatial development implies that any uneven development is temporary, because market forces will ensure that some sort of spatial equilibrium or balanced development will be achieved in the long run.

This view is based on the assumption that, following the logic of the rational economic man, both producers (firms) and consumers (workers) will move between regions in search of the most profitable location. Simply put, labour will move from poorer to richer regions (in search of higher wages) and capital will move in the opposite direction (in search of cheaper labour and land).

Even more complex neo-classical models that involve other factors of production (*e.g.* technology) are all built around the assumption that some sort of spatial equilibrium will be achieved in the long run, because such factors of production will inevitably spread or disperse over space. The processes

of spatial dispersal can indeed be observed in reality. However, the examples of spatial equilibrium that the neo-classical theory envisages, are hard to find. One way of accounting for this discrepancy is to acknowledge that, in real life, factors of production cannot move 'freely' over space. Indeed, there are various constraints involved. One of the obvious obstacles is the friction of distance.

The calculation of the cost associated with moving people, machinery, materials or goods across space and the implication of this for location in space forms the basis of the neo-classical location theory. Key concepts that build upon the location theory include the central place theory, urban hierarchy, market potential and accessibility. These concepts help us to understand how the friction of distance influences the location of economic activities in space.

Further insights into why economic activities simply do not disperse in space are, among others, offered by the concepts of agglomeration economies, increasing returns and cumulative causation. These latter concepts identify additional market advantages arising from the spatial concentration of economic activities. In essence, these concepts show that rather than having a self-correcting dispersal effect, market forces can in fact reinforce existing inequalities in space. The kind of spatial equilibrium envisaged by the neo-classical theory is therefore hard to achieve. It could be argued that these latter concepts 'use the approach and language of neo-classical economics to reach contrary conclusions'.

MARXIST-INSPIRED APPROACHES AND UNEVEN DEVELOPMENT

Marxist-inspired approaches in economic geography also challenge the neoclassical idea of spatial equilibrium, although coming from a completely different perspective. Marxist theory sees capitalism as a system based on the exploitation of labour. The profit imperative makes such a system incredibly dynamic, yet, at the same time, inherently unequal and crisis-prone. Internal contradictions mean that crises of overaccumulation are inevitable in such a system. Devaluation

must take place to kick-start the accumulation process all over again. Building on these systemic features of capitalism, Marxist economic geographers do not see inequalities in space as disappearing with the operation of market forces. Instead they consider uneven development as a permanent, unavoidable and, in fact, necessary feature of the capitalist market economy.

Indeed, in Marxist-inspired approaches, uneven development is usually seen as both the necessary precondition and the unavoidable consequence of capitalist economic growth. Several concepts have been put forward that try to describe the way capitalist economies work over space. One of them uses a 'see-saw' metaphor to describe the ebb and flow of capital from one region to another in search of profit. Destruction and devaluation of places left behind may create pre-conditions for future renewed growth. In a similar vein, the concept of spatial fix recognises that geographical space is an important element in the functioning of the capitalist economy and its ability to contain, absorb or delay crises.

This includes the expansion of the spatial horizons of the capitalist system, for example, in the form of new spaces of production or new regional markets. Such a spatial expansion (or spatial fix) is perhaps one of the ways in which the capitalist system is able to postpone the collapse predicted by Marx. In this view, geographical space plays a crucial role in the workings of the capitalist system. Another concept that tries to capture the operation of the capitalist economy over space is that of spatial divisions of labour. It describes the way in which capitalism creates spatial structures that assign distinct economic functions to particular regions.

The economic fortunes of these regions are thus linked to their position in the spatial division of labour within the wider economic structure. Related to this is a concept of core-periphery which conceptualises uneven development as a set of uneven economic relations between a (dominant) core region and (dominated) periphery region(s). Somewhat echoing the exploitative nature of capitalist class relations, the core-periphery concept suggests that rich regions (or countries)

exist thanks to the exploitation of peripheral regions (or countries). One way or other, in Marxist-inspired approaches, uneven development is always linked to the structural features of the economy. This is in stark contrast to some alternative approaches that are going to be examined in turn.

EVOLUTIONARY/INSTITUTIONALIST APPROACHES AND NEW ECONOMIC GEOGRAPHY

Economic geography approaches that draw from heterodox economics and the evolutionary/institutionalist perspective represent a diverse and evolving group. However, some common features are discernible. The evolutionary/ institutionalist perspective emphasises the importance of social, cultural and institutional factors for the understanding of the ways economies work. This is in contrast to both neo-classical views and the Marxist approach (that assumes that such factors are determined by, rather than being determinants of, the economy).

However, the evolutionary/institutionalist perspective sees the economy as always embedded in, and constituted by, social, cultural and institutional spheres. Economic geography approaches developed from this perspective thus see uneven development as inextricably linked to (or shaped by) institutional contexts. One of the key points that such economic geography approaches are making is that social, cultural and institutional contexts are placespecific. In other words, economic fortunes of regions (or whole countries) depend on the institutional arrangements that these regions (or countries) are able to create. At the regional level, for instance, the concept of 'institutional thickness' has been proposed to capture the strength of local/regional institutions, their ability to cooperate and to promote a coherent development strategy.

In line with the view that successful economies are increasingly knowledge-based or learning economies, successful regions have also been conceptualised as learning regions. The key feature of such regions is their ability to innovate, to learn and to accumulate knowledge in various forms, thanks to their institutional set-up. It is argued, for

instance, that the capacity to innovate and to learn depends on various collaborative networks, which are sustained thanks to the institutions of trust, shared culture and social capital, all of which are dependent on particular regional settings. In this view then, regions are in fact seen as key engines of the knowledge economy and uneven development in such an economy is a result of differences in regional 'institutional thickness', innovation capacity, learning and knowledge accumulation.

Interestingly, there are two opposing views with regard to the prospect of achieving balanced development in the knowledge-based or learning economy. The first view is based on the assumption that economically lagging regions (or nations) can catch-up because favourable conditions for growth can be created locally by making appropriate institutional arrangements. This view is further supported by the assumption that thanks to information and communication technology (ICT), the key resource in the knowledge economy-knowledge-can move freely around the world. It should therefore be possible for previously underdeveloped regions to emulate the success of leading regions such as Silicon Valley.

The second, and opposing, view suggests that uneven development will continue to be a feature in the knowledge-based economy. This view is based on the assumption that the key sources of competitiveness and economic success is non-standardised tacit knowledge (as opposed to standardised, written, explicit knowledge). Tacit knowledge, the argument goes, is embedded in local/regional institutions, regional innovation cultures and clusters and these are apparently place-specific to the extent that they cannot be replicated by regions elsewhere.

One way or another, the interest in regional institutional settings has been associated with the emergence of so-called new economic geography. While the term 'new economic geography' is used by some economists to describe recent advances in economics in relation to space in geography the term is used to describe an economic geography approach which moves away from viewing economic processes as

separate from social, cultural and political contexts and emphasises that these contexts are crucial for understanding economic dynamics. New economic geography therefore also enthusiastically embraces the notions of culture, social capital, ethnicity and gender in its study of the economy, reflecting a wider 'cultural turn' in social sciences.

9

Urban Geography

INTRODUCTION

Urban geography is the study of areas which have a high concentration of buildings and infrastructure. These are areas where the majority of economic activities are in the secondary sector and tertiary sectors.

They often have a high population density. Urban geography is that branch of science, which deals with the study of urban areas, in terms of concentration, infrastructure, economy, and environmental impacts. It can be considered a part of the larger field of human geography.

However, it can often overlap with other fields such as anthropology and urban sociology. Urban geographers seek to understand how factors interact over space, what function they serve and their interrelationships. Urban geographers also look at the development of settlements.

Therefore, it involves planning city expansion and improvements. Urban geography, then, attempts to account for the human and environmental impacts of the change. Urban geography focuses on the city in the context of space throughout countries and continents. Urban geography forms the theoretical basis for a number of professions including urban planning, site selection, real estate development, crime pattern analysis and logistical analysis.

AREAS OF STUDY

There are essentially two approaches to urban geography. The study of problems relating to the spatial distribution of

cities themselves and the complex patterns of movement, flows and linkages that bind them in space. Studies in this category are concerned with the city system. Secondly there is the study of patterns of distribution and interaction within cities, essentially the study of their inner structure. Studies in this category are concerned with the city as a system. A succinct way to define urban geography that recognizes the link between these two approaches within the subject is then, that "urban geography is the study of cities as systems within a system of cities."

Site and Situation

Site describes the location of a city with respect to its soil, water supply and relief, or more still the actual point on which a settlement is built while situation describes the surrounding area of the city such as other settlements, rivers, mountains and communication. Locations for cities are usually chosen for good reasons.

Benefits of certain locations can include:

- A wet area: water is a constant necessity for urban areas and is difficult to transport. For this reason many cities are located near or adjacent to rivers.
- A dry area: in wet areas a dry area offers protection from flooding and marshland.
- Easy access to building materials: stone, wood or clay are necessary for the construction of cities and are difficult to transport long distances.
- A strategic defensive position: historically many cities have been constructed on high ground in order to make attack more difficult and to give a good view of surrounding land. River meanders are also used as partial moats. Some cities were also built in swampy areas for the same reason.
- fuel supply: most cities were initially constructed near wood for burning and cooking. Today many cities are constructed near coal, oil and gas mines to make use of those resources (for example: Newcastle, Glasgow, Pittsburgh, Essen).

- A food supply: cities need some nearby land to be suitable for animal grazing or crop growing.
- A travel intersection point and bridging points: it is often useful for a city to be located at the intersection of rivers, roads or train lines in order to facilitate travel and trade. Bridging points are shallow areas that allow easy construction of bridges, (for example: London, Cologne).
- Historically many cities grew at so-called "break-of-bulk" points along navigable rivers, where a local obstacle such as rapids required trade goods to be trans-shipped from larger boats to smaller boats, for example: Chicago, Montreal.
- Shelter and aspect: it is desirable to construct cities located on the side of a slope that is protected from incoming winds, and in a direction that receives maximum sun exposure.

Cities as Centres of Manufacturing and Services

Cities differ in their economic makeup, their social and demographic characteristics and the roles they play within the city system. These differences can be traced back to regional variations in the local resources on which growth was based during the early development of the urban pattern and in part the subsequent shifts in the competitive advantage of regions brought about by changing locational forces affecting regional specialization within the framework of the market economy. Recognition of different city types necessitates their classification, and it is to this important aspect of urban geography that we now turn. Emphasis is on functional town classification and the basic underlying dimensions of the city system.

The purpose of classifying cities is twofold. On the one hand, it is undertaken in order to search reality for hypotheses. In this context, the recognition of different types of cities on the basis of, for example, their functional specialization may enable the identification of spatial regularities in the distribution and structure of urban functions and the

formulation of hypotheses about the resulting patterns. On the other hand, classification is undertaken to structure reality in order to test specific hypotheses that have already been formulated. For example, to test the hypotheses that cities with a diversified economy grow at a faster rate then those with a more specialized economic base, cities must first be classified so that diversified and specialized cities can be differentiated. The simplest way to classify cities is to identify the distinctive role they play in the city system.

There are three distinct roles:

1. Central places functioning primarily as service centres for local hinterlands.
2. Transportation cities performing break-of-bulk and allied functions for larger regions.
3. Specialized-function cities are dominated by one activity such as mining, manufacturing or recreation and serving national and international markets.

The composition of a cities labour force has traditionally been regarded as the best indicator of functional specialization, and different city types have been most frequently identified from the analysis of employment profiles. Specialization in a given activity is said to exist when employment in it exceeds some critical level. The relationship between the city system and the development of manufacturing has become very apparent.

The rapid growth and spread of cities within the heartland-hinterland framework after 1870 was conditioned to a large extent by industrial developments and that the decentralization of population within the urban system in recent years is related in large part to the movement of employment in manufacturing away from the traditional industrial centres. Manufacturing is found in nearly all cities, but its importance is measured by the proportion of total earnings received by the inhabitants of an urban area.

When 25 per cent or more of the total earnings in an urban region are derived from manufacturing, that urban areas is arbitrarily designated as a manufacturing centre. The location of manufacturing is affected by myriad economic and non-

economic factors, such as the nature of the material inputs, the factors of production, the market and transportation costs. Other important influences include agglomeration and external economies, public policy and personal preferences. Although it is difficult to evaluate precisely the effect of the market on the location of manufacturing activities, two considerations are involved: the nature of and demand for the product and transportation costs.

URBAN AREAS

Census statistics for urban areas are produced both because of the widespread interest in information for areas *per se* (as they are more readily identifiable as the traditional towns and cities of Great Britain than are administrative areas, most of which comprise a mixture of both urban and rural land), and for the complementary purpose of dividing the country.s population between those living in urban areas and those living in rural areas.

Furthermore, the Statistical Office of the European Communities (SOEC) requested member countries to define large urban agglomerations (of 100,000 or more population) after the 1980 round of censuses. This part of the Report covers the concept of an urban area and some of the variety of ways in which such areas may be defined. The definitions used for urban areas identified in this listing differ between areas in England and Wales and areas in Scotland.

THE CONCEPT

The traditional concept of a town or city would be a free-standing built-up area with a service core with a sufficient number and variety of shops and services, including perhaps a market, to make it recognisably urban in character.

It would have administrative, commercial, educational, entertainment and other social and civic functions and, in many cases, evidence of being historically well established. A local network of roads and other means of transport would focus on the area, and it would be a place drawing people for services and employment from surrounding areas. It would

often be a place known beyond its immediate vicinity. Urban areas in Britain are, however, more complex. On one hand, historically free-standing towns have, over the years, grown and coalesced into continuously built-up areas, and subsidiary central places have developed as suburbs and satellite towns. This was recognised in the definition of conurbations used in the 1951 Census8. At the other extreme, some historic towns have stagnated and have lost central place functions.

GENERAL DEFINITIONS OF URBAN AREAS

An obvious way to define a town is in terms of its administrative boundary-that is, the area administered by a city, borough or town council. This is the method that had been followed in censuses in Great Britain up to and including 1971. In England and Wales, until re-organisation of local government in 1974, the division of the country between boroughs, urban districts and rural districts provided an approximate urban/rural split, and in Scotland, until reorganisation in 1975, the division between cities, burghs and district councils provided a similar split.

But there were serious disadvantages in the use of such administrative boundaries. They tended to change only infrequently and thus often did not reflect the development of a town. Sometimes the boundary lay well beyond the town.s built-up area (over-bounding) and included tracts of rural countryside. More often they lay within the built-up area (under-bounding) and so included only part of the totality of the urban area.

The local government boundaries established after reorganisation in the mid-1970s, and in use at the time of the 1991 Census, were almost entirely unsuited for the definition of urban areas because many districts had been deliberately drawn up to bring together towns and the surrounding rural countryside into single administrative units.

There are, however, at least three other approaches to defining an urban area. It may be defined either in terms of the built-up area (the.bricks and mortar. approach); or, alternatively, it may be defined in terms of the areas for which

it provides services and facilities-the functional area. The functional area may embrace not only the built-up area but also free-standing settlements outside the urban area together with tracts of surrounding countryside if the population in these surrounding areas depends on the urban centre for services and employment.

A third method is to use density (either of population or of buildings) as an indicator of urbanisation. However, implementation of any of these approaches involves some arbitrary decisions in drawing up boundaries because, in practice, towns tend to merge physically and functionally with neighbouring towns and their hinterlands. The first attempt to define urban areas in a census was made after the 1951 Census and a limited range of statistics was published in the General Report from that Census.

After the 1966 Sample Census, the then Ministry of Housing and Local Government produced an analysis of de facto urban areas10 But neither of these provided a suitable base for statistics for urban and rural areas to be produced from later censuses. A new initiative was therefore necessary for the 1981 Census. The request from SOEC for member countries to define large urban agglomerations after the 1980 round of censuses, coincided with research at the then OPCS and the Department of Environment (DoE) into new methods of defining urban areas.

In England and Wales, two methods were considered:the first based on a combination of population density and land use; and the second on the extent of urban development indicated on Ordnance Survey (OS) maps. The latter was selected as it met the needs of both OPCS and DoE and enabled internationally comparable statistics to be produced for SOEC and the United Nations.

Basically, the same criteria were adopted for defining urban areas in the 1991 Census. In Scotland, the method used was a mix of the.bricks and mortar. approach and the population density methods described in paragraph 1.8. The definition of an urban area in England and Wales Generally, the terminology.urban. and.rural. has no fundamental

definitional basis. The starting point in the definition of urban areas in England and Wales in this Report is the identification of areas with land use which is irreversibly urban in character.

The definition used to identify urban land use is modelled on the developed areas classification produced by DoE, which, in turn, is based on the National Land Use Classification.

LAND INCLUDED AS URBAN LAND COMPRISES

- Permanent structures and the land on which they are situated (built-up site); for this purpose,.land. is defined as the ground covered by a permanent structure and any ground enclosed by, or closely associated with, such a structure;
- Transportation corridors (such as roads, railways and canals) which have built-up sites on one or both sides, or which link up built-up sites which are less than 50 metres apart;
- Transportation features such as airport and operational airfields, railway yards, motorway service areas and car parks;
- Mine buildings (but mineral workings and quarries are excluded);
- Any area completely surrounded by built-up sites. Areas such as playing fields and golf courses are excluded unless they are completely surrounded by built-up sites.

The prerequisite for the recognition of an urban area is that the area of urban land should extend for 20 hectares or more. Separate areas of urban land are linked if less than 50 metres apart. Land between built-up sites is not regarded as urban unless it satisfies one of the conditions. The critical factor in the recognition of an urban area is a minimum population of approximately 1,000 persons.

However, as there was no prior information on the 1991 populations of areas of urban land, a proxy threshold was applied by excluding areas with less than four 1991 Census Enumeration Districts (EDs). This resulted in the exclusion of some areas of urban land with more than 1,000 population,

but very few above 2,000. A rule recommended by the United Nations and used by a number of European Community members states is that areas of urban land of 20 or more hectares that are less than 200 metres apart are linked to form a continuous urban area.

Major urban agglomerations, such as Greater London and the metropolitan counties, are sub-divided in order to provide a more useful set of statistics and to enable some comparisons to be made with previously published census data. Some smaller urban agglomerations are also subdivided where appropriate, and, where possible, previously separate urban centres, where urban land has since merged, are also subdivided.

IDENTIFICATION OF URBAN AREAS IN ENGLAND AND WALES

The first stage was the updating, by Ordnance Survey (OS) of the 1981 set of 1:10,000 scale transparent overlays depicting the extent of urban land as defined by the criteria above as at 1 April 1991. These overlays were updated at OS headquarters from information supplied by each of their local field offices, making use of local intelligence including recent urban development which might not have been fully surveyed. The second stage was for OS to digitise the boundaries of the areas of urban land, including the subdivisions used in 1981. A computer analysis of the digitised boundaries and the population-weighted centroids of the 1991 Census EDs was then carried out.

This process identified those ED centroids within or near the boundary of each area of urban land. An ED was then defined as urban if its centroid was either within the area of urban land or within a buffer zone of 150 metres of it. From detailed inspection of a sample of areas, this buffer zone minimised the misclassification of EDs as rural when they were really urban in character, or vice versa.

Those areas of urban land with four or more such EDs were then classified as urban areas. Inspections were carried out on newly emerging urban areas in 1991, and on any 1981

urban areas that had apparently disappeared, to confirm that the treatment of these areas had been correct; similarly with those areas in 1981 that had merged or split.

URBAN PLANNING

Urban, city, and town planning integrates land use planning and transportation planning to improve the built, economic and social environments of communities. Regional planning deals with a still larger environment, at a less detailed level. Urban planning can include urban renewal, by adapting urban planning methods to existing cities suffering from decay and lack of investment. In the Neolithic period, agriculture and other techniques facilitated larger populations than the very small communities of the Paleolithic, which probably led to the stronger, more coercive governments emerging at that time.

The pre-Classical and Classical periods saw a number of cities laid out just as to fixed plans, though many tended to develop organically. Designed cities were characteristic of the Mesopotamian, Harrapan, and Egyptian civilizations of the third millennium BCE. Distinct characteristics of urban planning from remains of the cities of Harappa, Lothal, and Mohenjo-daro in the Indus Valley Civilization (in modern-day northwestern India and Pakistan) lead archeologists to conclude that they are the earliest examples of deliberately planned and managed cities.

The streets of many of these early cities were paved and laid out at right angles in a grid pattern, with a hierarchy of streets from major boulevards to residential alleys. Archaeological evidence suggests that many Harrapan houses were laid out to protect from noise and enhance residential privacy; many also had their own water wells, probably for both sanitary and ritual purposes.

These ancient cities were unique in that they often had drainage systems, seemingly tied to a well-developed ideal of urban sanitation. The Greek Hippodamus has been dubbed the “Father of City Planning” for his design of Miletus; Alexander commissioned him to lay out his new city of Alexandria, the

grandest example of idealized urban planning of the ancient Mediterranean world, where the city's regularity was facilitated by its level site near a mouth of the Nile. The Hippodamian, or grid plan, was the basis for subsequent Greek and Roman cities. The ancient Romans used a consolidated scheme for city planning, developed for military defense and civil convenience. The basic plan consisted of a central forum with city services, surrounded by a compact, rectilinear grid of streets, and wrapped in a wall for defence. To reduce travel times, two diagonal streets crossed the square grid, passing through the central square.

A river usually flowed through the city, providing water, transport, and sewage disposal. Many European towns, such as Turin, preserve the remains of these schemes, which show the very logical way the Romans designed their cities. They would lay out the streets at right angles, in the form of a square grid. All roads were equal in width and length, except for two, which were slightly wider than the others. One of these ran east–west, the other, north–south, and intersected in the middle to form the centre of the grid.

All roads were made of carefully fitted flag stones and filled in with smaller, hard-packed rocks and pebbles. Bridges were constructed where needed. Each square marked by four roads was called an insula, the Roman equivalent of a modern city block. Each insula was 80 yards (73 m) square, with the land within it divided. As the city developed, each insula would eventually be filled with buildings of various shapes and sizes and crisscrossed with back roads and alleys. Most insulae were given to the first settlers of a Roman city, but each person had to pay to construct his own house.

The city was surrounded by a wall to protect it from invaders and to mark the city limits. Areas outside city limits were left open as farmland. At the end of each main road was a large gateway with watchtowers. A portcullis covered the opening when the city was under siege, and additional watchtowers were constructed along the city walls. An aqueduct was built outside the city walls. The collapse of Roman civilization saw the end of Roman urban planning,

among other arts. Urban development in the Middle Ages, characteristically focused on a fortress, a fortified abbey, or a (sometimes abandoned) Roman nucleus, occurred "like the annular rings of a tree", whether in an extended village or the centre of a larger city. Since the new centre was often on high, defensible ground, the city plan took on an organic character, following the irregularities of elevation contours like the shapes that result from agricultural terracing.

The ideal of wide streets and orderly cities was not lost, however. A few medieval cities were admired for their wide thoroughfares and orderly arrangements, but the juridical chaos of medieval cities (where the administration of streets was sometimes passed down through noble families), and the characteristic tenacity of medieval Europeans in legal matters prevented frequent or large-scale urban planning until the Renaissance and the early-modern strengthening of central government administration, as European (and soon after, North American) society transited from city-states to what we would recognize as a more modern concept of a nation-state. Florence was an early model of the new urban planning, which took on a star-shaped layout adapted from the new star fort, designed to resist cannon fire.

This model was widely imitated, reflecting the enormous cultural power of Florence in this age; "[t]he Renaissance was hypnotized by one city type which for a century and a half—from Filarete to Scamozzi— was impressed upon utopian schemes: this is the star-shaped city". Radial streets extend outward from a defined centre of military, communal or spiritual power. Only in ideal cities did a centrally planned structure stand at the heart, as in Raphael's Sposalizio (Illustration) of 1504.

As built, the unique example of a rationally planned quattrocento new city centre, that of Vigevano (1493–95), resembles a closed space instead, surrounded by arcading. Filarete's ideal city, building on Leone Battista Alberti's De re aedificatoria, was named "Sforzinda" in compliment to his patron; its twelve-pointed shape, circumscribable by a "perfect" Pythagorean figure, the circle, took no heed of its

undulating terrain in Filarete's manuscript. This process occurred in cities, but ordinarily not in the industrial suburbs characteristic of this era which remained disorderly and characterized by crowding and organic growth. Following the 1695 bombardment of Brussels by the French troops of King Louis XIV, in which a large part of the city centre was destroyed, Governor Max Emanuel proposed using the reconstruction to completely change the layout and architectural style of the city. His plan was to transform the medieval city into a city of the new baroque style, modeled on Turin, with a logical street layout, with straight avenues offering long, uninterrupted views flanked by buildings of a uniform size.

This plan was opposed by residents and municipal authorities, who wanted a rapid reconstruction, did not have the resources for grandiose proposals, and resented what they considered the imposition of a new, foreign, architectural style. In the actual reconstruction, the general layout of the city was conserved, but it was not identical to that before the cataclysm. Despite the necessity of rapid reconstruction and the lack of financial means, authorities did take several measures to improve traffic flow, sanitation, and the aesthetics of the city. Many streets were made as wide as possible to improve traffic flow.

In the 1990s, the University of Kentucky voted the Italian town of Todi as the ideal city and "most livable town in the world", the place where man and nature, history and tradition, come together to create a site of excellence. In Italy, other examples of ideal cities planned just as to scientific methods are Urbino, Pienza, Ferrara, San Giovanni Valdarno, and San Lorenzo Nuovo. Many Central American civilizations also planned their cities, including sewage systems and running water.

In Mexico, Tenochtitlan was the capital of the Aztec empire, built on an island in Lake Texcoco in what is now the Federal District in central Mexico. At its height, Tenochtitlan was one of the largest cities in the world, with over 200,000 inhabitants. Shibam in Yemen features over 500 tower houses,

each rising 5 to 11 storeys high, with each floor being an apartment occupied by a single family. The city has some of the tallest mudbrick houses in the world, some over 100 feet (30 meters) high. In the developed countries of Western Europe, North America, Japan, and Australasia, planning and architecture can be said to have gone through various paradigms or stages of consensus in the last 200 years. Firstly, there was the industrialised city of the 19th century, where building was largely controlled by businesses and wealthy elites.

Around 1900, a movement began for providing citizens, especially factory workers, with healthier environments. The concept of the garden city arose and several model towns were built, such as Letchworth and Welwyn Garden City in Hertfordshire, UK, the world's first garden cities. These were small in size, typically providing for a few thousand residents. In the 1920s, the ideas of modernism began to surface in urban planning. Based on the ideas of Le Corbusier and using new skyscraper-building techniques, the modernist city stood for the elimination of disorder, congestion, and the small scale, replacing them with preplanned and widely spaced freeways and tower blocks set within gardens.

There were plans for large-scale rebuilding of cities in this era, such as the Plan Voisin, which proposed clearing and rebuilding most of central Paris. No large-scale plans were implemented until after World War II, however. Throughout the late 1940s and 1950s, housing shortages caused by wartime destruction led many cities to subsidize housing blocks. Planners used the opportunity to implement the modernist ideal of towers surrounded by gardens.

The most prominent example of an entire modernist city is Brasilia in Brazil, constructed between 1956 and 1960. By the late 1960s and early 1970s, many planners felt that modernism's clean lines and lack of human scale sapped vitality from the community, blaming them for high crime rates and social problems. Modernist planning fell into decline in the 1970s when the construction of cheap, uniform tower blocks ended in most countries, such as Britain and France.

Since then many have been demolished and replaced by other housing types. Rather than attempting to eliminate all disorder, planning now concentrates on individualism and diversity in society and the economy; this is the post-modernist era. Minimally planned cities still exist. Houston is a large city (with a metropolitan population of 5.5 million) in a developed country without a comprehensive zoning ordinance.

Houston does, however, restrict development densities and mandate parking, even though specific land uses are not regulated. Also, private-sector developers in Houston use subdivision covenants and deed restrictions to effect land-use restrictions resembling zoning laws. Houston voters have rejected comprehensive zoning ordinances three times since 1948. Even without traditional zoning, metropolitan Houston displays large-scale land-use patterns resembling zoned regions comparable in age and population, such as Dallas. This suggests that non-regulatory factors such as urban infrastructure and financing may be as important as zoning laws in shaping urban form.

SUSTAINABLE DEVELOPMENT AND SUSTAINABILITY

Sustainable development and sustainability influence today's urban planners. Some planners argue that modern lifestyles use too many natural resources, polluting or destroying ecosystems, increasing social inequality, creating urban heat islands, and causing climate change. Many urban planners, therefore, advocate sustainable cities. However, sustainable development is a recent, controversial concept. Wheeler, in his 1998, defines sustainable urban development as "development that improves the long-term social and ecological health of cities and towns."

He sketches a 'sustainable' city's features: compact, efficient land use; less automobile use, yet better access; efficient resource use; less pollution and waste; the restoration of natural systems; good housing and living environments; a healthy social ecology; a sustainable economy; community participation and involvement; and preservation of local culture and wisdom. Because of political and governance

structures in most jurisdictions, sustainable planning measures must be widely supported before they can affect institutions and regions. Actual implementation is often a complex compromise.

Collaborative Strategic Goal Oriented Programming (CoSGOP) is a collaborative and communicative way of strategic programming, decision-making, implementation, and monitoring oriented towards defined and specific goals. It is based on sound analysis of available information, emphasizes stakeholder participation, works to create awareness among actors, and is oriented towards managing development processes. It was adopted as a theoretical framework for analysing redevelopment processes in large urban distressed areas in European cities. CoSGOP is derived from goal-oriented planning which was oriented towards the elaboration and implementation of projects based on a logical framework, which was useful for embedding a specific project in a wider development frame and defining its major elements.

This approach had weaknesses: its logical rules were strictly applied and the expert language did not encourage participation. CoSGOP introduced a new approach characterized by communication with and active involvement of stakeholders and those to be affected by the programme; strategic planning based on the identification of strengths and weakness, opportunities and threats, as well as on scenario-building and visioning; the definition of goals as the basis for action; and long-term, flexible programming of interventions by stakeholders.CoSGOP is not a planning method but a process model.

It provides a framework for communication and joint decision-making, in a structured process characterized by feedback loops. It also facilitates stakeholder learning. The essential elements of CoSGOP are analysis of stakeholders (identifying stakeholders' perceptions of problems, interests, and expectations); analysis of problems and potentials (including objective problems and problems and potentials perceived by stakeholders); development of goals, improvement priorities, and alternatives (requiring intensive

communication and active stakeholder participation); specification of an improvement programme and its main activities (based on priorities defined with the stakeholders); assessment of possible impacts of the improvement programme; definition and detailed specification of key projects and their implementation; continuous monitoring of improvement activities, feedback, and adjustment of the programme (including technical and economic information and perceptions of stakeholders).CoSGOP has been applied in European cross-border policy programming, as well in local and regional development programming.

In 2004, the CoSGOP model was applied in the LUDA Project, starting with an analysis of the European experience of urban regeneration projects. Collaborative planning arose in the US in response to the inadequacy of traditional public participation techniques to provide real opportunities for the public to make decisions affecting their communities. Collaborative planning is a method designed to empower stakeholders by elevating them to the level of decision-makers through direct engagement and dialogue between stakeholders and public agencies, to solicit ideas, active involvement, and participation in the community planning process.

Active public involvement can help planners achieve better outcomes by making them aware of the public's needs and preferences and by using local knowledge to inform projects. When properly administered, collaboration can result in more meaningful participation and better, more creative outcomes to persistent problems than can traditional participation methods. It enables planners to make decisions that reflect community needs and values, it fosters faith in the wisdom and utility of the resulting project, and the community is given a personal stake in its success.

Experiences in Portland and Seattle have demonstrated that successful collaborative planning depends on a number of interrelated factors: the process must be truly inclusive, with all stakeholders and affected groups invited to the table; the community must have final decision-making authority; full

government commitment (of both financial and intellectual resources) must be manifest; participants should be given clear objectives by planning staff, who facilitate the process by providing guidance, consultancy, expert opinions, and research; and facilitators should be trained in conflict resolution and community organization.

ASPECTS

Aesthetics

In developed countries, there has been a backlash against excessive human-made clutter in the visual environment, such as signposts, signs, and hoardings. Other issues that generate strong debate among urban designers are tensions between peripheral growth, housing density and new settlements. There are also debates about the mixing tenures and land uses, versus distinguishing geographic zones where different uses dominate. Regardless, all successful urban planning considers urban character, local identity, respects heritage, pedestrians, traffic, utilities and natural hazards.

Planners can help manage the growth of cities, applying tools like zoning and growth management to manage the uses of land. Historically, many of the cities now thought the most beautiful are the result of dense, long lasting systems of prohibitions and guidance about building sizes, uses and features. These allowed substantial freedoms, yet enforce styles, safety, and often materials in practical ways. Many conventional planning techniques are being repackaged using the contemporary term smart growth. There are some cities that have been planned from conception, and while the results often don't turn out quite as planned, evidence of the initial plan often remains.

Safety

Historically within the Middle East, Europe and the rest of the Old World, settlements were located on higher ground (for defence) and close to fresh water sources. Cities have often grown onto coastal and flood plains at risk of floods and storm

surges. Urban planners must consider these threats. If the dangers can be localised then the affected regions can be made into parkland or green belt, often with the added benefit of open space provision. Extreme weather, flood, or other emergencies can often be greatly mitigated with secure emergency evacuation routes and emergency operations centres. These are relatively inexpensive and unintrusive, and many consider them a reasonable precaution for any urban space.

Many cities will also have planned, built safety features, such as levees, retaining walls, and shelters. In recent years, practitioners have also been expected to maximize the accessibility of an area to people with different abilities, practicing the notion of "inclusive design," to anticipate criminal behaviour and consequently to "design-out crime" and to consider "traffic calming" or "pedestrianisation" as ways of making urban life more pleasant. Some city planners try to control criminality with structures designed from theories such as socio-architecture or environmental determinism.

These theories say that an urban environment can influence individuals' obedience to social rules and level of power. The theories often say that psychological pressure develops in more densely developed, unadorned areas. This stress causes some crimes and some use of illegal drugs. The antidote is usually more individual space and better, more beautiful design in place of functionalism. Oscar Newman's defensible space theory cites the modernist housing projects of the 1960s as an example of environmental determinism, where large blocks of flats are surrounded by shared and disassociated public areas, which are hard for residents to identify with.

As those on lower incomes cannot hire others to maintain public space such as security guards or grounds keepers, and because no individual feels personally responsible, there was a general deterioration of public space leading to a sense of alienation and social disorder. Jane Jacobs is another notable environmental determinist and is associated with the "eyes

on the street" concept. By improving 'natural surveillance' of shared land and facilities of nearby residents by literally increasing the number of people who can see it, and increasing the familiarity of residents, as a collective, residents can more easily detect undesirable or criminal behaviour. However, this is not a new concept.

This was prevalent throughout the middle eastern world during the time of Mohamad. It was not only reflected in the general structure of the outside of the home but also the inside. The "broken-windows" theory argues that small indicators of neglect, such as broken windows and unkempt lawns, promote a feeling that an area is in a state of decay. Anticipating decay, people likewise fail to maintain their own properties. The theory suggests that abandonment causes crime, rather than crime causing abandonment.

Some planning methods might help an elite group to control ordinary citizens. Haussmann's renovation of Paris created a system of wide boulevards which prevented the construction of barricades in the streets and eased the movement of military troops. In Rome, the Fascists in the 1930s created ex novo many new suburbs in order to concentrate criminals and poorer classes away from the elegant town. Other social theories point out that in Britain and most countries since the 18th century, the transformation of societies from rural agriculture to industry caused a difficult adaptation to urban living.

These theories emphasize that many planning policies ignore personal tensions, forcing individuals to live in a condition of perpetual extraneity to their cities. Many people therefore lack the comfort of feeling "at home" when at home. Often these theorists seek a reconsideration of commonly used "standards" that rationalize the outcomes of a free market.

Slums

The rapid urbanization of the last century caused more slums in the major cities of the world, particularly in developing countries. Planning resources and strategies are needed to address the problems of slum development. Many

planners are calling for slum improvement, particularly the Commonwealth Association of Planners. When urban planners work on slums, they must cope with racial and cultural differences to ensure that racial steering does not occur. Slum were often "fixed" by clearance. However, more creative solutions are beginning to emerge such as Nairobi's "Camp of Fire" programme, where established slum-dwellers promise to build proper houses, schools, and community centres without government money, in return for land on which they have been illegally squatting on for 30 years. The "Camp of Fire" programme is one of many similar projects initiated by Slum Dwellers International, which has programmes in Africa, Asia, and South America.

Decay

Urban decay is a process by which a city, or a part of a city, falls into a state of disrepair and neglect. It is characterized by depopulation, economic restructuring, property abandonment, high unemployment, fragmented families, political disenfranchisement, crime, and desolate urban landscapes. During the 1970s and 1980s, urban decay was often associated with central areas of cities in North America and Europe. During this time, changes in global economies, demographics, transportation, and policies fostered urban decay. Many planners spoke of "white flight" during this time. This pattern was different than the pattern of "outlying slums" and "suburban ghettos" found in many cities outside of North America and Western Europe, where central urban areas actually had higher real estate values.

Starting in the 1990s, many of the central urban areas in North America have been experiencing a reversal of the urban decay, with rising real estate values, smarter development, demolition of obsolete social housing and a wider variety of housing choices.

Reconstruction and Renewal

Areas devastated by war or invasion challenge urban planners. Resources are scarce. The existing population has

needs. Buildings, roads, services and basic infrastructure like power, water and sewerage are often damaged, but with salvageable parts. Historic, religious or social centres also need to be preserved and re-integrated into the new city plan. A prime example of this is the capital city of Kabul, Afghanistan, which, after decades of civil war and occupation, has regions of rubble and desolation. Despite this, the indigenous population continues to live in the area, constructing makeshift homes and shops out of salvaged materials.

Any reconstruction plan, such as Hisham Ashkouri's City of Light Development, needs to be sensitive to the needs of this community and its existing culture and businesses. Urban Reconstruction Development plans must also work with government agencies as well as private interests to develop workable designs.

Transport

Transport within urbanized areas presents unique problems. The density of an urban environment increases traffic, which can harm businesses and increase pollution unless properly managed. Parking space for private vehicles requires the construction of large parking garages in high density areas. This space could often be more valuable for other development. Good planning uses transit oriented development, which attempts to place higher densities of jobs or residents near high-volume transportation.

For example, some cities permit commerce and multi-story apartment buildings only within one block of train stations and multilane boulevards, and accept single-family dwellings and parks farther away. Floor area ratio is often used to measure density. This is the floor area of buildings divided by the land area. Ratios below 1.5 are low density. Ratios above five constitute very high density. Most exurbs are below two, while most city centres are well above five.

Walk-up apartments with basement garages can easily achieve a density of three. Skyscrapers easily achieve densities of thirty or more. City authorities may try to encourage higher densities to reduce per-capita infrastructure costs. In the UK,

recent years have seen a concerted effort to increase the density of residential development in order to better achieve sustainable development. Increasing development density has the advantage of making mass transport systems, district heating and other community facilities (schools, health centres, etc.) more viable. However critics of this approach dub the densification of development as 'town cramming' and claim that it lowers quality of life and restricts market-led choice. Problems can often occur at residential densities between about two and five.

These densities can cause traffic jams for automobiles, yet are too low to be commercially served by trains or light rail systems. The conventional solution is to use buses, but these and light rail systems may fail where automobiles and excess road network capacity are both available, achieving less than 2% ridership. The Lewis-Mogridge Position claims that increasing road space is not an effective way of relieving traffic jams as latent or induced demand invariably emerges to restore a socially-tolerable level of congestion.

Suburbanization

In some countries, declining satisfaction with the urban environment is held to blame for continuing migration to smaller towns and rural areas (so-called urban exodus). Successful urban planning supported Regional planning can bring benefits to a much larger hinterland or city region and help to reduce both congestion along transport routes and the wastage of energy implied by excessive commuting.

Environmental Factors

Environmental protection and conservation are of utmost importance to many planning systems across the world. Not only are the specific effects of development to be mitigated, but attempts are made to minimize the overall effect of development on the local and global environment. This is commonly done through the assessment of Sustainable urban infrastructure and microclimate. In Europe this process is known as a Sustainability Appraisal. In most advanced urban

or village planning models, local context is critical. In many, gardening and other outdoor activities assumes a central role in the daily life of citizens. Environmental planners focus now on smaller and larger systems of resource extraction and consumption, energy production, and waste disposal. A practice known as Arcology seeks to unify the fields of ecology and architecture, using principles of landscape architecture to achieve a harmonious environment for all living things. On a small scale, the eco-village theory has become popular, as it emphasizes a traditional 100-140 person scale for communities.

An urban planner can use a number of quantitative tools to forecast impacts of development on the environmental, including roadway air dispersion models to predict air quality impacts of urban highways and roadway noise models to predict noise pollution effects of urban highways. As early as the 1960s, noise pollution was addressed in the design of urban highways as well as noise barriers.

The Phase I Environmental Site Assessment can be an important tool to the urban planner by identifying early in the planning process any geographic areas or parcels which have toxic constraints. Tall buildings in particular can have a substantial effect in channelling winds and shading large areas. The microclimate around the building will typically be assessed as part of the environmental impact assessment for the building.

Light and Sound

The urban canyon effect is a colloquial, non-scientific term referring to street space bordered by very high buildings. This type of environment may shade the sidewalk level from direct sunlight during most daylight hours. While an oft-decried phenomenon, it is rare except in very dense, hyper-tall urban environments, such as those found in Lower and Midtown Manhattan, Chicago's Loop and Kowloon in Hong Kong.

In urban planning, sound is usually measured as a source of pollution. Another perspective on urban sounds is developed in Soundscape studies emphasising that sound aesthetics involves more than noise abatement and decibel

measurements. Hedfors coined 'Sonotope' as a useful concept in urban planning to relate typical sounds to a specific place. Light pollution has become a problem in urban residential areas, not only as it relates to its effects on the night sky, but as some lighting is so intrusive as to cause conflict in the residential areas and paradoxically intense improperly installed security lighting may pose a danger to the public, producing excessive glare. The development of the full cutoff fixture, properly installed, has reduced this problem considerably.

PROCESS

Prior to the 1950, Urban Planning was seldom considered a unique profession. Planning focused on top-down processes by which the urban planner created the plans. The planner would know architecture, surveying, or engineering, bringing to the town planning process ideals based on these disciplines. They typically worked for national or local governments. Changes to the planning process Strategic Urban Planning over past decades have witnessed the metamorphosis of the role of the urban planner in the planning process.

More citizens calling for democratic planning and development processes have played a huge role in allowing the public to make important decisions as part of the planning process. Community organizers and social workers are now very involved in planning from the grassroots level. The term advocacy planning was coined by Paul Davidoff in his influential 1965 paper, "Advocacy and Pluralism in Planning" which acknowledged the political nature of planning and urged planners to acknowledge that their actions are not value-neutral and encouraged minority and under represented voices to be part of planning decisions.

Ozawa and Seltzer (1999) advocate a communicative planning model in education to teach planners to work within the social and political context of the planning process. In their paper "Taking Our Bearings: Mapping a Relationship among Planning Practice, Theory, and Education," the authors demonstrate the importance of educating planners beyond the

rational planning model in which planners make supposedly value-neutral recommendations based on science and reason. Through a survey of employers, it was found that the most highly rated skills in entry-level professional hiring are communication-based. The results suggest this view of planning as a communicative discourse as a possible bridge between theory and practice, and indicate that the education of planners needs to incorporate synthesis and communication across the curriculum.

Developers have also played huge roles in development, particularly by planning projects. Many recent developments were results of large and small-scale developers who purchased land, designed the district and constructed the development from scratch. The Melbourne Docklands, for example, was largely an initiative pushed by private developers to redevelop the waterfront into a high-end residential and commercial district.

Recent theories of urban planning, espoused, for example by Salingaros see the city as a adaptive system that grows just as to process similar to those of plants. They say that urban planning should thus take its cues from such natural processes. Such theories also advocate participation by inhabitants in the design of the urban environment, as opposed to simply leaving all development to large-scale construction firms. In the process of creating an urban plan or urban design, carrier-infill is one mechanism of spatial organization in which the city's figure and ground components are considered separately.

The urban figure, namely buildings, are represented as total possible building volumes, which are left to be designed by architects in following stages. The urban ground, namely in-between spaces and open areas. The carrier-infill approach is defined by an urban design performing as the carrying structure that creates the shape and scale of the spaces, including future building volumes that are then infilled by architects' designs.

The contents of the carrier structure may include street pattern, landscape architecture, open space, waterways, and other infrastructure. The infill structure may contain zoning,

building codes, quality guidelines, and Solar Access based upon a solar envelope. Carrier-Infill urban design is differentiated from complete urban design, such as in the monumental axis of Brasília, in which the urban design and architecture were created together. In carrier-infill urban design or urban planning, the negative space of the city, including landscape, open space, and infrastructure. The positive space, typically building site for future construction, are only represented as unresolved volumes. The volumes are representative of the total possible building envelope, which can then be infilled by individual architects.

SUBURBANIZATION

Suburbanization (or suburbanisation) is a term used to describe the growth of areas on the fringes of major cities. It is one of the many causes of the increase in urban sprawl. Many residents of metropolitan regions work within the central urban area, choosing instead to live in satellite communities called suburbs and commute to work via automobile or mass transit.

Others have taken advantage of technological advances to work from their homes, and chose to do so in an environment they consider more pleasant than the city. These processes often occur in more economically developed countries, especially in the United States, which is believed to be the first country in which the majority of the population lives in the suburbs, rather than in the cities or in rural areas. Proponents of containing urban sprawl argue that sprawl leads to urban decay and a concentration of lower income residents in the inner city.

CAUSES AND EFFECTS

Suburbanization can be linked to a number of different push and pull factors. Push factors include the congestion and population density of the cities, pollution caused by industry and high levels of traffic and a general perception of a lower quality of life in inner city areas. Pull factors include more open spaces and a perception of being closer to “nature”, lower

suburban house prices and property taxes in comparison to the city, and the increasing number of job opportunities in the suburban areas. Improvements in transportation infrastructure encourage suburbanization, as people become increasingly able to live in a suburb and commute in to the nearby town or city to work. Developments in railways, bus routes and roads are the main improvements that make suburbanization more practical. The increase in the number and size of highways is a particularly significant part of this effect. Government policies can have a significant effect on the process. In the United States, for instance, policies of the Federal government in the post-World War II era, such as the building of an efficient network of roads, highways and superhighways, and the underwriting of mortgages for suburban one-family homes, had an enormous influence on the pace of suburbanization in that country. In effect, the government was encouraging the transfer of the middle-class population out of the inner cities and into the suburbs, sometimes with devastating effects on the viability of the city centres.

However, some argue that the effect of Interstate Highway Systems on suburbanization is overstated. Researchers of this vein believe city centre populations would have declined even in the absence of highway systems, contending that suburbanization is a long-standing and almost universal process. They primarily argue that as incomes rise, most people want the range and choice offered by automobiles. In addition, there is no significant evidence directly linking the development of highway systems to declining urban populations. Insurance companies also fueled the push out of cities, as in many cases, it redlined inner-city neighbourhoods, denying mortgage loans there, and instead offering low rates in the suburban areas.

More recently, some urban areas have adopted “green belt” policies which limit growth in the fringe of a city, in order to encourage more growth in the urban core. It began to be realised that a certain amount of population density in the centre city is conducive to creating a good, working urban environment. Race also played a role in American

suburbanization. During World War I, the massive migration of African Americans from the South resulted in an even greater residential shift towards suburban areas. The cities became seen as dangerous, crime-infested areas, while the suburbs were seen as safe places to live and raise a family, leading to a social trend known in some parts of the world as white flight.

This phenomenon runs counter to much of the rest of the world, where slums mostly exist outside the city, rather than within them. With the increasing population of the older, more established suburban areas, many of the problems which were once seen as purely urban ones have manifested themselves there as well.

Some social scientists suggest that the historical processes of suburbanization and decentralization are instances of white privilege that have contributed to contemporary patterns of environmental racism. Recent developments in communication technology, such as the spread of broadband services, the growth of e-mail and the advent of practical home video conferencing, has enabled more people to work from home rather than commuting. Although this can occur either in the city or in the suburbs, the effect is generally decentralizing, which works against the largest advantage of the centre city, which is easier access to information and supplies due to centralization.

Similarly, the rise of efficient package express delivery systems, such as (in the United States) FedEx and UPS, which take advantage of computerization and the availability of an efficient air transportation system, also eliminates some of the advantages that were once to be had from having a business located in the city. Industrial, warehousing, and factory land uses have also moved to suburban areas.

Cheap telecommunications removes the need for company headquarters to be within quick courier distance of the warehouses and ports. Urban areas suffer from traffic congestion, which creates costs in extra driver costs for the company which can be reduced if they were in a suburban area near a highway. As with residential, lower property taxes

and low land prices encourage selling industrial land for profitable brownfield redevelopment. Suburban areas also offer more land to use as a buffer between industrial and residential and retail space to avoid NIMBY sentiments and gentrification pressure from the local community when residential and retail is adjacent to industrial space in an urban area. Suburban municipalities can offer tax breaks, specialized zoning, and regulatory incentives to attract industrial land users to their area, such as City of Industry, California. The overall effect of these developments is that businesses as well, and not just individuals, now see an advantage to locating in the suburbs, where the cost of buying land, renting space, and running their operations, is cheaper than in the city.

This continuing dispersal from a single city centre has led to other recent phenomena in American suburbs, the advent of edge cities and exurbs, arising out of clusters of office buildings built in suburban commercial centres around shopping malls and higher density developments. With more and more jobs for suburbanites being located in these areas rather than in the main city core that the suburbs grew out of, traffic patterns, which for decades centred on people commuting into the centre city to work in the morning and then returning home in the evening, have become more complex, with the volume of intra-suburban traffic increasing tremendously. By 2000, half of the US population lived in suburban areas.

EFFECTS ON PSYCHOLOGICAL HEALTH

Historically it was believed that living in highly urban areas resulted in social isolation, social disorganization, and psychological problems, and that living in suburbs would be more conducive to overall happiness, due to lower population density, lower crime, and a more stable population.

A study based on data from 1974, however, found this not to be the case, finding that people living in suburbs had neither greater satisfaction with their neighbourhood nor greater satisfaction with the quality of their lives as compared to people living in urban areas.