Housing

Types, Architecture and Geography

Himanshi Rana

Housing: Types, Architecture and Geography

Housing: Types, Architecture and Geography

Himanshi Rana

VIDYA BOOKS

Published by Vidya Books,
305, Ajit Bhawan,
21 Ansari Road,
Daryaganj, Delhi 110002

Himanshi Rana
ISBN: 978-93-5429-832-5

Contents

1

Introduction

Geography is a subject that above all helps us 'make sense of the world'. You could say that all subjects contribute to this – history, science, art… they all contribute to making sense of the world in some way. However, geography (literally, writing the world) has a particular take on this. As Ron Johnston wrote some time ago, geography studies 'the earth as the home of mankind'. Or as Peter Taylor says, geography is the 'world subject'. You cannot take the 'geo' out of geography – the physical shape and the form the earth takes (as a whole, or in your back garden!) – and Rachel Atherton's focus on the physical world is important for the balance of this book. Neither can you take out the people who occupy the earth's *space*, and who help to shape it. In doing so, they make particular *places* through their economic, social and cultural activity.

Thus, geography takes a particular interest in the twin ideas of place and space.

The idea of 'place' Every place has a particular location and a *unique set* of physical and human characteristics.

Furthermore, the same place can be *represented* differently. Places are dynamic and subject to constant change. What we think about places is both shaped by, and shapes, our *'geographical imagination'*.

Unique – real places, with all their similarities and differences, are unique. No two places are exactly the same. This does not mean that geographers study places one after the other as singular entities. There are universal needs and global

processes that impact everywhere – but they play out differently from place to place in the detail.

Represented – many places can simultaneously be represented differently. For example, a city can be described as an industrial heartland, a shopping heaven or tourist resort. Places can be represented in certain ways for specific purposes. Sometimes there are unintended consequences of representing places in certain ways: for example, what do we mean to convey by the term 'inner city'? (Dan Raven-Ellison explores these ideas of representing places to young people.)

Dynamic-places change; they have not always been like this. Geography has a role to play in teaching students to understand this, the potential of places to be different in the future.

Geographical imaginations – the ways individuals think about places depend to a large extent on the knowledge and understanding they have at their disposal – but also what they make of the images they and what they associate with the new or the strange. We all carry a great deal of 'geography' in our head. It (almost) goes without saying that the best way to study place is to do so directly – by getting 'out there' to experience and sense the world, and to try our best to interpret what we observe. (Andrew Turney focuses on young people's engagement with fieldwork as do others in parts of the chapters which follow.) The main purpose of doing this is to understand a place, or process, or feature, sometimes with a view to imagining, or envisioning, alternatives. What is this place like? What do I feel about this place? How could it change? It is this kind of thinking that David Hicks had in mind when he wrote that geography is the 'first curriculum subject to take (alternative) futures seriously'.

The Idea of 'Space'

Most phenomena (eg physical features, people, services, goods) are located and are distributed in space. They therefore have relative *locations* to each other and often *interact* with each other across space. Any *flows* or movements between these phenomena create *patterns and networks.* Spatial patterns, distributions and networks can be described and analysed, and

often explained by reference to social, economic, environmental and political processes.

Location **–** the Ordnance Survey has estimated that 80 per cent of information can be located – that is, it can be mapped. In some ways this 'fact' alone expresses the importance of 'spatial literacy' as a part of geography – for if we can locate phenomena using coordinates, we can also study their relative locations too.

Interact **–** this we do by studying layers of different information and seeking relationships – interactions – between the layers. Ultimately this may lead to undertaking spatial analysis using geographic information systems (GIS). The ability to recognise, interpret and understand spatial patterns, distributions and relationships is an aspect of spatial awareness, and is nurtured through geographical enquiry.

Flows **–** the movement of phenomena through space, eg migration. Flows are often expressive of links that exist between locations and contribute to the pattern of networks that bind social and economic systems, eg trade links.

Patterns and networks **–** these are often describable and often display predic characteristics, eg as shown by gravity models, giving concrete expression to ideas such as the 'friction of distance'. Distribution patterns are often uneven, eg the distribution of wealth at a global or national scale, or within the confines of a single city. It is possible to seek explanations for the patterns described by reference to the social, economic or environmental processes at work.

Part of the power of geography is realising the limits (as well as the usefulness) of the 'spatial science' perspective – or at least its dangers. Many geographers have expressed concern over 'spatial fetishism' which may result if we think that space itself has properties (beyond the fairly obvious, like distance) leading us to imagine 'spatial processes' at work.

This is a dubious idea. There certainly are economic, social, cultural and environmental processes that operate, often with spatially differentiated outcomes. But space can be *used* too. It can be manipulated, for example, by capitalists seeking the lowest labour costs in order to maximise returns. There is no

doubt that space is, in Thrift's words '(t)he fundamental stuff of human geography' and needs thinking carefully about: 'As with terms like "society" and "nature", space is not (just) a commonsense external background to human and social action.' There is a third big idea that provides geography with its fundamental architecture, influencing profoundly what we 'see' when studying place and space, and this is scale.

The idea of 'scale' Scale influences the way we represent what we see or experience. We can construct different resolutions of scale from the *personal*, *local* and *regional* to the *global*. In between, we have the *national* and international scales. These are very important politically and, like the others, exert great influence on the identity of individuals and groups. Choice of scale is therefore important in geographical enquiry, as is the realisation that scale resolutions are *interconnected*, as if by a single zoom lens.

Personal – the personal scale refers to personal space – the 'bubble' in which people are sometimes said to live – the world they inhabit in their person, and how they perceive the world.

Local – this is sometimes expressed as the *scale of experience*, and in school geography has given rise to 'locality studies' in which the focus of study is the daily lives of people – where they live, the work they do, where they shop and play.

Regional – this is a wider frame of reference, often resting on administrative concerns (such as the planning regions of England), but sometimes strongly associated with identity and linked to landscape or heritage (including, for example, former economic activity such a heavy engineering or mining). Many geographers would argue that regions provide a fundamental unit of study for geography, enabling us to classify and organise the world for descriptive and analytical purposes.

National – this has been expressed as the *scale of ideology*, in the sense that this is the political context in which people live as citizens in a relationship with a state or government. The borders of nations change, frequently as a result of violent conflict. Territories are often disputed, not least when valuable resources are at stake, such as oil or water. Even the idea can

be debated in geography, for idea of 'nation' is not straightforward – and does not always coincide with 'state'. Thus, most children in English schools today express multiple identities.

Although 'British' may be on their passports, they may think of themselves, for example, as Bangladeshi, English, Irish, Jamaican, Pakistani, Scottish or Welsh – or European, Asian, Islamic... or more likely a combination of these categories (and many more besides).

Global – the global scale has become ever more present in people's minds since the Apollo photographs of 1969 – and now with Google Earth. The global scale has been dubbed the *scale of reality* in the sense that economic, environmental, political and social processes operate on a global scale. We cannot fully understand High Street shopping in our locality, or industrial change in a region or country, without comprehending the global context in which decisions are made.

Interconnectedness – virtually any topic, when studied geographically, benefits from a 'scaled' approach. In essence this implies study at a range of scales so that ideas of global interconnectedness can be developed.

Place, space and scale are arguably the three really big ideas that underpin school geography. Opening up these ideas a little, as in the above, quickly shows their scope and potential. We can see the relevance of being able to 'think geographically' to anyone living in the world and wanting to understand and respond to the challenges facing them during the 21st century.

Over the years there have been many authoritative appeals for the spirit and purpose of geography. Often these are made slightly defensively: it is so obvious what the power of geography is, so why doesn't everyone see it!

One reason for this is the confused identity geography has, particularly between the *academic* discipline (in all its diversity and seemingly anarchic specialisms), *school* geography (with its clear imperative to serve educational aims and purposes) and the subject that resides in the *popular* imagination (emphasising factual knowledge and sustained through quiz shows and such like).

House

A house is a home, shelter, building or structure that is a dwelling or place for habitation by human beings. The term includes many kinds of dwellings ranging from rudimentary huts of nomadic tribes to free standing individual structures. In some contexts, "house" may mean the same as dwelling, residence, home, abode, lodging, accommodation, or housing, among other meanings. The social unit that lives in a house is known as a household. Most commonly, a household is a family unit of some kind, though households can be other social groups, such as single persons, or groups of unrelated individuals. Settled agrarian and industrial societies are composed of household units living permanently in housing of various types, according to a variety of forms of land tenure. English-speaking people generally call any building they routinely occupy "home". Many people leave their houses during the day for work and recreation, and return to them to sleep or for other activities.

History

The English word *house* is derived from the proto-Germanic *hud-dos*, thought possibly to be a derivative of the verbal root *hûd* 'to hide'. Terms in other languages show varying derivations.

The oldest house in the world is approximately from 10,000 BC and was made of mammoth bones, found at Mezhirich near Kiev in Ukraine. It was probably covered with mammoth hides. The house was discovered in 1965 by a farmer digging a new basement six feet below the ground.

Architect Norbert Schoenauer, in his book *6,000 Years of Housing*, identifies three major categories of types of housing: the "Pre-Urban" house, the "Oriental Urban" house, and the "Occidental Urban" house.

Types of Pre-Urban houses include temporary dwellings such as the Inuit igloo, semi-permanent dwellings such as the pueblo, and permanent dwellings such as the New England homestead. "Oriental Urban" houses include houses of the ancient Greeks and Romans, and traditional urban houses in

China, India, and Islamic cities. "Occidental Urban" houses include medieval urban houses, the Renaissance town house, and the houses, tenements and apartments of the 19th and 20th centuries. Houses of that time were generally made of simple and raw materials (rocks, sticks, woven cloth, etc.)

Structure

The developed world in general features three basic types of house that have their own ground-level entry and private open space, and usually on a separately titled parcel of land:

- Single-family detached houses – free-standing on all sides.
- Semi-detached houses (duplexes) – houses that are attached, usually to only one other house via a party wall.
- Terraced house (UK), also known as a *row house* or *townhouse* – attached to other houses, possibly in a row, each separated by a party wall.

In addition, there are various forms of attached housing where a number of dwelling units are co-located within the same structure, which share a ground-level entry and may or may not have any private open space, such as apartments (a.k.a. flats) of various scales. Another type of housing is movable, such as houseboats, caravans, and trailer homes.

In the United Kingdom, 27% of the population live in terraced houses and 32% in semi-detached houses, as of 2002. In the United States as of 2000, 61.4% of people live in detached houses and 5.6% in semi-detached houses, 26% in row houses or apartments, and 7% in mobile homes.

Function

Some houses transcend the basic functionality of providing "a roof over one's head" or of serving as a family "hearth and home". When a house becomes a display-case for wealth and/or fashion and/or conspicuous consumption, we may speak of a "great house". The residence of a feudal lord or of a ruler may require defensive structures and thus turn into a fort or a castle. The house of a monarch may come to house courtiers

and officers as well as the royal family: this sort of house may become a palace. Moreover, in time the lord or monarch may wish to retreat to a more personal or simple space such as a villa, a hunting lodge or a dacha. Compare the popularity of the holiday house or cottage, also known as a crib.

In contrast to a relatively upper class or modern trend to ownership of multiple houses, much of human history shows the importance of multi-purpose houses. Thus the house long served as the traditional place of work (the original cottage industry site or "in-house" small-scale manufacturing workshop) or of commerce (featuring, for example, a ground floor "shop-front" shop or counter or office, with living space above). During the Industrial Revolution there was a separation of manufacturing and banking from the house, though to this day some shopkeepers continue (or have returned) to live "over the shop".

Inside the House

Layout

Ideally, architects of houses design rooms to meet the needs of the people who will live in the house. Such designing, known as "interior design", has become a popular subject in universities. Feng shui, originally a Chinese method of situating houses according to such factors as sunlight and micro-climates, has recently expanded its scope to address the design of interior spaces with a view to promoting harmonious effects on the people living inside the house. Feng shui can also mean the "aura" in or around a dwelling. Compare the real-estate sales concept of "indoor-outdoor flow".

The square footage of a house in the United States reports the area of "living space", excluding the garage and other non-living spaces. The "square metres" figure of a house in Europe reports the area of the walls enclosing the home, and thus includes any attached garage and non-living spaces.

Parts

Many houses have several rooms with specialized functions. These may include a living/eating area, a sleeping area, and

(if suitable facilities and services exist) washing and lavatory areas. In traditional agriculture-oriented societies, domestic animals such as chickens or larger livestock (like cattle) often share part of the house with human beings. Most conventional modern houses will at least contain a bedroom, bathroom, kitchen (or kitchen area), and a living room. A typical "foursquare house" (as pictured) occurred commonly in the early history of the United States of America where they were mainly built, with a staircase in the centre of the house, surrounded by four rooms, and connected to other sections of the house (including in more recent eras a garage).

The names of parts of a house often echo the names of parts of other buildings, but could typically include:

Atrium

In modern architecture, an atrium (plural atria) is a large open space, often several storeys high and having a glazed roof and/or large windows, often situated within an office building and usually located immediately beyond the main entrance doors. Atria are popular with companies because they give their buildings "a feeling of space and light", but have been criticised by fire inspectors as they could allow fire to spread to a building's upper storeys more quickly.

History

The Latin word *atrium* referred to the open central court, from which the enclosed rooms led off, in the type of large ancient Roman house known as a domus.

The impluvium was the shallow pool sunken into the floor to catch the rainwater. Some surviving examples are beautifully decorated. The opening in the ceiling above the pool called for some means of support for the roof. And it is here where one differentiates between five different styles of atrium.

As the centrepiece of the house the atrium was the most lavishly furnished room. Also, it contained the little chapel to the ancestral spirits (lararium), the household safe (arca) and sometimes a bust of the master of the house. The term was also used for a variety of spaces in public and religious buildings,

mostly forms of arcaded courtyards, larger versions of the domestic spaces. Byzantine churches were often entered through such a space (as are many mosques, though the term is not usually used for Islamic architecture.

Tallest Atrium

As of 2007, Dubai's Burj Al Arab, has the tallest atrium. The Burj Al Arab was built to impress and to iconize the urban development in the city of Dubai.

Largest Atrium

The Luxor Hotel, in Las Vegas, Nevada, has the largest atrium in the world at 29 million cubic feet (820,000 m^3).

Glazed Atrium

The 19th century brought the industrial revolution with great advances in iron and glass manufacturing techniques. Courtyards could then have horizontal glazing overhead, eliminating some of the weather elements from the space and giving birth to the modern atrium.

One of the main public spaces at Federation Square, Melbourne, Australia is called The Atrium and is a street-like space, 5-stories high with glazed walls and roof. The structure and glazing pattern follow the system of fractals used to arrange the panels on the rest of the facades at Federation Square.

Attic

An attic is a space found directly below the pitched roof of a house or other building. As attics fill the space between the ceiling of the top floor of a building and the slanted roof, they are known for being awkwardly shaped spaces with exposed rafters and difficult-to-access corners. While some attics are converted into bedrooms or home offices, complete with windows and staircases, most attics remain hard to get to and neglected, and are typically used for storage.

Attics can also help control temperature in a house by providing a large mass of unmoving air. Hot air rising from lower floors of a building often gets trapped in the attic, further compounding their reputation for in hospitability. However in

recent years many attics have been insulated to help decrease heating costs since on average, uninsulated attics account for 15% of the total energy loss in a typical house.

In some places “attic” is used more specifically to apply to lofts which have boarded floors and ceilings, and usually windows or skylights, and then “loft” is kept to mean a dark, unboarded roof-space which lacks these features.

Alcove

Alcove (through the Spanish, *alcoba*, from the Arabic, *al-*, the, and *qubbah*, a vault) is an architectural term for a recess in a room, usually screened off by pillars, balustrades or drapery.

Usage: Though their apartment lacked a dining room, an *alcove* adjacent to the living room made for an adequate ambience for dinner.

In geography and geology, the term Alcove is used for a wind-eroded depression in the side of a cliff of a homogenous rock type, famous from sandstones of the Colorado Plateau like the Navajo Sandstone.

Basement/Cellar

A basement is one or more floors of a building that are either completely or partially below the ground floor. Basements are typically used as a utility space for a building where such items as the furnace, water heater, breaker panel or fuse box, car park, and air-conditioning system are located; so also are amenities such as the electrical distribution system, and cable television distribution point.

In British English the word “basement” is used for underground floors of, for example, department stores but is used for a space below the ground floor of a house only when it is habitable, with windows and (usually) its own access. The word cellar is used to apply to any such large underground room. Subcellar is a cellar that lies further underneath.

Historical Development

For most of its early history, the basement took one of two forms. It could be little more than a cellar, or it could be a

section of a building containing rooms and spaces similar to those of the rest of the structure, as in the case of basement flats and basement offices.

However, beginning with the development of large, mid-priced suburban homes in the 1950s, the basement, as a space in its own right, gradually took hold. Initially, it was typically a large, concrete-floored space, accessed by indoor stairs, and with exposed columns and beams along the walls and ceilings, or sometimes, walls of poured concrete or concrete cinder block.

Types of Basement

There are various structural designs for basements.

Daylight Basement

A daylight basement or a "walk-out basement" is contained in a house situated on a slope, so that part of the level is above ground, with a doorway to the outside. The part of the floor covered by the ground can be considered the true basement area. From the street, some daylight basement homes appear to be one story. Others appear to be a conventional two story home from the street (with the buried, or basement, portion in the back). Occupants can walk out at that point without having to use the stairs. For example, if the ground slopes downwards towards the back of the house, the basement is at or above grade (ground level) at the back of the house. It is a modern design because of the added complexity of uneven foundations; where the basement is above grade, the foundation is deeper at that point and must still be below the frostline.

Full-size windows can be installed in a daylight basement. These can provide exits for bedrooms (building bedrooms in basements is usually illegal without an outside escape). Ventilation is improved over fully-buried basement homes, with less dampness and mold problems. Daylight basements can be used for several purposes-as a garage, as maintenance rooms, or as living space. The buried portion is often used for storage, laundry room, hot water tanks, and HVAC.

Daylight basement homes typically appraise higher than standard-basement homes, since they include more viable living spaces. In some parts of the U.S. however the appraisal for

daylight basement space is half that of ground and above ground level square footage. Designs accommodated include split-foyer and split-level homes. Garages on both levels are sometimes possible. As with any multi-level home, there are savings on roofing and foundations.

Look-out Basement

In a "look-out" basement, the basement walls extend sufficiently above ground level that some of the basement windows are above ground level. Where the site slopes gently and is insufficient for a walk-out basement, a look-out basement tends to result. Sometimes, a look-out basement is deliberately constructed even on a flat site. The advantage is that the basement windows are all above grade. The disadvantage is that the main floor entry is above grade as well, necessitating steps to get up to the main floor. The raised bungalow design solves this by lowering the entry half-way between the main floor and basement to make a dramatic, high-ceiling foyer. It is a very economical design because the basement is shallower, and excavation costs are minimized.

Walk-up Basement

A "walk-up" basement is any basement that has an exterior entrance via a stairwell. Some designs cover the stairwell with angled "basement doors" or "bulkhead doors" to keep rain water from accumulating in the stairwell.

When initially built, the main floor joists are often exposed and the walls and floors concrete (with insulation, where appropriate). Unfinished basements allow for easy access to the main floor for renovation to the main floor. Finishing the basement can add significant floor space to a house (doubling it in the case of a bungalow) and is a major renovation project.

Cellar

A cellar is a type of basement primarily used for the storage of food and drink (especially wine) for use throughout the year. A cellar is intended to remain at a constant cool (not freezing) temperature all year round and usually has either a small window/opening or some form of air ventilation (air/draught bricks, etc.) in order to help eliminate damp or stale air. Cellars

are more common in the UK in older houses, with most terraced housing built during late 19th, and early 20th Century having cellars. These were important shelters from air raids during World War II. In parts of the U.S. that are prone to tornadoes cellars still serve as shelter in the event of a direct hit on the house from a tornado or other storm damage caused by strong winds.

Except for Britain, Australia and New Zealand, cellars are popular in most western countries. In the UK, almost all new homes built since the 1960s have no cellar or basement due to the extra cost of digging down further into the sub-soil and a requirement for much deeper foundations and water-proof tanking. The obverse has recently become common, where the impact of smaller home-footprints has led to roof-space being utilised for further living space and now many new homes are built with third-floor living accommodation. For this reason people tend to store food and drink in a garage. The majority of continental European houses have cellars, although a large proportion of people live in apartments or flats rather than houses. In North America, cellars usually are found in rural or older homes on the coasts and in the South. However, full basements are commonplace in new houses in the US Midwest and other areas subject to tornado activity or requiring foundations below the frost line.

Crawl Space

A crawl space (as the name suggests) is a type of basement in which one cannot stand up — the height may be as little as a foot, and the surface is often soil. They offer a convenient access to pipes, substructures and a variety of other areas that may be difficult or expensive to access otherwise. While a crawlspace cannot be used as living space, it can be used as storage, often for infrequently used items. Care must be taken in doing so, however, as water from the damp earth, humidity entering from crawlspace vents, and moisture seeping through porous concrete will create a perfect environment for mold, mildew to form on any surface in the crawlspace, especially cardboard boxes, wood floors and surfaces, drywall and some types of insulation.

Health and safety issues must be considered when installing a crawl space. As air warms in a home, it rises and leaves through the upper regions of the house, much in the same way that air moves through a chimney. This phenomenon, called the "stack effect," causes the home to suck air up from the crawlspace into the main area of the home. Mold spores and fecal material from dust mites in the crawlspace come up with the air, agitating breathing problems such as asthma and creating a variety of health-related problems.

These can be placed directly on the dirt, but it is more desirable to finish with a plastic vapour barrier that will not support mold growth or allow humidity from the earth into the basement. This helps to insulate the crawlspace and discourages the habitation of insects and vermin by breaking the ecological chain by which the insects feed off the mold and vermin feed on the insects as well as creating a physical inorganic barrier that deters their entrance into the space. Almost unheard of in the 1990s, these barriers have become increasingly popular in recent years.

Design and Structural Considerations

Structurally, for houses, the basement walls typically form the foundation. In warmer climates, houses sometimes do not have basements because they are not necessary (although many still prefer them). In colder climates, the foundation must be below the frostline. Unless constructed in very cold climates, the frost line is not so deep as to justify an entire level below the ground, although it is usually deep enough that a basement is the assumed standard. In places with oddly stratified soil substrata or high water tables, such as most of Texas, Oklahoma, Arkansas, and areas within 50 miles of the Gulf of Mexico, basements are usually not financially feasible unless the building is a large apartment or commercial structure. In many earthquake-prone areas, such as Southern California, basements are not common because of the possibility of collapse during an earthquake.

Some designs elect to simply leave a crawl space under the house, rather than a full basement. Most other designs justify further excavations to create a full height basement, sufficient

for another level of living space. Even so, basements in Canada and the northern United States were typically only 7 feet 10 inches (2.39 m) in height, rather than the standard full 8 feet (2.44 m) of the main floors. Older homes may have even lower basement heights as the basement walls were concrete block and thus, could be customized to any height. Modern builders offer higher basements as an option. The cost of the additional depth of excavation is usually quite expensive. Thus, houses almost certainly never have multi-story basements though 9' basements heights are a frequent choice among new home buyers. For large office or apartment buildings in prime locations, the cost of land may justify multi-story basement parking garages.

The concrete floor in most basements is structurally not part of the foundation; only the basement walls are. If there are posts supporting a main floor beam to form a post and beam system, these posts typically go right through the basement floor to a footing underneath the basement floor. It is the footing that supports the post and the footing is part of the house foundation. Load-bearing wood-stud walls will rest directly on the concrete floor. Under the concrete floor is typically gravel or crushed stone to facilitate draining. The floor is typically four inches (100 mm) thick and rest on top of the foundation footings. The floor itself is typically sloped towards a drain point, in case of leaks.

Since warm air rises, basements are typically cooler than the rest of the house. In summer, this makes basements damp, due to the higher relative humidity. Dehumidifiers are recommended. In winter, additional heating, such as a fireplace or baseboard heaters may be required. A well-defined central heating system may minimize this requirement. Heating ducts typically run in the ceiling of the basement (since there is not an empty floor below to run the ducts). Ducts extending from the ceiling down to the floor help heat the cold floors of the basement. Older or cheaper systems may simply have the heating vent in the ceiling of the basement.

The finished floor is typically raised off the concrete basement floor though modern laminate flooring is typically placed on concrete floors in Canada with a thin foam underlay.

Radiant heating systems may be embedded right within the concrete floor. Even if unfinished and unoccupied, basements are heated in order to ensure relative warmth of the floor above, and to prevent water supply pipes, drains, etc. from freezing and bursting in winter. It is recommended that the basement walls be insulated to the frostline. In Canada, the walls of finished basements typically are insulated to the floor with vapour barrier(s) to prevent moisture transmission. However, a finished basement should avoid wood or wood-laminate flooring, and metal framing and other moisture resistant products should be used. Finished basements can be costly to maintain due to deterioration of waterproofing materials or lateral earth movement etc. Below-ground structures will never be as dry as one above ground, and measures must be taken to circulate air and dehumidify area. [1]

Drainage Considerations

Basement floor drains need to be filled regularly to prevent the trap from drying out and sewer gas from escaping into the basement. The drain trap can be topped up automatically by the condensation from air conditioners or high-efficiency furnaces. A small tube from another downpipe is sometimes used to keep the trap from drying out. Some advocate the use of special radon gas traps. In areas where storm and sanitary sewers are combined, and there is the risk of sewage backing up, backflow prevention devices in all basement drains may be mandated by code and definitely are recommended even if not mandated.

The main water cut-off valve is usually in the basement. Basements often have “clean outs” for the sanitary and storm sewers, where these pipes can be accessed. The storm sewer access is only needed where the weeping tiles drain into the storm sewers.

Other than with walk-out or look-out basements, windows in basements require a well and are below grade. Clear window well covers may be required to keep the window wells from accumulating rain water. There should be drains in the window well, connected to the foundation drains.

If the water table outside the basement is above the height of the basement floor, then the foundation drains or the weeping tiles outside the footings may be insufficient to keep the basement dry. A sump pump may be required. It can be located anywhere and is simply in a well that is deeper than the basement floor.

Even with functioning sump pumps or low water tables, basements may become wet after rainfall, due to improper drainage. The ground next to the basement must be graded such that water flows away from the basement wall. Downspouts from roof gutters should drain freely into the storm sewer or directed away from the house. Downspouts should not be connected to the foundation draintiles. If the draintiles become clogged by leaves or debis from the rain gutters, the roof water would cause basement flooding through the draintile. Damp-proofing or waterproofing materials are typically applied to outside of the basement wall. It is virtually impossible to make a concrete wall waterproof, over the long run, so drainage is the key. There are draining membranes that can be applied to the outside of the basement that create channels for water against the basement wall to flow to the foundation drains.

Where drainage is inadequate, waterproofing may be needed. There are numerous ways to waterproof a basement, but most systems fall into one of three categories:

- Tanking – Systems that bond to the basement structure and physically hold back groundwater.
- Cavity Drainage – Dimpled plastic membranes are used to line the floors and walls of the basement, creating a “drained cavity.” Any water entering this drained cavity is diverted to a sump pump and pumped away from the basement.
- Exterior Foundation Drain – Installing an exterior foundation drain that will drain away by gravity is the most effective means to waterproof a basement. An exterior system allows water to flow away from the basement without using pumps or electricity. An exterior drain also allows for the installation of a waterproof membrane to the foundation walls.

The waterproofing system can be applied to the inside or the outside walls of a basement. When waterproofing existing basements it is much cheaper to waterproof the basement on the inside. Waterproofing on the outside requires the expense of excavation, but does offer a number of advantages for a homeowner over the long term. Among them are:

- Gravity system
- No pumps or electrical wiring required
- Membrane applied to exterior walls to prevent dampness, mold, moisture, and soil gases from entering the home
- Permanent solution

Basement Culture/Finishings

Unfinished Basement

This first unfinished design, found principally in spaces larger than the traditional cellar, is common in residences throughout America and Canada. One usually finds within it a water heater, various pipes running along the ceiling and downwards to the floor, and sometimes a workbench, a freezer or refrigerator, or a washer/dryer set. Boxes of various materials, and objects unneeded in the rest of the house, are also often stored there; in this regard, the unfinished basement takes the place both of the cellar and of the attic. Home workshops are often located in the basement, since sawdust, metal chips, and other mess or noise are less of a nuisance there. The basement can contain all of these objects and still be considered to be "unfinished," as they are either mostly or entirely functional in purpose.

Finished Basement

In this case the space has been designed, either during construction or at a later point by the owners, to function as a fully habitable addition to the house. Frequently most or all of the basement is used as a recreation room or living room, but it is not uncommon as well to find there (either instead of or alongside the living/recreation room) a guest bedroom or teenager's room, a bathroom, a home office, a home gym, a

home theatre, a basement bar, a sauna, and one or more closets. Occasionally a part of the basement is unfurnished and is used for storage, a workshop, and/or a laundry room; when this is the case the water heater and furnace will also often be located there, although in some cases the entire basement is finished, and the water heater and furnace are boxed off into a closet.

Partially-finished Basement

The main point of distinction between this type of basement and the two others lies in its being either entirely unmodified (unlike the finished basement) beyond the addition of furniture, recreational objects and appliances, and/or exercise equipment on the bare floor, or slightly modified through the installation (besides any or all of the aforementioned items) of loose carpet and perhaps simple light fixtures.

In both cases, the objects found there—many of which could be found in a finished basement as well—might include the following: weight sets and other exercise equipment; the boom boxes or entertainment systems used during exercise; musical instruments (which are not in storage, as they would technically be in an unfinished basement; an assembled drum set would be the most easily identified of these); football tables, chairs, couches and entertainment appliances of lesser quality than those in the rest of the house; refrigerators, stand-alone freezers, and microwaves (the first and the second being also sometimes used as supplementary storage units in an unfinished basement); and sports pennants and/or other types of posters which are attached to the walls.

As the description suggests, this type of basement, which also might be called “half-finished,” is likely used by teenagers and children. The entire family might utilize a work-out area. It is also common to have a secondary (or primary) home office in a partially-finished basement, as well as a workbench and/or a space for laundry appliances.

Toilets and showers sometimes exist in this variety of basement, as many North American basements are designed to allow for their installation.

Real Estate Floorspace Measures

In Canada, historically the basement area was excluded from advertised square footage of a house as it was not part of the living space. For example, a "2,000-square-foot bungalow" would, in reality, have 4,000 square feet (370 m^2) of floor space. More recently, finished space has become increasingly acceptable as a measure which includes the developed basement areas of a home. Due to fire code requirements, most jurisdictions require an emergency egress (through either egress-style windows, or, in the case of a walk-out basement, a door) to include the basement square footage as living space.

Bathroom (in Various Senses of the Word)

A bathroom is a room that may have different functions depending on the culturalist context. In the most literal sense, the word bathroom means "a room with a bath". Because the traditional bathtubs have partly made way for modern showers, including steam showers, the more general definition is "a room where one bathes". There can be just a shower, just a bathtub or both; and often both plumbing fixtures are combined in the bathtub. The room may also contain a sink, often called a "wash basin" or "hand basin" (in parts of the USA) and often a "lavatory".

In the United States, "bathroom" commonly means "a room containing a lavatory". In other countries this is usually called the "toilet" or alternatively "water closet" (WC), lavatory or "loo". The word "bathroom" is also used in the U.S. for a public toilet (the more formal U.S. term being "restroom").

In the United States, bathrooms are generally categorized as master bathroom, containing a shower and a tub that is adjoining to a master bedroom, a "full bathroom" (or "full bath"), containing four plumbing fixtures: bathtub, shower, toilet, and sink; "half (1/2) bath" (or "powder room") containing just a toilet and sink; and "3/4 bath" containing toilet, sink, and shower, although the terms vary from market to market. In some U.S. markets, a toilet, sink, and shower are considered a "full bath". This lack of a single, universal definition commonly results in discrepancies between advertised and actual number

of baths in real estate listings. An additional complication is that there are currently two ways of notating the number of bathrooms in a dwelling. One method is to count a half bathroom as ".5" and then add this to the number of full bathrooms (e.g., "2.5" baths would mean 2 full baths and 1 half bath). The other, newer method is to put the number of full bathrooms to the left side of the decimal point and to put the number of half bathrooms to the right of the decimal point (e.g., "2.1" would mean 2 full baths and 1 half bath; "3.2" would mean 3 full baths and 2 half baths).

Design Considerations

The design of a bathroom must account for the use of both hot and cold water, in significant quantities, for cleaning the human body. The water is also used for moving solid and liquid human waste to a sewer or septic tank. Water may be splashed on the walls and floor, and hot humid air may cause condensation on cold surfaces. From a decorating point of view the bathroom presents a challenge. Ceiling, wall and floor materials and coverings should be impervious to water and readily and easily cleaned.

The use of ceramic or glass, as well as smooth plastic materials, is common in bathrooms for their ease of cleaning. Such surfaces are often cold to the touch, however, and so water-resistant bath mats or even bathroom carpets may be used on the floor to make the room more comfortable. Alternatively, the floor may be heated, possibly by strategically placing heater conduits close to the surface.

Electrical appliances, such as lights, heaters, and heated towel rails, generally need to be installed as fixtures, with permanent connections rather than plugs and sockets. This minimizes the risk of electric shock.

Ground-fault circuit interruptor electrical sockets can reduce the risk of electric shock, and are required for bathroom socket installation by electrical and building codes in the United States and Canada. In some countries, such as the United Kingdom, only special sockets suitable for electric shavers are permitted in bathrooms, and are labelled as such.

History of Bathrooms

Although it was not with hygiene in mind, the first records for the use of baths date back as far as 3000 B.C. At this time water had a strong religious value, being seen as a purifying element for both body and soul, and so it was not uncommon for people to be required to cleanse themselves before entering a sacred area. Baths are recorded as part of a village or town life throughout this period, with a split between steam baths in Europe and America and cold baths in Asia. Communal baths were erected in a distinctly separate area to the living quarters of the village, with a view to preventing evil spirits from entering the domestic quarters of a commune.

According to Teresi et al. (2002):

The third millennium B.C. was the “Age of Cleanliness.” Toilets and sewers were invented in several parts of the world, and Mohenjo-Daro circa 2800 B.C. had some of the most advanced, with lavatories built into the outer walls of houses. These were “Western-style” toilets made from bricks with wooden seats on top. They had vertical chutes, through which waste fell into street drains or cesspits. Sir Mortimer Wheeler, the director general of archaeology in India from 1944 to 1948, wrote, “The high quality of the sanitary arrangements could well be envied in many parts of the world today.”

Nearly all of the hundreds of houses excavated had their own bathing rooms. Generally located on the ground floor, the bath was made of brick, sometimes with a surrounding curb to sit on. The water drained away through a hole in the floor, down chutes or pottery pipes in the walls, into the municipal drainage system. Even the fastidious Egyptians rarely had special bathrooms.

Not all ancient baths were in the style of the large pools that often come to mind when one imagines the Roman baths; the earliest surviving bathtub dates back to 1700 B.C, and hails from the Palace of Knossos in Crete. What is remarkable about this tub is not only the similarity with the baths of today, but also the way in which the plumbing works surrounding it differ so little from modern models. A more advanced prehistoric (15th century BC and before) system of baths and plumbing

is to be found in the excavated town of Akrotiri, on the Aegean island of Thera. There, alabaster tubs and other bath fittings were found, along with a sophisticated twin plumbing system to transport hot and cold water separately. This was probably because of easy access to geothermic hot springs on this volcanic island. Both the Greeks and the Romans recognised the value of bathing as an important part of their lifestyles. Writers such as Homer had their heroes bathe in warm water so as to regain their strength; it is perhaps notable that the mother of Achilles bathed him in order to gain his invincibility. Palaces have been uncovered throughout Greece with areas that are dedicated to bathing, spaces with ceramic bathtubs, as well as sophisticated drainage systems. Homer uses the word "baths", later *loutrá*, from the verb *loúein*, to bathe. The same root finds an even earlier attestation on Linear B tablets, in the name of the River Lousios ("bathing" [river]), in Arcadia.

The Roman attitudes towards bathing are well documented; they built large purpose-built thermal baths, marking not only an important social development, but also providing a public source of relaxation and rejuvenation. Here was a place where people could meet to discuss the matters of the day and enjoy entertainment. During this period there was a distinction between private and public baths, with many wealthy families having their own thermal baths in their houses. Despite this they still made use of the public baths, showing the value that they had as a public institution. The strength of the Roman Empire was telling in this respect; imports from throughout the world allowed the Roman citizens to enjoy ointments, incense, combs, and mirrors.

Although some sources suggest that bathing declined following the collapse of the Roman Empire, this is not completely accurate. It was actually the Middle Ages that saw the beginning of soap production, proof that bathing was definitely not uncommon. It was only after the Renaissance that bathing declined; water was feared as a carrier of disease, and thus sweat baths and heavy perfumes were preferred.

In fact throughout the 16th, 17th, and 18th centuries, the use of public baths declined gradually in the west, and private spaces were favoured, thus laying the foundations for the

bathroom, as it was to become, in the 20th century. However in Japan shared bathing in sento and onsen (spas) still exists; the latter being very popular.

Bath/Shower

A bath, bathtub, or tub is a plumbing fixture used for bathing. Most modern bathtubs are made of acrylic or fiberglass, but alternatives are available in enamel over steel or cast iron, and occasionally waterproof finished wood. A bathtub is usually placed in a bathroom either as a stand-alone fixture or in conjunction with a shower. Modern bathtubs have overflow and waste drains and may have taps mounted on them. They may be built-in or free standing or sometimes sunken. Until recently, most bathtubs were roughly rectangular in shape but with the advent of acrylic thermo formed baths, more shapes are becoming available. Bathtubs are commonly white in colour although many other colours can be found. The process for enamelling cast iron bathtubs was invented by the Scottish born American David Dunbar Buick.

Two main styles of bathtub are common:

- Western-style bathtubs in which the bather lies down. These baths are typically shallow and long.
- Eastern style bathtubs in which the bather sits up. These are known as of uro in Japan and are typically short and deep.

Clawfoot Tub

The clawfoot tub or claw-foot tub was considered a luxury item in the late 19th century, modern technology has contributed to a drop in the price of clawfoot tubs. Clawfoot tubs usually require more water than a standard bathtub. While true antique clawfoot tubs are still considered collectible items, new reproduction clawfoot tubs are chosen by remodellers and new home builders.

Clawfoot tubs come in 5 major styles:

- Classic Roll Rim, Roll Top, or Flat Rim tubs as seen in the picture above.

- Slipper tubs-where one end is raised and sloped creating a more comfortable lounging position.
- Double Slipper Tubs-where both ends are raised and sloped.
- Double Ended Tubs-where both ends of the tub are rounded. Notice how one end of the classic tub is rounded and one is fairly flat.
- Pedestal Tub-Pedestal tubs, unlike all the styles listed above, do not have claw feet. The tub rests on a pedestal in what most would term an art deco style. Evidence of pedestal tubs dates back to the Isle of Crete in 1000 BC.

Baby Bathtub

A baby bathtub is one used for bathing infants, especially those not yet old enough to sit up on their own. These can be either a small, stand-alone bath that is filled with water from another source, or a device for supporting the baby that is placed in a standard bathtub. Both types are designed to allow the baby to recline while keeping its head out of the water.

Hot Tubs

Hot tubs are common heated pools used for relaxation and sometimes for therapy. The "hippie" era (1950–1970) popularized them in America in songs and movies.

Whirlpool Tubs

Whirlpool tubs first became popular in America during the 1960s and 70s. A spa is also called a "jacuzzi" since the word became a generic after plumbing component manufacturer Jacuzzi introduced the "Spa Whirlpool" in 1968. Air bubbles may be introduced into the nozzles via an air-bleed venturi pump.

History of Bathing

Documented early plumbing systems for bathing go back as far as around 3300 BC with the discovery of copper water pipes beneath a palace in the Indus Valley Civilization of ancient India. Evidence of the earliest surviving personal sized

bath tub was found on the Isle of Crete where a 5-foot (1.5 m) long pedestal tub was found built from hardened pottery. This tub is the most likely forefather of the classic 19th century clawfoot tub.

The Roman Empire is most widely known as the early champions of bathing. Around 500 BC Roman citizens were encouraged to bathe daily in one of the many public baths. Private bathing rooms were far more ornate and typically would resemble shallow swimming pools that encompassed the entire room. The Romans used marble for the tubs, lead and bronze for pipes, and created a complex sewage system for sanitation purposes. The Roman empire set the early bar for modern personal hygiene.

Contrary to popular belief, bathing and sanitation were not a lost practice with the collapse of the Roman Empire. Soapmaking first became an established trade during the Early Middle Ages. Also, contrary to myth, chamberpots were not disposed of out the window and into streets in the Middle Ages- this was instead a Roman practice. Bathing in fact did not fall out of fashion until shortly after the Renaissance, replaced with the heavy use of sweat-bathing and perfume, as it was thought that water could carry disease into the body through the skin. Modern sanitation was not widely adopted until the 19th and 20th centuries.

The bathtub's modern spouse, the toilet, had problems gaining acceptance. Sir John Harington invented the first flushing toilet for himself and for his godmother, Queen Elizabeth I, in 1596. When Harington published a book describing his invention, he was roundly chided by peers, embarrassing him to the point of retirement from plumbing. His two toilets were the only ones he ever produced. The next water closet would not be seen for 200 years when it was introduced by Alexander Cummings in 1775. This event would mark the very beginnings of the modern bathroom.

It was now time for the piping to catch up with the fixtures. Until the 19th century, most water pipes in the US were made from hollow trees. In the early 1800s, cast-iron production began reducing American reliance on England for this material.

Finally, in 1848, The National Public Health Act was passed in the US, creating a plumbing code for the first time.

In 1883, Standard Sanitary Manufacturing Company and Kohler Company began producing cast-iron bathtubs. Far from the ornate feet and luxury most associated with clawfoot tubs, an early Kohler example was advertised as a "horse trough/hog scalder, when furnished with four legs will serve as a bathtub." The item's use as hog scalder was considered a more important marketing point than its ability to function as a bathtub. Everyone knew what a hog scalder or horse trough was, but many people at that time had never bathed in a tub. The tubs eventually caught on because of the sanitary and easy-to-clean surfaces that prevent the spread of disease.

A few years later, Thomas Twyford created the first valveless toilet constructed from ceramic. Before this time, toilets were normally made from metal and wood. Thomas Crapper would gain fame as the inventor of the modern toilet when he bought the rights to a patent for a "Silent Valveless Water Waste Preventer", but he did not invent the toilet.

The bathing world was rocked by controversy when a completely inaccurate account of bathing and bathtub history was published by H.L. Mencken in 1917. What began as a light attempt at humor ended up being adopted by the public and even reputable publications. While perhaps good reading, Mencken's account of laws prohibiting bathing, and much more, is not true.

The end of World War I resulted in a housing construction boom in the United States and a new conception of the purpose-built modern bathroom. Bathrooms prior to World War I were typically converted bedrooms or spare rooms, not rooms built originally to contain bathroom fixtures. Complete with toilet, sink, and tub, the modern bathroom was a feature of 100% of new homes by the end of the 20th century, whereas only 1% of homes had bathrooms in 1921.

In the latter half of the 20th century, the once popular clawfoot tub morphed into a built-in tub with a small apron front. This enclosed style afforded easier maintenance and, with the emergence of coloured sanitary ware, more design

options for the homeowner. The Crane Company introduced coloured bathroom fixtures to the US market in 1928, and slowly this influx of design options and easier cleaning and care led to the near demise of clawfoot-style tubs.

Firestopping a Bathtub Drain

If the bathtub is located in a building with multiple stories, where the floors are required to have a fire-resistance rating, the drain from the bathtub causes a service penetration firestop to be required, which must be built in accordance with the provisions of the local building code. Originally, the drain pipe is made of copper, which is non-combustible. Since the pipe itself will not give way in the event of a fire, the firestop can be made of conventional means, such as firestop mortar or silicone sealant, each topping off a packing material. If the pipe were made of plastic, however, the firestop would likely involve intumescent materials, which would expand in the event of a fire, in order to choke off and seal the melting and disappearing plastic pipe.

A shower (or shower-bath) is an area in which one bathes underneath a spray of water. People very commonly use soap and shampoo while showering.

History

The original showers were neither indoor structures nor man-made, but were common natural formations: waterfalls. The falling water rinsed the bathers completely clean and was more efficient than bathing in a traditional basin, which required manual transport of both fresh and waste water. Ancient man began to reproduce these natural phenomena by pouring jugs of water, often very cold, over themselves after washing. There has been evidence of early upper class Egyptian and Mesopotamians having indoor shower rooms where servants would bathe them in the privacy of their own homes. However, these were a far cry from modern shower facilities; they had only rudimentary drainage systems and water was carried, not pumped, into the room.

The first group of people to have showers that would be recognizable to a modern person were the ancient Greeks.

Their aqueducts and sewage systems made of lead pipes allowed water to be pumped both into and out of large communal shower rooms used by elites and common citizens alike. These rooms have been discovered at the site of the city Pergamum and can also be found represented in pottery of the era. The depictions are very similar to modern locker room shower, and even included bars to hang up clothing.

The ancient Romans in their love of everything Greek also followed this convention. Their famous bathhouses can be found all around the Mediterranean and as far out as modern day England. The Romans not only had these showers, but also believed in bathing multiple times a week, if not every day. After the fall of the Roman Empire and the rise of Christianity, practicing what is today considered good hygiene became a religious taboo and was abandoned almost completely from the late Middle Ages until the Victorian era.

The advanced water and sewage systems developed by the Greeks and Romans quickly broke down and fell out of use after the fall of their great empires. It was not until the 19th century that a system nearly as complex or reliable as the Greek and Roman sewers was rebuilt. The first showers in the modern era were self-contained units where water could be reused several times. In the early 19th century (probably around 1810, though there is some contradiction among sources), the English Regency Shower was anonymously invented. The original design was over ten feet tall, and was made of several metal pipes painted to look like bamboo. On the top of the unit was a basin connected to these pipes.

The water was pumped through a nozzle and over the occupant's shoulders before being collected and pumped back into the basin. This prototype went through several renovations including hand pumped models, models with several sprayers, and those with interchangeable nozzles. The reinvention of reliable indoor plumbing around 1850 allowed the freestanding showers to be connected to a running water source, making them easier to use. In addition the increase in access to heated water made bathing more comfortable and popular. Even with the new improvements in their design, the shower remained less popular than the bath until the second half of the 20th

century when it all but replaced bathtubs in most western bathrooms.

Types of Showers

Public

Following in the tradition of ancient Greece, many modern athletic and aquatic facilities are equipped with showers. These can be in the form of individual stalls equipped with curtains to maintain privacy or of group shower rooms much like those pictured on ancient Greek pottery. The latter is generally a large open room with several nozzles, or shower heads, either installed directly into the walls of the room or on posts throughout the space.

In addition to washing after vigorous exercise, a variety of shower has been brought into use by governments and their military forces around the world, this is called the field shower. Modern weapons used in battle often have dangerous after effects including: caustic chemicals, deadly biological agents, and radioactive materials. Not only can these harm the intended targets, but also the aggressor's forces. As a result, field showers are often employed to remove these potentially deadly weapons from a soldier's body.

Domestic

Despite the innovations in plumbing and water treatment, the domestic shower is much the same as it was in the late 19th century. The two most commonly found types of showers are the stall shower and the shower/bathtub. The former is solely a shower shielded by a glass door for privacy and to contain any stray water droplets. The latter can be used to take a bath or a shower and is shielded by a sliding shower curtain again for privacy and water containment. Though most domestic units have a single overhead nozzle, more elaborate multi-head showers can be found in custom bathrooms.

Other Types of Showers

- Air shower, a type of bathing where high pressure air is used to blow off excess dust particles from cleanroom personnel.

- Electric shower, a shower stall device to locally heat shower water with electrical power.
- Field shower.
- Navy shower, a method of showering that allows for significant conservation of water and energy.
- Power shower, a shower stall device to locally increase the water pressure available to the shower head by means of an electric pump.
- Steam shower, a type of bathing where a humidifying steam generator produces steam that is dispersed around a person's body.
- Vichy shower, a shower where large quantities of warm water are poured over a spa patron while the user lies within a shallow (wet) bed, similar to a massage table, but with drainage for the water.
- Roman shower an architecturally designed type of shower that does not require a door or curtain.
- Emergency showers are installed in laboratories and other facilities that use hazardous chemicals, and are required by law in the United States. Emergency showers are designed to deluge continuously at around 30-60 gallons per minute for at least 15 minutes, and should be located at most 10 seconds away from potential users.

Times of Showers

Usage

Shower usage in the latter half of the 20th century has skyrocketed. Personal hygiene became a primary concern and bathing everyday or multiple times a day is common among Western cultures. Showering is generally faster than bathing and uses less water. This quick and efficient concept explains its popularity as it fits in with the fast paced lifestyles of modern people. In addition, showering, as opposed to taking a bath, is recommended for older people because it reduces the risk of injury related to falling. Also, as previously mentioned field showers are used to remove dangerous materials from the clothing and skin of affected parties.

Cultural Significance

Showering is mostly part of a daily routine primarily to promote cleanliness and prevent odour, disease and infection. Advances in science and medicine in the 19th century began to realize the benefit of regular bathing to an individual's health. As a result, most modern western cultures encourage a daily personal hygiene regimen. Showering has also developed the reputation as a relaxing and generally therapeutic activity.

Installation

Installation of a shower requires several water transportation pipes. These include the pipe for hot water, cold water, and the drainage pipe.

There are many specific types of showers that can be installed. These include, complete shower units which are all encompassing showers that include the pan, walls, and often the shower head, as well and pieced together units in which you buy the pan, shower head and doors all separately. It is almost always better to ask a certified professional to do the installation of a complete shower if you are not familiar with it.

Structure and Design

Designs for shower facilities vary by location and purpose. There are free-standing showers, but also showers which are integrated into a bathtub. Showers are separated from the surrounding area through watertight curtains (shower curtain), sliding doors, or folding doors, in order to protect the space from spraying water. Showers with a level entry wet room are becoming very popular, especially due to improvements in waterproofing systems and prefabricated components. Best practice requires a waterproofing material to cover the walls and floor of the shower area that are then covered with tile, or in some countries with a sheet material like vinyl.

Places such as a swimming pool, a locker room, or a military facility, have multiple showers. There may be communal shower rooms without divisions, or shower stalls (typically open at the top.)

Shower Heads

A shower head is a perforated nozzle that distributes the water over a large solid angle. Thus less water can be used to wet the same area. Low flow shower heads can use water more efficiently by aerating the water stream. Some shower heads can be adjusted to spray different patterns of water. Hard water may result in calcium and magnesium deposits clogging the head, reducing the flow and changing the spray pattern. For descaling, various acidic chemicals or brushes can be used or some heads have rubber-like jets that can be manually descaled. A homemade remedy is to immerse it in a solution of water and vinegar for a while, since the vinegar is able to dissolve limescale.

Shower curtains, “shower curtain” redirects here. For the physical phenomenon named after shower curtains.

Shower curtains are curtains used in bathtubs with a shower or shower enclosures. They are usually made from vinyl, cloth or plastic. The shower curtain has two main purposes: to provide privacy and to prevent water from flooding or spraying into the bathroom. Shower curtains usually surround the bath inside the tub or shower area, and are held up with railings or curtain rods on the ceiling. To accommodate the different types of bathtub shapes, railings can come in different sizes and are flexible in their design. Many people use two shower curtains: one that is inside the tub, which is mainly functional or decorative as well, and an outer shower curtain, which is purely decorative.

Shower Doors

Shower doors are doors used in bathrooms that help keep water inside a shower or bathtub and are great alternatives to shower curtains. They are available in many different styles such as framed or frameless, sliding or swing. They are usually constructed of aluminum, clear glass, plexi-glass or tempered glass. Shower doors can come in many different hardware finishes and glass patterns that can match other bathroom hardware such as faucets and shower heads. There are also shower doors that are in a neo angle design for use on shower pans that have the neo design as well. The design of the shower

pan is extremely important as the shower door must be the type required for the pan in order to work.

Wet Rooms

A wet room is a shower within a bathroom with a barrier-free floor, level with its surroundings. This structure consists of two phases of construction:

- Phase 1: Structural, which consists of a gradient or slope, an outlet hole, and a foul air trap connecting the floor to the waste pipes.
- Phase 2: Waterproofing. Best practice would suggest multiple layers of defence. Grout is used to fill gaps between tiles, but this material is generally porous. Tiles are generally waterproof, so larger surface areas of grout are less waterproof. Thus small mosaic tiles offer less of a defence than large format tiles. This means sub-tile waterproofing is important when tiles are being used.

Equipment Used in Showers

- Pressure balanced shower valve, a device to provide constant shower water pressure and prevent temperature fluctuations.
- Sharko Shower, a tethered showerhead used for massage.
- Shower cap, a cap worn while showering or bathing, to protect hair from becoming wet.
- Shower radio, a radio that is waterproofed to allow it to be used in a bathroom or other wet environment.
- Sunshower, a device to locally heat shower water with solar power.

Toilet

A toilet is a plumbing fixture primarily intended for the disposal of human excreta: urine and fecal matter. Additionally, vomit and menstrual waste are sometimes disposed of in toilets in Western societies. The word *toilet* describes the fixture and, especially in British English, the room containing the fixture.

In American English, the latter is euphemistically called a *restroom* or *bathroom*. The latter term often describes a room that also contains a bath tub. A room with only a toilet and a sink is sometimes called a *half-bathroom*, a *half bath*, or a *powder room*.

There are two basic types of modern toilets: the dry toilet and the wet (flush) toilet, the latter being the most commonly known and producer of blackwater. The dry toilet needs no plumbing for water input or evacuation, but is often coupled with a ventilation system.

Prior to the introduction of modern flush toilets, most human waste disposal took place outdoors in outhouses or latrines. However, the ancient cities of the Indus Valley Civilization, e.g., Harappa and Mohenjo-daro which are located in present day India and Pakistan had flush toilets attached to a sophisticated sewage system —and other forms of toilets were used both in the time of the Romans and Egyptians as well. Although a precursor to the modern flush toilet system was designed in 1596 by John Harington, the toilet did not enter into widespread use until the late nineteenth century, when it was adopted in English upper class residences.

Types of Toilets

The most common toilet in developed nations is the flush toilet, in which water carries the waste into sewers.

The most common design in western countries is the sitting toilet. Squat toilets are still used by the majority of the world's population.

Public Toilets

Public toilets, public lavatories, or public conveniences are toilets that are accessible to the general public with common access from the street. Conveniences being the collective term for male and female designated toilets, convenience (singular) usually acquiring a gender attribute.

A public toilet may or may not cost money to use; for those that do, see "pay toilet". Between the categories of outright free and outright pay toilets, there is a grey area of toilets where

a fee is expected, but not enforced. A charge levied in the UK during the mid-20th century was one British penny, hence the generally adopted term “spend a penny” meaning to use the toilet.

Public facilities often have several toilets partitioned by *stalls* (US) or *cubicles* (UK). Facilities for men often also have separate urinals, either wall-mounted fixtures designed for a single user, or a constantly-draining basin or trough for collective use. Wall-mounted urinals are sometimes separated by small partitions or other obstructions for privacy, i.e., to keep the user’s genitals hidden from public view.

Outdoor public toilets (in the street, around parks, etc.) are a form of street furniture. For mixed sex arrangements, there are cubicles varying from simple devices with little or no plumbing to more luxurious versions that automatically clean themselves after every use. Facilities without walls all around are typically for urination only, and for men only; although passers-by can see the urinating men from the back, they cannot see the genitals. These street urinals are known as *Pissoirs* after the French term.

Some facilities are mobile, and can thus be put in place where and when needed, e.g., for a weekend at an entertainment venue. Additionally, some can be sunk into the ground (and thereby made inoperable), for the periods that they are not needed. The idea behind this is that some people do not like the sight of a public toilet in the street, and they are more easily hidden than repeatedly moved. This type is typically installed in entertainment areas and made operational during weekend evenings and nights.

A portable toilet is an outdoor public toilet with walls which can either be connected to the local sewage system or store the waste and be emptied from time to time. Many toilets can be cleaned on the spot, or at a central location in the case of a mobile toilet or urinal. In Europe, public toilets are also set up for cities as a compensation for advertising permits. They are part of a street furniture contract between the out-of-home advertising company and the city council. The reason for this combination is the shortage in city budgets.

Terms used to identify a public toilet will vary from region to region. *The Gents* and *The Ladies* are commonly used British terms meaning the male and female toilet respectively. Some European public toilets may be marked "WC" (Water Closet); while in the Philippines the label "CR" (comfort room) is common.

Some public toilets have begun to be provided with flushable paper toilet seat covers which allow the user the comfort of knowing that they are not in contact with a surface previously used by a stranger. There is however no medical evidence that these prevent the spread of disease.

Toilets for People with Disabilities

Some toilet areas (otherwise known as "stalls"), are specially adapted for people with disabilities. These are wide enough to allow the entry and use by a person in a wheelchair, and often feature hand-holds or grab bars bolted to the wall, enabling the person to maneuver onto the toilet, if necessary. Some countries have legal requirements for the accessibility of toilets.

Gender and Public Toilets

Separation by sex is characteristic of public toilets, with writings or pictograms of a man or a woman used to indicate where their respective toilets are. Warsaw, Poland is a rare exception where a triangle indicates male and a circle indicates female. In restaurants, bars and night clubs, the identifications can be designed to match the decoration of the premises, using male and female figures or parts of the body, text, or even puns, making it difficult for some customers to identify them.

Sex-separated public toilets are a source of difficulty for some people. For example, people with children of the opposite sex must choose between bringing the child into a toilet not designated for the child's gender, or entering a toilet not designated for one's own. Men caring for babies often find that only the women's washroom has been fitted with a change table. People with disabilities who need assistance to use the restroom have an additional problem if their helper is the opposite sex.

Sex-separated public toilets are often difficult to negotiate for transgendered people, who are often subject to

embarrassment, harassment, or even assault or arrest by others offended by the presence of a person they interpret as being of the other gender (whether due to their outward presentation or their genital status). Transgendered people have been arrested for using not only toilets that correspond to their gender of identification, but also ones that correspond to the sex they were born with.

Some public places (such as facilities targeted to the transgendered or LGBT communities, and a few universities and offices) provide individual washrooms that are not gender-specified, specifically in order to respond to the concerns of gender-variant people; but this remains very rare and often controversial.

A significant number of facilities have additional gender-neutral public toilets for a different reason — they are marked not for being for females or males, but as being accessible to persons with disabilities, and are adequately equipped to allow a person using a wheelchair and/or with mobility concerns to use them.

Amnesty International includes segregated toilets among the measures to ensure the safety of girls in schools.

Family Restrooms

Another recent development in public toilets is the gender-neutral toilet or "family restroom". These areas contain multiple stalls designed for maximum privacy and a communal washing area for use by both genders. The family restroom is designed so that a parent with a young child of the opposite gender can take the child into the restroom without the concerns associated with single-gender restrooms. Family restrooms have started appearing in newly-built sports stadiums, amusement parks, shopping malls, and major museums.

Toilets in Public Transport

There are usually toilets in airliners, regional rail trains, and often in long-distance buses and ferries, but not in metros, school buses, trams, and other buses. Many newer trains have a waste reservoir, but, in older trains and still in some newer ones, the contents simply fall on the tracks, hence the notice

which appears in many train toilets: “Please do not flush while the train is standing at a station”.

Lavatories on aircraft consist of a sink, a waste bin, and a toilet. On many newer aircraft the toilet does not flush with water; rather, suction removes the waste into a collection bin below cabin level. This type is generically known as a vacuum lavatory.

Private Toilets

Toilets in private homes are almost never separated by sex. However, the size of a home or facility bears on the availability of options. Small facilities are limited by their space to the toilet options they can offer; it is more common to find a higher number of choices in a large facility. The same is true for homes; in more affluent households in the USA, where the homes are usually larger, bathrooms are also often more spacious than average, and more numerous. In such homes, bathrooms (especially master bathrooms) are increasingly being designed with a small adjoining room (en suite) exclusively for the toilet, as well as separate washing basins. This makes it easier for couples who share a bathroom to maintain their desired level of privacy and personal space. In Australia, it has long been the case that the toilet is in a separate room from the bathroom.

“High-tech” Toilets

Advanced technology is being integrated into toilets with more functions, especially in Japan. The biggest maker of these toilets is TOTO. Such toilets can cost anywhere from US$200 to $5,000. The features are operated by control pads (sometimes with bilingual labels), and even hand-held remote control devices. Some of these features are:

- Automatic-flushing mechanisms, operated by a photocell or other sensor. Typically these flush a toilet when the user stands up, or flush a urinal when the user steps away
- Water jets, or “bottom washers” like a bidet, as an alternative to toilet paper

- The "Portable Washlet", Toto's portable hand-held bottom washer
- Blow dryers, to dry the body after use of water jets
- Artificial flush sounds, to mask noises such as body functions
- Urine and stool analysis, for medical monitoring. Matsushita's "Smart Toilet" checks blood pressure, temperature, and blood sugar
- Digital clock, to monitor time spent at the toilet
- Automatic lid operation, to open and close the lid
- Heated seats (some of which may overheat)
- Deodorizing fans
- Automated paper toilet-seat-cover replacers, which automatically replace a paper toilet-seat cover with the push of a button
- Electric Toilet Brushes
- Invented in Australia in 1980, and available in more than thirty countries, are dual flush toilets, also known as *duosets*. Two buttons allow for the user to select between a flush for urine or feces. Because the density of urine is nearly equal to that of the water around it, it requires far less water to flush into a home's sewage system. Because most of a households' flushes are for urine, dual flush toilets can save a significant amount of water

A toilet that pays its users has been opened in Musiri, Tamil Nadu, India. It is the first of its kind. The feces it receives are composted, and the urine is used as fertilzer for bananas and other food crops. Users are paid up to 12 U.S. cents a month.

"Lo-tech" Toilets

According to The Global Water Supply and Sanitation Assessment 2000 by the World Health Organization, 40% of the global population does not have access to *excreta disposal facilities*, mostly in Asia and Africa. There are efforts to design

toilets that are easy to build and maintain with simple materials, that are also hygienic. The World Toilet Organization has created some designs.

Toilets on Fire-resistance Rated Floors

Toilets in multi-storey buildings, located on fire-resistance rated floors typically require at least two through-penetrations, which can compromise the rating of the floor if left untreated. One opening is for the fresh water supply to flush and/or fill the water tank. The other through-penetration is for the drain pipe. The fresh water supply line requires routine firestopping. The drain pipe, however, is exempt from firestopping in many building codes, particularly when noncombustible piping is used, because the penetration terminates on the unexposed side in a ceramic bowl filled with water, which can withstand significant fires. Intumescent firestops are often used, in the event plastic pipes are used for toilet drains, so that the melting plastic pipe is choked off in the event of an accidental fire. It is, however, customary to fill the metallic drain pipe annulus with rockwool packing. Even with the best of intentions, it would be difficult for the firestopper to install a sealant, because he is not allowed or inclined to remove the flange, which is what is partially used to support the drain pipe below during the installation process.

Grey Water

In some areas with water shortage issues, some people have come up with an alternative approach. In order to conserve levels of potable water, some installations use grey water for toilets. Grey water is waste water produced from processes such as washing dishes, laundry and bathing.

History

According to Teresi et al. (2002):

The third millennium B.C. was the “Age of Cleanliness.” Toilets and sewers were invented in several parts of the world, and Mohenjo-Daro circa 2800 B.C. had some of the most advanced, with lavatories built into the outer walls of houses. These were “Western-style” toilets made from bricks with

wooden seats on top. They had vertical chutes, through which waste fell into street drains or cesspits. Sir Mortimer Wheeler, the director general of archaeology in India from 1944 to 1948, wrote, “The high quality of the sanitary arrangements could well be envied in many parts of the world today.”

The toilets at Mohenjo-Daro, described above, were only used by the affluent classes. Most people would have squatted over old pots set into the ground. The people of the Harappan civilization in Pakistan and north-western India had water-flushing toilets in each house that were linked with drains covered with burnt clay bricks.

Early water flushing toilets are also found at Skara Brae in Orkney, Scotland, which was occupied from about 3100 BC until 2500 BC. Some of the houses there have a drain running directly beneath them, and some of these had a cubicle over the drain. Around the 18th century BC, toilets started to appear in Minoan Crete; Egypt in the time of the Pharaohs and ancient Persia. In Roman civilization, toilets were sometimes part of public bath houses.

Roman toilets, like the ones pictured to the right, are commonly thought to be used in the sitting position. But sitting toilets only came into general use in the mid-19th century in the western world. The Roman toilets were probably elevated to raise them above open sewers, rather than for sitting. Squat toilets are still used by the majority of the world’s population.

Sustainability

The amount of water used in toilets is a significant portion of personal water usage, with an average of 24 gallons used per capita per day in 1990 in the United States. One system used to combat this is the “yellow mellow” system, in which a toilet is only flushed when it contains solid waste, and not only one person’s-worth of urine. The custom is often described by the phrase “If it’s yellow, let it mellow. If it’s brown, flush it down.” This system reduces the frequency of toilet flushing significantly.

Since 1990 new regulations and toilet designs have been aimed at reducing the amount of water used in each flush.

Furthermore, dual-flush toilets are in increasing use, especially in Europe. A dual-flush toilet has two flush options: one button or handle flushes the entire tank, for solid waste, and an alternate handle or button uses only part of the water in the tank, for smaller loads. Unlike the yellow mellow system, this does not decrease the frequency of flushes, but instead decreases the quantity of water used by flushing for smaller loads.

Etymology

The word "toilet" came to be used in English along with other French fashions.

It originally referred to the *toile*, French for "cloth", draped over a lady or gentleman's shoulders while their hair was being dressed, and then (in both French and English) by extension to the various elements, and also the whole complex of operations of hairdressing and body care that centred at a dressing table, also covered by a cloth, on which stood a mirror and various brushes and containers for powder and make-up: this ensemble was also a *toilette*, as also was the period spent at the table, during which close friends or tradesmen were often received. The English poet Alexander Pope in *The Rape of the Lock* (1717) described the intricacies of a lady's preparation:

"And now, unveil'd, the toilet stands display'd

Each silver vase in mystic order laid."

These various senses are first recorded by the OED in rapid sequence in the later 17th century: the set of "articles required or used in dressing" 1662, the "action or process of dressing" 1681, the cloth on the table 1682, the cloth round the shoulders 1684, the table itself 1695, and the "reception of visitors by a lady during the concluding stages of her toilet" 1703 (also known as a "toilet-call"), but in the sense of a special room the earliest use is 1819, and this does not seem to include a lavatory.

Through the 18th century, everywhere in the English-speaking world, these various uses centred around a lady's draped dressing-table remained dominant. In the 19th century, apparently first in the United States, the word was adapted as a genteel euphemism for the room and the object as we know

them now, perhaps following the French usage *cabinet de toilette*, much as *powder-room* may be coyly used today, and this has been linked to the introduction of public toilets, for example on railway trains, which required a plaque on the door. The original usages have become obsolete, and the table has become a *dressing-table*.

Vestiges of the original meaning continue to be reflected in terms such as *toiletries*, *eau de toilette* and *toiletry bag* (to carry flannels, soaps, etc). This seemingly contradictory terminology has served as the basis for various parodies e.g. *Cosmopolitan* magazine ("If it doesn't say 'eau de toilette' on the label, it most likely doesn't come from the famed region of Eau de Toilette in France and might not even come from toilets at all.")

The word *toilet* itself may be considered an impolite word in the United States, while elsewhere the word is used without any embarrassment. The choice of the word used instead of *toilet* is highly variable, not just by regional dialect but also, at least in Britain, by class connotations. Nancy Mitford wrote an essay out of the choice of wording; see U and non-U English.

Some manufacturers show this uneasiness with the word and its class attributes: American Standard, the largest manufacturer, sells them as "toilets", yet the higher priced products of the Kohler Company, often installed in more expensive housing, are sold as *commodes* or *closets*, words which also carry other meanings. Confusingly, products imported from Japan such as TOTO are referred to as "toilets", even though they carry the cachet of higher cost and quality. When referring to the room or the actual piece of equipment, the word *toilet* is often substituted with other euphemisms and dysphemisms.

As old euphemisms have become accepted, they have been progressively replaced by newer ones, an example of the euphemism treadmill at work. The choice of word used to describe the room or the piece of plumbing relies as much on regional variation (dialect) as on social situation and level of formality (register).

Lavatory

The term *lavatory*, abbreviated in slang to *lav*, derives from the Latin *lavâtôrium*, which in turn comes from Latin *lavâre*, to wash. The word was used to refer to a vessel for washing, such as a sink/wash basin, and thus came to mean a room with such washing vessels, as for example in medieval monasteries, where the *lavatorium* was the monks' communal washing area. The toilets in monasteries however were not in the *lavatorium* but in the reredorter. Nevertheless the word was later associated with toilets and the meaning evolved into its current one, namely the polite and formal euphemism for a toilet and the room containing it. Lavatory is the common signage for toilets on commercial airlines around the world, see Aircraft lavatory.

Loo

The origin of the (chiefly British) term *loo* is unknown. According to the OED, the etymology is obscure, but it might derive from the word Waterloo. The first recorded entry is in fact from James Joyce's *Ulysses* (1922)*: "O yes, mon loup. How much cost? Waterloo. Watercloset".*

Other theories are:

- That it derives from the term "gardyloo" (a corruption of the French phrase *gardez l'eau* (or maybe: Gare de l'eau!) loosely translated as "watch out for the water!") which was used in medieval times when chamber pots were emptied from a window onto the street. However the first recorded usage of "loo" comes long after this term became obsolete.
- That the word comes from nautical terminology, loo being an old-fashioned word for lee. The standard nautical pronunciation (in British English) of *leeward* is *looward*. Early ships were not fitted with toilets but the crew would urinate over the side of the vessel. However it was important to use the leeward side. Using the windward side would result in the urine blown back on board: hence the phrases 'pissing into the wind' and 'spitting into the wind'. Even now most yachtsmen refer to *the loo* rather than *the heads.*

- That the word derives from the 17th century preacher Louis Bourdaloue. Bourdaloue's sermons at the Saint Paul-Saint Louis Church in Paris lasted at least three hours and myth has it that wealthier ladies took along "travelling" chamber pots that could be hidden under their dresses whenever the need arose to avoid the need to leave. Due to the popularity of the myth the bowls became known as Bourdaloues after the preacher and the name became corrupted to portaloos and sometimes just plain loos due to the habit of shortening words in slang.

WC

The *WC* refers to the initial letters of Water Closet, used commonly in France (pronounced "le vay-say" or "le vater"), Romania (pronounced "veh-cheu") and Hungary (pronounced "vey-tsay"). The term is also used in the Netherlands (pronounced "waysay"), Germany (pronounced "ve-tse"), Denmark (pronounced "ve-se"), and Norway (pronounced "vay-say") and Poland (pronounced "vu-tse"). *WC*, despite being an English language abbreviation widely used internationally, is a term not in common use in English-speaking countries like the United Kingdom or the United States.

CR

The *CR* refers to the initial letters of *Comfort Room*, used commonly in the Philippines.

Khazi

Lexicographer Eric Partridge derives *khazi*, also spelt karzy, kharsie or carzey, from a low Cockney word *carsey* originating in the late 19th century and meaning a privy. Carsey also referred to a den or brothel. It is presumably derived from the Italian *casa* for house, with the spelling influenced by its similar sound to khaki. Khazi is now most commonly used in the city of Liverpool in the UK, away from its cockney slang roots.

An alternative derivation is from Christopher Chippindale, who states that Khazi derives from Army slang used by expatriate officers of the British Empire who took a dislike to

the habits of and steaming rain forest inhabited by the Khasi people of the Khasia hills on the northern frontier of India.

Dunny

The Dunny is an Australian expression for an outside toilet or outhouse. The person who appeared weekly to empty the pan beneath the seat was known as the dunnyman. The word derives from the British dialect word dunnekin, meaning dung-house.

It is now an informal word used for any lavatory and is most often used referring to drop or pit lavatories in the Australian bush.

Privy

The Privy is an old fashioned term used more in the North of England and in Scotland; "privy" is an old alternative for "private", as in Privy council. It is used interchangeably in North America for various terms for the outhouse.

Netty

The netty is the most common word used in the North East England. Many outsiders are often bemused when a Geordie or a Mackem states they are "gannin te the netty" (going to the bathroom).

The etymology of the word is uncertain, but it is believed to be either derived from a corruption of "necessity" or from graffiti scrawled on Hadrian's wall. It is linked to the Italian word *gabinetti* meaning "toilets" (singular *gabinetto*).

Derivations of "House"

The standalone toilet has been variously known as backhouse, house of ease, house of office, little house, or outhouse.

The "house of office" was a common name for a toilet in seventeenth century England, used by, among others, Samuel Pepys on numerous occasions: *October 23, 1660:...going down into my cellar..., I put my foot into a great heap of turds, by which I find Mr. Turner's house of office is full and comes into my cellar.*

Latrine

Latrine is a term common in the military, specifically for the Army and Air Force for any point of entry facility where human waste is disposed of, which a civilian might call a bathroom or toilet, regardless of how modern or primitive it is. Traditionally the Royal Navy along with the United States Navy and Marine Corps use the nautical term "Head" to describe the same type of facility, regardless of whether it is located on a ship or on the land.

Bedroom (or Nursery, for Infants or Small Children)

A bedroom is a private room where people usually sleep for the night or relax during the day.

Many houses in North America, Australia and Europe have at least two bedrooms—usually a master bedroom (dedicated to the heads of the household, such as a husband and wife) and one or more bedrooms for either the children or guests.

In some jurisdictions there are basic features (such as a closet and a "means of egress") which a room must have in order to be qualify as a bedroom. In many states, such as Alaska, bedrooms are not required to have closets and must instead meet minimum size requirements. Nevertheless, some real estate agents may stretch the definition when listing a home for sale.

In buildings with multiple self-contained housing units (e.g., apartments), the number of bedrooms varies widely. While many such units have at least one bedroom—frequently, these units have at least two—some of these units may not have a specific room dedicated for use as a bedroom. (These units may be known by various names, including *studio, efficiency, bedsit*, and others.)

Furniture and other items in bedrooms vary greatly, depending on taste and local tradition. For instance, a master bedroom may include a bed of a specific size (double, king or queen-sized); one or more dressers (or perhaps, a wardrobe armoire); a nightstand; one or more closets; and carpeting.

Built-in closets are less common in Europe than in North America; thus there is greater use of freestanding wardrobes or armoires in Europe.

Bedding used in northern Europe (especially in Scandinavia) is significantly different from that used in North America and other parts of Europe. In Japan futons are common.

Some bedrooms also include such items as a make-up desk, television, personal computer, air conditioning and various accessories (such as lamps, telephone and an alarm clock).

Sometimes, a master bedroom is connected to a dedicated bathroom, often called an ensuite.

Children's Bedrooms

In addition to a bed (or, if shared by two or more children, a bunk bed), a child's bedroom may include a small closet or dressers, a toy box or computer game console, bookcase or other items.

2

Geography of a House

A nursery is usually, in American connotations, a bedroom within a house or other dwelling set aside for an infant or toddler. A typical nursery would contain a crib (or similar type of bed), a table or platform for the purpose of changing diapers (also known as a changing table), as well as various items required for the care of the child (such as baby powder and medicine). A nursery is generally designated for the smallest bedroom in the house, as a baby requires very little space until at least walking age; the premise being that the room is used almost exclusively for sleep. However, the room in many cases could remain the bedroom of the child well into his or her teenage years, or until a younger sibling is born, and the parents decide to move the older child into another larger bedroom, if one should be available.

In Victorian and Edwardian times, for the wealthy and mid-tier classes, a nursery was a suite of rooms at the top of a house, including the night nursery, where the children slept, and a day nursery, where they ate and played, or a combination thereof. The nursery suite would include some bathroom facilities and possibly a small kitchen.

The nurse (nanny) and nursemaid (assistant) slept in the suite too, to be within earshot of the sleeping children. The schoolroom might also be adjacent, but the governess, whose job it was to teach the children, would not be part of the nursery; she would have her own bedroom, possibly in another wing. Fictional portrayals of nurseries abound, for example in

the writings of Kipling and E. Nesbit; perhaps the most famous nursery is that in *Mary Poppins*, or the nursery in J.M. Barrie's *Peter Pan*.

Box-room/Storage Room

Many houses are built to contain a box-room (box room or boxroom) that is easily identifiable, being smaller than the others. The small size of these rooms limits their use, and they tend to be used as a small single bedroom, small child's bedroom, or as a storage room.

Traditionally, and often seen in country houses and larger suburban houses up until the 1930s in Britain, the box room was literally for the storage of boxes, trunks, portmanteaux, and the like, rather than for bedroom use.

Conservatory

A conservatory is a glass and metal structure traditionally found in the garden of a large house or public park. Modern conservatories are smaller, can be made of PVC, and are often added to houses for home improvement purposes.

The traditional nineteenth century conservatory was a large greenhouse used for growing tender and rare plants, or, less often, for birds and rare animals – sometimes with the plants and animals living together. An orangery is similar to a large greenhouse or conservatory and was used originally to winter citrus trees and house exotic plants.

Many cities, especially those in cold climates and with large European populations, have built municipal conservatories to display tropical plants and hold flower displays. This type of conservatory was popular in the early nineteenth century, and by the end of the century people were also giving them a social use (e.g., tea parties). Conservatory architecture varies from typical Victorian glasshouses to modern styles, such as geodesic domes. Many were large and impressive structures and are included in the list below.

Smaller garden conservatories became popular in the second half of the twentieth century, as places which are part-greenhouses, for conserving plants, and part-recreational, as

a solarium or sunroom. They are often used as an extra room rather than for horticulture.

In the UK, a conservatory can also refer to a smaller glass enclosure attached to a house. In other parts of the world this is referred to as a sunroom. In the UK there is a legal definition of a conservatory, it is a building that has at least 50% of its side wall area glazed and at least 75% of its roof glazed with translucent materials, either polycarbonate sheeting or glass.

Dining Room

A dining room is a room for consuming food. In modern times it is usually adjacent to the kitchen for convenience in serving, although in medieval times it was often on an entirely different floor level. Historically the dining room is furnished with a rather large dining table and a number of dining chairs; the most common table shape is generally rectangular with two armed end chairs and an even number of un-armed side chairs along the long sides.

History

In the Middle Ages, upper class Britons and other European nobility in castles or large manor houses dined in the Great Hall. This was a large multi-function room capable of seating the bulk of the population of the house. The family would sit at the head table on a raised dais, with the rest of the population arrayed in order of diminishing rank away from them. Tables in the great hall would tend to be long trestle tables with benches. The sheer number of people in a Great Hall meant it would probably have had a busy, bustling atmosphere. Suggestions that it would also have been quite smelly and smoky are probably, by the standards of the time, unfounded. These rooms had large chimneys and high ceilings and there would have been a freeflow of air through the numerous door and window openings.

It is true that the owners of such properties began to develop a taste for more intimate gatherings in smaller 'parlers' or 'privee parlers' off the main hall but this is thought to be due as much to political and social changes as to the greater comfort afforded by such rooms. In the first instance, the Black

Death that ravaged Europe in the 14th Century caused a shortage of labour and this had led to a breakdown in the feudal system. Also the religious persecutions following the dissolution of the monasteries under Henry VIII made it unwise to talk freely in front of large numbers of people.

Over time, the nobility took more of their meals in the parlour, and the parlour became, functionally, a dining room (or was split into two separate rooms). It also migrated farther from the Great Hall, often accessed via grand ceremonial staircases from the dais in the Great Hall. Eventually dining in the Great Hall became something that was done primarily on special occasions.

Toward the beginning of the 18th Century, a pattern emerged where the ladies of the house would withdraw after dinner from the dining room to the drawing room. The gentlemen would remain in the dining room having drinks. The dining room tended to take on a more masculine tenor as a result.

Modern Dining Rooms in North America

A typical North American dining room will contain a table with chairs arranged along the sides and ends of the table, as well as other pieces of furniture, (often used for storing formal china), as space permits. Often tables in modern dining rooms will have a removable leaf to allow for the larger number of people present on those special occasions without taking up extra space when not in use. Although the “typical” family dining experience is at a wooden table or some sort of kitchen area, some choose to make their dining rooms more comfortable by using couches or comfortable chairs.

In modern American and Canadian homes, the dining room is typically adjacent to the living room, being increasingly used only for formal dining with guests or on special occasions. For informal daily meals, most medium size houses and larger will have a space adjacent to the kitchen where table and chairs can be placed, larger spaces are often known as a dinette while a smaller one is called a breakfast nook. Smaller houses and condos may have a breakfast bar instead, often of a different height than the regular kitchen counter (either raised for stools or lowered for chairs). If a home lacks a dinette, breakfast nook,

or breakfast bar, then the kitchen or family room will be used for day-to-day eating.

This was traditionally the case in England, where the dining room would for many families be used only on Sundays, other meals being eaten in the kitchen.

In Australia, while the use of the dining room is still prevalent, family meals are also often eaten at a breakfast counter or in front of the television in the lounge.

Family Room or Den

A family room is an informal, all-purpose room in a house similar to a living room. The family room is designed to be a place where family and guests gather for group recreation like talking, reading, watching TV, and other family activities. Often, the family room is located adjacent to the kitchen, and at times, flows into it with no visual breaks. A family room often has doors leading to the back yard and specific outdoor living areas such as a deck, garden, or terrace.

The distinction between a family room, a living room, and a recreation room may be fluid. In homes with more than one, the living room is usually the more formal room, often reserved for guests, special occasions, and the display of items such as antiques or artwork. The recreation room is typically in the basement and used for games and playtime. In homes with only one, the terms are generally synonymous. It is not uncommon for someone who grew up calling such a room by only one term to have no idea of the distinction between the two. In floorplans, a “great room” is where the living room and family room are combined into one high-ceilinged room adjacent to the kitchen.

Fireplace (for Warmth During Winter; Generally not Found in Warmer Climates)

A fireplace is an architectural structure to contain a fire for heating and, especially historically, for cooking. A fire is contained in a firebox or firepit; a chimney or other flue directs gas and particulate exhaust to escape. Fireplaces are a central household feature, as the flames and crackling sounds are

comforting, even when not necessary for heat or cooking. Fireplace mantels are a focus for interior decoration.

Types of Fireplace

A. Cool air enters.

B. The cool air is heated and is released.

C. Smoke is released.

A fireplace may have: a foundation, a hearth, a firebox, a fireplace mantel, an ashdump door, a chimney crane, a cleanout door, a grate, a lintel, a lintel bar, overmantel, a chimney breast, a damper, a smoke chamber, a throat, a flue, a chimney chase, a crown, a cap, a shroud, or a spark arrestor.

Fireplace types:

- Masonry (brick or stone fireplaces and chimneys. This type of fireplace is popular due to its nostalgic qualities.
- Manufactured ("prefab") fireplaces with sheet metal fire boxes.

Masonry and prefab fireplaces can be fueled with wood, natural gas, biomass and lp/propane fuel sources.

- Ventless Fireplaces (duct free/rom-venting fireplaces) that are fueled by either gel, LP/bottled gas or natural gas. Some states and local counties have laws and ordinances regarding these types of fireplaces. They require the least installation and are the most efficient fireplace. The gas burning version of a vent free fireplace while using less fuel, burns that fuel at close to 100% efficiency. They must be sized appropriately to the area to be heated. Aside from the heat output there are also air quality control problems due to the amount of moisture they release into the room air, and oxygen sensor and carbon monoxide sensors are safety essentials.

Chimney/flue types:

- Masonry (brick or stone fireplaces and chimneys) with or without tile lined flue. Unreinforced masonry chimneys do not stand up to earthquakes well.

- Reinforced concrete chimneys. Fundamental flaws (the difference in thermal expansion rates between steel rebar and concrete which caused the chimney flues to crack when heated) bankrupted the US manufacturers and obsoleted the technique. This is evidenced by vertical cracks on the exterior of the chimney.
- Metal-lined flue: Double or triple walled metal pipe running up inside a new or existing wood framed or masonry chase.

Newly constructed flues may feature a chase cover, a cap, and a spark arrestor at the top to keep small animals out and sparks from exiting the chimney cavity.

History

Ancient fire pits were sometimes built in the ground in the center of a hut or dwelling. Smoke escaped through holes in the roof. Smoke would be blown outside or back into the room. Chimneys, invented much later, partially fixed this problem, venting smoke outside.

In 1678 Prince Rupert, nephew of Charles I, raised the grate of the fireplace, improving the airflow and venting system. The 1700s saw two important developments in the history of fireplaces. Ben Franklin developed a convection chamber for the fireplace that greatly improved the efficiency of fireplaces and wood stoves. He also improved the airflow by pulling air from a basement and venting out a longer area at the top. In the later 1700s, Count Rumford designed a fireplace with a tall, shallow firebox that was better at drawing the smoke up and out of the building. The shallow design also improved greatly the amount of radiant heat projected into the room. Rumford's design is the foundation for modern fireplaces.

One famous tradition in the United States during the Great Depression was President Franklin Delano Roosevelt's "fireside chats", weekly radio addresses in which he made use of the family gathering time to state his views.

Many homes no longer have open fireplaces, their inefficient heating replaced by central heating, or electric heaters, its social function by the home entertainment center. Some

fireplaces have been closed off not allowing them to be used. Some have been made unable to be used by feeding a telephone, television antenna, cable TV or satellite TV wire down them. For homeowners that want the ambiance of a fireplace without the energy loss they have a few options. They can install into a new home or addition a high efficiency gas or wood fireplace. They do not have the appeal of a true open fireplace, but offer the fireplace effect while adding true heating value to the home. For people with existing fireplaces, the alternative to simply closing them up is to install a high efficiency gas, wood or biomass fireplace insert. Some governments have a partial ban on solid fuel burning fireplaces due to air pollution. Ventless fireplaces have received attention recently: they are free standing, requiring no chimney and no hearth. Prefabricated fireplaces are popular because of their lower construction cost and safer and more reliable operation. Brick or stone fireplaces can be designed to meet exact specifications for opening size, depth, and facing material. They cost more to build and require more maintenance.

Accessories

A wide range of accessories are used with fireplaces, which vary between countries and regions, and historical periods. For the interior, common in recent Western cultures are grates, fireguards, logboxes, andirons, pellet baskets, and fire dogs, all of which cradle fuel and accelerate burning. Heavy metal firebacks are sometimes used to capture and reradiate heat, to protect the back of the fireplace, and as decoration. For fireplace tending, tools include pokers, bellows, tongs, shovels, brushes and toolstands.

Foyer

A foyer is a large, vast room or complex of rooms (in a theatre, opera, concert hall, showroom, cinema, etc.) adjacent to the auditorium. It is a repose area for spectators and place of venues, especially used before performance and during intermissions, but also as a place of celebrations or festivities after performance. Usually a foyer is a large, specially designed hall, but sometimes it is a corridor surrounding the main hall.

It is furnished and big enough to enable spectators to stroll, get together and rest. Foyers are commonly adorned with art works, permanent or temporary exhibitions related to the activity of the institution, and a refreshment room or buffet. Moreover, the foyer can be the main place of some events such as vernissage, meetings with the artists, actors' benefit, etc.

A foyer in a house is usually a small entry area or room by the front door. Other public rooms such as the living room, dining room, and family room typically attach to it, along with any main stairway. It was initially intended as an "airlock", separating the fireplace-heated rooms from the (colder, in winter) front entrance, where cold air infiltration made for cold drafts and low temperatures. It is commonly used for outer garment and umbrella storage for both residents and guests.

Social Housing

In social housing a *Foyer* is a service that combines housing for homeless young people with other services such as guidance and support.

The Foyer movement started in France, but is now gaining popularity in other countries. The first Foyers in the UK were launched in 1992 and as of 2008 there are well over 100 in operation.

Front Room (in Various Senses of the Phrase)

A living room, also known as sitting room, lounge room or lounge (in the United Kingdom and Australia), is a room for entertaining guests, reading, watching TV or other activities. The term front room can also be used to describe a living room, because in many homes the living room is at the very front.

In modern homes and apartments, the living room has replaced the old-fashioned front parlour. In the 19th century, the front parlour was the room in the house used for formal social events, including where the recently deceased were laid out before their funeral. The term marks the twentieth-century effort of architects and builders to strip the parlour of its burial and mourning associations. This room was relabeled with the more affirmative term "living room" in the 20th century.

A typical western living room will be furnished with a sofa, chairs, occasional tables, a television or stereo equipment, and bookshelves, lamps, rugs, as well as other pieces of furniture. Traditionally, a sitting room in the United Kingdom would have a fireplace. In Japan, people traditionally sat on tatami instead of chairs, but Western-style decor is also common to have in Japanese homes nowadays.

In the United States, sometimes the living room is reserved for more formal and quiet entertaining while a separate recreation room or family room is used for more casual activities and drinking. In recent years, the term “great room” has come to be used to denote the family room, especially if it is open to the kitchen, and may feature a vaulted ceiling.

Garage

A residential garage is part of a home, or an associated building, designed or used for storing a vehicle or vehicles. In some places the term is used synonymously with “carport”, though that term normally describes a structure that is not completely enclosed.

History and Creation

The genesis of the garage occurred when Henry Ford invented the Quadracycle in 1896 in his coal shed. Doors in the shed weren’t large enough to allow Ford to remove his new invention and give it a test drive. So he pounded an opening in the brick wall large enough to escape the confines of the dusty shed and motored down the lane. Little did he know that he was inadvertently inventing the garage. Since then, the garage has played the role of incubator for other American entrepreneurs for more than 100 years.

British Residential Garages

Those British homes that have a garage have a single or double garage either built into the main building (thus subtracting from the living area), detached within the grounds, often the back garden, or in a communal block. As the typical size of a family car has increased significantly over the past thirty years some garages can no longer be comfortably used

to park a car and increasingly the garage is used as a general storage space.

The common term for these structures in the first decades of the Twentieth Century was motor house. Traditionally, garage doors were wooden, opening either as two leaves or sliding horizontally. Newer garages were fitted with metal up-and-over doors. Increasingly, in new homes, such doors are electrically operated.

Traditionally a small British single garage is 8 by 16 feet (2.4□×□4.9□m), a medium is 9 by 18 feet (2.7□×□5.5□m), and a large single garage is 10 by 20 feet (3.0□×□6.1□m). Family saloons are bigger on average than was the case 3 years ago, so the larger size is now preferred. A typical large family car like the Ford Mondeo is about 15 by 6 feet (4.6□×□1.8□m), so even with the larger size garage it is necessary to park to one side to be able to open the driver's door wide enough to get into it.

Types of Garages

The most popular types of garage are four:

- The Up-and-Over Door: Is a single sectioned door which is pulled to the roof. It changes its angle directly 90° degrees.
- The Sectional Door: Its perhaps the most popular garage door. It is a few sectioned door (usually 4 and 5 sections long) which passes its angle in a rough curve in 90° degrees.
- The Round and Corner Door (also called Side Sectional Door): Basically its the Sectional Door but sideways. These are using for space optimizing. You usually don't need a roof for this type of door.
- The Roller Garage Door: It's a lot like the Sectional Door but this has more sections, and instead of moving from the floor to the roof, this one just rolls up, as its name says.

United States Residential Garages

In most American single family and town houses featuring a garage, the garage has a door on the side of the building for

vehicles to enter and stay. Most garage doors open upward using an electric chain drive, which can usually be remotely controlled from the resident's vehicle with a small radio transmitter.

Garages are connected to the nearest road with a driveway. Interior space for one or two cars is typical, and garages built since the 1960s typically have a door directly connecting the garage to the interior of the house (an "attached Garage"). Earlier garages were often detached and located in the back yard of the house, accessed either via a long driveway or from an alley.

In the past, garages were often separate buildings from the house ("detached garage"), almost resembling modern sheds. On occasion, a garage would be built with an apartment above it, which could be rented out. As automobiles became more popular, the idea of attaching the garage directly to the home grew into a common practice. While a person with a separate garage must walk outdoors in any type of weather, a person with an attached garage has a much shorter walk inside a building.

Garages are often where the attic entrance is located. Used also to store tools, bicycles, lawn mowers and other such items, most garages have unfinished concrete floors. Since they are heavily used for storage, and as work space for home improvement projects, some home owners do not use their garage to store their car. Many two-car garages only have one usable space. Some garages contain a separate storage room to partially alleviate the problem.

Hallway/Passage/Vestibule

Hearth – often an Important Symbolic Focus of Family Togetherness

In architecture, a hall is fundamentally a relatively large space enclosed by a roof and walls. In the Iron Age, a mead hall was such a simple building and was the residence of a lord and his retainers. Later, rooms were partitioned from it, so that today the hall of a house is the space inside the front door from which the rooms are reached.

Thus:

- Deriving from the above, a hall is often the term used to designate a British or Irish country house.
- In later medieval Europe, the main room of a castle or manor house was the great hall.
- Where the hall inside the front door of a house is elongated, it may be called a passage, corridor, or hallway. The corresponding space upstairs is a landing.
- In a medieval building, the hall was where the fire was kept. With time, its functions as dormitory, kitchen, parlour and so on were divided off to separate rooms or, in the case of the kitchen, a separate building.

On the same principle:

- Many buildings at colleges and universities are formally titled "_____ Hall", typically being named after the person who endowed it, for example, King's Hall, Cambridge. Others, such as Lady Margaret Hall, Oxford, commemorate respected people. Between these in age, Nassau Hall at Princeton University began as the single building of the then college. In medieval origin, these were the halls in which the members of the university lived together during term time. In many cases, some aspect of this community remains.
- At colleges in the universities of Oxford and Cambridge, Hall is the dining hall for students, with High Table at one end for fellows. Typically, at "Formal Hall", gowns are worn for dinner during the evening, whereas for "informal Hall" they are not.
- Many Livery Companies (e.g., in the City of London) have a Hall that is their headquarters and meeting place.

Similarly:

- A hall is also a building consisting largely of a principal room, that is rented out for meetings and social affairs. It may be privately or government-owned, such as a function hall owned by one company used for weddings and cotillions (organized and run by the same company

on a contractual basis) or a community hall available for rent to anyone.

Following a line of similar development:

- In office buildings and larger buildings (theatres, cinemas etc), the entrance hall is generally known as the foyer (the French for fire-place). The atrium, a name sometimes used in public buildings for the entrance hall, was the central courtyard of a Roman house.

Derived from the residential meanings of the word:

- Hall is also a surname of people, one of whose ancestors lived in a hall as distinct from one such as David M. Cote, whose ancestor will have lived in a cote, a much humbler place shared with the livestock.

Association with Salt

From a completely separate derivation:

A Hall is a brand of bitter (beer) made in Germany and sold worldwide, mainly across America.

- In German speaking areas, Hall (with a short *a*) can also form part of a town name, like Halle, where the name refers to hall, the Celtic word for salt (compare Welsh *halen* or Breton *holen* or Cornish *holan*). In this connection, Hall is the short form of the name of:

1. The medieval German town Schwäbisch Hall, where Hall was its whole name prior to 1933,
2. The Austrian town Hall in Tirol near Innsbruck, which used to be called Solbad Hall from 1938 to 1974,
3. Hallstatt in Austria which gave its name to the Celtic Hallstatt culture.

Sir Charles Hallé (originally Karl Halle) lent his name to the Hallé Orchestra. His forbears were probably associated with the German town of Halle. The accent was added to his name in order to assist English-speakers in pronouncing the word. In the ancient world, the Celts were neighbours of the Greeks whose word for salt was *halos* (*'áëïó*). While European

science was developing, some branches of it adopted the Greek language as the source of its terminology. We therefore have words like halogen, halide, halotrichite and halocarbon.

Kitchen

A kitchen is a room or part of a room used for cooking and food preparation.

In the West, a modern residential kitchen is typically equipped with a stove, a sink with hot and cold running water, a refrigerator and kitchen cabinets arranged according to a modular design. Many households have a microwave oven, a dishwasher and other electric appliances. The main function of a kitchen is cooking or preparing food but it may also be used for dining and entertaining.

History

The evolution of the kitchen is linked to the invention of the cooking range or stove and the development of water infrastructure capable of supplying water to private homes. Until the 18th century, food was cooked over an open fire. Technical advances in heating food in the 18th and 19th centuries, changed the architecture of the kitchen. Before the advent of modern pipes, water was brought from an outdoor source such as wells, pumps or springs.

Antiquity

The houses in Ancient Greece were commonly of the atrium-type: the rooms were arranged around a central courtyard. In many such homes, a covered but otherwise open patio served as the kitchen. Homes of the wealthy had the kitchen as a separate room, usually next to a bathroom (so that both rooms could be heated by the kitchen fire), both rooms being accessible from the court. In such houses, there was often a separate small storage room in the back of the kitchen used for storing food and kitchen utensils.

In the Roman Empire, common folk in cities often had no kitchen of their own; they did their cooking in large public kitchens. Some had small mobile bronze stoves, on which a fire could be lit for cooking. Wealthy Romans had relatively well-

equipped kitchens. In a Roman villa, the kitchen was typically integrated into the main building as a separate room, set apart for practical reasons of smoke and sociological reasons of the kitchen being operated by slaves. The fireplace was typically on the floor, placed at a wall—sometimes raised a little bit—such that one had to kneel to cook. There were no chimneys.

Middle Ages

Early medieval European longhouses had an open fire under the highest point of the building. The "kitchen area" was between the entrance and the fireplace. In wealthy homes there was typically more than one kitchen. In some homes there were upwards of three kitchens. The kitchens were divided based on the types of food prepared in them. In place of a chimney, these early buildings had a hole in the roof through which some of the smoke could escape. Besides cooking, the fire also served as a source of heat and light to the single-room building. A similar design can be found in the Iroquois longhouses of North America.

In the larger homesteads of European nobles, the kitchen was sometimes in a separate sunken floor building to keep the main building, which served social and official purposes, free from indoor smoke.

The first known stoves in Japan date from about the same time. The earliest findings are from the Kofun period (3rd to 6th century). These stoves, called *kamado*, were typically made of clay and mortar; they were fired with wood or charcoal through a hole in the front and had a hole in the top, into which a pot could be hanged by its rim. This type of stove remained in use for centuries to come, with only minor modifications. Like in Europe, the wealthier homes had a separate building which served for cooking. A kind of open fire pit fired with charcoal, called *irori*, remained in use as the secondary stove in most homes until the Edo period (17th to 19th century). A *kamado* was used to cook the staple food, for instance rice, while *irori* served both to cook side dishes and as a heat source.

The kitchen remained largely unaffected by architectural advances throughout the Middle Ages; open fire remained the only method of heating food. European medieval kitchens were

dark, smoky, and sooty places, whence their name *"smoke kitchen"*. In European medieval cities around the 10th to 12th centuries, the kitchen still used an open fire hearth in the middle of the room. In wealthy homes, the ground floor was often used as a stable while the kitchen was located on the floor above, like the bedroom and the hall. In castles and monasteries, the living and working areas were separated; the kitchen was sometimes moved to a separate building, and thus could not serve anymore to heat the living rooms. In some castles the kitchen was retained in the same structure, but servants were strictly separated from nobles, by constructing separate spiral stone staircases for use of servants to bring food to upper levels. An extant example of such a medieval kitchen with servants' staircase is at Muchalls Castle in Scotland. In Japanese homes, the kitchen started to become a separate room within the main building at that time.

With the advent of the chimney, the hearth moved from the center of the room to one wall, and the first brick-and-mortar hearths were built. The fire was lit on top of the construction; a vault underneath served to store wood. Pots made of iron, bronze, or copper started to replace the pottery used earlier. The temperature was controlled by hanging the pot higher or lower over the fire, or placing it on a trivet or directly on the hot ashes. Using open fire for cooking (and heating) was risky; fires devastating whole cities occurred frequently.

Leonardo da Vinci invented an automated system for a rotating spit for spit-roasting: a propeller in the chimney made the spit turn all by itself. This kind of system was widely used in wealthier homes. Beginning in the late Middle Ages, kitchens in Europe lost their home-heating function even more and were increasingly moved from the living area into a separate room. The living room was now heated by tiled stoves, operated from the kitchen, which offered the huge advantage of not filling the room with smoke.

Freed from smoke and dirt, the living room thus began to serve as an area for social functions and increasingly became a showcase for the owner's wealth. In the upper classes, cooking and the kitchen were the domain of the servants, and the

kitchen was set apart from the living rooms, sometimes even far from the dining room. Poorer homes often did not have a separate kitchen yet; they kept the one-room arrangement where all activities took place, or at the most had the kitchen in the entrance hall.

The medieval smoke kitchen (or Farmhouse kitchen) remained common, especially in rural farmhouses and generally in poorer homes, until much later. In a few European farmhouses, the smoke kitchen was in regular use until the middle of the 20th century. These houses often had no chimney, but only a smoke hood above the fireplace, made of wood and covered with clay, used to smoke meat. The smoke rose more or less freely, warming the upstairs rooms and protecting the woodwork from vermin.

Colonial American Kitchens

In Colonial America, the pioneers cooked over a fireplace in a corner of the cabin. The kitchen became a separate room only later. In the south, where the climate and sociological conditions differed, the kitchen was often relegated to an outhouse, separate from the mansion, for much of the same reasons as in the feudal kitchen in medieval Europe: the kitchen was operated by slaves, and their working place had to be separated from the living area of the masters by the social standards of the time. Separate “summer kitchens” were also common on large farms in the north. These were used to prepare meals for harvest workers and tasks such as canning.

Industrialization

Technological advances during industrialization brought major changes to the kitchen. Iron stoves, which enclosed the fire completely and were more efficient, appeared. Early models included the Franklin stove around 1740, which was a furnace stove intended for heating, not for cooking. Benjamin Thompson in England designed his “Rumford stove” around 1800. This stove was much more energy efficient than earlier stoves; it used one fire to heat several pots, which were hung into holes on top of the stove and were thus heated from all sides instead of just from the bottom. However, his stove was designed for

large kitchens; it was too big for domestic use. The “Oberlin stove” was a refinement of the technique that resulted in a size reduction; it was patented in the U.S. in 1834 and became a commercial success with some 90,000 units sold over the next 30 years. These stoves were still fired with wood or coal. Although the first gas street lamps were installed in Paris, London, and Berlin at the beginning of the 1820s and the first U.S. patent on a gas stove was granted in 1825, it was not until the late 19th century that using gas for lighting and cooking became commonplace in urban areas.

The urbanization in the second half of the 19th century induced other significant changes that would ultimately change the kitchen. Out of sheer necessity, cities began planning and building water distribution pipes into homes, and built sewers to deal with the waste water. Gas pipes were laid; gas was used first for lighting purposes, but once the network had grown sufficiently, it also became available for heating and cooking on gas stoves. At the turn of the 20th century, electricity had been mastered well enough to become a commercially viable alternative to gas and slowly started replacing the latter. But like the gas stove, the electrical stove had a slow start. The first electrical stove had been presented in 1893 at the World’s Columbian Exposition in Chicago, but it was not until the 1930s that the technology was stable enough and began to take off.

Industrialization also caused social changes. The new factory working class in the cities was housed under generally poor conditions. Whole families lived in small one or two-room apartments in tenement buildings up to six stories high, badly aired and with insufficient lighting. Sometimes, they shared apartments with “night sleepers”, unmarried men who paid for a bed at night. The kitchen in such an apartment was often used as a living and sleeping room, and even as a bathroom. Water had to be fetched from wells and heated on the stove. Water pipes were laid only towards the end of the 19th century, and then often only with one tap per building or per story. Brick-and-mortar stoves fired with coal remained the norm until well into the second half of the century. Pots and kitchenware were typically stored on open shelves, and parts

of the room could be separated from the rest using simple curtains.

In contrast, there were no dramatic changes for the upper classes. The kitchen, located in the basement or the ground floor, continued to be operated by servants. In some houses, water pumps were installed, and some even had kitchen sinks and drains (but no water on tap yet, except for some feudal kitchens in castles). The kitchen became a much cleaner space with the advent of "cooking machines", closed stoves made of iron plates and fired by wood and increasingly charcoal or coal, and that had flue pipes connected to the chimney. For the servants the kitchen continued to also serve as a sleeping room; they slept either on the floor, or later in narrow spaces above a lowered ceiling, for the new stoves with their smoke outlet no longer required a high ceiling in the kitchen. The kitchen floors were tiled; kitchenware was neatly stored in cupboards to protect them from dust and steam. A large table served as a workbench; there were at least as many chairs as there were servants, for the table in the kitchen also doubled as the eating place for the servants.

The middle class tried to imitate the luxurious dining styles of the upper class as best as it could. Living in smaller apartments, the kitchen was the main room—here, the family lived. The study or living room was saved for special occasions such as an occasional dinner invitation. Because of this, these middle-class kitchens were often more homely than those of the upper class, where the kitchen was a work-only room occupied only by the servants. Besides a cupboard to store the kitchenware, there were a table and chairs, where the family would dine, and sometimes—if space allowed—even a fauteuil or a couch.

Gas pipes were first laid in the late 19th century, and gas stoves started to replace the older coal-fired stoves. Gas was more expensive than coal, though, and thus the new technology was first installed in the wealthier homes. Where workers' apartments were equipped with a gas stove, gas distribution would go through a coin meter. In rural areas, the older technology using coal or wood stoves or even brick-and-mortar open fireplaces remained common throughout. Gas and water

pipes were first installed in the big cities; small villages were connected only much later.

Rationalization

To streamline work processes, Taylorism and time-motion studies were used to optimize processes. The German kitchen brand 'Poggenpohl', established in 1892 by Friedemir Poggenpohl, introduced ergonomic work-top heights and storage chutes that were later adopted by Schütte-Lihotzk's Frankfurt Kitchen. These ideas also spilled over into domestic kitchen architecture because of a growing trend that called for a professionalization of household work, noted in the mid-19th century by Catharine Beecher and amplified by Christine Frederick's publications in the 1910s.

Working class women frequently worked in factories to ensure the family's survival, as the men's wages often did not suffice. Social housing projects led to the next milestone: the "Frankfurt kitchen". Developed in 1926, this kitchen measured 1.9 m by 3.4 m (approximately 6 ft 2 in by 11 ft 2 in, with a standard layout. It was built for two purposes: to optimize kitchen work to reduce cooking time (so that women would have more time for the factory) and to lower the cost of building decently-equipped kitchens. The design, created by Margarete Schütte-Lihotzky, was the result of detailed time-motion studies and heavily influenced by the railway dining car kitchens of the period. It was built in some 10,000 apartments in a social housing project of architect Ernst May in Frankfurt.

The initial reception was heavily critical: people were not accustomed to the changed processes also designed by Schütte-Lihotzky; it was so small that only one person could work in it; some storage spaces intended for raw loose food ingredients such as flour were reachable by children. But the Frankfurt kitchen embodied a standard for the rest of the 20th century in rental apartments: the "work kitchen". Too small to live or dine in, it was soon criticized as "exiling the women in the kitchen", but the post-World War II conservatism coupled with economic reasons prevailed. The kitchen once more was seen as a work place that needed to be separated from the living areas. Practical reasons also played a role in this development:

just as in the bourgeois homes of the past, one reason for separating the kitchen was to keep the steam and smells of cooking out of the living room.

Unit / Fitted

Friedemir Poggenpohl, led innovation in the kitchen area by presenting the 'reform kitchen' in 1928 with interconnecting cabinets & functional interiors. The reform kitchen was a forerunner to the later unit kitchen, & fitted kitchen. Poggenpohl presented the form 1000, the world's first unit kitchen, at the imm Cologne Furniture Fair in 1950.

The idea of standardized dimensions and layout developed for the Frankfurt kitchen took hold while Poggenpohl began exporting to neighboring countries which for the first time required a kitchen specifier known today as a kitchen designer. The equipment used remained a standard for years to come: hot and cold water on tap and a kitchen sink and an electrical or gas stove and oven. Not much later, the refrigerator was added as a standard item.

The concept was refined in the "Swedish kitchen" using unit furniture with wooden fronts for the kitchen cabinets. Soon the concept was amended by the use of smooth synthetic door and drawer fronts, first in white, recalling a sense of cleanliness and alluding to sterile lab or hospital settings, but soon after in more lively colors, too.

Unit construction since its introduction has defined the developed of the modern kitchen, with pre-manufactured modules using mass manufacturing techniques developed during World War Two greatly bringing down the cost of a kitchen. Units which are kept on the floor are called *"floor units"* or *"floor cabinets"* on which a kitchen worktop, originally often formica and or now made of granite, marble, tile or wood. The units which are held on the wall for storage purposes are termed as "wall units" or "wall cabinets". In small areas of kitchen in an apartment, even a "tall storage unit" is available for effective storage. In cheaper brands, all cabinets are kept a uniform colour, normally white, with the interchangeable doors and accessories chosen by the customer to give a varied look. In more expensive brands, the cabinets are produced in

a uniform with the doors colours and finishes, for an older more bespoke look.

Technicalization

A trend began in the 1940s in the United States to equip the kitchen with electrified small and large kitchen appliances such as blenders, toasters, and later also microwave ovens. Following the end of World War II, massive demand in Europe for low-price, high-tech consumer goods led to Western European kitchens being designed to accommodate new appliances such as refrigerators and electric/gas cookers.

Parallel to this development in tenement buildings was the evolution of the kitchen in homeowner's houses. There, the kitchens usually were somewhat larger, suitable for everyday use as a dining room, but otherwise the ongoing technicalization was the same, and the use of unit furniture also became a standard in this market sector.

General technocentric enthusiasm even led some designers to take the "work kitchen" approach even further, culminating in futuristic designs like Luigi Colani's "kitchen satellite" (1969, commissioned by the German high-end kitchen manufacturer Poggenpohl for an exhibit), in which the room was reduced to a ball with a chair in the middle and all appliances at arm's length, an optimal arrangement maybe for "applying heat to food", but not necessarily for actual cooking. Such extravaganzas remained outside the norm, though.

In the former Eastern bloc countries, the official doctrine viewed cooking as a mere necessity, and women should work "for the society" in factories, not at home. Also, housing had to be built at low costs and quickly, which led directly to the standardized apartment block using prefabricated slabs.

The kitchen was reduced to its minimums and the "work kitchen" paradigm taken to its extremes: in East Germany for instance, the standard tenement block of the model "P2" had tiny 4 m^2 kitchens in the inside of the building (no windows), connected to the dining and living room of the 55 m^2 apartment and separated from the latter by a pass-through or a window.

Open Kitchens

Starting in the 1980s, the perfection of the extractor hood allowed an open kitchen again, integrated more or less with the living room without causing the whole apartment or house to smell. Before that, only a few earlier experiments, typically in newly built upper middle class family homes, had open kitchens. Examples are Frank Lloyd Wright's *House Willey* (1934) and *House Jacobs* (1936). Both had open kitchens, with high ceilings (up to the roof) and were aired by skylights. The extractor hood made it possible to build open kitchens in apartments, too, where both high ceilings and skylights were not possible.

The re-integration of the kitchen and the living area went hand in hand with a change in the perception of cooking: increasingly, cooking was seen as a creative and sometimes social act instead of work, especially in upper social classes. Besides, many families also appreciated the trend towards open kitchens, as it made it easier for the parents to supervise the children while cooking. The enhanced status of cooking also made the kitchen a prestige object for showing off one's wealth or cooking professionalism. Some architects have capitalized on this "object" aspect of the kitchen by designing freestanding "kitchen objects". However, like their precursor, Colani's "kitchen satellite", such futuristic designs are exceptions.

Another reason for the trend back to open kitchens (and a foundation of the "kitchen object" philosophy) is changes in how food is prepared. Whereas prior to the 1950s most cooking started out with raw ingredients and a meal had to be prepared from scratch, the advent of frozen meals and pre-prepared convenience food changed the cooking habits of many people, who consequently used the kitchen less and less. For others, who followed the "cooking as a social act" trend, the open kitchen had the advantage that they could be with their guests while cooking, and for the "creative cooks" it might even become a stage for their cooking performance. The "Trophy Kitchen" is highly equipped with very expensive and sophisticated appliances which are used primarily to impress visitors and to project social status, rather than for actual cooking.

Domestic Kitchen Planning

Domestic kitchen design *per se* is a relatively recent discipline. The first ideas to optimize the work in the kitchen go back to Catharine Beecher's *A Treatise on Domestic Economy* (1843, revised and republished together with her sister Harriet Beecher Stowe as *The American Woman's Home* in 1869). Beecher's "model kitchen" propagated for the first time a systematic design based on early ergonomics. The design included regular shelves on the walls, ample work space, and dedicated storage areas for various food items. Beecher even separated the functions of preparing food and cooking it altogether by moving the stove into a compartment adjacent to the kitchen.

Christine Frederick published from 1913 a series of articles on "New Household Management" in which she analyzed the kitchen following Taylorist principles, presented detailed time-motion studies, and derived a kitchen design from them. Her ideas were taken up in the 1920s by architects in Germany and Austria, most notably Bruno Taut, Erna Meyer, and Margarete Schütte-Lihotzky. A social housing project in Frankfurt (the *Römerstadt* of architect Ernst May) realized in 1927/8 was the breakthrough for her Frankfurt kitchen, which embodied this new notion of efficiency in the kitchen.

While this "work kitchen" and variants derived from it were a great success for tenement buildings, home owners had different demands and did not want to be constrained by a $6.4\,\mathrm{m}^2$ kitchen. Nevertheless, kitchen design was mostly ad-hoc following the whims of the architect. In the U.S., the "Small Homes Council", since 1993 the "Building Research Council", of the School of Architecture of the University of Illinois at Urbana-Champaign was founded in 1944 with the goal to improve the state of the art in home building, originally with an emphasis on standardization for cost reduction. It was there that the notion of the *kitchen work triangle* was formalized: the three main functions in a kitchen are storage, preparation, and cooking (which Catharine Beecher had already recognized), and the places for these functions should be arranged in the kitchen in such a way that work at one place does not interfere with work at another place, the distance between these places

is not unnecessarily large, and no obstacles are in the way. A natural arrangement is a triangle, with the refrigerator, the sink, and the stove at a vertex each.

This observation led to a few common kitchen forms, commonly characterized by the arrangement of the kitchen cabinets and sink, stove, and refrigerator:

- A *single-file kitchen (or one-way galley)* has all of these along one wall; the work triangle degenerates to a line. This is not optimal, but often the only solution if space is restricted. This may be common in an attic space that is being converted into a living space, or a studio apartment.
- The *double-file kitchen (or two-way galley)* has two rows of cabinets at opposite walls, one containing the stove and the sink, the other the refrigerator. This is the classical work kitchen.
- In the *L-kitchen*, the cabinets occupy two adjacent walls. Again, the work triangle is preserved, and there may even be space for an additional table at a third wall, provided it does not intersect the triangle.
- A *U-kitchen* has cabinets along three walls, typically with the sink at the base of the "U". This is a typical work kitchen, too, unless the two other cabinet rows are short enough to place a table at the fourth wall.
- The *block kitchen (or island)* is a more recent development, typically found in open kitchens. Here, the stove or both the stove and the sink are placed where an L or U kitchen would have a table, in a freestanding "island", separated from the other cabinets. In a closed room, this does not make much sense, but in an open kitchen, it makes the stove accessible from all sides such that two persons can cook together, and allows for contact with guests or the rest of the family, since the cook does not face the wall anymore.

In the 1980s there was a backlash against industrial kitchen planning and cabinets with people installing a mix of work surfaces and free standing furniture, led by kitchen designer Johnny Grey and his concept of the "Unfitted Kitchen".

Modern kitchens often have enough informal space to allow for people to eat in it without having to use the formal dining room. Such areas are called "breakfast areas", "breakfast nooks" or "breakfast bars" if the space is integrated into a kitchen counter. Kitchens with enough space to eat in are sometimes called "eat-in kitchens".

Other Kitchen Types

Restaurant and canteen kitchens found in hotels, hospitals, educational and work place facilities, army barracks, and similar establishments are generally (in developed countries) subject to public health laws. They are inspected periodically by public-health officials, and forced to close if they do not meet hygienic requirements mandated by law.

Canteen kitchens (and castle kitchens) were often the places where new technology was used first. For instance, Benjamin Thompson's "energy saving stove", an early-19th century fully-closed iron stove using one fire to heat several pots, was designed for large kitchens; another thirty years passed before they were adapted for domestic use.

Today's western restaurant kitchens typically have tiled walls and floors and use stainless steel for other surfaces (workbench, but also door and drawer fronts) because these materials are durable and easy to clean. Professional kitchens are often equipped with gas stoves, as these allow cooks to regulate the heat quicker and more finely than electrical stoves. Some special appliances are typical for professional kitchens, such as large installed deep fryers, steamers, or a bain-marie. (As of 2004, steamers — not to be confused with a pressure cooker — are beginning to find their way into domestic households, sometimes as a combined appliance of oven and steamer.) The fast food and convenience food trends have also changed the way restaurant kitchens operate. There is a trend for restaurants to only "finish" delivered convenience food or even just re-heat completely prepared meals, maybe at the utmost grilling a hamburger or a steak.

The kitchens in railway dining cars present special challenges: Space is constrained, and, nevertheless, the personnel must be able to serve a great number of meals

quickly. Especially in the early history of railways this required flawless organization of processes; in modern times, the microwave oven and prepared meals have made this task much easier. Galleys are kitchens aboard ships or aircraft (although the term *galley* is also often used to refer to a railroad dining car's kitchen). On yachts, galleys are often cramped, with one or two burners fueled by an LP gas bottle, but kitchens on cruise ships or large warships are comparable in every respect with restaurants or canteen kitchens. On passenger airliners, the kitchen is reduced to a mere pantry, the only function reminiscent of a kitchen is the heating of in-flight meals delivered by a catering company. An extreme form of the kitchen occurs in space, *e.g.*, aboard a Space Shuttle (where it is also called the "galley") or the International Space Station. The astronauts' food is generally completely prepared, dehydrated, and sealed in plastic pouches, and the kitchen is reduced to a rehydration and heating module.

Outdoor areas in which food is prepared are generally not considered to be kitchens, although an outdoor area set up for regular food preparation, for instance when camping, might be called an "outdoor kitchen". Military camps and similar temporary settlements of nomads may have dedicated kitchen tents.

In schools where home economics (HE) or food technology (previously known as "domestic science") are taught, there will be a series of kitchens with multiple equipment (similar in some respects to laboratories) solely for the purpose of teaching. These will consist of six to twelve workstations, each with their own oven, sink and kitchen utensils.

Kitchens Types by Region

Japan

Kitchens in Japan are called Daidokoro. Daidokoro is the place where food is prepared in a Japanese house. Until the Meiji era, a kitchen was also called *kamado* (K0~0i0; lit. stove) and there are many sayings in the Japanese language that involve kamado as it was considered the symbol of a house and the term could even be used to mean "family" or "household"

(similar to the English word “hearth”). When separating a family, it was called *Kamado wo wakeru*, which means “divide the stove”. *Kamado wo yaburu* (lit. “break the stove”) means that the family was bankrupt.

Larder

A larder is a cool area for storing food prior to use. Larders were commonplace in houses before the widespread use of the refrigerator.

Essential qualities of a larder are that it should be:

- as cool as possible
- close to food preparation areas
- constructed so as to exclude flies and vermin
- easy to keep clean
- equipped with shelves and cupboards appropriate to the food being stored

In the northern hemisphere, most houses would arrange to have their larder and kitchen on the north or east side of the house where it received least sun. In Australia and New Zealand larders were placed on the south or east sides of the house for the same reason.

Many larders have small unglazed windows with the window opening covered in fine mesh. This allows free circulation of air without allowing flies to enter. Many larders have tiled or painted walls to simplify cleaning. Older larders and especially those in larger houses have hooks in the ceiling to hang joints of meat or game. Others have insulated containers for ice, anticipating the future development of refrigerators.

A pantry may contain a thrawl, which is a term used in Yorkshire and Derbyshire, and is a stone slab or shelf used to keep food cool in the days before refrigeration was domestically available. In the late medieval hall, a thrawl would have been appropriate to a larder. In a large or moderately large nineteenth century house, all these rooms would have been placed as low in the building as possible, or as convenient, in order to use the mass of the ground to retain a low summer temperature. For this reason, a buttery was usually called the cellar by this

stage. Very few modern houses have larders since this need is now satisfied by refrigerators, freezers, and by the convenience of modern grocery stores that obviate the need to store food for long periods.

History

In medieval households the larder was an office responsible for meat and fish, as well as the room where these commodities were kept. It was headed by a *larderer*. The Scots term for larder was *the spence*, and so in Scotland larderers (also pantlers and cellarers) were known as *spencers*. This is one of the derivations of the modern surname.

The office generally was subordinated to the kitchen, and only existed as a separate office in larger households. It was closely connected with other offices of the kitchen, such as the saucery and the scullery. Larders were used in the Indus River Valley to store bones of oxen, sheep, and goats. These larders were made of large clay pots.

Laundry Room

A laundry room (also called a utility room) is a room where clothes are washed. In a modern home, a laundry room would be equipped with an automatic washing machine and clothes dryer,and often a large basin, called a laundry tub, for hand-washing delicate articles of clothing such as sweaters, and an ironing board. A typical laundry room is located in the basement of older homes, but in many modern homes, the laundry room might be found on the main floor near the kitchen or upstairs near the bedrooms.

Another typical location is adjacent to the garage and the laundry room serves as a mudroom for the entrance from the garage. As the garage is often at a different elevation (or grade) than the rest of the house, the laundry room that serves as an entrance from the garage that may be sunken from the rest of the house. This avoids or minimizes the need for stairs between the garage and the house.

Laundry rooms may also include storage cabinets, countertops for folding clothes, and, space permitting, a small sewing machine.

Living Room

A living room, also known as sitting room, lounge room or lounge (in the United Kingdom and Australia), is a room for entertaining guests, reading, watching TV or other activities. The term front room can also be used to describe a living room, because in many homes the living room is at the very front.

In modern homes and apartments, the living room has replaced the old-fashioned front parlour. In the 19th century, the front parlour was the room in the house used for formal social events, including where the recently deceased were laid out before their funeral. The term marks the twentieth-century effort of architects and builders to strip the parlour of its burial and mourning associations. This room was relabeled with the more affirmative term “living room” in the 20th century.

A typical western living room will be furnished with a sofa, chairs, occasional tables, a television or stereo equipment, and bookshelves, lamps, rugs, as well as other pieces of furniture. Traditionally, a sitting room in the United Kingdom would have a fireplace. In Japan, people traditionally sat on tatami instead of chairs, but Western-style decor is also common to have in Japanese homes nowadays.

In the United States, sometimes the living room is reserved for more formal and quiet entertaining while a separate recreation room or family room is used for more casual activities and drinking. In recent years, the term “great room” has come to be used to denote the family room, especially if it is open to the kitchen, and may feature a vaulted ceiling.

Loft

A loft can be an upper storey or attic in a building, directly under the roof. Alternatively, it can be a loft apartment which is a large adaptable open space either created or converted for residential use.

Attic

An upper room or storey in a building, mainly in a barn, directly under the roof, used either for storage (as in most private houses), for a specific purpose, e.g. an “organ loft” in

a church, or to sleep in (sleeping loft). In this sense it is roughly synonymous with attic, the major difference being that an attic typically constitutes an entire floor of the building, while a loft covers only a few rooms, leaving one or more sides open to the lower floor. In barns a hayloft is often larger than the ground floor as it would contain a year's worth of hay.

An attic loft can often be converted to form functional living accommodation.

Loft Apartment

Loft apartments are apartments that are generally built from former industrial buildings. When industrial developments are developed into condominiums instead of apartments, they may be called loft condominiums. The general term warehouse-to-loft conversions may sometimes be used for development of industrial buildings into apartments and condominiums. "Loft-style" may also refer simply to developments where a street-level business occupies the first floor while apartment "lofts" are placed above the first floor.

Sometimes, loft apartments are one component of municipal urban renewal initiatives that also include renovation of industrial buildings into art galleries and studio space as well as promotion of a new part of the city as an "arts district."

Originally popular with artists, they are now highly sought-after by other bohemians, and the gentrification of the former manufacturing sectors of large cities is now a familiar pattern. One such sector is Manhattan's Meatpacking District. The adoption of the Adaptive Reuse Ordinance (2001) in the City of Los Angeles (primarily the Arts District) is another example of such legislation to encourage the conversion of no longer economically viable industrial and commercial buildings to residential loft communities. Such is the demand for these spaces that real estate developers have taken to creating ready-made "lofts" in urban areas that are gentrifying or that seem primed to do so. While some of these units are created by developers during the renovation of old buildings, a number of them are included in the floor plans of brand new developments. Both types of pre-fab loft offer buyers or renters proximity to urban amenities afforded by traditional lofts, but without

perceived safety risks of living in economically depressed formerly industrial areas.

Real estate industry distinguishes between “hard lofts”, which are former industrial buildings converted to residential or live/work use, and “soft lofts”, which are loft-style residential buildings built entirely anew as described above.

Other Lofts

Commercial Loft

A commercial loft refers to a building that has ceilings over 17 feet (5 m) in height and a second story area for storage or offices above. These are usually industrial spaces with an added office element on a second level.

Live/Work Loft

A live/work loft is a space designed to house a resident and their business. This concept has been a vital part of the redevelopment of major downtown cities' inner cores. The concept of cutting costs on space, travel and more is essential in the live/work loft.

Rigging Loft

A raised area or gallery in a shipyard where workers stand while fitting rigging.

Parachute Loft

A large, open, high ceilinged space where parachute riggers re-pack parachutes into parachute containers.

Sail Loft

A large open space used by sailmakers to spread out sails.

Church Architecture

Some churches have a choir loft, where the singers stand or sit during services. Sometimes the church organ is located in a loft.

Loft Conversions

It is fairly common to convert part of a home into a loft to

create an extra room in order to prevent needing to move to a new house. The most common additions are an extra bedroom or study. The attic area of a building tends to be unused, but when converted can add a large amount of floor space.

Window

A window is a transparent opening in a wall or door that allows the passage of light and, if not closed or sealed, air and sound. Windows are usually glazed or covered in some other transparent or translucent material like a float glass. Windows are held in place by frames, which prevent them from collapsing in.

Etymology

The word *window* originates from the Old Norse 'vindauga', from 'vindr – wind' and 'auga – eye', i.e. "*wind eye*". In Norwegian Nynorsk and Icelandic the Old Norse form has survived to this day (in Icelandic only as a less used synonym to *gluggi*), in Swedish the word *vindöga* remains as a term for a hole through the roof of a hut, and in the Danish language 'vindue' and Norwegian Bokmål 'vindu', the direct link to 'eye' is lost, just like for 'window'. The Danish (but not the Bokmål) word is pronounced fairly similar to *window*.

Window is first recorded in the early 13th century, and originally referred to an unglazed hole in a roof. *Window* replaced the Old English 'eagþyrl', which literally means 'eye-hole,' and 'eagduru' 'eye-door'. Many Germanic languages however adopted the Latin word 'fenestra' to describe a window with glass, such as standard Swedish 'fönster', or German 'Fenster'. The use of *window* in English is probably due to the Scandinavian influence on the English language by means of loanwords during the Viking Age. In English the word *fenester* was used as a parallel until the mid-1700s and *fenestration* is still used to describe the arrangement of windows within a façade.

History

Primitive windows were just holes in a wall. Later, windows were covered with animal hide, cloth, or wood. Shutters that could be opened and closed came next. Over time, windows

were built that both protected the inhabitants from the elements and transmitted light: mullioned glass windows, which joined multiple small pieces of glass with leading, paper windows, flattened pieces of translucent animal horn, and plates of thinly sliced marble. The Romans were the first to use glass for windows.

In Alexandria ca. 100 AD, cast glass windows, albeit with poor optical properties, began to appear. Mullioned glass windows were the windows of choice among European well-to-do, whereas paper windows were economical and widely used in ancient China, Korea and Japan. In England, glass became common in the windows of ordinary homes only in the early 17th century whereas windows made up of panes of flattened animal horn were used as early as the 14th century in Northern Britain. Modern-style floor-to-ceiling windows became possible only after the industrial glass making process was perfected.

Types of Windows

Double-hung Sash Window

This sash window is the traditional style of window in the USA, and many other places that were formerly colonized by the UK, with two parts (sashes) that overlap slightly and slide up and down inside the frame. The two parts are not necessarily the same size. Nowadays, most new double-hung sash windows use spring balances to support the sashes, but traditionally, counterweights held in boxes on either side of the window were used. These were and are attached to the sashes using pulleys of either braided cord or, later, purpose-made chain. Double-hung sash windows were traditionally often fitted with shutters. Sash windows may be fitted with simplex hinges which allow the window to be locked into hinges on one side, while the rope on the other side is detached, allowing the window to be opened for escape or cleaning.

Single-hung Sash Window

One sash is movable (usually the bottom one) and the other fixed. This is the earlier form of sliding sash window, and is also cheaper.

Horizontal Sliding Sash Window

Has two or more sashes that overlap slightly but slide horizontally within the frame. In the UK, these are sometimes called *Yorkshire* sash windows, presumably because of their traditional use in that county.

Casement Window

A window with a hinged sash that swings in or out like a door comprising either a side-hung, top-hung (also called "awning window"), or occasionally bottom-hung sash or a combination of these types, sometimes with fixed panels on one or more sides of the sash. In the USA these are usually opened using a crank, but in parts of Europe they tend to use projection friction stays and espagnolette locking. Formerly, plain hinges were used with a casement stay. Handing applies to casement windows to determine direction of swing. The casement window is the dominant type now found in the UK and parts of Europe.

Awning Window

An awning window is a casement window that is hung horizontally, hinged on top, so that it swings outward like an awning.

Hopper Window

A hopper window is a bottom hung casement window that opens similar to a draw bridge typically opening to the outside.

Tilt and Slide Window

A window (more usually a door-sized window) where the sash tilts inwards at the top and then slides horizontally behind the fixed pane.

Tilt and Turn Window

A window which can either tilt inwards at the top, or can open inwards hinged at the side.

Transom Window

A window above a door; in an exterior door the transom window is often fixed, in an interior door it can open either by

hinges at top or bottom, or rotate on hinges. It provided ventilation before forced air heating and cooling. A fan-shaped transom is known as a fanlight, especially in the British Isles.

Jalousie Window

Also known as a louvered window, the jalousie window consists of parallel slats of glass or acrylic that open and close like a Venetian blind, usually using a crank or a lever. They are used extensively in tropical architecture. A jalousie door is a door with a jalousie window.

Clerestory Window

A window set in a roof structure or high in a wall, used for daylighting.

Skylight

A flat or slope window used for daylighting, built into a roof structure that is out of reach.

Roof Window

A sloped window used for daylighting, built into a roof structure that is within reach.

Roof Lantern

A roof lantern is a multi-paned glass structure, resembling a small building, built on a roof for day or moon light. Sometimes includes an additional clerestory. May also be called a cupola.

Bay Window

A multi-panel window, with at least three panels set at different angles to create a protrusion from the wall line.

Oriel window

A window with many panels. It is most often seen in Tudor-style houses and monasteries. An oriel window projects from the wall and does not extend to the ground. Oriel windows originated as a form of porch. They are often supported by brackets or corbels. Buildings in the Gothic Revival style often have oriel windows.

Thermal Window

Thermal, or Diocletian, windows are large semicircular windows (or niches) which are usually divided into three lights (window compartments) by two vertical mullions. The central compartment is often wider than the two side lights on either side of it.

Fixed Window

A window that cannot be opened, whose function is limited to allowing light to enter (Unlike an unfixed window, which can open and close). Clerestory windows are often fixed. Transom windows may be fixed or operable.

Picture Window

A very large fixed window in a wall, typically without glazing bars, or glazed with only perfunctory glazing bars near the edge of the window. Picture windows are intended to provide an unimpeded view, as if framing a picture.

Multi-lit Window

A window glazed with small panes of glass separated by wooden or lead “glazing bars”, or “muntins”, arranged in a decorative “glazing pattern” often dictated by the architectural style at use. Due to the historic unavailability of large panes of glass, this was the prevailing style of window until the beginning of the twentieth century, and is traditionally still used today.

Emergency Exit/Egress Window

A window big enough and low enough so that occupants can escape through the opening in an emergency, such as a fire. In the United States, exact specifications for emergency windows in bedrooms are given in many building codes. Vehicles, such as buses and aircraft, frequently have emergency exit windows as well.

Stained Glass Window

A window composed of pieces of coloured glass, transparent or opaque, frequently portraying persons or scenes. Typically

the glass in these windows is separated by lead glazing bars. Stained glass windows were popular in Victorian houses and some Wrightian houses, and are especially common in churches.

French Window

A French window, also known as a *French door* is really a type of door, but one which has one or more panes of glass set into the whole length of the door, meaning it also functions as a window. In Italy they are very common, usually overlooking a terrace, known as *portafinestra* (door-window).

Technical Terms

In insulated glass production, the term “lite”, or “light”, refers to a glass pane, several of which may be used to construct the final window product. For example, a sash unit, consisting of at least one sliding glass component, is typically composed of two lites, while a fixed window is composed of one lite. The terms “single-light”, “double-light” etc refer to the number of these glass panes in a window.

The lites in a window sash are divided horizontally and vertically by narrow strips of wood or metal called muntins. More substantial load bearing or structural vertical dividers are called mullions, with the corresponding horizontal dividers referred to as transoms.

In the United States, the term *replacement window* means a framed window designed to slip inside the original window frame from the inside after the old sashes are removed. In Europe, however, it usually means a complete window including a replacement outer frame.

The U.S., term *new construction window* means a window with a nailing fin designed to be inserted into a rough opening from the outside before applying siding and inside trim. A nailing fin is a projection on the outer frame of the window in the same plane as the glazing, which overlaps the prepared opening, and can thus be ‘nailed’ into place.

In the UK and mainland Europe, windows in new-build houses are usually fixed with long screws into expanding plastic plugs in the brickwork. A gap of up to 13mm is left around all

four sides, and filled with expanding polyurethane foam. This makes the window fixing weatherproof but allows for expansion due to heat.

A beam over the top of a window is known as the lintel or transom.

In the US, the NRFC Window Label lists the following terms:

- Thermal transmittance (U-factor). Best values are around U-0.15 (equal to 0.8 W/m2/K)
- Solar heat gain coefficient (SHGC) (ratio of solar heat (infrared) passing through the glass to incident solar heat)
- Visible transmittance (VT) (ratio of transmitted visible light divided by incident visible light)
- Air Leakage (AL) (Measured in cubic foot per minute per linear foot of crack between sash and frame)
- Condensation Resistance (CR) (Measured between 1 and 100. The higher the number, the higher the resistance of the formation of condensation)

Window Construction

Windows can be a significant source of heat transfer. Therefore, insulated glazing units consist of two or more panes to reduce the transfer of heat.

Grids or Muntins

These are the decorative, usually wood pieces that separate a larger pane into smaller segments. The muntins are generally held to the window frame using a pin of some sort.

Glazing and Filling

Low-emissivity coated panes reduce heat transfer by radiation, which, depending on which surface is coated, helps prevent heat loss (in cold climates) or heat gains (in warm climates).

High thermal resistance can be obtained by evacuating or filling the insulated glazing units with gases such as argon or

krypton, which reduces conductive heat transfer due to their low thermal conductivity. Performance of such units depends on good window seals and meticulous frame construction to prevent entry of air and loss of efficiency.

Modern double-pane and triple-pane windows often include one or more low-e coatings to reduce the window's U-factor. In general, soft-coat low-e coatings tend to result in a lower solar heat gain coefficient (SHGC) than hard-coat low-coatings.

Modern windows are usually glazed with one large sheet of glass per sash, while windows in the past were glazed with multiple panes separated by "glazing bars", or "muntins", due to the unavailability of large sheets of glass. Today, glazing bars tend to be decorative, separating windows into small panes of glass even though larger panes of glass are available, generally in a pattern dictated by the architectural style at use. Glazing bars are typically wooden, but occasionally lead glazing bars soldered in place are used for more intricate glazing patterns.

Other Construction Details

Many windows have movable window coverings such as blinds or curtains to keep out light, provide additional insulation, or ensure privacy. Windows allow natural light to enter, but too much can have negative effects such as glare and heat gain. Additionally, while windows allow the user to see the outside, there needs to be a way to maintain privacy on in the inside. Window coverings are practical accommodations for these issues.

Windows and the Sun

Historically, windows are designed with surfaces parallel to vertical building walls. Such a design allows considerable solar light and heat penetration due to the most commonly occurring incidence of sun angles. In passive solar building design, an extended eave is typically used to control the amount of solar light and heat entering the window(s).

An alternate method would be to calculate a more optimum angle for mounting windows which accounts for summer sun load minimization, with consideration of the actual latitude of the particular building. An example where this process has

been implemented is the Dakin Building, Brisbane, California; much of the fenestration has been designed to reflect summer heat load and assist in preventing summer interior over-illumination and glare, by designing window canting to achieve a near 45 degree angle.

Solar Window

Photovoltaïc windows not only provide a clear view and illuminate rooms, but also use sunlight to efficiently help generate electricity for the building. In most cases, translucent photovoltaïc cells are used.

Window Coverings

A window covering is a shading or screening device that can be used for multiple purposes. For example, some window coverings are used to control solar heat gain and glare. Typically, there are external shading devices and internal shading devices.

For high-rise buildings, smart glass can be used as an alternative.

Office or Study

An office is generally a room or other area in which people work, but may also denote a position within an organization with specific duties attached to it; the latter is in fact an earlier usage, office as place originally referring to the location of one's duty.

When used as an adjective, the term *office* may refer to business-related tasks. In legal writing, a company or organization has offices in any place that it has an official presence, even if that presence consists of, for example, a storage silo rather than an office.

An office is an architectural and design phenomenon and a social phenomenon, whether it is a tiny office such as a bench in the corner of a "Mom and Pop shop" of extremely small size through entire floors of buildings up to and including massive buildings dedicated entirely to one company. In modern terms an office usually refers to the location where white-collar workers are employed.

History of Offices

The word stems from the Latin officium, as its equivalents in various mainly romance languages and may or may not have walls or barriers as defined by Turlach Murphy (Wing half back for Rostrevor). Interestingly, this was not necessarily a place, but rather an often mobile 'bureau' in the sense of a human staff or even the abstract notion of a formal position, such as a magistrature. The relatively elaborate Roman bureaucracy would not be equaled for centuries in the West after the fall of Rome, even partially reverting to illiteracy, while the East preserved a more sophisticated administrative culture, both under Byzantium and under Islam.

Offices in classical antiquity were often part of a palace complex or a large temple. There was usually a room where scrolls were kept and scribes did their work. Ancient texts mentioning the work of scribes allude to the existence of such "offices". These rooms are sometimes called "libraries" by some archaeologists and the general press because one often associates scrolls with literature. In fact they were true offices since the scrolls were meant for record keeping and other management functions such as treaties and edicts, and not for writing or keeping poetry or other works of fiction.

The medieval chancery was usually the place where most government letters were written and where laws were copied in the administration of a kingdom. The rooms of the chancery often had walls full of pigeonholes, constructed to hold rolled up pieces of parchment for safekeeping or ready reference, a precursor to the book shelf. The introduction of printing during the Renaissance did not change these early government offices much.

Pre-industrial illustrations such as paintings or tapestries often show us personalities or eponyms in their private offices, handling record keeping books or writing on scrolls of parchment. All kinds of writings seemed to be mixed in these early forms of offices. Before the invention of the printing press and its distribution there was often a very thin line between a private office and a private library since books were read or written in the same space at the same desk or table, and

general accounting and personal or private letters were also done there.

Office Structure

There are many different ways of arranging the space in an office and whilst these vary according to function, managerial fashions and the culture of specific companies can be even more important. Choices include, how many people will work within the same room.

At one extreme, each individual worker will have their own room; at the other extreme a large open plan office can be made up of one main room with tens or hundreds of people working in the same space. Open plan offices put multiple workers together in the same space, and some studies have shown that they can improve short term productivity, i.e. within a single software project. At the same time, the loss of privacy and security can increase the incidence of theft and loss of company secrets. A type of compromise between open plan and individual rooms is provided by the cubicle, possibly made most famous by the Dilbert cartoon series, which solves visual privacy to some extent, but often fails on acoustic separation and security. Most cubicles also require the occupant to sit with their back towards anyone who might be approaching; workers in walled offices almost always try to position their normal work seats and desks so that they can see someone entering, and in some instances, install tiny mirrors on things such as computer monitors.

Office Buildings

While offices can be built in almost any location in almost any building, some modern requirements for offices make this more difficult. These requirements can be both legal (*i.e. light levels must be sufficient*) or technical (*i.e. requirements for computer networking*). Alongside such other requirements such as security and flexibility of layout, this has led to the creation of special buildings which are dedicated only or primarily for use as offices. An office building, also known as an office block, is a form of commercial building which contains spaces mainly designed to be used for offices.

The primary purpose of an office building is to provide a workplace and working environment primarily for administrative and managerial workers. These workers usually occupy set areas within the office building, and usually are provided with desks, PCs and other equipment they may need within these areas.

An office building will be divided into sections for different companies or may be dedicated to one company. In either case, each company will typically have a reception area, one or several meeting rooms, singular or open-plan offices, as well as toilets.

Many office buildings also have kitchen facilities and a staff room, where workers can have lunch or take a short break.

Office and Retail Rental Rates

Rental rates for office and retail space are typically quoted in terms of money per floor-area–time, usually money per floor-area–year. For example, the rate for a particular property may be 290 dollars per square-meter–year ($290/m^2·a$) (or $29/ft^2·a$), and rates in the area could range $200/m^2·a–$500/m^2·a$.

In many countries, rent is typically paid monthly even if usually discussed in terms of years.

Example: A particular $200\ m^2$ space is priced at $150/m^2·a$: $(200\ m^2) \times (\$150/m^2·a)/(12\ mo/a) = \$2500/month$.

In a *gross lease*, the rate quoted is an all-inclusive rate. One pays a set amount of rent per time and the landlord is responsible for all other expenses such as costs of utilities, taxes, insurance, maintenance, and repairs.

The *triple net* lease is one in which the tenant is liable for a share of various expenses such as property taxes, insurance, maintenance, utilities, climate control, repairs, janitorial services and landscaping.

Grading

The Building Owners and Managers Association International (BOMA) classifies office space into three categories: Class A, Class B, and Class C. According to BOMA,

Class A office buildings (NL, ZH) have the “most prestigious buildings competing for premier office users with rents above average for the area.” BOMA states that Class A facilities have “high quality standard finishes, state of the art systems, exceptional accessibility and a definite market presence.”

BOMA describes Class B office buildings as those that compete “for a wide range of users with rents in the average range for the area.” BOMA states that Class B buildings have “adequate systems” and finishes that “are fair to good for the area,” but that the buildings do not compete with Class A buildings for the same prices. According to BOMA Class C buildings are aimed towards “tenants requiring functional space at rents below the average for the area.

Pantry

A pantry is a room where food, provisions or dishes are stored and served in an ancillary capacity to the kitchen. The derivation of the word is from the same source as the Old French term *paneterie*; that is from *pain*, the French form of the Latin *pane* for bread.

In a late medieval hall, there were separate rooms for the various service functions and food storage. A pantry was where bread was kept and food preparation associated with it done. The head of the office responsible for this room was referred to as a pantler. There were similar rooms for storage of bacon and other meats (larder), alcoholic beverages (buttery) known for the “butts” of barrels stored there, and cooking (kitchen).

In America, pantries evolved from Early American “butteries”, built in a cold north corner of a Colonial home [more commonly referred to and spelled as “butt’ry”], into a variety of pantries in self-sufficient farmsteads. Butler’s pantries, or china pantries, were built between the dining room and kitchen of a middle class English or American home, especially in the latter part of the 19th into the early 20th centuries. Great estates, such as Biltmore Estate in Asheville, North Carolina [1] or Stan Hywet Hall in Akron, Ohio [2] had large warrens of pantries and other domestic “offices”, echoing their British ‘Great House’ counterparts.

Butler's Pantry

A butler's pantry or serving pantry is a utility room in a large house. It is usually located adjacent to the kitchen or to the wine cellar and usually contains counters (*worktops* in British English) or tables and sinks and may or may not be used for storing food.

Common uses for the butler's pantry are storage, cleaning and counting of silver; European butlers often slept in the pantry, as their job was to keep the silver under lock and key. The wine log and merchant's account books may be kept in the butler's pantry. The room is used by the butler and other domestic staff; it is often called a butler's pantry even in households where there is no butler.

The Hoosier Cabinet

First developed in the early 1900s by the Hoosier Manufacturing Company in New Castle, Indiana, and popular into the 1930s, the Hoosier cabinet and its many imitators soon became an essential fixture in American kitchens.

Often billed as a "pantry and kitchen in one," the Hoosier brought the ease and readiness of a pantry with its many storage spaces and working counter right into the kitchen. It was sold in catalogues and through a unique sales program geared towards farm wives. The popularity of the Hoosier would herald a gradual shift towards increased cabinetry and workspaces in the American kitchen until they, like the pantry, became all but obsolete. Today the Hoosier cabinet is a much sought-after domestic icon and widely reproduced.

Asian Pantry

Traditionally kitchens in Asia have been more open format than those of the West. The function of the pantry was generally served by wooden cabinetry. In Japan a kitchen cabinet is called a "Mizuya Tansu". A substantial tradition around wood working and cabinetry in general developed in Japan, especially throughout the Tokugawa era. A huge number of designs for Tansu (chests or cabinets) were made, each tailored towards one specific purpose or another.

The idea is very similar to that of the Hoosier Cabinet above, with a wide variety of functions being served by specific design innovations.

Modern Pantry

The pantry is making a comeback in American and English homes as part of a resurgence of nesting and homekeeping since the late 1990s. It is one of the most requested features in American homes today, despite larger kitchen sizes than ever before. There is a charm and nostalgia to the pantry, as well as a practical, utilitarian purpose.

The term may also be used for any small storeroom used for non-perishable foods such as canned goods; it need not be located near the kitchen, and is often found in a basement.

Books on Pantries

Chapters of earlier books, particularly written during the era of domestic science and home economics in the latter half of the 19th century, featured how to furnish, keep and clean a pantry. Catharine E. Beecher and Harriet Beecher Stowe in their seminal *The American Woman's Home*, written in 1869, [3] advocated the elimination of the pantry by having pantry shelving and cabinetry come into the kitchen. This idea did not take hold in American households until a century later, by which time the pantry had become a floor-to-ceiling cabinet in the post-War kitchen. During the Victorian period and until the Second World War when housing changed considerably, pantries were commonplace in virtually all American homes. This was because kitchens were small and strictly utilitarian and not the domestic, often well-appointed, center of the home that we enjoy today (or that our Colonial predecessors had). Thus, pantries were important workspaces with their built-in shelving, cupboards and countertops.

In the last chapter of *These Happy Golden Years*, Laura Ingalls Wilder wrote a descriptive account of the pantry that Almanzo Wilder built for her in their first home together in DeSmet, South Dakota. It details a working farmhouse pantry in great detail which she sees for the first time after her marriage to Wilder and subsequent journey to their new home.

Pantry raids were often common themes in children's literature and early 20th century advertising. Perhaps the most famous pantry incident in literature was when Mark Twain's Tom Sawyer had to do penance for his getting into his Aunt Polly's jam in her pantry: as punishment, he had to white-wash her fence.

Parlour

Parlour (or parlor), from the French word *parloir*, from *parler* ("to speak"), denotes an "audience chamber". In parts of the United Kingdom and the United States, parlours are common names for certain types of food service houses, restaurants (i.e. "ice cream parlour" and "pizza parlour") or special service areas, such as tattoo parlours. Thus, "parlor" appears to be used as a term denoting "a social space"; prefixes such as "pizza", "tattoo", "billiard", or "betting" describe the setting's other most notable aspect — beyond socializing. The dialect-specific usage of this term (i.e. as opposed to "ice cream shop" or "pizzeria") varies by region. "Parlour" is also used in other settings, such as "Beer parlor", wine parlor, or, in at least one case, "Spaghetti parlor." The term Parlour has even been seen to describe a coffee shop as the "coffee parlor."

In dairy farming, the room in which milking takes place is called the milking parlour.

The "inner parlours" in 1 Chronicles 28:11 in the Bible were the small rooms or chambers which Solomon built all round two sides and one end of the Temple (1 Kings 6:5), "side chambers", or they may have been, as some think, the porch and the holy place.

In 1 Samuel 9:22 in the Bible, the Revised Version reads "guest chamber", a chamber at the high place specially used for sacrificial feasts.

In medieval Christian usage, the parlour was one of two rooms in a monastery. The 'outer parlour' was the room where the monks or nuns could receive a visitor and conduct business with outsiders. It was generally located in the west range of the buildings of the cloister, close to the main entrance. The 'inner parlour' was located off the cloister next to the chapter

house in the east range of the monastery. Most orders required a general silence in the cloister, which was the place where the monks engaged in study, and the inner parlour was a convenient place for the monks to engage in conversation freely.

In modern use, the parlour is a formal *sitting room* in a large house or mansion. In the late nineteenth century, it was often a formal room used only on Sundays or special occasions, and closed during the week. The parlour contained a family's best furnishings, works of art and other display items. The body of a recently deceased member of the household would be laid out in the parlour while funeral preparations were made. As a result of a twentieth-century effort by architects and decorators to strip the parlour of its burial and mourning associations, helped by the advent of funeral parlors, in most homes the parlour has been replaced by the living room.

Pew/Porch

A pew is a long bench seat used for seating members of a congregation or choir in a church.

Churches were not commonly furnished with permanent pews before the coming of the Protestant Reformation. The rise of the sermon as a central act of Christian worship, especially in Protestantism, made the pew an indispensable item of church furniture. Most Orthodox churches do not have pews; they have stands instead.

In some churches, pews were installed at the expense of the congregants, and were their personal property; there was no general public seating in the church itself. In these churches, *pew deeds* recorded title to the pews, and were used to convey them. Pews were originally purchased from the church by their owners under this system, and the purchase price of the pews went to the costs of building the church. When the pews were privately owned, their owners sometimes enclosed them in *pew boxes*, and the pews were frequently not of uniform construction. Conversely, some churches were fitted with uniform box pews throughout (some of these may have been owned by families or held as possessions of farms in the parish) so that all would be available to the general congregation. The purchase or rental

of pews was sometimes controversial, as in the case of B. T. Roberts, eventually free churches prevailed.

Pews are generally made of wood and arranged in rows facing the altar in a church. This area where the congregation sits is called the nave. Usually a pathway is left between pews in the center of the sanctuary to allow for a procession; some have benchlike cushioned seating or even footrests, although more traditional, conservative churches usually have neither cushions nor footrests.

Many pews have slots behind each pew; these may hold Bibles and hymnals as well as other church literature. Sometimes the church may also provide stations on certain rows that allow the hearing impaired to use headsets in order to hear the sermon. In many churches pews are permanently attached to the floor.

In churches with a tradition of public kneeling prayer, pews are usually equipped with kneelers in front of the seating bench so members of the congregation can kneel on them instead of the floor. These kneelers essentially have long, usually padded boards which run lengthwise parallel to the seating bench of the pew. These kneeler boards may be 15 cm or so wide and elevated perhaps 10-15 cm above the floor, but dimensions can vary widely. Permanently attached kneelers are often made so they can be rotated or otherwise moved up out of the way when the congregation members are not kneeling. Pews are often used to seat an audience in a courtroom.

Recreation Room/Rumpus room/Television Room

A recreation room (also known as a rec room, rumpus room, or ruckus room) is a room used for a variety of purposes, such as parties, games and other everyday or casual use. The term is common in the United States, but is less common in the United Kingdom where the preferred term is games room. Often children and teenagers will entertain their friends in the rec room, which is often located in the basement, away from the main living areas of the house.

Recreation rooms can vary in themes and styles, but they generally have a basic setup:

Entertainment

Recreation rooms are normally centred around some form of entertainment, typically an audio/video setup. This can consist of something as elaborate as a projection screen with surround sound or something as simple as a base model television.

Seating

Chesterfield, pub tables/chairs, bar stools, and recliners are all used in recreation rooms.

Games

Tabletop games are frequent in recreation rooms. In addition to games played on a normal table are those using custom tables such as table tennis (ping pong), table football (foosball), air hockey, and billiards (pool). Other games can include dart boards and arcade games.

Food & Drink

Popcorn machines, ice cream machines, soda fountains, and classic soda coolers can sometimes be found in recreation rooms.

Shrines to Serve the Religious Functions Associated with a Family

A shrine is a holy or sacred place, which is dedicated to a specific deity, ancestor, hero, martyr, saint, daemon or similar figure of awe and respect, at which they are venerated or worshipped.

Shrines often contain idols, relics, or other such objects associated with the figure being venerated. A shrine at which votive offerings are made is called an altar. Shrines are found in many of the world's religions, including Christianity, Islam, Hinduism, Buddhism, Wicca, Chinese folk religion and Shinto, as well as in secular and non-religious settings such as a war memorial. Shrines can be found in various settings, such as churches, temples, cemeteries, or in the home, although portable shrines are also found in some cultures.

A shrine may become a focus of a cult image.

Types of Shrines

Temple Shrines

Many shrines are located within buildings designed specifically for worship, such as a church in Christianity, or a mandir in Hinduism. A shrine here is usually the centre of attention in the building, and is given a place of prominence. In such cases, adherents of the faith assemble within the building in order to venerate the deity at the shrine.

Household Shrines

Historically, in Hinduism, Buddhism and Roman Catholicism, as well as in modern faiths, such as Neopaganism, a shrine can commonly be found within the home or shop. This shrine is usually a small structure or a setup of pictures and figurines dedicated to a deity that is part of the official religion, to ancestors or to a localised household deity.

Small household shrines are very common among the Chinese and people from South and Southeast Asia, whether Hindu, Buddhist or Christian. Usually a small lamp and small offerings are kept daily by the shrine. Some household shrines are on a shelf; Chinese shrines may stand directly on the floor.

Yard Shrines

Small outdoor yard shrines are found at the places of many peoples, following various religions, including historically, Christianity. Many consist of a statue of Christ or a saint, on a pedestal or in an alcove, while others may be elaborate groupings, including paintings, statuary, and architectural elements, such as walls, roofs, glass doors and ironwork fences, etc.

In the United States, some Christians have small yard shrines; some of these resemble side altars, since they are composed of a statue placed in a niche or grotto; this type is colloquially referred to as a *bathtub madonna*.

Religious Shrines

Shrines are found in most, though not all, religions. As distinguished from a temple, a shrine usually houses a particular

relic or cult image, which is the object of worship or veneration, or is constructed to set apart a site which is thought to be particularly holy, as opposed to being placed for the convenience of worshippers. Shrines therefore attract the practice of pilgrimage.

Christianity

Shrines are found in many, though not all, forms of Christianity. Roman Catholicism, the largest denomination of Christianity, has many shrines, as does Orthodox Christianity.

In the Roman Catholic Code of Canon law, canons 1230 and 1231 read: "The term shrine means a church or other sacred place which, with the approval of the local Ordinary, is by reason of special devotion frequented by the faithful as pilgrims. For a shrine to be described as national, the approval of the Episcopal Conference is necessary. For it to be described as international, the approval of the Holy See is required."

Another use of the term "shrine" in colloquial Catholic terminology is a niche or alcove in most-especially larger-churches used by parishioners when praying privately in the church. They were also called Devotional Altars, since they could look like small Side Altars or bye-altars. Shrines were always centred on some image of Christ or a saint-for instance, a statue, painting, mural or mosaic, and may have had a reredos behind them (without a Tabernacle built in).

However, Mass would not be celebrated at them; they were simply used to aid or give a visual focus for prayers. Side altars, where Mass could actually be celebrated, were used in a similar way to shrines by parishioners. Side altars were specifically dedicated to The Virgin Mary, Saint Joseph as well as other saints.

A nativity set could be viewed as a shrine.

Islam

Islamic communities have developed a rich tradition of shrine culture. Most Islamic shrines are dedicated to various Sufi Saints-spiritually elevated ascetics from various mystical orders within Islam, and are widely scattered throughout the

Islamic world. It is a tradition to commemorate the death of the Saint, his so called "Marriage to God," by holding festivals at his tomb to commemorate his life. In several countries, the local shrine is a focal point of the community, with several localities named specifically for the local saint.

In some parts of the Islamic world, such as in Pakistan, these festivals are multi-day events and even draw members of the Hindu minority who often revere the Muslim saint, such as in the case of the famous Lal Baz Qalandar shrine in Sindh, Pakistan-an important example of religious syncretism that blurs the distinction between members of different religions. Sufi shines in Bangladesh, India, and Pakistan are also host to a night of commemoration by songs and dances every Thursday. In fact, the Urdu word for Thursdays, Jumeraat, is derived from the practice of visiting shrines on Thursdays.

In Turkey, the famous Whirling Dervishes perform their dance at the shrine of Jalal-ud-Din Rumi in Konya, while in Morocco and Algeria, brotherhoods of Black African Sufis, the Gnouia, perform elaborate song and dances at the shrines of their Saints.

Further, Shia's have several shrines dedicated to various religious figures important in their history, and several elaborate shrines are dedicated to Shia Saints and religious figures, most notably in Kerbala, Najaf, and Samarra in Iraq, and Qum and Mashad in Iran. Other important Shia shrines are located in Mazar-e-Sharif ("the Noble Shrine") in Afghanistan, and in Damascus, Syria.

Numerous Shia and Sufi shrines were once located in Saudi Arabia, but were destroyed in the 1930s by Saudi Arabia's puritanical Wahabbi sect. Other important Shrines were once found in Central Asia, but many were destroyed by the Soviets.

According to hardline orthodox interpretations of Islam, such as that of the Wahabbis, it is totally forbidden to build building over graves. In fact, the Wahabbists smashed every shrine they found. The Wahabbist sect of Islam has also inspired a hard-line and anti-Shrine ideology in traditionally tolerant and shrine-revering areas, such as in Egypt and Pakistan, on the grounds that they are forbidden within Islam, and in the

case of Pakistan, are a throwback to pre-Islamic Hindu traditions. The intolerant view towards shrines in those countries is a recent phenomenon in global Islam.

Hinduism

In Hinduism, a shrine is a place where a god or goddess is worshipped. Shrines are typically located inside a temple known as a mandir, though many Hindus also have a household shrine as well.

Sometimes a human is venerated at a Hindu shrine along with a deity, for instance the 19th century religious teacher Sri Ramakrishna is venerated at the Ramakrishna Temple in Kolkata, India.

Central to a Hindu shrine is a statue of a deity, which is known as a murti. Hindus believe that the deity that they are worshiping actually enters and inhabits the murti. This is given offerings like candles, food, flowers, and incense. In some cases, particularly among devotees of the goddess Kâlî in northern India, animals are sacrificed to the deity.

At a mandir, the congregation often assembles in front of a shrine, and, led by priests, give offerings and sing devotional hymns.

Buddhism

In Buddhism, a shrine refers to a place where veneration is focused on the Buddha or one of the bodhisattvas. Monks, nuns and laypeople all give offerings to these revered figures at these shrines and also meditate in front of them.

Typically, Buddhist shrines contain a statue of either the Buddha, or (in the Mahayana and Vajrayana forms of Buddhism), one of the various bodhisattvas. They also commonly contain candles, along with offerings such as flowers, purified water, food, and incense. Many shrines also contain sacred relics, such as the alleged tooth of the Buddha held at a shrine in Sri Lanka.

Site-specific shrines in Buddhism, particularly those that contain relics of deceased buddhas and revered monks, are often designed in the traditional form known as the stupa.

Bahá'í

The two most well-known Bahá'í shrines serve as the resting places for the respective remains of the two central figures of the Bahá'í Faith, the Báb and Bahá'u'lláh. They are the focal points of a Bahá'í pilgrimage:

- The Shrine of the Báb in Haifa, Israel.
- The Shrine of Bahá'u'lláh in Acre, Israel.

Neopaganism

In the many different neopagan faiths, which include Wicca, Hellenic Polytheistic Reconstructionism, Neo-Druidry, and Germanic Neopaganism, shrines serve many different purposes.

In the neopagan religion of Wicca, a shrine is a place where the Horned God and the Triple Goddess are worshipped. However, they are more commonly referred to with the term "altar." In other Pagan religions, shrines may be dedicated to one or many different Gods and Goddesses. As in Wicca, household worship is usually centred around them.

Religions Without Shrines

Certain religions do not feature shrines at all, either because they believe they are fundamentally wrong, or because they simply do not need them. Spiritualism, whilst believing in a God, does not typically make use of shrines.

Secular Shrines

In the United States and some other countries, landmarks may be called "historic shrines." Notable shrines of this type include:

- The Alamo
- Fort McHenry
- Touro Synagogue in Newport, Rhode Island
- Shrine of Remembrance, a war memorial in Melbourne, Victoria, Australia
- Shrine of Remembrance, a war memorial in Brisbane, Australia

By extension the term *shrine* has come to mean any place (or virtual cyber-place) dedicated completely to a particular person or subject.

Stairwell

Stairway, staircase, stairwell, flight of stairs or simply stairs are names for a construction designed to bridge a large vertical distance by dividing it into smaller vertical distances, called steps. Stairways may be straight, round, or may consist of two or more straight pieces connected at angles.

Special stairways include escalators and ladders. Alternatives to stairways are elevators, stairlifts and inclined moving sidewalks as well as stationary inclined sidewalks.

Components and Terminology

Step

The step is composed of the tread and riser.

Tread

The part of the stairway that is stepped on. It is constructed to the same specifications (thickness) as any other flooring. The tread "depth" is measured from the outer edge of the step to the vertical "riser" between steps. The "width" is measured from one side to the other.

Riser

The vertical portion between each tread on the stair. This may be missing for an "open" stair effect.

Nosing

An edge part of the tread that protrudes over the riser beneath. If it is present, this means that horizontally, the total "run" length of the stairs is not simply the sum of the tread lengths, the treads actually overlap each other slightly.

Starting step or Bullnose

Where stairs are open on one or both sides, the first step above the lower floor may be wider than the other steps and rounded. The balusters typically form a semicircle around the

circumference of the rounded portion and the handrail has a horizontal spiral called a “volute” that supports the top of the balusters.

Besides the cosmetic appeal, starting steps allow the balusters to form a wider, more stable base for the end of the handrail. Handrails that simply end at a post at the foot of the stairs can be less sturdy, even with a thick post. A double bullnose can be used when both sides of the stairs are open.

Stringer, Stringer Board or Sometimes just String

The structural member that supports the treads and risers. There are typically two stringers, one on either side of the stairs; though the treads may be supported many other ways. The stringers are sometimes notched so that the risers and treads fit into them. Stringers on open-sided stairs are often open themselves so that the treads are visible from the side. Such stringers are called “cut” stringers. Stringers on a closed side of the stairs are closed, with the support for the treads routed into the stringer.

Winders

Winders are steps that are narrower on one side than the other. They are used to change the direction of the stairs without landings. A series of winders form a circular or spiral stairway. When three steps are used to turn a 90° corner, the middle step is called a kite winder as a kite-shaped quadrilateral.

Trim

Trim (e.g. quarter-round or baseboard trim) is normally applied where walls meet floors and often underneath treads to hide the reveal where the tread and riser meet. Shoe moulding may be used between where the lower floor and the first riser meet. Trimming a starting step is a special challenge as the last riser above the lower floor is rounded.

Flexible, plastic trim is available for this purpose, however wooden mouldings are still used and are either cut from a single piece of rounded wood, or bent with laminations Scotia is concave moulding that is underneath the nosing between the riser and the tread above it.

The Railing System

The balustrade is the system of railings and balusters that prevents people from falling over the edge.

Banister, Railing or Handrail

The angled member for handholding, as distinguished from the vertical balusters which hold it up for stairs that are open on one side; there is often a railing on both sides, sometimes only on one side or not at all, on wide staircases there is sometimes also one in the middle, or even more.

The term “banister” is sometimes used to mean just the handrail, or sometimes the handrail and the balusters or sometimes just the balusters.

Volute

A handrail end element for the bullnose step that curves inward like a spiral. A volute is said to be right or left-handed depending on which side of the stairs the handrail is as one faces up the stairs.

Turnout

Instead of a complete spiral volute, a turnout is a quarter-turn rounded end to the handrail.

Gooseneck

The vertical handrail that joins a sloped handrail to a higher handrail on the balcony or landing is a gooseneck.

Rosette

Where the handrail ends in the wall and a half-newel is not used, it may be trimmed by a rosette.

Easings

Wall handrails are mounted directly onto the wall with *wall brackets*. At the bottom of the stairs such railings flare to a horizontal railing and this horizontal portion is called a “starting easing”. At the top of the stairs, the horizontal portion of the railing is called a “over easing”.

Core Rail

Wood handrails often have a metal core to provide extra strength and stiffness, especially when the rail has to curve against the grain of the wood. The archaic term for the metal core is “core rail”.

Baluster

A term for the vertical posts that hold up the handrail. Sometimes simply called *guards* or *spindles*. Treads often require two balusters. The second baluster is closer to the riser and is taller than the first. The extra height in the second baluster is typically in the middle between decorative elements on the baluster. That way the bottom decorative elements are aligned with the tread and the top elements are aligned with the railing angle.

Newel

A large baluster or post used to anchor the handrail. Since it is a structural element, it extends below the floor and subfloor to the bottom of the floor joists and is bolted right to the floor joist. A *half-newel* may be used where a railing ends in the wall. Visually, it looks like half the newel is embedded in the wall. For open landings, a newel may extend below the landing for a decorative *newel drop*.

Baserail or Shoerail

For systems where the baluster does not start at the treads, they go to a baserail. This allows for identical balusters, avoiding the second baluster problem.

Fillet

A decorative filler piece on the floor between balusters on a balcony railing.

Handrails may be *continuous* (sometimes called *over-the-post*) or *post-to-post* (or more accurately “newel-to-newel”). For continuous handrails on long balconies, there may be multiple newels and *tandem caps* to cover the newels. At corners, there are *quarter-turn caps*. For post-to-post systems, the newels project above the handrails.

Another, more classical, form of handrailing which is still in use is the tangent method. A variant of the Cylindric method of layout, it allows for continuous climbing and twisting rails and easings. It was defined from principles set down by architect Peter Nicholson in the 18th century.

Other Terminology

Balcony

For stairs with an open concept upper floor or landing, the upper floor is functionally a balcony. For a straight flight of stairs, the balcony may be long enough to require multiple newels to support the length of railing. In modern homes, it is common to have hardwood floors on the first floor and carpet on the second. The homeowner should consider using hardwood nosing in place of carpet. Should the carpet be subsequently replaced with hardwood, the balcony balustrade may have to be removed to add the nosing.

Flight

A flight is an uninterrupted series of steps.

Floating Stairs

A flight of stairs is said to be “floating” if there is nothing underneath. The risers are typically missing as well to emphasize the open effect. There may be only one stringer or the stringers otherwise minimized. Where building codes allow, there may not even be handrails.

Landing or Platform

A landing is the area of a floor near the top or bottom step of a stair. An intermediate landing is a small platform that is built as part of the stair between main floor levels and is typically used to allow stairs to change directions, or to allow the user a rest. As intermediate landings consume floor space they can be expensive to build. However, changing the direction of the stairs allows stairs to fit where they would not otherwise, or provides privacy to the upper level as visitors downstairs cannot simply look up the stairs to the upper level due to the change in direction.

Runner

Carpeting that runs down the middle of the stairs. Runners may be directly stapled or nailed to the stairs, or may be secured by specialized bar that holds the carpet in place where the tread meets the riser.

Spandrel

If there is not another flight of stairs immediately underneath, the triangular space underneath the stairs is called a “spandrel”. It is frequently used as a closet.

Staircase

This term is often reserved for the stairs themselves: the steps, railings and landings; though often it is used interchangeably with “stairs” and “stairway”. In the UK, however, the term “staircase” denotes what in the U.S. is called “stairway”, but usually includes the casing-the walls, bannisters and underside of the stairs or roof above.

Stairway

This term is often reserved for the entire stairwell and staircase in combination; though often it is used interchangeably with “stairs” and “staircase”.

Measurements

- The rise height or rise of each step is measured from the top of one tread to the next. It is not the physical height of the riser; the latter excludes the thickness of the tread. A person using the stairs would move this distance vertically for each step they take.
- The tread depth is measured from the edge of the nosing to the vertical riser.
- The going is measured from the edge of the nosing to the edge of nosing in plan view. A person using the stairs would move this distance forward with each step they take.
- The total run or total going of the stairs is the horizontal distance from the first riser to the last riser. It is often

not simply the sum of the individual tread lengths due to the nosing overlapping between treads.

- The total rise of the stairs is the height between floors (or landings) that the flight of stairs is spanning.
- The slope or pitch of the stairs is the total rise divided by the total run (not the individual riser and treads due to the nosing). It is sometimes called the rake of the stairs. The pitch line is the imaginary line along the tip of the nosing of the treads. In the UK, stair pitch is measured in degrees from the horizontal.
- Headroom is the height above the nosing of a tread to the ceiling above it.
- Walkline-for curved stairs, the inner radius of the curve may result in very narrow treads. The "walkline" is the imaginary line some distance away from the inner edge on which people are expected to walk. Building code will specify the distance. Building codes will then specify the minimum tread size at the walkline.
- To avoid confusion, the number of steps in a set of stairs is always the number of risers, not the number of treads.

The easiest way to calculate the rise and run is to use a stair stringer calculator.

Ergonomics and Building Code Requirements

Ergonomically and for safety reasons, stairs have to have certain measurements in order for people to comfortably use them. Building codes will typically specify certain measurements so that the stairs are not too steep or narrow. Building codes will specify:

- Minimum tread length, typically 9 inches (230 mm) excluding the nosing for private residences. However, most human feet are longer than this, thus people's feet don't actually fit on the tread of the step.
- Maximum riser height, typically 8.25 inches (210 mm). Note that by specifying the maximum riser height and minimum tread length, a maximum slope is established.

Residential building codes will typically allow for steeper stairs than public building codes.

- Minimum riser height: Some building codes also specify a minimum riser height, often 5 inches (130 mm).
- Riser-Tread formula: Sometimes the stair parameters will be something like riser + tread equals 17–18 inches (430–460 mm) or another formula is 2 times riser + tread equals 24 inches (610 mm). Thus a 7 inches (180 mm) rise and a 10 inches (250 mm) tread exactly meets this code. If only a 2 inches (51 mm) rise is used then a 20 inches (510 mm) tread is required. This is based on the principle that a low rise is more like walking up a gentle incline and so the natural swing of the leg will be longer. This makes low rise stairs very expensive in terms of the space consumed. Such low rise stairs were built into the Winchester Mystery House to accommodate the infirmities of the owner, Sarah Winchester, before the invention of the elevator. These stairways, called "Easy Risers" consist of five flights wrapped into a multi turn arrangement with a total width equal to more than four times the individual flight width and a depth roughly equal to one flight's run plus this width. The flights have varying numbers of steps.
- Variance on riser height and tread depth between steps on the same flight should be very low. Building codes require variances no larger than 0.1875 inches (4.76 mm) between depth of adjacent treads or the height of adjacent risers; within a flight, the tolerance between the largest and smallest riser or between the largest and smallest tread can not exceed 0.375 inches (9.5 mm). The reason is that on a continuous flight of stairs, people get used to a regular step and may trip if there is a step that is different, especially at night. The general rule is that all steps on the same flight must be identical. Hence, stairs are typically custom made to fit the particular floor to floor height and horizontal space available. Special care must be taken on the first and last risers. Stairs must be supported directly by

the subfloor. If thick flooring (e.g. thick hardwood planks) are added on top of the subfloor, it will cover part of the first riser, reducing the effective height of the first step. Likewise at the top step, if the top riser simply reaches the subfloor and thick flooring is added, the last rise at the top may be higher than the last riser. The first and last riser heights of the rough stairs are modified to adjust for the addition of the finished floor.

- Maximum nosing protrusion, typically 1.25 inches (32 mm) to prevent people from tripping on the nosing.
- Height of the handrail. This is typically between 34 and 38 inches (860 and 970 mm), measured to the nose of the tread. The minimum height of the handrail for landings may be different and is typically 36 inches (910 mm).
- Handrail diameter. The size has to be comfortable for grasping and is typically between 1.25 and 2.675 inches (32 and 67.9 mm).
- Maximum space between the balusters of the handrail. This is typically 4 inches (100 mm).
- Openings (if they exist) between the bottom rail and treads are typically no bigger than 6 inches (150 mm).
- Minimum headroom.
- Maximum vertical height between floors or landings. This allows people to rest and limits the height of a fall.
- Mandate handrails if there is more than a certain number of steps (typically 2 risers).
- Minimum width of the stairway, with and without handrails.
- Not allow doors to swing over steps; the arc of doors must be completely on the landing/floor.
- A Stairwell may be designated as an Area of refuge as well as a fire escape route, due to its fire-resistance rated design and fresh air supply.

Jacques-François Blondel in his 1771 Cours d'architecture was the first known person to establish the ergonomic relationship of tread and riser dimensions. He specified that 2 x riser + tread = step length.

It is estimated that a noticeable mis-step occurs once in 7,398 uses and a minor accident on a flight of stairs occurs once in 63,000 uses. Some people choose to live in residences without stairs so that they are protected from injury.

Stairs are not suitable for wheelchairs and other vehicles. A stairlift is a mechanical device for lifting wheelchairs up and down stairs. For sufficiently wide stairs, a rail is mounted to the treads of the stairs. A chair is attached to the rail and the person on the chair is lifted as the chair moves along the rail.

Forms

Stairs can take a large number of forms, combining winders and landings.

The simplest form is the straight flight of stairs, without any winders nor landings. It is not often used in modern homes because:

- the upstairs is directly visible from the bottom of a straight flight of stairs.
- it is potentially more dangerous in that a fall is not interrupted until the bottom of the stairs.
- a straight flight requires enough space for the entire run of the stairs.

However, a straight flight of stairs is easier to design and construct than one with landings. Additionally, the rhythm of stepping is not interrupted in a straight run, which may offset the increased fall risk by helping to prevent a misstep in the first place. Most modern stairs incorporate at least one landing. "L" shaped stairways have one landing and usually change in direction by 90 degrees. "U" shaped stairs may employ a single wider landing for a change in direction of 180 degrees, or 2 landings for two changes in direction of 90 degrees each. Use of landings and a possible change of direction have the following effects:

- The upstairs is not directly visible from the bottom of the stairs, which can provide more privacy for the upper floor.
- A fall can be arrested at the landing.
- Though the landings consume total floor space, there is no requirement for a large single dimension, allowing more flexible floorplan designs.
- For larger stairs, particularly in exterior applications, a landing can provide a place to rest the legs.

Spiral and Helical Stairs

Spiral stairs wind around a central pole. They typically have a handrail on the outer side only, and on the inner side just the central pole. A squared spiral stair assumes a square stairwell and expands the steps and railing to a square, resulting in unequal steps (larger where they extend into a corner of the square). A pure spiral assumes a circular stairwell and the steps and handrail are equal and positioned screw-symmetrically. A tight spiral stair with a central pole is very space efficient in the use of floor area.

The term “spiral” is used incorrectly for a staircase from a mathematical viewpoint, as a mathematical spiral lies in a single plane and moves towards or away from a central point. A spiral staircase by the mathematical definition therefore would be of little use as it would afford no change in elevation. The correct mathematical term for motion where the locus remains at a fixed distance from a fixed line whilst moving in a circular motion about it is “helix”. The presence or otherwise of a central pole does not affect the terminology applied to the design of the structure.

Spiral stairs in medieval times were generally made of stone and typically wound in a clockwise direction (from the ascendor’s point of view), in order to place at a disadvantage attacking swordsmen who were most often right-handed). This asymmetry forces the right-handed swordsman to engage the central pike and degrade his mobility compared with the defender who is facing down the stairs. Extant 14th to 17th century examples of these stairways can be seen at Muchalls

Castle, Crathes Castle and Myres Castle in Scotland. Exceptions to the rule exist, however, as may be seen in the above image of the Scala of the Palazzo Contarini del Bovolo, which winds up anti-clockwise.

Developments in manufacturing and design have led to the introduction of kit form spiral stair. Steps and handrails can be bolted together to form a complete unit. These stairs can be made out of steel, timber, concrete or a combination of materials.

Helical or circular stairs do not have a central pole and there is a handrail on both sides. These have the advantage of a more uniform tread width when compared to the spiral staircase. Such stairs may also be built around an elliptical or oval planform. A double helix is possible, with two independent helical stairs in the same vertical space, allowing one person to ascend and another to descend, without ever meeting if they choose different helixes (examples: Château de Chambord, Château de Blois, Crédit Lyonnais headquarters in Paris). Fire escapes, though built with landings and straight runs of stairs, are often functionally double helixes, with two separate stairs intertwinned and occupying the same floor space. This is often in support of legal requirements to have two separate fire escapes.

Both spiral and helical stairs can be characterized by the number of turns that are made. A “quarter-turn” stair deposits the person facing 90 degrees from the starting orientation. Likewise there are half-turn, three-quarters-turn and full-turn stairs. A continuous spiral may make many turns depending on the height. Very tall multi turn spiral staircases are usually found in old stone towers within fortifications, churches and in lighthouses. Winders may be used in combination with straight stairs to turn the direction of the stairs. This allows for a large number of permutations.

History

The earliest spiral staircases appear in Temple A in the Greek colony Selinunte, Sicily, to both sides of the cella. The temple was constructed around 480–470 BC.

Alternating Tread Stairs

Where there is insufficient space for the full run length of normal stairs, alternating tread stairs may be used. Alternating tread stairs allow for safe forward-facing descent of very steep stairs. The treads are designed such that they alternate between treads for each foot: one step is wide on the left side; the next step is wide on the right side. There is insufficient space on the narrow portion of the step for the other foot to stand, hence the person must always use the correct foot on the correct step. The slope of alternating tread stairs can be as high as 65 degrees as opposed to standard stairs which are almost always less than 45 degrees. The advantage of alternating tread stairs is that people can descend face forward. The only other alternative in such short spaces would be a ladder which requires backward-facing descent. Alternating tread stairs may not be safe for small children, the elderly or the physically challenged. Building codes typically classify them as ladders and will only allow them where ladders are allowed, usually basement or attic utility or storage areas not frequently accessed.

The image on the right illustrates the space efficiency gained by an alternating tread stair. The alternating tread stair appearing on the image's center, with green-coloured treads. The alternating stair requires one unit of space per step: the same as the half-width step on its left, and half as much as the full-width stair on its right. Thus, the horizontal distance between steps is in this case reduced by a factor of two reducing the size of each step.

The horizontal distance between steps is reduced by a factor less than two if for constructional reasons there are narrow "unused" steps.

There is often glide plane symmetry: the mirror image with respect to the vertical center plane corresponds to a shift by one step. Alternating tread stairs have been in use since at least 1888.

Notable Stairways

- The longest stairway is listed by Guinness Book of Records as the service stairway for the Niesenbahn

funicular railway near Spiez, Switzerland, with 11,674 steps and a height of 1669 m (5476 ft). The stairs are employee-only.

- A flight of 7,200 steps (including inner temple Steps), with 6,293 Official Mountain Walkway Steps, leads up the East Peak of Mount Tai in China.
- The Ha»ikû Stairs, on the island of O»ahu, Hawai»i, are approximately 4,000 steps which climb nearly 1/2 of a mile. Originally used to access longwire radio radio antennas which were strung high above the Ha»ikû Valley, between Honolulu and Kâne»ohe, they are closed to hikers.
- The Flørli stairs, in Lysefjorden, Norway, have 4,444 wooden steps which climb from sea level to 740 meters. It is a maintenance stairway for the water pipeline to the old Flørli hydro plant. The hydro plant is now closed down, and the stairs are open to the public. The stairway is claimed to be the longest wooden stairway in the world.
- The CN Tower's staircase reaches the main deck level after 1,776 steps and the Sky Pod above after 2,579 steps; it is the tallest metal staircase on Earth.
- The Penrose stairs, devised by Lionel and Roger Penrose, are a famous impossible object. The image distorts perspective in such a manner that the stairs appear to be never-ending, a physical impossibility. The image was adopted by M. C. Escher in his iconic lithograph *Ascending and Descending*.

Sunroom

A sunroom is a structure which is constructed onto the side of a house, usually, to allow enjoyment of the surrounding landscape while being sheltered from adverse weather conditions such as rain and wind. The concept is popular in the United States, Europe, Canada, Northern Ireland, Australia and New Zealand.

In Great Britain, it is normally described as a conservatory, although the room may not contain plants. However a British

sunroom has a solid opaque roof whereas a conservatory has a transparent or semi-transparent roof.

Design

The structure is often referred to as a patio room, solarium, conservatory, patio enclosure or Florida Room. It can be constructed of brick, breeze block, wood, glass or PVC. The brick or wood base makes up the main support for the PVC, referred to as the “knee wall”, which is attached to the top of it. The glass panels are large and often clear instead of frosted. The roof may be of glass panels but is more usually of a plastic material which lets in sunlight. Some sunrooms are designed for scenic view, while others are designed to collect sunlight for warmth and light. These, usually called solariums, are found in Northern (low sun angle) or cold (high altitude) locations. Solariums have walls made up of glass (or plastic), often curved joining windows, and glass roofs. Sunrooms tend to have conventional roofs.

Newer rooms are typically constructed of aluminum framing with tempered glass as the primary structure. The room system is normally constructed of aluminum insulated panels or glass for the “high end” options. Skylights may be included in the insulated panels. The outside of the roof is normally constructed with a shingled roofing material.

Whereas the majority of florida rooms or sunrooms of the past appeared to be disassociated with the home, newer public taste places a great deal of emphasis in blending the sunroom into the architecture of the home.

With the latest technologies of glass and heat resistant technology, sunrooms are now able to be used as efficiently in the southern states such as Florida, Texas and Arizona as is possible in the colder, northern states.

History

Farmhouses and urban row homes featured a covered porch as a place for the user to sit and relax. With the suburbanization of America, families increasingly used their back patios and gardens for this purpose. However, weather conditions often made patios unusable at times, providing an incentive for

families to cover and screen in their patios for privacy and for shelter.

As this trend evolved, so did improvements in glass manufacture, making it possible to attach storm windows together to enclose a patio space.

During the 1960s, professional re-modelling companies developed affordable systems to enclose a patio or deck, offering design, installation, and full service warranties. Patio rooms featured lightweight, engineered roof panels, single pane glass, and aluminium construction. These versatile patio rooms extended the outdoor season, provided protection from rain, wind and insects, and gave homeowners extra space. The interior of a sun room warms quickly in sunlight, even on cold days, and may provide a means of heating the part of the main house into which the sun room or conservatory opens. Furniture and plants located in a sun room/conservatory should be resistant to temperature change.

As customers became more energy conscious and building technology aware, patio and sunrooms became available with insulated glass, vinyl and vinyl-wood composite framework, and more elaborate designs. Many American companies also began to offer greenhouses and conservatories, which were popular in Europe.

Niche Markets

European companies discovered a niche market where customers wanted extra privacy. This meant that blinds and curtains were specially developed to be fitted into the sunroom without damaging the stability of the structure. This has proved a profitable industry where blinds can now be controlled from electronic hand-held devices.

Another market is for specialised flooring in sunrooms. In earlier sunrooms, floors were often tiled because of the possibility of roof leaks, and cold air entering resulted in the room becoming chilly. Floors with heated pipe and insulation are now available. Types of flooring are available in a wide variety of materials and forms and customers are no longer restricted to tiles. Older sunrooms which are not structurally sound may be prone to

leaks and draughts, so traditional tiled floors are still in demand. Newer pre-engineered sunroom designs must meet strict criteria to obtain building permits and product approvals through various agencies. Certain features such as thermal breaks and glass that is designed to meet the high demands of a sunroom will greatly aid in the utilization of the sunroom in a manner that will prevent leakage and allow for full year 'round usage.

Price Range and Specification

Prices vary widely according to 1.) location, 2.) builder, 3.) size and 4.) specification. "Contemporary" sunrooms are often the most affordable option, while more elaborate designs cost more.

1. Location: The most affordable option, in terms of location is to place the building on a level, easily accessible site. A site requiring extensive ground preparation or with a difficult access route will increase the cost to the consumer. Generally speaking, a local manufacturer of a sun room will incur least expense when delivering the flat pack panels. Whereas a distant company will have to consider haulage costs and pass them on to the consumer.
2. Builder: A garden room, garden studio or sun room specialist company.
3. Size: Any size is possible, but an attached sun room will have a maximum allowable size before planning approval is required. As planning regulations vary from region to region, always check with your local office.
4. Specification: Sustainable and carbon responsible building focuses on energy efficiency and thermal efficiency. Structural insulated panels (SIPS) offer a high level of thermal efficiency when compared to conventional timber-framed structures. There are two main categories of SIPS: EPS-the lesser expanded polystyrene foam panel and XPS-the better extruded polyurethane foam panel. XPS rates as almost twice as thermally efficient as the EPS therefore will require less energy in heating and cooling the building. To be

more precise, a 100 mm thick EPS panel is far less efficient than a 100 mm thick XPS panel.

Solarium

A solarium is similar to a sunroom in that both are glass structures designed for people to enjoy the sun without being directly touched by the rays of the sun. The chief difference is that solariums often have curved glass corners and glass roofs.

Workshop

A workshop is a room or building which provides both the area and tools (or machinery) that may be required for the manufacture or repair of manufactured goods. Apart from the larger factories, workshops were the only places of production in the days before industrialisation.

Backshop

Some repair industries, such as the locomotive and aircraft repair operations have specialized workshops called backshops.

Some houses have a pool in the background, or a trampoline, or a playground.

Construction

In the United States, modern house-construction techniques include light-frame construction (in areas with access to supplies of wood) and adobe or sometimes rammed-earth construction (in arid regions with scarce wood-resources). Some areas use brick almost exclusively, and quarried stone has long provided walling. To some extent, aluminum and steel have displaced some traditional building materials. Increasingly popular alternative construction materials include insulating concrete forms (foam forms filled with concrete), structural insulated panels (foam panels faced with oriented strand board or fiber cement), and light-gauge steel framing and heavy-gauge steel framing.

More generally, people often build houses out of the nearest available material, and often tradition and/or culture govern construction-materials, so whole towns, areas, counties or even states/countries may be built out of one main type of material.

For example, a large fraction of American houses use wood, while most British and many European houses utilize stone or brick. In the 1900s, some house designers started using prefabrication. Sears, Roebuck & Co. first marketed their Sears Catalogue Homes to the general public in 1908. Prefab techniques became popular after World War II. First small inside rooms framing, then later, whole walls were prefabricated and carried to the construction site. The original impetus was to use the labour force inside a shelter during inclement weather. More recently builders have begun to collaborate with structural engineers who use computers and finite element analysis to design prefabricated steel-framed homes with known resistance to high wind-loads and seismic forces. These newer products provide labour savings, more consistent quality, and possibly accelerated construction processes.

Lesser-used construction methods have gained (or regained) popularity in recent years. Though not in wide use, these methods frequently appeal to homeowners who may become actively involved in the construction process. They include:

- Cannabrick construction
- Cordwood construction
- Geodesic domes
- Straw bale construction
- Wattle and daub

Energy-efficiency

In the developed world, energy-conservation has grown in importance in house-design. Housing produces a major proportion of carbon emissions (30% of the total in the UK, for example).

Development of a number of low-energy building types and techniques continues. They include the zero-energy house, the passive solar house, the autonomous buildings, the superinsulated and houses built to the *Passivhaus* standard.

Earthquake Protection

One tool of earthquake engineering is base isolation which is increasingly used for earthquake protection. Base isolation

is a collection of structural elements of a building that should substantially decouple it from the shaking ground thus protecting the building's integrity and enhancing its seismic performance. This technology, which is a kind of seismic vibration control, can be applied both to a newly designed building and to seismic upgrading of existing structures.

Normally, excavations are made around the building and the building is separated from the foundations. Steel or reinforced concrete beams replace the connections to the foundations, while under these, the isolating pads, or *base isolators*, replace the material removed. While the *base isolation* tends to restrict transmission of the ground motion to the building, it also keeps the building positioned properly over the foundation. Careful attention to detail is required where the building interfaces with the ground, especially at entrances, stairways and ramps, to ensure sufficient relative motion of those structural elements.

Legal Issues

Buildings with historical importance have restrictions.

United Kingdom

New houses in the UK are not covered by the Sale of Goods Act. When purchasing a new house the buyer has less legal protection than when buying a new car. New houses in the UK may be covered by a NHBC guarantee but some people feel that it would be more useful to put new houses on the same legal footing as other products.

United States and Canada

In the US and Canada, many new houses are built in housing tracts, which provide homeowners a sense of "belonging" and the feeling they have "made the best use" of their money. However, these houses are sometimes built as cheaply and quickly as possible by large builders seeking to maximize profits. Many environmental health issues may be ignored or minimized in the construction of these structures. In one case in Benicia, California, a housing tract was built over an old landfill. Home buyers were never told, and only found out when some began having reactions to high levels of lead and chromium.

Identifying Houses

With the growth of dense settlement, humans designed ways of identifying houses and/or parcels of land. Individual houses sometimes acquire proper names; and those names may acquire in their turn considerable emotional connotations: see for example the house of *Howards End* or the castle of *Brideshead Revisited*. A more systematic and general approach to identifying houses may use various methods of house numbering.

Animal Houses

Humans often build "houses" for domestic or wild animals, often resembling smaller versions of human domiciles. Familiar animal houses built by humans include bird-houses, hen-houses/ chicken-coops and doghouses (kennels); while housed agricultural animals more often live in barns and stables. However, human interest in building houses for animals does not stop at the domestic pet. People build bat-houses, nesting-sites for wild ducks and other birds, bee houses, giraffe houses, kangaroo houses, worm houses, hermit crab houses, as well as shelters for many other animals.

Shelter

Forms of (relatively) simple shelter may include:

- Bus stop
- Camper
- Chalet
- Cottage
- Dugout
- Gazebo
- Hangar
- Houseboat
- Hut
- Lean-to
- Log Cabin
- Shack

- Tent
- Caravan
- Umbrella
- Yaodong

Houses and Symbolism

Houses may express the circumstances or opinions of their builders or their inhabitants. Thus a vast and elaborate house may serve as a sign of conspicuous wealth, whereas a low-profile house built of recycled materials may indicate support of energy conservation.

Houses of particular historical significance (former residences of the famous, for example, or even just very old houses) may gain a protected status in town planning as examples of built heritage and/or of streetscape values. Commemorative plaques may mark such structures.

Home ownership provides a common measure of prosperity in economics. Contrast the importance of house-destruction, tent dwelling and house rebuilding in the wake of many natural disasters.

Peter Olshavsky's House for the Dance of Death provides a 'pataphysical variation on the house.

Heraldry

Heraldry is the profession, study, or art of devising, granting, and blazoning arms and ruling on questions of rank or protocol, as exercised by an officer of arms. *Heraldry* comes from Anglo-Norman *herald*, from the Germanic compound *harja-waldaz*, "army commander". The word, in its most general sense, encompasses all matters relating to the duties and responsibilities of officers of arms. To most, though, heraldry is the practice of designing, displaying, describing, and recording coats of arms and heraldic badges.

Historically, it has been variously described as "the shorthand of history" and "the floral border in the garden of history." The origins of heraldry lie in the need to distinguish participants in combat when their faces were hidden by iron

and steel helmets. Eventually a formal system of rules developed into ever more complex forms of heraldry.

The system of blazoning arms that is used in English-speaking countries today was developed by the officers of arms in the Middle Ages. This includes a stylized description of the escutcheon (shield), the crest, and, if present, supporters, mottoes, and other insignia. Certain rules apply, such as the Rule of tincture. A thorough understanding of these rules is a key to the art of heraldry. The rules and terminology differ from country to country; indeed several national styles had developed by the end of the Middle Ages, but there are some aspects that carry over internationally.

Though heraldry is nearly 900 years old, it is still very much in use. Many cities and towns in Europe and around the world still make use of arms. Personal heraldry, both legally protected and lawfully assumed, has continued to be used around the world. Heraldic societies exist to promote education and understanding about the subject.

Origins and History

As early as predynastic Egypt, an emblem known as a *serekh* was used to indicate the extent of influence of a particular regime, sometimes carved on ivory labels attached to trade goods, but also used to identify military allegiances and in a variety of other ways. It led to the development of the earliest hieroglyphs. This practice seems to have grown out of the use of animal mascots, whose pelts or bodies were literally affixed to staves or standards, as depicted on the earliest cosmetic palettes of the period. Some of the oldest *serekhs* consist of a striped or cross-hatched box, representing a palace or city, with a crane, scorpion, or other animal drawn standing on top. Before long, a falcon representing Horus became the norm as the animal on top, with the individual Pharaoh's symbol usually appearing in the box beneath the falcon, and above the stripes representing the palace.

Ancient warriors often decorated their shields with patterns and mythological motifs. These symbols could be used to identify the warriors when their faces were obscured by helmets. Army units of the Roman Empire were identified by the distinctive

markings on their shields. These were not heraldic in the medieval and modern sense, as they were associated with units, not individuals or families.

At the time of the Norman conquest of England, heraldry in its essential sense of an *inheritable* emblem had not yet been developed. The knights in the Bayeux Tapestry carry shields, but there appears to have been no system of hereditary coats of arms. The seeds of heraldic structure in personal identification can be detected in the account in a contemporary chronicle of Henry I of England, on the occasion of his knighting his son-in-law Geoffrey V, Count of Anjou, in 1127. He placed to hang around his neck a shield painted with golden lions. The funerary enamel of Geoffrey (died 1151), dressed in blue and gold and bearing his blue shield emblazoned with gold lions, is the first recorded depiction of a coat of arms.

By the middle of the 12th century, coats of arms were being inherited by the children of armigers (persons entitled to use a coat of arms) across Europe. Between 1135 and 1155, seals representing the generalized figure of the owner attest to the general adoption of heraldic devices in England, France, Germany, Spain, and Italy. By the end of the century, heraldry appears as the sole device on seals. In England, the practice of using marks of cadency arose to distinguish one son from another; it was institutionalized and standardized by John Writhe in the early 15th century.

In the late Middle Ages and the Renaissance, heraldry became a highly developed discipline, regulated by professional officers of arms. As its use in jousting became obsolete, coats of arms remained popular for visually identifying a person in other ways — impressed in sealing wax on documents, carved on family tombs, and flown as a banner on country homes. The first work of heraldic jurisprudence, *De Insigniis et Armis*, was written in the 1350s by Bartolus de Saxoferrato, a professor of law at the University of Padua.

From the beginning of heraldry, coats of arms have been executed in a wide variety of media, including on paper, painted wood, embroidery, enamel, stonework and stained glass. For the purpose of quick identification in all of these, heraldry

distinguishes only seven basic colors and makes no fine distinctions in the precise size or placement of charges on the field. Coats of arms and their accessories are described in a concise jargon called *blazon*. This technical description of a coat of arms is the standard that is adhered to no matter what artistic interpretations may be made in a particular depiction of the arms.

The specific meaning of each element of a coat of arms is subjective. Though the original armiger may have placed particular meaning on a charge, these meanings are not necessarily retained from generation to generation. Unless canting arms incorporate an obvious pun on the bearer's name, it may difficult to find meaning in them.

As changes in military technology and tactics made plate armour obsolete, heraldry became detached from its original function. This brought about the development of "paper heraldry" under the Tudors. Designs and shields became more elaborate at the expense of clarity. During the 19th century, especially in Germany, many coats of arms were designed to depict a natural landscape, including several charges tinctured "proper" (*i.e.* the way they appear in nature). This form has been termed "Landscape heraldry". The 20th century's taste for stark iconic emblems made the simple styles of early heraldry fashionable again.

The Rules of Heraldry

Shield and Lozenge

The focus of modern heraldry is the armorial achievement, or the coat of arms, the central element of which is the escutcheon or shield. In general, the shape of the shield employed in a coat of arms is irrelevant, because the fashion for the shield-shapes employed in heraldic art has changed through the centuries. Sometimes a blazon specifies a particular shape of shield. These specifications mostly occur in non-European contexts—such as the coat of arms of Nunavut and the former Republic of Bophuthatswana, with the arms of North Dakota (as distinguished from its seal) providing an even more unusual example, while the State of Connecticut specifies a "rococo"

shield —but not completely, as the Scottish Public Register records an escutcheon of oval form for the Lanarkshire Master Plumbers' and Domestic Engineers' (Employers') Association, and a shield of square form for the Anglo Leasing organisation.

Traditionally, as women did not go to war, they did not bear a shield. Instead, women's coats of arms were shown on a lozenge—a rhombus standing on one of its acute corners or a cartouche. This continues true in much of the world, though some heraldic authorities, such as Scotland's, with its ovals for women's arms, make exceptions. In Canada, the restriction against women's bearing arms on a shield was eliminated. In Scotland and Ireland, women may, under certain circumstances, be permitted to display their arms on a shield. Non-combatant clergy also have used the lozenge and the cartouche – an oval – for their display.

Tinctures

Tinctures are the colors, metals, and furs used in heraldry, though the depiction of charges in their natural colors or "proper" are also regarded as tinctures, the latter distinct from any color that such a depiction might approximate. Heraldry is essentially a system of identification, so the most important convention of heraldry is the rule of tincture. To provide for contrast and visibility, metals (generally lighter tinctures) must never be placed on metals, and colors (generally darker tinctures) must never be placed on colors. Where a charge overlies a partition of the field, the rule does not apply. There are other exceptions-the most famous being the arms of the kingdom of Jerusalem, consisting of gold crosses on white.

The names used in English blazon for the colors and metals come mainly from French and include *Or* (gold), *argent* (white), *azure* (blue), *gules* (red), *sable* (black), *vert* (green), and *purpure* (purple). A number of other colors – including *bleu-celeste, sanguine, tenné* and *murrey* – are occasionally found, typically for special purposes.

Certain patterns called *furs* can appear in a coat of arms, though they are (rather arbitrarily) defined as tinctures, not patterns. The two common furs are *ermine* and *vair*. Ermine represents the winter coat of the stoat, which is white with a

black tail. Vair represents a kind of squirrel with a blue-gray back and white belly. Sewn together, it forms a pattern of alternating blue and white shapes.

Heraldic charges can be displayed in their natural colors. Many natural items such as plants and animals are described as *proper* in this case. Proper charges are very frequent as crests and supporters. Overuse of the tincture "proper" is viewed as decadent or bad practice.

Variations of the Field

The field of a shield, or less often a charge or crest, is sometimes made up of a pattern of colors, or *variation*. A pattern of horizontal (barwise) stripes, for example, is called *barry*, while a pattern of vertical (palewise) stripes is called *paly*. A pattern of diagonal stripes may be called *bendy* or *bendy sinister*, depending on the direction of the stripes. Other variations include *chevrony*, *gyronny* and *chequy*. For further variations, these are sometimes combined to produce patterns of *barry-bendy*, *paly-bendy*, *lozengy* and *fusilly*. Semés, or patterns of repeated charges, are also considered variations of the field. The Rule of tincture applies to all semés and variations of the field.

Divisions of the Field

The field of a shield in heraldry can be divided into more than one tincture, as can the various heraldic charges. Many coats of arms consist simply of a division of the field into two contrasting tinctures. These are considered divisions of a shield, so the rule of tincture can be ignored. For example, a shield divided azure and gules would be perfectly acceptable. A line of partition may be straight or it may be varied.

Ordinaries

In the early days of heraldry, very simple bold rectilinear shapes were painted on shields. These could be easily recognized at a long distance and could be easily remembered. They therefore served the main purpose of heraldry—identification. As more complicated shields came into use, these bold shapes were set apart in a separate class as the "honorable ordinaries".

They act as charges and are always written first in blazon. Unless otherwise specified they extend to the edges of the field. Though ordinaries are not easily defined, they are generally described as including the cross, the fess, the pale, the bend, the chevron, the saltire, and the pall.

There is a separate class of charges called sub-ordinaries which are of a geometrical shape subordinate to the ordinary. According to Friar, they are distinguished by their order in blazon. The sub-ordinaries include the inescutcheon, the orle, the tressure, the double tressure, the bordure, the chief, the canton, the label, and flaunches.

Ordinaries may appear in parallel series, in which case blazons in English give them different names such as pallets, bars, bendlets, and chevronels. French blazon makes no such distinction between these diminutives and the ordinaries when borne singly. Unless otherwise specified an ordinary is drawn with straight lines, but each may be indented, embattled, wavy, engrailed, or otherwise have their lines varied.

Charges

A charge is any object or figure placed on a heraldic shield or on any other object of an armorial composition. Any object found in nature or technology may appear as a heraldic charge in armory. Charges can be animals, objects, or geometric shapes. Apart from the ordinaries, the most frequent charges are the cross—with its hundreds of variations—and the lion and eagle. Other common animals are stags, Wild Boars, martlets, and fish. Dragons, bats, unicorns, griffins, and more exotic monsters appear as charges and as supporters.

Animals are found in various stereotyped positions or *attitudes*. Quadrupeds can often be found rampant—standing on the left hind foot. Another frequent position is passant, or walking, like the lions of the coat of arms of England. Eagles are almost always shown with their wings spread, or displayed.

In English heraldry the crescent, mullet, martlet, annulet, fleur-de-lis, and rose may be added to a shield to distinguish cadet branches of a family from the senior line. These cadency marks are usually shown smaller than normal charges, but it

still does not follow that a shield containing such a charge belongs to a cadet branch. All of these charges occur frequently in basic undifferenced coats of arms.

Marshalling

To *marshal* two or more coats of arms is to combine them in one shield, to express inheritance, claims to property, or the occupation of an office. This can be done in a number of ways, of which the simplest is impalement: dividing the field *per pale* and putting one whole coat in each half. Impalement replaced the earlier dimidiation – combining the dexter half of one coat with the sinister half of another – because dimidiation can create ambiguity between, for example, a bend and a chevron.

A more versatile method is quartering, division of the field by both vertical and horizontal lines. This practice originated in Spain after the 13th century. As the name implies, the usual number of divisions is four, but the principle has been extended to very large numbers of "quarters".

Quarters are numbered from the dexter chief (the corner nearest to the right shoulder of a man standing behind the shield), proceeding across the top row, and then across the next row and so on. When three coats are quartered, the first is repeated as the fourth; when only two coats are quartered, the second is also repeated as the third. The quarters of a personal coat of arms correspond to the ancestors from whom the bearer has inherited arms, normally in the same sequence as if the pedigree were laid out with the father's father's... father (to as many generations as necessary) on the extreme left and the mother's mother's... mother on the extreme right. A few lineages have accumulated hundreds of quarters, though such a number is usually displayed only in documentary contexts. The Scottish and Spanish traditions resist allowing more than four quarters, preferring to subdivide one or more "grand quarters" into sub-quarters as needed.

The third common mode of marshalling is with an inescutcheon, a small shield placed in front of the main shield. In Britain this is most often an "escutcheon of pretence" indicating, in the arms of a married couple, that the wife is an heraldic heiress (that is, she inherits a coat of arms because

she has no brothers). In continental Europe an inescutcheon (sometimes called a "heart shield") usually carries the ancestral arms of a monarch or noble whose domains are represented by the quarters of the main shield.

In German heraldry, animate charges in combined coats usually turn to face the centre of the composition.

Helm and Crest

In English the word "crest" is commonly (but erroneously) used to refer to an entire heraldic achievement of armorial bearings. The technical use of the heraldic term crest refers to just one component of a complete achievement. The crest rests on top of a helmet which itself rests on the most important part of the achievement: the shield.

The modern crest has grown out of the three-dimensional figure placed on the top of the mounted knights' helms as a further means of identification. In most heraldic traditions, a woman does not display a crest, though this tradition is being relaxed in some heraldic jurisdictions, and the stall plate of Lady Marion Fraser in the Thistle Chapel in St Giles, Edinburgh, shows her coat on a lozenge but with helmet, crest, and motto.

The crest is usually found on a wreath of twisted cloth and sometimes within a coronet. Crest-coronets are generally simpler than coronets of rank, but several specialized forms exist; for example, in Canada, descendants of the United Empire Loyalists are entitled to use a Loyalist military coronet (for descendants of members of Loyalist regiments) or Loyalist civil coronet (for others).

When the helm and crest are shown, they are usually accompanied by a mantling. This was originally a cloth worn over the back of the helmet as partial protection against heating by sunlight. Today it takes the form of a stylized cloak hanging from the helmet. Typically in British heraldry, the outer surface of the mantling is of the principal color in the shield and the inner surface is of the principal metal, though peers in the United Kingdom use standard colourings regardless of rank or the colourings of their arms. The mantling is sometimes conventionally depicted with a ragged edge, as if damaged in

combat, though the edges of most are simply decorated at the emblazoner's discretion.

Clergy often refrain from displaying a helm or crest in their heraldic achievements. Members of the clergy may display appropriate head wear. This often takes the form of a small crowned, wide brimmed hat, sometimes, outwith heraldry, called a galero with the colors and tassels denoting rank; or, in the case of Papal arms until the inauguration of Pope Benedict XVI in 2005, an elaborate triple crown known as a tiara. Benedict broke with tradition to substitute a mitre in his arms. Orthodox and Presbyterian clergy do sometimes adopt other forms of head gear to ensign their shields. In the Anglican tradition, clergy members may pass crests on to their offspring, but rarely display them on their own shields.

Mottoes

An armorial motto is a phrase or collection of words intended to describe the motivation or intention of the armigerous person or corporation. This can form a pun on the family name as in Thomas Nevile's motto "Ne vile velis." Mottoes are generally changed at will and do not make up an integral part of the armorial achievement. Mottoes can typically be found on a scroll under the shield. In Scottish heraldry where the motto is granted as part of the blazon, it is usually shown on a scroll above the crest, and may not be changed at will. A motto may be in any language.

Supporters and other Insignia

Supporters are human or animal figures or, very rarely, inanimate objects, usually placed on either side of a coat of arms as though supporting it. In many traditions, these have acquired strict guidelines for use by certain social classes. On the European continent, there are often fewer restrictions on the use of supporters. In the United Kingdom, only peers of the realm, a few baronets, senior members of orders of knighthood, and some corporate bodies are granted supporters. Often, these can have local significance or a historical link to the armiger.

If the armiger has the title of baron, hereditary knight, or higher, he may display a coronet of rank above the shield. In

the United Kingdom, this is shown between the shield and helmet, though it is often above the crest in Continental heraldry.

Another addition that can be made to a coat of arms is the insignia of a baronet or of an order of knighthood. This is usually represented by a collar or similar band surrounding the shield. When the arms of a knight and his wife are shown in one achievement, the insignia of knighthood surround the husband's arms only, and the wife's arms are customarily surrounded by a meaningless ornamental garland of leaves for visual balance.

Differencing and Cadency

Since arms pass from parents to offspring, and there is frequently more than one child per couple, it is necessary to distinguish the arms of siblings and extended family members from the original arms as passed on from eldest son to eldest son. Over time several schemes have been used.

National Styles

The emergence of heraldry occurred across western Europe almost simultaneously in the various countries. Originally, heraldic style was very similar from country to country. Over time, heraldic tradition diverged into four broad styles: German-Nordic, Gallo-British, Latin, and Eastern. In addition it can be argued that newer national heraldic traditions, such as South African and Canadian, have emerged in the twentieth century.

German-Nordic Heraldry

Coats of arms in Germany, the Scandinavian countries, Estonia, Latvia, Czech lands and northern Switzerland generally change very little over time. Marks of difference are very rare in this tradition as are heraldic furs. One of the most striking characteristics of German-Nordic heraldry is the treatment of the crest. Often, the same design is repeated in the shield and the crest. The use of multiple crests is also common. The crest is rarely used separately as in British heraldry, but can sometimes serve as a mark of difference between different branches of a family. Torse is optional. Heraldic courtoisie is observed: that is, charges in a composite shield (or two shields

displayed together) usually turn to face the centre. Coats consisting only of a divided field are somewhat more frequent in Germany than elsewhere.

Dutch Heraldry

The Low Countries were great centres of heraldry in medieval times. One of the famous armorials is the Gelre Armorial or *Wapenboek*, written between 1370 and 1414. Coats of arms in the Netherlands were not controlled by an official heraldic system like the two in the United Kingdom, nor were they used solely by noble families.

Any person could develop and use a coat of arms if they wished to do so, provided they did not usurp someone else's arms, and historically, this right was enshrined in Roman Dutch law.

As a result, many merchant families had coats of arms even though they were not members of the nobility. These are sometimes referred to as *burgher arms,* and it is thought that most arms of this type were adopted while the Netherlands was a republic (1581–1806). This heraldic tradition was also exported to the erstwhile Dutch colonies.

Dutch heraldry is characterised by its simple and rather sober style, and in this sense, is closer to its medieval origins than the elaborate styles which developed in other heraldic traditions.

Gallo-British Heraldry

The use of cadency marks to difference arms within the same family and the use of semy fields are distinctive features of Gallo-British heraldry (in Scotland the most significant mark of cadency being the bordure, the small brisures playing a very minor role). It is common to see heraldic furs used. In the United Kingdom, the style is notably still controlled by royal officers of arms. French heraldry experienced a period of strict rules of construction under the Emperor Napoleon. English and Scots heraldries make greater use of supporters than other European countries. Furs, chevrons and five-pointed stars are more frequent in France and Britain than elsewhere.

Latin Heraldry

The heraldry of southern France, Portugal, Spain, and Italy is characterized by a lack of crests, and uniquely shaped shields. Portuguese and Spanish heraldry occasionally introduce words to the shield of arms, a practice disallowed in British heraldry. Latin heraldry is known for extensive use of quartering, because of armorial inheritance via the male and the female lines. Moreover, Italian heraldry is dominated by the Roman Catholic Church, featuring many shields and achievements, most bearing some reference to the Church.

Trees are frequent charges in Latin arms. Charged bordures, including bordures inscribed with words, are seen often in Spain.

Central and Eastern European Heraldry

Eastern European heraldry is in the traditions developed in Bulgaria, Serbia, Croatia, Hungary, Lithuania, Poland, Ukraine, and Russia. Eastern coats of arms are characterized by a pronounced, territorial, clan system — often, entire villages or military groups were granted the same coat of arms irrespective of family relationships. In Poland, nearly six hundred unrelated families are known to bear the same Jastrzêbiec coat of arms. Marks of cadency are almost unknown, and shields are generally very simple, with only one charge. Many heraldic shields derive from ancient house marks. At the least, fifteen per cent of all Hungarian personal arms bear a severed Turk's head, referring to their wars against the Ottoman Empire.

Modern Heraldry

Heraldry flourishes in the modern world; institutions, companies, and private persons continue using coats of arms as their pictorial identification. In the United Kingdom and Ireland, the English Kings of Arms, Scotland's Lord Lyon King of Arms, and the Chief Herald of Ireland continue making grants of arms. There are heraldic authorities in Canada, South Africa, Spain, and Sweden that grant or register coats of arms. In South Africa, the right to armorial bearings is also determined by Roman Dutch law, inherited from the 17th century

Netherlands. Heraldic societies abound in Africa, Asia, Australasia, the Americas and Europe.

Heraldry aficionados participate in the Society for Creative Anachronism, medieval revivals, micronationalism, et cetera. People see heraldry as a part of their national and personal heritages, and as a manifestation of civic and national pride. Today, heraldry is not a worldly expression of aristocracy, merely a form of identification.

Military heraldry continues developing, incorporating blazons unknown in the medieval world. Nations and their subdivisions — provinces, states, counties, cities, etc. — continue building upon the traditions of civic heraldry. The Roman Catholic Church, the Church of England, and other Churches maintain the tradition of ecclesiastical heraldry for their high-rank prelates, religious orders, universities, and schools.

3

Urban Housing

An urban area is characterized by higher population density and vast human features in comparison to areas surrounding it. Urban areas may be cities, towns or conurbations, but the term is not commonly extended to rural settlements such as villages and hamlets. Urban areas are created and further developed by the process of urbanization. Measuring the extent of an urban area helps in analyzing population density and urban sprawl, and in determining urban and rural populations (Cubillas 2007).

Unlike an urban area, a metropolitan area includes not only the urban area, but also satellite cities plus intervening rural land that is socio-economically connected to the urban core city, typically by employment ties through commuting, with the urban core city being the primary labour market. In fact, urbanized areas agglomerate and grow as the core population/economic activity center within a larger metropolitan area or envelope. Metropolitan areas tend to be defined using counties or county sized political units as building blocks. Counties tend to be stable political boundaries; economists prefer to work with economic and social statistics based on metropolitan areas. Urbanized areas are a more relevant statistic for determining per capita land usage and densities (Dumlao & Felizmenio 1976).

Definitions

They vary somewhat amongst different nations. European countries define urbanized areas on the basis of urban-type

land use, not allowing any gaps of typically more than 200 meters, and use satellite imagery instead of census blocks to determine the boundaries of the urban area. In less developed countries, in addition to land use and density requirements, a requirement that a large majority of the population, typically 75%, is not engaged in agriculture and/or fishing is sometimes used.

Australia

In Australia, urban areas are referred to as "urban centres" and are defined as population clusters of 1000 or more people, with a density of 200 or more persons per square kilometre.

Canada

In Canada, an urban area is an area that has more than 400 people per square kilometre and has more than 1,000 people. If two or more urban areas are within two kilometres of each other, they are merged into a single urban area. The boundaries of an urban area are not influenced by municipal or even provincial boundaries.

China

In China, an urban area is an urban district, city and town with a population density higher than 1,500 people per square kilometre. As for urban districts with a population density lower than 1,500 people per square kilometre, only the population that lives in streets, town sites, and adjacent villages is counted as urban population.

France

In France, an urban area is a zone (*aire urbaine*) encompassing an area of built-up growth (called an "urban unit" (*unité urbaine*)-close in definition to the North American urban area) and its commuter belt (*couronne périurbaine*). Although the official INSEE translation of *aire urbaine* is "urban area", most North Americans would find the same as being similar in definition to their metropolitan area.

Japan

In Japan urbanized areas are defined as contiguous areas

of densely inhabited districts (DIDs) using census enumeration districts as units with a density requirement of 4,000 inhabitants per square kilometre (10,000 /sq mi).

New Zealand

Statistics New Zealand defines New Zealand urban areas for statistical purposes as a settlement with a population of a thousand people or more.

Norway

Statistics Norway defines urban areas ("tettsteder") similarly to the other Nordic countries. Unlike in Denmark and Sweden, the distance between each building has to be of less than 50 meters, although exceptions are made due to parks, industrial areas, rivers, and similar. Groups of houses less than 400 metres from the main body of an urban area are included in the urban area.

Poland

In Poland, official "urban" population figures simply refer to those localities which have the status of towns (*miasta*). The "rural" population is that of all areas outside the boundaries of these towns. This distinction may give a misleading impression in some cases, since some localities with only village status may have acquired larger and denser populations than many smaller towns.

Sweden

Urban areas in Sweden (*tätorter*) are statistically defined localities, totally independent of the administrative subdivision of the country. There are 1,940 such localities in Sweden, with a population ranging from 200 to 1,252,000 inhabitants.

United Kingdom

The United Kingdom's Office for National Statistics produced census results from urban areas since 1951, since 1981 based upon the extent of irreversible urban development indicated on Ordnance Survey maps. The definition is an extent of at least 20 hectares and at least 1,500 census residents. Separate areas are linked if less than 200 metres apart. Included

are transportation features. The largest urban area is Greater London, followed by the West Midlands county, Greater Manchester, Greater Glasgow and Merseyside.

United States

In the United States there are two categories of urban area. The term *urbanized area* denotes an urban area of 50,000 or more people. Urban areas under 50,000 people are called *urban clusters*. Urbanized areas were first delineated in the United States in the 1950 census, while urban clusters were added in the 2000 census. There are 1,371 urban areas and urban clusters with more than 10,000 people.

The U.S. Census Bureau defines an urban area as: "Core census block groups or blocks that have a population density of at least 1,000 people per square mile (386 per square kilometer) and surrounding census blocks that have an overall density of at least 500 people per square mile (193 per square kilometer)."

The concept of Urbanized Areas as defined by the U.S. Census Bureau is often used as a more accurate gauge of the size of a city, since in different cities and states the lines between city borders and the urbanized area of that city are often not the same.

For example, the city of Greenville, South Carolina has a city population under 60,000 but an urbanized area over 300,000, while Greensboro, North Carolina has a city population over 200,000 but an urbanized area population of around 270,000 — meaning that Greenville is actually "larger" for some intents and purposes, but not for others, such as taxation, local elections, etc.

The largest urban area in the United States is that of New York City, with its city proper population exceeding 8 million and its metropolitan area population almost 19 million. The next four largest urban areas in the U.S. are those of Los Angeles, Chicago, Miami and Philadelphia. About 70 percent of the population of the United States lives within the boundaries of urbanized area (210 out of 300 million). Combined, these areas occupy about 2 percent of the United States. The majority

of urbanized area residents are suburbanites; core central city residents make up about 30 percent of the urbanized area population (about 60 out of 210 million).

Urban Economics

Urban Economics is broadly the economic study of urban areas. As such, it involves using the tools of economics to analyze urban issues such as crime, education, public transit, housing, and local government finance. More narrowly, it is a branch of microeconomics that studies urban spatial structure and the location of households and firms. Much urban economic analysis relies on a particular model of urban spatial structure, the monocentric city model pioneered in the 1960s by William Alonso, Richard Muth, and Edwin Mills. While most other forms of neoclassical economics do not account for spatial relationships between individuals and organizations, urban economics focuses on these spatial relationships to understand the economic motivations underlying the formation, functioning, and development of cities.

Since its formulation in 1964, William Alonso's monocentric city model of a disc-shaped Central Business District (CBD) and surrounding residential region has served as a starting point for urban economic analysis. Monocentricity has become weaker over time due to changes in technology, particularly due to faster and cheaper transportation (which makes it possible for commuters to live farther from their jobs in the CBD) and communications (which allow back-office operations to move out of the CBD). Additionally, recent research has sought to explain the polycentricity described in Joel Garreau's Edge City. Several explanations for polycentric expansion have been proposed and summarized in models that account for factors such as utility gains from lower average land rents and increasing (or constant returns) due to economies of agglomeration.

Urban economics is rooted in the location theories of von Thünen, Alonso, Christaller, and Lösch that began the process of spatial economic analysis (Capello & Nijkamp 2004:3-4). Economics is the study of the allocation of scarce resources, and as all economic phenomena take place within a geographical

space, urban economics focuses of the allocation of resources across space in relation to urban areas (Arnott & McMillen 2006:7) (McCann 2001:1). Other branches of economics ignore the spatial aspects of decision making but urban economics focuses not only on the location decisions of firms, but also of cities themselves as cities themselves represent centers of economic activity (O'Sullivan 2003:1).

Many spatial economic topics can be analyzed within either an urban or regional economics framework as some economic phenomena primarily affect localized urban areas while others are felt over much larger regional areas (McCann 2001:3). Arthur O'Sullivan believes urban economics is divided into six related themes: market forces in the development of cities, land use within cities, urban transportation, urban problems and public policy, housing and public policy, and local government expenditures and taxes. (O'Sullivan 2003:13-14).

Market Forces in the Development of Cities

Market forces in the development of cities relates to how the location decision of firms and households causes the development of cities. The nature and behavior of markets depends somewhat on their locations therefore market performance partly depends on geography (McCann 2001:1). If a firm locates in a geographically isolated region, their market performance will be different than a firm located in a concentrated region. The location decisions of both firms and households create cities that differ in size and economic structure. When industries cluster, like in the Silicon Valley in California, they create urban areas with dominant firms and distinct economies. By looking at location decisions of firms and households, the urban economist is able to address why cities develop where they do, why some cities are large and others small, what causes economic growth and decline, and how local governments affect urban growth (O'Sullivan 2003:14). Because urban economics is concerned with asking questions about the nature and workings of the economy of a city, models and techniques developed within the field are primarily designed to analyze phenomena that are confined within the limits of a single city (McCann 2001:2).

Land Use Within Metropolitan Areas

Looking at land use within metropolitan areas, the urban economist seeks to analyze the spatial organization of activities within cities. In attempts to explain observed patterns of land use, the urban economist examines the intra-city location choices of firms and households. Considering the spatial organization of activities within cities, urban economics addresses questions in terms of what determines the price of land and why those prices vary across space, the economic forces that caused the spread of employment from the central core of cities outward, identifying land-use controls, such as zoning, and interpreting how such controls affect the urban economy (O'Sullivan 2003:14).

Economic Policy in Urban Areas

Economic policy is often implemented at the urban level thus economic policy is often tied to urban policy (McCann 2001:3). Urban problems and public policy tie into urban economics as the theme relates urban problems, such as poverty or crime, to economics by seeking to answer questions with economic guidance. For example, does the tendency for the poor to live close to one another make them even poorer? (O'Sullivan 2003:15).

Urban Transportation and Urban Economics

Urban transportation is a theme of urban economics because it affects land-use patterns as transportation affects the relative accessibility of different sites. Issues that tie urban transportation to urban economics include the deficit that most transit authorities have, and efficiency questions about proposed transportation developments such as light-rail (O'Sullivan 2003:14).

Housing and Public Policy

Housing and public policy relate to urban economics as housing is a unique type of commodity. Because housing is immobile, when a household chooses a dwelling, it is also choosing a location. Urban economists analyze the location choices of households in conjunction with the market effects of housing policies (O'Sullivan 2003:15).

Government Expenditures and Taxes in Urban Economics

The final theme of local government expenditures and taxes relates to urban economics as it analyzes the efficiency of the fragmented local governments presiding in metropolitan areas (O'Sullivan 2003:15).

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.

History

Agriculture and other techniques facilitated larger populations than the very small communities of the Paleolithic. They may have led to stronger, more coercive governments at the same time. The pre-Classical and Classical ages saw a number of cities laid out according 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 (c. 407 BC) 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 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 defence 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. The Romans had a very logical way of designing their cities. They laid 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 formed the center of the grid and intersected in the middle. One ran east–west, the other north–south. They were slightly wider than the others. All roads were made of carefully fitted stones and smaller, hard-packed stones. 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 center of a larger city. Since the new center 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 strengthening of all central governments, from city-states to the kings of France, characteristic of that epoch.

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 center 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 center, 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 center 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 according 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* (based on Le Corbusier's Ville Contemporaine), 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.

Reaction

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 article, 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 analyzing redevelopment processes in large urban distressed areas in European cities.

Background of CoSGOP'

CoSGOP is derived from goal-oriented planning (Gesellschaft für Technische Zusammenarbeit-GTZ 1988), 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 program; 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.

Elements of CoSGOP

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

program and its main activities (based on priorities defined with the stakeholders); assessment of possible impacts of the improvement program; 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).

Application

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 in the United States

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 of Planning

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. Refer to Foucault and the Encyclopedia of the Prison System for more details. 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 behavior. 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 (relatively unregulated) 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" program, where established slum-dwellers promise to build proper houses, schools, and community centers without government money, in return for land on which they have been illegally squatting on for 30 years.

The "Camp of Fire" program is one of many similar projects initiated by Slum Dwellers International, which has programs in Africa, Asia, and South America.

A slum, as defined by the United Nations agency UN-HABITAT, is a run-down area of a city characterized by substandard housing and squalor and lacking in tenure security. According to the United Nations, the proportion of urban dwellers living in slums decreased from 47 percent to 37 percent in the developing world between 1990 and 2005. However, due to rising population, the number of slum dwellers is rising. One billion people worldwide live in slums and the figure will likely grow to 2 billion by 2030.

The term has traditionally referred to housing areas that were once relatively affluent but which deteriorated as the original dwellers moved on to newer and better parts of the city, but has come to include the vast informal settlements found in cities in the developing world.

Many shack dwellers vigorously oppose the description of their communities as 'slums' arguing that this results in them being pathologised and then, often, subject to threats of evictions. Many academics have vigorously criticized UN-Habitat and the World Bank arguing that their 'Cities Without Slums' Campaign has led directly to a massive increase in forced evictions.

Although their characteristics vary between geographic regions, they are usually inhabited by the very poor or socially disadvantaged. Slum buildings vary from simple shacks to permanent and well-maintained structures. Most slums lack clean water, electricity, sanitation and other basic services.

Etymology

"Slum" was originally used mainly in the phrase "back slum," meaning a back room and later "back alley". The origin of this word is thought to come from the Irish phrase '*S lom é* (pron. s'lum ae) meaning 'exposed vulnerable place' The Oxford English Dictionary says it may be a "cant" word of Roma (Gypsy) origin. The etymologist Eric Partridge says flatly that it is "of unknown origin."

Other terms that are often used interchangeably with "slum" include shanty town, favela, skid row, barrio, and ghetto although each of these may have a somewhat different meaning. Slums are distinguished from shanty towns and favelas in that the latter initially are low-class settlements, whereas slums are generally constructed early on as relatively affluent or possibly a prestigious communities. The term "shanty town" also suggests that the dwellings are improvised shacks, made from scrap materials, and usually without proper sanitation, electricity, or telephone services. Skid row refers to an urban area with a high homeless population and a term is most commonly used in the United States. Barrio may refer to an upper-class area in some Spanish-speaking countries, and is only used to describe a low-class community in the United States. Ghetto refers to a neighbourhood based on shared ethnicity. By contrast, identification of an area as a slum is based solely on socio-economic criteria, not on racial, ethnic, or religious criteria.

Characteristics

The characteristics associated with slums vary from place to place. Slums are usually characterized by urban decay, high rates of poverty, illiteracy, and unemployment. They are commonly seen as "breeding grounds" for social problems such as crime, drug addiction, alcoholism, high rates of mental illness, and suicide. In many poor countries they exhibit high rates of disease due to unsanitary conditions, malnutrition, and lack of basic health care. However some like Dharavi in Mumbai are a hive of business activity such as leather work, cottage industries etc. Rural depopulation with thousands arriving daily into the cities makes slum clearance an uphill struggle.

In fact one could argue that the presence of slums reflects true democracy(free movements of people)-as only a totalitarian state could 'eradicate' slums. No Indian needs a pass to enter Mumbai-however Chinese citizens need passes to enter Shanghai and Beijing.

A UN Expert Group has created an operational definition of a slum as an area that combines to various extents the following characteristics: inadequate access to safe water; inadequate access to sanitation and other infrastructure; poor structural quality of housing; overcrowding; and insecure residential status. A more complete definition of these can be found in the 2003 UN report titled "Slums of the World: The face of urban poverty in the new millennium?". The report also lists various attributes and names that are given by individual countries which are somewhat different than these UN characteristics of a slum.

Low socioeconomic status of its residents is another common characteristic given for a slum.

In many slums, especially in poor countries, many live in very narrow alleys that do not allow vehicles (like ambulances and fire trucks) to pass. The lack of services such as routine garbage collection allows rubbish to accumulate in huge quantities. The lack of infrastructure is caused by the informal nature of settlement and no planning for the poor by government officials. Additionally, informal settlements often face the brunt of natural and man-made disasters, such as landslides, as well as earthquakes and tropical storms. Fires are often a serious problem.

Many slum dwellers employ themselves in the informal economy. This can include street vending, drug dealing, domestic work, and prostitution. In some slums people even recycle trash of different kinds (from household garbage to electronics) for a living-selling either the odd usable goods or stripping broken goods for parts or raw materials.

Slums are often associated with Victorian Britain, particularly in industrial, northern English towns, lowland Scottish towns and Dublin City in Ireland. These were generally still inhabited until the 1940s, when the government started

slum clearance and built new council houses. There are still many examples left of former slum housing in the UK, however they have generally been restored into more modern housing.

Growth and Countermeasures

Recent years have seen a dramatic growth in the number of slums as urban populations have increased in the Third World.

In April 2005, the director of UN-HABITAT stated that the global community was falling short of the Millennium Development Goals which targeted significant improvements for slum dwellers and an additional 50 million people have been added to the slums of the world in the past two years. According to a 2006 UN-HABITAT report, 327 million people live in slums in Commonwealth countries-almost one in six Commonwealth citizens. In a quarter of Commonwealth countries (11 African, 2 Asian and 1 Pacific), more than two out of three urban dwellers live in slums and many of these countries are urbanising rapidly.

The number of people living in slums in India has more than doubled in the past two decades and now exceeds the entire population of Britain, the Indian Government has announced.

Many governments around the world have attempted to solve the problems of slums by clearing away old decrepit housing and replacing it with modern housing with much better sanitation. The displacement of slums is aided by the fact that many are squatter settlements whose property rights are not recognized by the state. This process is especially common in the Third World. Slum clearance often takes the form of eminent domain and urban renewal projects, and often the former residents are not welcome in the renewed housing. For example, in the Philippine slums of Smokey Mountain, located in Tondo, Manila, projects have been enforced by the Government and non-government organizations to allow urban resettlement sites for the slum dwellers. According to a UN-Habitat report, over 2 million people in the Philippines live in slums, and in the city of Manila alone, 50% of the over 11 million inhabitants live in slum areas.

Moreover new projects are often on the semi-rural peripheries of cities far from opportunities for generating livelihoods as well as schools, clinics etc. At times this has resulted in large movements of inner city slum dwellers militantly opposing relocation to formal housing on the outskirts of cities.

In some countries, leaders have addressed this situation by rescuing rural property rights to support traditional sustainable agriculture, however this solution has met with open hostility from capitalists and corporations. It also tends to be relatively unpopular with the slum communities themselves, as it involves moving out of the city back into the countryside, a reverse of the rural-urban migration that originally brought many of them into the city.

Critics argue that slum clearances tend to ignore the social problems that cause slums and simply redistribute poverty to less valuable real estate. Where communities have been moved out of slum areas to newer housing, social cohesion may be lost. If the original community is moved back into newer housing after it has been built in the same location, residents of the new housing face the same problems of poverty and powerlessness. There is a growing movement to demand a global ban of 'slum clearance programmes' and other forms of mass evictions.

Alleged Positive Aspects of Slums

In recent years, some environmentalists such as Stewart Brand and organizations such as the United Nations Population Fund suggested that despite the poor living conditions, slums are positive both environmentally and socially. Because the slum is characterized by a very high density of housing, its environmental impact is smaller than that of diffuse rural communities. The fertility rate of new slum dwellers is below the replacement rate; this mitigates dangers associated with overpopulation that results from manpower-intensive subsistence agriculture, and frees up arable land for the nature, or more efficient industrialized agriculture. Slum dwellers also appear to have vastly better opportunities for getting jobs, starting small businesses and climbing out of poverty than rural inhabitants.

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 centers 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 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 & 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 according to process similar to those of plants. They say that urban planning should thus take its cues from such natural processes.

New Urbanism

New Urbanism is an urban design movement, which promotes walkable neighborhoods that contain a range of housing and job types. It arose in the United States in the early 1980s and continues to reform many aspects of real estate development and urban planning.

New Urbanism is strongly influenced by urban design standards prominent before the rise of the automobile and encompasses principles such as traditional neighborhood design (TND) and transit-oriented development (TOD). It is also closely related to Regionalism, Environmentalism and the broader concept of smart growth.

The organizing body for New Urbanism is the Congress for the New Urbanism, founded in 1993. Its foundational text is the *Charter of the New Urbanism*, which says:

We advocate the restructuring of public policy and development practices to support the following principles: neighborhoods should be diverse in use and population; communities should be designed for the pedestrian and transit as well as the car; cities and towns should be shaped by physically defined and universally accessible public spaces and community institutions; urban places should be framed by architecture and landscape design that celebrate local history, climate, ecology, and building practice.

New urbanists support regional planning for open space, context-appropriate architecture and planning, and the balanced development of jobs and housing. They believe their strategies can reduce traffic congestion, increase the supply of affordable housing, and rein in urban sprawl. The *Charter of the New Urbanism* also covers issues such as historic preservation, safe streets, green building, and the redevelopment of brownfield land.

Background

Until the mid 20th century, cities were generally organized into and developed around mixed-use walkable neighborhoods. For most of human history this meant a city that was entirely walkable, although with the development of mass transit the

reach of the city extended outward along transit lines, allowing for the growth of new pedestrian communities such as streetcar suburbs. But with the advent of cheap automobiles and favorable government policies, attention began to shift away from cities and towards ways of growth more focused on the needs of the car. Specifically, after World War II urban planning largely centred around the use of municipal zoning ordinances to segregate residential from commercial and industrial development, and focused on the construction of low density single family detached houses as the preferred housing option for the growing middle class.

The physical separation of where people lived from where they worked, shopped and frequently spend their recreational time, together with low housing density, which often drastically reduced population density relative to historical norms, made automobiles indispensable for efficient transportation and contributed to the emergence of a culture of automobile dependency.

This new system of development, with its rigorous separation of uses, became known as "conventional suburban development" or pejoratively as urban sprawl, arose after World War II. The majority of U.S. citizens now live in suburban communities built in the last fifty years, and automobile use per capita has soared.

Although New Urbanism as an organized movement would only arise later, a number of activists and thinkers soon began to criticize the modernist planning techniques being put into practice. Social philosopher and historian Lewis Mumford criticized the "anti-urban" development of post-war America. *The Death and Life of Great American Cities,* written by Jane Jacobs in the early 1960s, called for planners to reconsider the single-use housing projects, large car-dependent thoroughfares, and segregated commercial centers that had become the "norm."

Rooted in these early dissenters, New Urbanism emerged in the 1970s and 80s with the urban visions and theoretical models for the reconstruction of the "European" city proposed by architect Leon Krier, and the "pattern language" theories of Christopher Alexander.

In 1991, the Local Government Commission, a private nonprofit group in Sacramento, California, invited architects Peter Calthorpe, Michael Corbett, Andrés Duany, Elizabeth Moule, Elizabeth Plater-Zyberk, Stefanos Polyzoides, and Daniel Solomon to develop a set of community principles for land use planning. Named the *Ahwahnee Principles* (after Yosemite National Park's Ahwahnee Hotel), the commission presented the principles to about one hundred government officials in the fall of 1991, at its first Yosemite Conference for Local Elected Officials.

Calthorpe, Duany, Moule, Plater-Zyberk, Polyzoides, and Solomon founded the Chicago-based Congress for the New Urbanism in 1993. The CNU has grown to more than 3,000 members, and is the leading international organization promoting new urbanist design principles. It holds annual Congresses in various U.S. cities.

New Urbanism is a broad movement that spans a number of different disciplines and geographic scales. And while the conventional approach to growth remains dominant, New Urbanist principles have become increasingly influential in the fields of planning, architecture, and public policy.

Defining Elements

According to husband-and-wife town planners Andrés Duany and Elizabeth Plater-Zyberk, two of the founders of the Congress for the New Urbanism, they observed mixed-use streetscapes with corner shops, front porches, and a diversity of well-crafted housing while living in one of New Haven's Victorian neighborhoods.

1. The neighborhood has a discernible center. This is often a square or a green and sometimes a busy or memorable street corner. A transit stop would be located at this center.
2. Most of the dwellings are within a five-minute walk of the center, an average of roughly ¼ mile or 1,320 feet (0.4 km).
3. There are a variety of dwelling types — usually houses, rowhouses, and apartments — so that younger and

older people, singles, and families, the poor, and the wealthy may find places to live.

4. At the edge of the neighborhood, there are shops and offices of sufficiently varied types to supply the weekly needs of a household.
5. A small ancillary building or garage apartment is permitted within the backyard of each house. It may be used as a rental unit or place to work (for example, an office or craft workshop).
6. An elementary school is close enough so that most children can walk from their home.
7. There are small playgrounds accessible to every dwelling — not more than a tenth of a mile away.
8. Streets within the neighborhood form a connected network, which disperses traffic by providing a variety of pedestrian and vehicular routes to any destination.
9. The streets are relatively narrow and shaded by rows of trees. This slows traffic, creating an environment suitable for pedestrians and bicycles.
10. Buildings in the neighborhood center are placed close to the street, creating a well-defined outdoor room.
11. Parking lots and garage doors rarely front the street. Parking is relegated to the rear of buildings, usually accessed by alleys.
12. Certain prominent sites at the termination of street vistas or in the neighborhood center are reserved for civic buildings. These provide sites for community meetings, education, and religious or cultural activities.
13. The neighborhood is organized to be self-governing. A formal association debates and decides matters of maintenance, security, and physical change. Taxation is the responsibility of the larger community.

Examples

United States

New urbanism is having a growing influence on how and

where metropolitan regions choose to grow. At least fourteen large-scale planning initiatives are based on the principles of linking transportation and land-use policies, and using the neighborhood as the fundamental building block of a region. Miami,Florida has adopted the most ambitious new urbanist-based zoning code reform yet undertaken by a major U.S. city.

More than six hundred new towns, villages, and neighborhoods in the U.S. following new urbanism principles are planned or under construction. Hundreds of new, small-scale, urban and suburban infill projects are under way to reestablish walkable streets and blocks. In Maryland and several other states, new urbanist principles are an integral part of *smart growth* legislation.

In the mid-1990s, the U.S. Department of Housing and Urban Development (HUD) adopted the principles of the new urbanism in its multi-billion dollar program to rebuild public housing projects nationwide. New urbanists have planned and developed hundreds of projects in infill locations. Most were driven by the private sector, but many, including HUD projects, used public money.

The Cotton District

The Cotton District was the first new urbanist development, begun in 1968 long before the new urbanism movement was organized. The District is located in Starkville, Mississippi bordering Mississippi State University, and consists mostly of residential rental units for college students along with restaurants, bars and retail. The Cotton District got its name because it is built in an area that surrounds an old cotton mill.

Seaside

Seaside, Florida, the first fully new urbanist town, began development in 1981 on eighty acres (324,000 m^2) of Florida Panhandle coastline. It was featured on the cover of the Atlantic Monthly in 1988, when only a few streets were completed, and has become internationally famous for its architecture, and the quality of its streets and public spaces.

Seaside is now a tourist destination and appeared in the movie *The Truman Show*. Lots sold for $15,000 in the early

1980s, and slightly over a decade later, the price had escalated to about $200,000. Today, most lots sell for more than a million dollars, and some houses top $5 million.

Stapleton

The site of the former Stapleton International Airport in Denver, Colorado, closed in 1995, is now being redeveloped by Forest City Enterprises., Stapleton is expected to be home to at least 30,000 residents,six schools and 2 million square feet (180,000 m^2) of retail. Construction began in 2001. Northfield Stapleton, one of the development's major retail centers, recently opened.

Mountain House

Mountain House is a new town between Tracy, California and Livermore, California. Mountain House is one of latest New Urbanism projects in the United States. Construction started in 2001. Mountain House will consist of 12 villages, each with its own elementary school, park, and commercial area. In addition, a future train station, transit center and bus system are planned for Mountain House.

Mesa Del Sol

Mesa del Sol-is the largest new urbanist project in the United States, was design by architect Peter Calthorpe and is being developed by Forest City Enterprises.It could take five decades to reach full build-out of Mesa del Sol but when finished it could have population of 100,000,38,000 residential units, a 1,400-acre industrial office park, four town centers,a Urban center and a Downtown creating a twin city within Albuquerque.

Haile Plantation

Haile Plantation, Florida, is a 2,600 household (1,700 acre) development of regional impact southwest of the City of Gainesville, within Alachua County. Haile Village Center is a traditional neighborhood center within the development. It was originally started in 1978 and completed in 2007. In addition to the 2,600 homes the neighborhood consists of two merchant centers (one a New England narrow street village and the other

a chain grocery strip mall). There are also two public elementary schools and an 18-hole golf course.

Disney's Celebration, Florida

In June 1996, the Walt Disney Company unveiled its 5,000 acre (20 km^2) town of Celebration, near Orlando, Florida. Celebration opened its downtown in October, 1996, while Seaside's downtown was still mostly unbuilt. It has since eclipsed Seaside as the best-known new urbanist community, but Disney shuns the label, calling Celebration simply a "town." Disney has been criticized for insipid nostalgia, and heavy-handed rules and management.

Other Countries

New Urbanism is closely related to the Urban village movement in Europe. They both occurred at similar times and share many of the same principles although urban villages has an emphasis on traditional city planning. In Europe many brown-field sites have been redeveloped since the 1980s following the models of the traditional city neighbourhoods rather than Modernist models. One well-publicized example is Poundbury in England, a suburban extension to the town of Dorchester, which was built on land owned by the Duchy of Cornwall under the overview of Prince Charles. The original masterplan was designed by Leon Krier. A report carried out after the first phase of construction found a high degree of satisfaction by residents, although the aspirations to reduce car dependency had not been successful. Rising house prices and a perceived premium have made the open market housing unaffordable for many local people.

The Council for European Urbanism (C.E.U.), formed in 2003, shares many of the same aims as the US New Urbanists. C.E.U.'s Charter is a development of the Congress for the New Urbanism Charter revised and reorganised to relate better to European conditions. An Australian organisation, Australian Council for New Urbanism has since 2001 run conferences and events to promote new urbanism in that country. A New Zealand Urban Design Protocol was created by the Ministry for the Environment in 2005.

There are many developments around the world that follow New Urbanist principles to a greater or lesser extent:

- Orchid Bay, Belize is one of the largest New Urbanist projects in Central America and the Caribbean.
- Val d'Europe, east of Paris, France. Developed by Disneyland Resort Paris, this town is a kind of European counterpart to Walt Disney World Celebration City.
- McKenzie Towne is a new urbanist development which commenced in 1995 by Carma Developers LP in Calgary and has an expected completion of 2011.
- The Alta de Lisboa project, in north Lisbon, Portugal, is one of the largest new urbanist projects in Europe.
- The structure plan for Thimphu, Bhutan, follows Principles of Intelligent Urbanism, which share underlying axioms with the New Urbanism.
- Jakriborg, in Southern Sweden, is a recent example of the new urbanist movement.
- Other developments can be found in Heulebrugge, the Netherlands; Knokke-Heist, in Belgium; and Fonti di Matilde, Italy.

There are several such developments in South Africa. The most notable is Melrose Arch in Johannesburg. The first development in the Eastern Cape, one of the lesser known provinces in the country, is located in East London. The development, announced in 2007, comprises 30 hectares. It is made up of three apartment complexes together with over 30 residential site as well as 20,000 sqm of residential and office space. The development is valued at over R2-billion ($250-million).

New Urbanism Organizations

The primary organization promoting the New Urbanism in the United States is the Congress for the New Urbanism (CNU). The Congress has met annually since 1993 when they held their first meeting in Alexandria, VA with approximately 100 attendees. By 2008 the Congress was drawing 2,000 to 3,000 attendees to the annual meetings. The Congress began forming

local and regional chapters circa 2004 with the founding of the New England and Florida Chapters. By 2009 there were 12 official chapters and interest groups for 11 more.

While the CNU has international participation, sister organizations have been formed in other areas of the world including the Council for European Urbanism (CEU), the Movement for Israeli Urbanism (MIU) and the Australian Council for the New Urbanism.

By 2002 student chapters referring to themselves as Students for the New Urbanism began appearing at universities including the University of Georgia, University of Notre Dame, and the University of Miami. In 2003, a group of younger professionals and students met at the 11th Congress in Washington, D.C. and began developing a "Manifesto of the Next Generation of New Urbanists".

The Next Generation of New Urbanists held their first major session the following year at the 12th meeting of the CNU in Chicago in 2004.

The group has continued meeting annually as of 2009 with a focus on young professionals, students, new member issues, and ensuring the flow of fresh ideas and diverse viewpoints within the New Urbanism and the CNU. Spin off projects of the New Generation of the New Urbanists include the Living Urbanism publication first published in 2008.

The CNU has spawned publications and research groups. Publications include the *New Urban News* and the *New Town Paper*. Research groups have formed independent nonprofits to research individual topics such as the Form-Based Codes Institute, The National Charrette Institute and the Center for Applied Transect Studies.

In the United Kingdom New Urbanist and European urbanism principles are practised and taught by the The Prince's Foundation for the Built Environment. Other organisations promote New Urbanism as part of their remit, such as INTBAU, A Vision of Europe, and others.

The CNU and other national organizations have also formed partnerships with like-minded groups. Organizations under

the banner of Smart Growth also often work with the Congress for the New Urbanism.

In addition the CNU has formed partnerships on specific projects such as working with the [United States Green Building Council] and the National Resources Defence Council to develop the LEED for Neighborhood Development standards and with the Institute of Transportation Engineers to develop a Context Sensitive Solutions (CSS) Design manual.

4

Rural Housing

Rural areas are large and isolated areas of an open country (in reference to open fields and not forests etc.), often with low population density. The terms “countryside” and “rural areas” are not synonyms: a “countryside” refers to rural areas that are open. A forest, wetlands, etc. with a low population density is not a countryside. About 91 percent of the rural population now earn salaried incomes, often in urban areas. The 10 percent who still produce resources generate 20 percent of the world’s coal, copper, and oil; 10 percent of its wheat, 20 percent of its meat, and 50 percent of its corn. The efficiency of these farms is due in large part to the commercialization of the farming industry, and not single family operations.

United States

Today, 75 percent of the United States’ inhabitants live in suburban and urban areas, but cities occupy only 2 percent of the country. Rural areas occupy the remaining 98 percent.

The U.S. Census Bureau, the USDA’s Economic Research Service, and the Office of Management and Budget (OMB) have come together to help define rural areas.

United States Census Bureau

The Census Bureau definitions (new to the 2000 census), which are based on population density, defines rural areas as all territory outside of Census Bureau-defined urbanized areas and urban clusters.

- An urbanized area consists of a central city and surrounding areas whose population ("urban nucleus") is greater than 50,000. They may or may not contain individual cities with 50,000 or more; rather, they must have a core with a population density generally exceeding 1,000 persons per square mile; and may contain adjoining territory with at least 500 persons per square mile (other towns outside of an urbanized area whose population exceeds 2,500).
- Thus, rural areas comprise open country and settlements with fewer than 2,500 residents; areas designated as rural can have population densities as high as 999 per square mile or as low as 1 person per square mile. USDA.
- The USDA's Office of Rural Development may define rural by various population thresholds. The 2002 farm bill (P.L. 107-171, Sec. 6020) defined rural and rural area as any area other than (1) a city or town that has a population of greater than 50,000 inhabitants, and (2) the urbanized areas contiguous and adjacent to such a city or town.
- The rural-urban continuum codes, urban influence codes, and rural county typology codes developed by USDA's Economic Research Service (ERS) allow researchers to break out the standard metropolitan and nonmetropolitan areas into smaller residential groups. For example, a metropolitan county is one that contains an urbanized area, or one that has a twenty-five percent commuter rate to an urbanized area regardless of population.

OMB

Under the Core Based Statistical Areas used by the OMB,

- a metropolitan county, or Metropolitan Statistical Area, consists of (1) central counties with one or more urbanized areas (as defined by the Census Bureau) and (2) outlying counties that are economically tied to the core counties as measured by worker commuting data (i.e. if 25% of workers living there commute to the core

counties, or if 25% of the employment in the county consists of workers coming from the central counties).

- Non-metro counties are outside the boundaries of metro areas and are further subdivided into Micropolitan Statistical Areas centred on urban clusters of 10,000-50,000 residents, and all remaining non-core counties.

Rural Schools

National Center for Education Statistics (NCES) revised its definition of rural schools in 2006 after working with the Census Bureau to create a new locale classification system to capitalize on improved geocoding technology and the 2000 Office of Management and Budget (OMB) definitions of metro areas that rely less on population size and county boundaries than proximity of an address to an urbanized area. The new classification system has four major local categories— city, suburban, town, and rural —each of which is subdivided into three subcategories. Cities and suburbs are subdivided into the categories small, midsize, or large; towns and rural areas are subdivided by their proximity to an urbanized area into the categories fringe, distant, or remote. These twelve categories are based on several key concepts that Census uses to define an area's urbanicity: principal city, urbanized area, and urban cluster. Rural areas are designated by census as those areas that do not lie inside an urbanized area or urban cluster. NCES has classified all schools into one of these twelve categories based on schools' actual addresses and their corresponding coordinates of latitude and longitude. Not only does this mean that the location of any school can be identified precisely, but also that distance measures can be used to identify town and rural subtypes."

Rural Health

Rural health definitions can be different for establishing underserved areas or health care accessibility in rural areas of the United States. According to the handbook, Definitions of Rural: A Handbook for Health Policy Makers and Researchers, "Residents of metropolitan counties are generally thought to have easy access to the relatively concentrated health services of the county's central areas. However, some metropolitan

counties are so large that they contain small towns and rural, sparsely populated areas that are isolated from these central clusters and their corresponding health services by physical barriers." To address this type of rural area, "Harold Goldsmith, Dena Puskin, and Dianne Stiles (1992) described a methodology to identify small towns and rural areas within large metropolitan counties (LMCs) that were isolated from central areas by distance or other physical features." This became the Goldsmith Modification definition of rural. "The Goldsmith Modification has been useful for expanding the eligibility for federal programs that assist rural populations—to include the isolated rural populations of large metropolitan counties."

United Kingdom

In the UK, "rural" is defined by the government Department for Environment, Food and Rural Affairs (DEFRA), using population data from the latest census, such as the United Kingdom Census 2001. These definitions have various grades, but the upper point is any local government area with less than 26% of its population living in a market town ("market town" being defined as any settlement which has permission to hold a street market).

Rural Health

An NHS patient is defined as rural if they live more than 5 km (3.1 mi) from either a doctor or a dispensing chemist. This is important for defining whether the patient is expected to collect their own medicines. While doctors' surgeries in towns will not have a dispensing chemist, instead expecting patients to use a high-street chemist to purchase their prescription medicines, in rural village surgeries, an NHS dispensary will be built into the same building).

Australia

In Australia rural health has been influenced by issues with getting medical staff to stay in remote outback areas. The state of Queensland has used a unique model of nursing care in rural and remote "outback " hospitals. A RIPRN is a Registered Nurse that often works where there is limited

medical coverage. They offer a greater diversity of skills and knowledge than other rural RNs. In many cases functioning between the traditional level of RN and Medical Doctor.

Rural Economics

Rural economics is the study of rural economies, including:

- farm and non-farm industry
- economic growth, development, and change
- size and spatial distribution of production and household units and interregional trade
- land use
- housing and non-housing as to supply and demand
- migration and (de)population
- finance
- government policies as to development, investment, regulation, and transportation
- general-equilibrium and welfare analysis, for example, system interdependencies and rural-urban income disparities

Rural Markets

Rural Markets are defined as those segments of overall market of any economy, which are distinct from the other types of markets like stock market, commodity markets or Labour economics. Rural Markets constitute an important segment of overall economy, for example, in the USA, out of about 3000 countries, around 2000 counties are rural, that is, non-urbanized, with population of 55 million. Typically, a rural market will represent a community in a rural area with a population of 2500 to 30000[1].

Significance

In recent years, rural markets have acquired significance in countries like China and India, as the overall growth of the economy has resulted into substantial increase in the purchasing power of the rural communities. On account of the green revolution in India, the rural areas are consuming a large

quantity of industrial and urban manufactured products. In this context, a special marketing strategy, namely, *rural marketing* has taken shape.

Sometimes, *rural marketing* is confused with *agricultural marketing* – the later denotes marketing of produce of the rural areas to the urban consumers or industrial consumers, whereas rural marketing involves delivering manufactured or processed inputs or services to rural producers or consumers. Also, when we consider the scenario of India and China, there is a picture that comes out,huge market for the developed products as well as the labour support. This has led to the change in the mindset of the marketers to move to these parts of the world.

Also rural market is getting an importance because of the saturation of the urban market.

As due to the competition in the urban market, the market is more or so saturated as most of the capacity of the purchasers have been targeted by the marketers.So the marketers are looking for extending their product categories to an unexplored market i.e. the rural market.

This has also led to the CSR activities being done by the corporate to help the poor people attain some wealth to spend on their product categories. Here we can think of HLL (now, HUL) initiatives in the rural India. One of such project is the Project Shakti, which is not only helping their company attain some revenue but also helping the poor women of the village to attain some money which is surely going to increase their purchasing power.

Also this will increase their brand loyalty as well as recognition in that area. Similarly we can think of the ITC E-Chaupal, which is helping the poor farmers get all the information about the weather as well as the market price of the food grains they are producing.

In other view these activities are also helping the companies increase their brand value. So as it is given above the significance of the rural market has increased due to the saturation of the urban market as well as in such conditions the company which will lead the way will be benefited as shown by the success of HUL and ITC initiatives.

Economics

Affordable Housing

Affordable housing is a term used to describe dwelling units whose total housing costs are deemed "affordable" to those that have a median income. Although the term is often applied to rental housing that is within the financial means of those in the lower income ranges of a geographical area, the concept is applicable to both renters and purchasers in all income ranges. This article focuses on the affordability of owner-occupied and private rental housing as social housing is a specialised tenure.

In the United States and Canada, a commonly accepted guideline for housing affordability is a housing cost that does not exceed 30% of a household's gross income. Housing costs considered in this guideline generally include taxes and insurance for owners, and usually include utility costs. When the monthly carrying costs of a home exceed 30–35% of household income, then the housing is considered unaffordable for that household.

Supply and Demand

In the United States, a key element in determining affordable housing is acceptable commuting time/distance. In Southern California, for example, a household's inhabitants must decide whether to pay more for housing to keep commuting time and expense low, or to accept a long and/or expensive commute in order to obtain "better" housing.

Household Income

A primary factor in housing affordability is household income. The most common approach is to consider the percentage of income that a household is spending on housing costs.

Another method of studying affordability looks at the regular hourly wage of full-time workers who are paid only the minimum wage (as set by their local, regional, or national government). The hope is that a full-time worker will be able to afford at least a small apartment in the area that he or she works in.

Other countries look at those living in relative poverty, which is usually defined as making less than 60% of the median household income. In their policy reports, they consider the presence or absence of housing for people making 60% of the median income.

Housing Costs

The other major factor is the measurement of housing costs.

Some organization and agencies consider the cost of purchasing a single-family home; others look exclusively at the cost of renting an apartment.

Many U.S. studies, for example, focus primarily on the median cost of renting a two-bedroom apartment in a large apartment complex for a new tenant. These studies often lump together luxury apartments and slums, as well as desirable and undesirable neighborhoods. While this practice is known to distort the true costs, it is difficult to provide accurate information for the wide variety of situations without the report being unwieldy.

Normally, only legal, permitted, separate housing is considered when calculating the cost of housing. The low rent costs for a room in a single family home, or an illegal garage conversion, or a college dormitory are generally excluded from the calculation, no matter how many people in an area live in such situations. Because of this study methodology, median housing costs tend to be slightly inflated.

Costs are generally considered on a cash (not accrual) basis. Thus a person making the last payment on a large home mortgage might live in officially unaffordable housing one month, and very affordable housing the following month, when the mortgage is paid off.

This distortion can be significant in areas where real estate costs are high, even if incomes are similarly high, because a high income allows a higher proportion of the income to be dedicated towards buying an expensive home without endangering the household's ability to buy food or other basic necessities. Furthermore, the absolute availability of housing

is not generally considered in the calculation of affordable housing. In a depressed or sparsely settled rural area, for example, the predicted price of the canonical median two-bedroom apartment may be quite easily affordable even to a minimum-wage worker– if only any apartments had ever been built.

Cost of the "Right to Build"

An article in the November 2007 issue of Atlantic Monthly reported on a study of the cost of obtaining the "right to build" (i.e. a building permit, red tape, bureaucracy, etc.) in different U.S. cities. The "right to build" cost does not include the cost of the land or the cost of constructing the house. The study was conducted by Harvard economists Edward Glaeser and Kristina Tobio. According to the chart accompanying the article, the cost of obtaining the "right to build" adds approximately $600,000 to the cost of each new house that is built in San Francisco.

Consequences of Affordable Housing Shortages

A common measure of community-wide affordability is the number of homes that a household with a certain percentage of median income can afford.

For example, in a perfectly balanced housing market, the median household (and the half of the households which are wealthier) could officially afford the median housing option, while those poorer than the median home could not afford the median home. 50% affordability for the median home indicates a balanced market.

A community might track the percentage of its housing that is affordable to households earning 60% of median income. In addition to the distress it causes families who cannot easily find a place to live, lack of affordable housing is considered by many urban planners to have negative effects on a community's overall health. For example, lack of affordable housing can make low-cost labour more scarce, and increase demands on transportation systems (as workers travel longer distances between jobs and affordable housing). Housing cost increases in U.S. cities have been linked to declines in enrollment at local schools.

Policy Tools

Numerous policies in the U.S. and abroad have been designed to address the problem of inadequate supplies of affordable housing. Sophisticated secondary market mechanisms, inclusionary zoning, and land banking are three prominent tools, as well as tax and fiscal policies that result in reducing the cost of mortgages and the cost of borrowing. Other more recently promoted policy tools include relaxation of prohibitions against accessory dwelling units, and reduction of the amount of parking that must be built for a new structure.

Affordable housing is a controversial reality of contemporary life, for gains in affordability often result from expanding land available for housing or increasing the density of housing units in a given area. Ensuring a steady supply of affordable housing means ensuring that communities weigh real and perceived livability impacts against the sheer necessity of affordability. The process of weighing the impacts of locating affordable housing is quite contentious, and is laden with race and class implications.

Affordability by Country

United States

Comprehensive data for the most affordable and least affordable places in the U.S. is published each year by an affordable housing non-profit organization, the National Low Income Housing Coalition. The NLIHC promotes a guideline of 30% of household income as the upper limit of affordability.

Under this definition, most people in the United States have secured affordable housing arrangements. In 2001, the median household paid $658 per month in total housing costs. A total of 20% of households are deemed to be living in unaffordable housing: Nine percent of all households are renters in unaffordable housing, and eleven percent of all households are homeowners with high housing costs.

In the 2000 U.S. Census, the median homeowner with a mortgage (70% of homeowners and 48% of census respondents) spent $1,088 each month, or 21.7% of household income, on

housing costs. The median homeowner without a mortgage (30% of all homeowners (80% of elderly homeowners) and 20% of respondents) spent $295 per month, or 10.5% of household income, on housing costs. Renters in 2001 (32% of respondents) spent $633 each month, or 29% of household income, on housing costs.

Housing Subsidies by Country

Australia

Australians in receipt of many social security benefits from Centrelink who rent housing from a private landlord are eligible for rent assistance. Rent assistance is a subsidy paid directly to the tenant in addition to the basic Centrelink benefit such as the Age Pension or the Disability Pension. The amount of rent assistance paid depends on the amount of rent payable, whether the tenant has dependents and how many dependents there are. Tenants who live in public housing in Australia are not eligible for rent assistance.

Australians buying a home for the first time are eligible for a first home owner grant. These grants were introduced on 1 July 2000 and are jointly funded by the Commonwealth government and the state and territory governments. First home buyers are currently eligible for grants of $14,000 (for established dwellings) or $21,000 (for newly constructed dwellings) to alleviate the costs of entering the housing market.

The Commonwealth government in 2008 introduced first home saver accounts, whereby those saving for a new home are eligible for government contributions to their savings account, subject to conditions.

United Kingdom

The United Kingdom has a long tradition of promoting affordable social rented housing. This may be owned by local councils or housing associations. There are also a range of affordable home ownership options, including shared ownership (where a tenant rents part share in the property from a social landlord, and owns the remainder). The government has also attempted to promote the supply of owner occupied affordable

stock for purchase, principally by using the land-use planning system to require that housing developers provide a proportion of lower cost housing within new developments. This approach is commonly known as inclusionary zoning and the current mechanism for securing the provision of affordable housing as part of a planning application for new housing development is through the use of a S.106 Agreement. In Scotland a Section 75 Agreement (Section 75 of the 1997 Act) is the equivalent of England's S.106 agreement.

A high proportion of homes in the UK were previously council-owned, but the numbers have been reduced since the early 1980s due to initiatives of the Thatcher government that restricted council housing construction and provided financial and policy support to other forms social housing. In 1980, the Conservative government of Margaret Thatcher introduced the Right to Buy scheme, offering council tenants the opportunity to purchase their housing at a discount of up to 60% (70% on leasehold homes such as flats). Alongside Right to Buy, council-owned stock was further diminished as properties were transferred to housing associations. Council Tenants in some instances have chosen to transfer management of the properties to arms-length non-profit organisations. The tenants still remained Council tenants, and the housing stock still remained the property of the Council. This change in management was encouraged by extra funding from central government to invest in the housing stock under the Decent Homes Programme. The program required council housing to be brought up to a set standard was combined with restrictions on the amounts that councils could borrow and led to an increase in such arms length management organisations being set up. In some areas, significant numbers of council houses were demolished as part of urban regeneration programmes, due to the poor quality of stock, low levels of demand and social problems.

In rural areas where local wages are low and house prices are higher (especially in regions with holiday homes) there are especial problems. Planning restrictions severely limit rural development. but if there is evidence of need then Exception sites can be used for people with a local connection. This evidence is normally provided by a housing Needs survey carried out by

a Rural Housing Enabler working for the local Rural Community Council.

Housing associations are not-for-profit organisations with a history that goes back before the start of the 20th century. The number of homes under their ownership grew significantly from the 1980s as successive governments sought to make them the principal form of social housing, in preference to local authorities. Many of the homes previously under the ownership of local authorities have been transferred newly established housing associations, including some of the largest in the country. Despite being not-for-profit organisations, housing association rents are typically higher than for council housing. Renting a home through a housing association can in some circumstances prove costlier than purchasing a similar property through a mortgage.

United States

The federal government in the U.S. provides subsidies to make housing more affordable. Financial assistance is provided for homeowners through the mortgage interest tax deduction and for lower income households through housing subsidy programs. In the 1970s the federal government spent similar amounts on tax reductions for homeowners as it did on subsidies for low-income housing. However, by 2005, tax reductions had risen to $120 billion per year, representing nearly 80 percent of all federal housing assistance. The Advisory Panel on Federal Tax Reform for President Bush proposed reducing the home mortgage interest deduction in a 2005 report.

Housing assistance from the federal government for lower income households can be divided into three parts:

- "Tenant based" subsidies given to an individual household, known as the Section 8 program
- "Project based" subsidies given to the owner of housing units that must be rented to lower income households at affordable rates
- Public Housing, which is usually owned and operated by the government. (Some public housing projects are managed by subcontracted private agencies)

"Project based" subsidies are also known by their section of the U.S. Housing Act or the Housing Act of 1949, and include Section 8, Section 236, Section 221(d)(3), Section 202 for elderly households, Section 515 for rural renters, Section 514/516 for farmworkers and Section 811 for people with disabilities. There are also housing subsidies through the Section 8 program that are project based. The United States Department of Housing and Urban Development (HUD) and USDA Rural Development administer these programs, and have further information on the particular programs on the agencies' respective web sites: HUD and USDA, Rural Development. HUD and USDA Rural Development programs have ceased to produce large numbers of units since the 1980s. Since 1986, the Low-Income Housing Tax Credit program has been the primary federal program to produce affordable units; however, the housing produced in this program is less affordable than the former HUD programs.

One of the most unique US public housing initiatives was the development of subsidized middle-class housing during the late New Deal (1940-42) under the auspices of the Mutual Ownership Defence Housing Division of the Federal Works Agency under the direction of Colonel Lawrence Westbrook. These eight projects were purchased by the residents after the Second World War and as of 2009 seven of the projects continue to operate as mutual housing corporations owned by their residents. These projects are among the very few definitive success stories in the history of the US public housing effort.

In the U.S., households are commonly defined in terms of the amount of realized income they earn relative to the Area Median Income or AMI. Localized AMI figures are calculated annually based on a survey of comparably-sized households within geographic ranges known as metropolitan statistical areas, as defined by the US Office of Management and Budget. For U.S. housing subsidies, households are categorized by federal law as follows:

- Moderate income households earn between 80% and 120% of AMI.
- Low income households earn between 50% and 80% of AMI.

- Very low income households earn no more than 50% of AMI.

Some states and cities in the United States operate a variety of affordable housing programs, including supportive housing programs, transitional housing programs and rent subsidies as part of public assistance programs. Local and state governments can adapt these income limits when administering local affordable housing programs; however, U.S. federal programs must adhere to the definitions above. For the Section 8 voucher program, the maximum household contribution to rent can be as high as 40% gross income.

Additional Resources

Canada

In Canada, the Social Housing Services Corporation (SHSC) is a leader in providing group services for social housing providers. SHSC was created in the Province of Ontario in 2002 to provide group services for social housing providers (public, non-profit and co-op housing) following the downloading of responsibility for over 270,000 social housing units to local municipalities. It is a non-profit corporation governed by a board of municipal, non-profit and co-op housing representatives. Its mandate is to provide Ontario housing providers and service managers with bulk purchasing, insurance, investment and information services that add significant value to their operations.

With an annual budget of $4.5 million, SHSC and its two subsidiaries, SOHO and SHSC Financial Inc. offers a dedicated insurance program for social housing providers, bulk gas purchasing and an innovative energy efficiency retrofit program which coordinates energy audits, expertise, funding, bulk purchasing of energy-efficient goods, training and education, and data evaluation. SHSC manages and provides investment advice to housing providers on capital reserves valued at more than $390 million. Working closely with other housing sector organizations and non-governmental organizations, SHSC also supports and develops independent housing-related research, including a new Housing Internship program for graduate-

level researchers. Recently there has been a move toward the integration of affordable social housing with market housing and other uses, such as the 2006-10 redevelopment of the Woodward's building site in Vancouver.

Zoning changes in some areas of Canada to permit laneway houses has been part of the EcoDensity movement to permit home owners to create small affordable rental units in their backyards.

United States

Governmental and quasi-governmental agencies that contribute to the work of ensuring the existence of a steady supply of affordable housing in the United States are the U.S. Department of Housing and Urban Development (HUD), USDA Rural Development, the Federal Home Loan Bank, Fannie Mae, and Freddie Mac. Important private sector institutions worth consulting are the National Association of Home Builders and the National Association of Realtors. Valuable research institutions with staff dedicated to the analysis of "affordable housing" includes: The Center for Housing Policy, Brookings Institution, the Urban Institute and the Joint Center for Housing Studies at Harvard University and the Furman Center for Real Estate and Urban Policy at New York University, and the Center on Budget and Policy Priorities. Several of these institutions (the Fannie Mae Foundation, Urban Institute, Brookings Institution Metropolitan Policy Program, Enterprise Community Partners, LISC, the Harvard Joint Center for Housing Studies, and others) partnered to create KnowledgePlex, an online information resource devoted to affordable housing and community development issues. Additional alignments have been established with Starta Development Starta Development to ease the process of funding application with the use of technology.

United Kingdom

All major housing associations are registered with the Housing Corporation, which regulates them and provides grants for development. Housing associations that are registered with the Corporation are also known as Registered Social Landlords.

The Department for Communities and Local Government has responsibility for housing in England. In January 2007 it announced a planned merger between the Housing Corporation and regeneration body English Partnerships to create the Homes and Communities Agency (initially announced as "Communities England"). This new body is likely to have access to more than £4 billion in resources.

In contrast to the rest of the United Kingdom, social housing in Northern Ireland is regulated by the Northern Ireland Housing Executive, which was established to take on ownership of former council stock and prevent sectarian allocation of housing to people from one religion.

Housing Bubble

A real estate bubble or property bubble (or housing bubble for residential markets) is a type of economic bubble that occurs periodically in local or global real estate markets. It is characterized by rapid increases in valuations of real property such as housing until they reach unsustainable levels relative to incomes and other economic elements, followed by a reduction in price levels.

Whether real estate bubbles can or should be identified or prevented, and whether they have broader macroeconomic importance or not are debated within and between different schools of economic thought, as detailed below. The financial crisis of 2007–2010 was related to the collapse of real estate bubbles, notably in the United States.

Identification and Prevention

As with all types of economic bubbles, whether real estate bubbles can be identified or prevented is contentious. Bubbles are generally not contentious in hindsight, after a peak and crash. Within mainstream economics, some argue that real estate bubbles cannot be identified as they occur and cannot or should not be prevented, with government and central bank policy rather cleaning up after the bubble bursts.

Others within mainstream economics and in heterodox economics, such as American economist Robert Shiller and British magazine *The Economist,* argue that housing market

indicators can be used to identify real estate bubbles. Some argue further that governments and central banks can and should take action to prevent bubbles from forming, or to deflate existing bubbles.

Macroeconomic Significance

Within mainstream economics, economic bubbles, and in particular real estate bubbles, are not considered major concerns. Within some schools of heterodox economics, by contrast, real estate bubbles are considered of critical importance and a fundamental cause of financial crises and ensuing economic crises.

The mainstream economic view is that economic bubbles primarily effect first a temporary boost in wealth, and secondly a redistribution of wealth. When prices go up, there is a positive wealth effect – property owners feel richer, and hence spend more, and when prices go down, there is a negative wealth effect – property owners feel poorer, and hence spend less. It is argued that these effects can be smoothed by counter-cyclical monetary and fiscal policy. Secondly, the ultimate effect on owners who bought before the bubble formed and did not sell is zero – throughout, they owned the property. Conversely, those who bought when low and sold high profited, while those who bought high and sold low or held until the price had fallen lost money, though this ultimately is simply redistribution of wealth and, it is argued, of little economic significance.

In some schools of heterodox economics, notably Austrian economics and Post-Keynesian economics, real estate bubbles are seen as an example of credit bubbles (pejoratively, speculative bubbles), because property owners generally use borrowed money to purchase property, in the form of mortgages. These are then argued to cause financial and hence economic crises. This is first argued empirically – numerous real estate bubbles have been followed by economic slumps, and it is argued that there is a cause-effect relationship between these.

Austrian business cycle theory takes a supply-side view, arguing that real estate bubbles cause misallocation of resources – too many houses and offices are built, and too many resources (materials and labour) are wasted in building unneeded

buildings. Further, this distorts the industrial base, yielding an excess of homebuilders who must then retrain and retool when the bubble bursts, this transition between non-productive and productive uses of resources (and the malinvestment during the lead-up) being a proximate cause of the resulting economic slump.

Fred Foldvary, economist at Santa Clara University, has synthesized the Austrian-school theory of the cycle with the land-based theory of Henry George. His proposition is that this geo-Austrian theory fits the 18-year real estate cycle as discovered by real estate economist Homer Hoyt.

The Post-Keynesian theory of debt deflation takes a demand-side view, arguing that property owners not only *feel* richer, but *borrow* against the increased value of their property (as via a home equity line of credit), or borrow money to speculate in property, buying property with borrowed money in the expectation that it will rise in value – this last view is associated with Hyman Minsky and his Financial Instability Hypothesis. When the bubble bursts, the value of the property decreases but, crucially, the level of debt does not. The burden of repaying or defaulting on this debt is argued to depress aggregate demand and be the proximate cause of the ensuing economic slump.

Recent Real Estate Bubbles

The crash of the Japanese asset price bubble from 1990 on has been very damaging to the Japanese economy and the lives of many Japanese who have lived through it, as is also true of the crash in 2005 of the real estate bubble in China's largest city, Shanghai. Unlike a stock market crash following a bubble, a real-estate "crash" is usually a slower process, because the real estate market is less liquid than the stock market. Other sectors such as office, hotel and retail generally move along with the residential market, being affected by many of same variables (incomes, interest rates, etc.) and also sharing the "wealth effect" of booms. Therefore this article focuses on housing bubbles and mentions other sectors only when their situation differs from housing.

As of 2007, real estate bubbles had existed in the recent past or were widely believed to still exist in many parts of the

world, especially in the United States, Argentina, Britain, Netherlands, Italy, Australia, New Zealand, Ireland, Spain, Lebanon, France, Poland, South Africa, Israel, Greece, Bulgaria, Croatia, Canada, Norway, Singapore, South Korea, Sweden, Baltic states, India, Romania, Russia, Ukraine and China. Then U.S. Federal Reserve Chairman Alan Greenspan said in mid-2005 that "at a minimum, there's a little 'froth' (in the U.S. housing market) ... it's hard not to see that there are a lot of local bubbles." The *Economist* magazine, writing at the same time, went further, saying "the worldwide rise in house prices is the biggest bubble in history". Real estate bubbles are invariably followed by severe price decreases (also known as a house price crash) that can result in many owners holding negative equity (a mortgage debt higher than the current value of the property).

Housing Market Indicators

In attempting to identify bubbles before they burst, economists have developed a number of financial ratios and economic indicators that can be used to evaluate whether homes in a given area are fairly valued. By comparing current levels to previous levels that have proven unsustainable in the past (*i.e.* led to or at least accompanied crashes), one can make an educated guess as to whether a given real estate market is experiencing a bubble. Indicators describe two interwoven aspects of housing bubble: a valuation component and a debt (or leverage) component. The valuation component measures how expensive houses are relative to what most people can afford, and the debt component measures how indebted households become in buying them for home or profit (and also how much exposure the banks accumulate by lending for them). A basic summary of the progress of housing indicators for U.S. cities is provided by *Business Week*.

Housing Affordability Measures

- The *price to income ratio* is the basic affordability measure for housing in a given area. It is generally the ratio of median house prices to median familial disposable incomes, expressed as a percentage or as years of income. It is sometimes compiled separately

for first time buyers and termed *attainability*. This ratio, applied to individuals, is a basic component of mortgage lending decisions. According to a back-of-the-envelope calculation by Goldman Sachs, a comparison of median home prices to median household income suggests that U.S. housing in 2005 is overvalued by 10%. "However, this estimate is based on an average mortgage rate of about 6%, and we expect rates to rise," the firm's economics team wrote in a recent report. According to Goldman's figures, a one-percentage-point rise in mortgage rates would reduce the fair value of home prices by 8%.

- The *deposit to income ratio* is the minimum required downpayment for a typical mortgage, expressed in months or years of income. It is especially important for first-time buyers without existing home equity; if the downpayment becomes too high then those buyers may find themselves "priced out" of the market. For example, as of 2004 this ratio was equal to one year of income in the UK.

Another variant is what the National Association of Realtors calls the "housing affordability index" in its publications. (The NAR's methodology was criticized by some analysts as it does not account for inflation. Other analysts, however, consider the measure appropriate, because both the income and housing cost data is expressed in terms that include inflation and, all things being equal, the index implicitly includes inflation). In either case, the usefulness of this ratio in identifying a bubble is debatable; while downpayments normally increase with house valuations, bank lending becomes increasingly lax during a bubble and mortgages are offered to borrowers who would not normally qualify for them.

- The *Affordability Index* measures the ratio of the actual monthly cost of the mortgage to take-home income. It is used more in the United Kingdom where nearly all mortgages are variable and pegged to bank lending rates. It offers a much more realistic measure of the ability of households to afford housing than the crude price to income ratio. However it is more difficult to

calculate, and hence the price to income ratio is still more commonly used by pundits. In recent years, lending practices have relaxed, allowing greater multiples of income to be borrowed. Some speculate that this practice in the longterm cannot be sustained and may ultimately lead to unaffordable mortgage payments, and repossession for many.

- The *Median Multiple* measures the ratio of the median house price to the median annual household income. This measure has historically hovered around a value of 3.0 or less, but in recent years has risen dramatically, especially in markets with severe public policy constraints on land and development. The Demographia International Housing Affordability Survey uses the Median Multiple in its 6-nation report.

Housing debt measures

- The *housing debt to income ratio* or *debt-service ratio* is the ratio of mortgage payments to disposable income. When the ratio gets too high, households become increasingly dependent on rising property values to service their debt. A variant of this indicator measures total home ownership costs, including mortgage payments, utilities and property taxes, as a percentage of a typical household's monthly pre-tax income; for example see RBC Economics' reports for the Canadian markets.
- The *housing debt to equity ratio* (not to be confused with the corporate debt to equity ratio), also called loan to value, is the ratio of the mortgage debt to the value of the underlying property; it measures financial leverage. This ratio increases when homeowners refinance and tap into their home equity through a second mortgage or home equity loan. A ratio of 1 means 100% leverage; higher than 1 means negative equity.

Housing Ownership and Rent Measures

- The *ownership ratio* is the proportion of households who own their homes as opposed to renting. It tends

to rise steadily with incomes. Also, governments often enact measures such as tax cuts or subsidized financing to encourage and facilitate home ownership. If a rise in ownership is not supported by a rise in incomes, it can mean either that buyers are taking advantage of low interest rates (which must eventually rise again as the economy heats up) or that home loans are awarded more liberally, to borrowers with poor credit. Therefore a high ownership ratio combined with an increased rate of subprime lending may signal higher debt levels associated with bubbles.

- The *price-to-earnings ratio* or *P/E ratio* is the common metric used to assess the relative valuation of equities. To compute the P/E ratio for the case of a rented house, divide the price of the house by its potential earnings or net income, which is the market annual rent of the house minus expenses, which include maintenance and property taxes. This formula is:

$$\text{House P/E ratio} = \frac{\text{House price}}{\text{Rent} - \text{Expenses}}$$

The house price-to-earnings ratio provides a direct comparison to P/E ratios used to analyze other uses of the money tied up in a home. Compare this ratio to the simpler but less accurate *price-rent ratio* below.

- The *price-rent ratio* is the average cost of ownership divided by the received rent income (if buying to let) or the estimated rent that would be paid if renting (if buying to reside)

$$\text{House Price-Rent ratio} = \frac{\text{House price}}{\text{Monthly Rent x 12}}$$

The latter is often measured using the "owner's equivalent rent" numbers published by the Bureau of Labour Statistics. It can be viewed as the real estate equivalent of stocks' price-earnings ratio; in other terms it measures how much the buyer is paying for each dollar of received rent income (or dollar saved from rent spending). Rents, just like corporate and

personal incomes, are generally tied very closely to supply and demand fundamentals; one rarely sees an unsustainable "rent bubble" (or "income bubble" for that matter). Therefore a rapid increase of home prices combined with a flat renting market can signal the onset of a bubble. The U.S. price-rent ratio was 18% higher than its long-run average as of October 2004.

- The *gross rental yield*, a measure used in the United Kingdom, is the total yearly gross rent divided by the house price and expressed as a percentage:

$$\text{Gross Rental Yield} = \frac{\text{Monthly Rent x 12}}{\text{House Price}} \text{ x } 100\%$$

This is the reciprocal of the house price-rent ratio. The *net rental yield* deducts the landlord's expenses (and sometimes estimated rental voids) from the gross rent before doing the above calculation; this is the reciprocal of the house P/E ratio.

Because rents are received throughout the year rather than at its end, both the gross and net rental yields calculated by the above are somewhat less than the true rental yields obtained when taking into account the monthly nature of rental payments.

- The *occupancy rate* (opposite: *vacancy rate*) is essentially the number of occupied units divided by the total number of units in a given region (in commercial real estate, it is usually expressed in terms of area such as square meters for different grades of buildings). A low occupancy rate means that the market is in a state of oversupply brought about by speculative construction and purchase. In this context, supply-and-demand numbers can be misleading: sales demand exceeds supply, but rent demand does not.

Housing Price Indices

Measures of house *price* are also used in identifying housing bubbles; these are known as house price indices (HPIs).

A noted series of HPIs for the United States are the Case–Shiller indices, devised by American economists Karl Case, Robert Shiller, and Allan Weiss. As measured by the Case–

Shiller index, the US experienced a housing bubble peaking in the second quarter of 2006 (2006 Q2).

Real Estate Bubbles in the 2000s

As of 2006, several areas of the world are thought by some to be in a bubble state, although the subject is highly controversial. This hypothesis is based on similar patterns in real estate markets of a wide variety of countries. This includes similar patterns of overvaluation and excessive borrowing based on those overvaluations.

Some economists maintain that there is not enough similarity to assert a world trend. Others assert that there are enough common characteristics to call it a broad pattern; the reasons for such a pattern can be attributed to any of a number of macroeconomic trends. One such trend might be the rapid growth of developing economies such as the BRIC group. This has caused significant growth in monetary reserves and savings in those countries, which in turn has made possible extension of credit elsewhere.

The subprime mortgage crisis, with its accompanying impacts and effects on economies in various nations, has given some credence to the idea that these trends might have some common characteristics.

United States Housing Bubble

The United States housing bubble is an economic bubble affecting many parts of the United States housing market, including areas of California, Florida, Nevada, Arizona, Colorado, Michigan, Utah, Idaho, Illinois, Ohio, Georgia, Indiana, Virginia, Maryland, Oregon, Rhode Island, New Jersey, Tennessee, Arkansas, New Hampshire, Massachusetts and Hawaii [1] housing prices peaked in early 2005, started to decline in 2006 and 2007, and may not yet have hit bottom. On December 30, 2008 the Case-Shiller home price index reported its largest price drop in its history. Increased foreclosure rates in 2006–2007 among U.S. homeowners led to a crisis in August 2008 for the subprime, Alt-A, collateralized debt obligation (CDO), mortgage, credit, hedge fund, and foreign bank markets. In October 2007, the U.S. Secretary of the

Treasury called the bursting housing bubble "the most significant risk to our economy."

Any collapse of the U.S. Housing Bubble has a direct impact not only on home valuations, but the nation's mortgage markets, home builders, real estate, home supply retail outlets, Wall Street hedge funds held by large institutional investors, and foreign banks, increasing the risk of a nationwide recession. Concerns about the impact of the collapsing housing and credit markets on the larger U.S. economy caused President George W. Bush and the Chairman of the Federal Reserve Ben Bernanke to announce a limited bailout of the U.S. housing market for homeowners who were unable to pay their mortgage debts.

In 2008 alone, the United States government allocated over $900 billion to special loans and rescues related to the US housing bubble, with over half going to the quasi-government agencies of Fannie Mae, Freddie Mac, and the Federal Housing Administration. On December 24, 2009 the Treasury Department made an unprecedented announcement that it would be providing Fannie Mae and Freddie Mac unlimited financial support for the next three years despite acknowledging losses in excess of $400 billion so far. Treasury has been criticized for encroaching on spending powers that are enumerated for Congress alone by the US constitution, and for violating limits imposed by the Housing and Economic Recovery Act of 2008.

Background

Housing bubbles may occur in local or global real estate markets. In their late stages, they are typically characterized by rapid increases in the valuations of real property until unsustainable levels are reached relative to incomes, price-to-rent ratios, and other economic indicators of affordability. This may be followed by decreases in home prices that result in many owners finding themselves in a position of negative equity—a mortgage debt higher than the value of the property. The underlying causes of the housing bubble are complex. Factors include historically low interest rates, lax lending standards, and a speculative fever. This bubble may be related to the stock market or dot-com bubble of the 1990s. This bubble

roughly coincides with the real estate bubbles of the United Kingdom, Hong Kong, Spain, Poland, Hungary and South Korea.

Bubbles can be definitively identified only in hindsight after a market correction, which in the U.S. housing market began in 2005–2006. Former U.S. Federal Reserve Board Chairman Alan Greenspan said "We had a bubble in housing", and also said in the wake of the subprime mortgage and credit crisis in 2007, "I really didn't get it until very late in 2005 and 2006." The mortgage and credit crisis was caused by the inability of a large number of home owners to pay their mortgages as their low introductory-rate (sub-prime) mortgages reverted to regular interest rates. Freddie Mac CEO Richard Syron concluded, "We had a bubble", and concurred with Yale economist Robert Shiller's warning that home prices appear overvalued and that the correction could last years, with trillions of dollars of home value being lost. Greenspan warned of "large double digit declines" in home values "larger than most people expect." Problems for home owners with good credit surfaced in mid-2007, causing the U.S.'s largest mortgage lender, Countrywide Financial, to warn that a recovery in the housing sector was not expected to occur at least until 2009 because home prices were falling "almost like never before, with the exception of the Great Depression." The impact of booming home valuations on the U.S. economy since the 2001–2002 recession was an important factor in the recovery, because a large component of consumer spending was fueled by the related refinancing boom, which allowed people to both reduce their monthly mortgage payments with lower interest rates and withdraw equity from their homes as their value increased.

Timeline

Identifying the Housing Bubble

Although many people claim that an economic bubble is difficult to identify except in hindsight, numerous economic and cultural factors led several economists (especially in late 2004 and early 2005) to argue that a housing bubble existed in the U.S. In the 2004 article "Bush's House of Cards" in The Nation, Dean Baker identified the nature and depth of the housing bubble and the political reasons it was being ignored.

Claims that there was a housing bubble were contested by many at the time, particularly in the period 2004–2006, with some rejecting the "house bubble" label in 2008. Claims that there was no warning of the crisis were further repudiated in an August 2008 article in the *The New York Times*, which reported that in mid-2004 Richard F. Syron, the CEO of Freddie Mac, received a memo from David Andrukonis, the company's former chief risk officer, warning him that Freddie Mac was financing risk-laden loans that threatened Freddie Mac's financial stability. In his memo, Mr. Andrukonis wrote that these loans "would likely pose an enormous financial and reputational risk to the company and the country." The article revealed that more than two-dozen high-ranking executives said that Mr. Syron had simply decided to ignore the warnings. Other cautions came as early as 2001, when the late Federal Reserve governor Edward Gramlich warned of the risks posed by sub-prime mortgages. Reuters reported in October 2007 that a Merrill Lynch analyst too had warned in 2006 that companies could suffer from their subprime investments.

The *Economist* magazine stated, "The worldwide rise in house prices is the biggest bubble in history," so any explanation needs to consider its global causes as well as those specific to the United States. The then Federal Reserve Board Chairman Alan Greenspan said in mid-2005 that "at a minimum, there's a little 'froth' (in the U.S. housing market)... it's hard not to see that there are a lot of local bubbles"; Greenspan admitted in 2007 that *froth* "was a euphemism for a bubble." In early 2006, President Bush said of the U.S. housing boom: "If houses get too expensive, people will stop buying them... Economies should cycle."

On the basis of 2006 market data that were indicating a marked decline, including lower sales, rising inventories, falling median prices and increased foreclosure rates, some economists have concluded that the correction in the U.S. housing market began in 2006. A May 2006 *Fortune* magazine report on the US housing bubble states: "The great housing bubble has finally started to deflate... In many once-sizzling markets around the country, accounts of dropping list prices have replaced tales of waiting lists for unbuilt condos and bidding wars over humdrum

three-bedroom colonials." The chief economist of Freddie Mac and the director of Harvard University's Joint Center for Housing Studies (JCHS) denied the existence of a national housing bubble and expressed doubt that any significant decline in home prices was possible, citing consistently rising prices since the Great Depression, an anticipated increased demand from the Baby Boom generation, and healthy levels of employment. However, some have suggested that the funding received by JCHS from the real estate industry may have affected their judgment. David Lereah, former chief economist of the National Association of Realtors (NAR), distributed "Anti-Bubble Reports" in August 2005 to "respond to the irresponsible bubble accusations made by your local media and local academics." Among other statements, the reports stated that people "should [not] be concerned that home prices are rising faster than family income", that "there is virtually no risk of a national housing price bubble based on the fundamental demand for housing and predictable economic factors", and that "a general slowing in the rate of price growth can be expected, but in many areas inventory shortages will persist and home prices are likely to continue to rise above historic norms." Following reports of rapid sales declines and price depreciation in August 2006, Lereah admitted that he expected "home prices to come down 5% nationally, more in some markets, less in others. And a few cities in Florida and California, where home prices soared to nose-bleed heights, could have 'hard landings'."

National home sales and prices both fell dramatically in March 2007 — the steepest plunge since the 1989 Savings and Loan crisis. According to NAR data, sales were down 13% to 482,000 from the peak of 554,000 in March 2006, and the national median price fell nearly 6% to $217,000 from a peak of $230,200 in July 2006.

John A. Kilpatrick, of Greenfield Advisors, was cited by Bloomberg News on June 14, 2007, on the linkage between increased foreclosures and localized housing price declines: "Living in an area with multiple foreclosures can result in a 10 per cent to 20 per cent decrease in property values." He went on to say, "In some cases that can wipe out the equity of

homeowners or leave them owing more on their mortgage than the house is worth. The innocent houses that just happen to be sitting next to those properties are going to take a hit."

The US Senate Banking Committee held hearings on the housing bubble and related loan practices in 2006, titled "The Housing Bubble and its Implications for the Economy" and "Calculated Risk: Assessing Non-Traditional Mortgage Products". Following the collapse of the subprime mortgage industry in March 2007, Senator Chris Dodd, Chairman of the Banking Committee held hearings and asked executives from the top five subprime mortgage companies to testify and explain their lending practices. Dodd said that "predatory lending practices" had endangered home ownership for millions of people. In addition, Democratic senators such as Senator Charles Schumer of New York were already proposing a federal government bailout of sub-prime borrowers in order to save homeowners from losing their residences.

Causes

National bubble or local bubbles?

Home price appreciation has been non-uniform to such an extent that some economists, including former Fed Chairman Alan Greenspan, have argued that United States was not experiencing a nationwide housing bubble *per se*, but a number of local bubbles. However, in 2007 Greenspan admitted that there was in fact a bubble in the US housing market, and that "all the froth bubbles add up to an aggregate bubble." Despite greatly relaxed lending standards and low interest rates, many regions of the country saw very little growth during the "bubble period". Out of 20 largest metropolitan areas tracked by the S&P/Case-Shiller house price index, six (Dallas, Cleveland, Detroit, Denver, Atlanta, and Charlotte) saw less than 10% price growth in inflation-adjusted terms in 2001–2006. During the same period, seven metropolitan areas (Tampa, Miami, San Diego, Los Angeles, Las Vegas, Phoenix, and Washington DC) appreciated by more than 80%.

However, housing bubbles did not manifest themselves in each of these areas at the same time. San Diego and Los Angeles had maintained consistently high appreciation rates

since late 1990s, whereas the Las Vegas and Phoenix bubbles did not develop until 2003 and 2004 respectively.

Somewhat paradoxically, as the housing bubble deflates some metropolitan areas (such as Denver and Atlanta) have been experiencing high foreclosure rates, even though they did not see much house appreciation in the first place and therefore did not appear to be contributing to the national bubble. This was also true of some cities in the Rust Belt such as Detroit and Cleveland, where weak local economies had produced little house price appreciation early in the decade but still saw declining values and increased foreclosures in 2007. As of January 2009 California, Michigan, Ohio and Florida were the states with the highest foreclosure rates.

By July 2008 year-to-date prices had declined in 24 of 25 U.S. metropolitan areas, with California and the southwest experiencing the greatest price falls. According to the reports, only Milwaukee had seen an increase in house prices after July 2007.

Side Effects

The unprecedented increase in house prices between 1997 and 2005 produced numerous wide-ranging effects in the economy of the United States.

- One of the most direct effects was on the construction of new houses. In 2005, 1,283,000 new single-family houses were sold, compared with an average of 609,000 per year during 1990–1995. The largest home builders, such as D. R. Horton, Pulte, and Lennar, saw their largest share prices and revenues in 2004–2005. D. R. Horton's stock went from $3 in early 1997 to all-time high of $42.82 on July 20, 2005. Pulte Corp's revenues grew from $2.33 billion in 1996 to $14.69 billion in 2005.
- Mortgage equity withdrawals-primarily home equity loans and cash-out refinancings-grew considerably since early 1990s. According to US Federal Reserve estimates, in 2005 homeowners extracted $750 billion of equity from their homes (up from $106 billion in 1996),

spending two thirds of it on personal consumption, home improvements, and credit card debt.

- It is widely believed that the increased degree of economic activity produced by the expanding housing bubble in 2001–2003 was partly responsible for averting a full-scale recession in the U.S. economy following the dot-com bust.
- Rapidly growing house prices and increasing price gradients forced many residents to flee the expensive centers of many metropolitan areas, resulting in the explosive growth of exurbs in some regions. The population of Riverside County, California almost doubled from 1,170,413 in 1990 to 2,026,803 in 2006, due to its relative proximity to San Diego and Los Angeles. On the East Coast, Loudoun County, Virginia, near Washington, DC, saw its population triple between 1990 and 2006.

The real estate market correction of 2006–2007 reversed these trends. As of August 2007, D.R. Horton's and Pulte Corp's shares had fallen to 1/3 of their respective peak levels as new residential home sales fell. Some of the cities and regions that had experienced the fastest growth during 2000–2005 began to experience high foreclosure rates. It was suggested that the weakness of the housing industry and the loss of the consumption that had been driven by the withdrawal of mortgage equity could lead to a recession, but as of mid-2007 the existence of this recession had not yet been ascertained. In March 2008, Thomson Financial reported that the "Chicago Federal Reserve Bank's National Activity Index for February sent a signal that a recession [had] probably begun."

The share prices of Fannie Mae and Freddie Mac plummeted in 2008 as investors worried that they lacked sufficient capital to cover the losses on their $5 trillion portfolio of loans and loan guarantees.

Housing Market Correction

Basing their statements on historic U.S. housing valuation trends, many economists and business writers predicted market corrections ranging from a few percentage points to 50% or

more from peak values in some markets, and although this cooling had yet not affected all areas of the U.S., some warned that it still could, and that the correction would be "nasty" and "severe". Chief economist Mark Zandi of the economic research firm Moody's Economy.com predicted a "crash" of double-digit depreciation in some U.S. cities by 2007–2009. In a paper he presented to a Federal Reserve Board economic symposium in August 2007, Yale University economist Robert Shiller warned, "The examples we have of past cycles indicate that major declines in real home prices—even 50 per cent declines in some places—are entirely possible going forward from today or from the not-too-distant future."

Subprime Mortgage Industry Collapse

In March 2007, the United States' sub-prime mortgage industry collapsed due to higher-than-expected home foreclosure rates, with more than 25 sub-prime lenders declaring bankruptcy, announcing significant losses, or putting themselves up for sale. The manager of the world's largest bond fund, PIMCO, warned in June 2007 that the sub-prime mortgage crisis was not an isolated event and would eventually take a toll on the economy and ultimately have an impact in the form of impaired home prices. Bill Gross, a "most reputable financial guru", sarcastically and ominously criticized the credit ratings of the mortgage-based CDOs now facing collapse:

AAA? You were wooed, Mr. Moody's and Mr. Poor's, by the makeup, those six-inch hooker heels, and a "tramp stamp." Many of these good-looking girls are not high-class assets worth 100 cents on the dollar... [T]he point is that there are hundreds of billions of dollars of this toxic waste... This problem [ultimately] resides in America's heartland, with millions and millions of overpriced homes".

Business Week has featured predictions by financial analysts that the sub-prime mortgage market meltdown would result in earnings reductions for large Wall Street investment banks trading in mortgage-backed securities, especially Bear Stearns, Lehman Brothers, Goldman Sachs, Merrill Lynch, and Morgan Stanley. The solvency of two troubled hedge funds managed by Bear Stearns was imperiled in June 2007 after

Merrill Lynch sold off assets seized from the funds and three other banks closed out their positions with them. The Bear Stearns funds once had over $20 billion of assets, but lost billions of dollars on securities backed by sub-prime mortgages. H&R Block reported that it had made a quarterly loss of $677 million on discontinued operations, which included the sub-prime lender Option One, as well as writedowns, loss provisions for mortgage loans and the lower prices achievable for mortgages in the secondary market. The unit's net asset value had fallen 21% to $1.1 billion as of April 30, 2007. The head of the mortgage industry consulting firm Wakefield Co. warned, "This is going to be a meltdown of unparalleled proportions. Billions will be lost." Bear Stearns pledged up to U.S. $3.2 billion in loans on June 22, 2007 to bail out one of its hedge funds that was collapsing because of bad bets on sub-prime mortgages. Peter Schiff, president of Euro Pacific Capital, argued that if the bonds in the Bear Stearns funds were auctioned on the open market, much weaker values would be plainly revealed. Schiff added, "This would force other hedge funds to similarly mark down the value of their holdings. Is it any wonder that Wall street is pulling out the stops to avoid such a catastrophe?... Their true weakness will finally reveal the abyss into which the housing market is about to plummet." The *New York Times* report connects the hedge fund crisis with lax lending standards: "The crisis this week from the near collapse of two hedge funds managed by Bear Stearns stems directly from the slumping housing market and the fallout from loose lending practices that showered money on people with weak, or subprime, credit, leaving many of them struggling to stay in their homes."

On August 9, 2007, BNP Paribas announced that it could not fairly value the underlying assets in three funds because of its exposure to U.S. subprime mortgage lending markets. Faced with potentially massive (though unquantifiable) exposure, the European Central Bank (ECB) immediately stepped in to ease market worries by opening lines of € 96.8 billion (U.S. $130 billion) of low-interest credit. One day after the financial panic about a credit crunch had swept through Europe, the U.S. Federal Reserve Bank conducted an "open market operation" to inject U.S. $38 billion in temporary reserves

into the system to help overcome the ill effects of a spreading credit crunch, on top of a similar move the previous day. In order to further ease the credit crunch in the U.S. credit market, at 8:15 a.m. on August 17, 2007 the chairman of the Federal Reserve Bank Ben Bernanke decided to lower the discount window rate, which is the lending rate between banks and the Federal Reserve Bank, by 50 basis points to 5.75% from 6.25%. The Federal Reserve Bank stated that the recent turmoil in the U.S. financial markets had raised the risk of an economic downturn.

In the wake of the mortgage industry meltdown, Senator Chris Dodd, Chairman of the Banking Committee held hearings in March 2007 in which he asked executives from the top five sub-prime mortgage companies to testify and explain their lending practices. Dodd said that "predatory lending practices" were endangering home ownership for millions of people. In addition, Democratic senators such as Senator Charles Schumer of New York were already proposing a federal government bailout of sub-prime borrowers like the bailout made in the Savings and Loan crisis, in order to save homeowners from losing their residences. Opponents of such a proposal asserted that a government bailout of sub-prime borrowers is not in the best interests of the U.S. economy because it would simply set a bad precedent, create a moral hazard, and worsen the speculation problem in the housing market.

Lou Ranieri of Salomon Brothers, creator of the mortgage-backed securities market in the 1970s, warned of the future impact of mortgage defaults: "This is the leading edge of the storm. ... If you think this is bad, imagine what it's going to be like in the middle of the crisis." In his opinion, more than $100 billion of home loans are likely to default when the problems seen in the sub-prime industry also emerge in the prime mortgage markets. Former Federal Reserve Chairman Alan Greenspan had praised the rise of the sub-prime mortgage industry and the tools which it uses to assess credit-worthiness in an April 2005 speech. Because of these remarks, as well as his encouragement of the use of adjustable-rate mortgages, Greenspan has been criticized for his role in the rise of the housing bubble and the subsequent problems in the mortgage

industry that triggered the economic crisis of 2008. Concerning the sub-prime mortgage mess, Greenspan later admitted that "I really didn't get it until very late in 2005 and 2006."

On September 13, 2007, the British bank Northern Rock applied to the Bank of England for emergency funds because of liquidity problems related to the subprime crisis. This precipitated a bank run at Northern Rock branches across the UK by concerned customers who took out "an estimated £2bn withdrawn in just three days".

5

Architecture of Housing

Architecture can mean:

- The art and science of designing and erecting buildings and other physical structures.
- The practice of an architect, where architecture means to offer or render professional services in connection with the design and construction of a building, or group of buildings and the space within the site surrounding the buildings, that have as their principal purpose human occupancy or use.
- A general term to describe buildings and other structures.
- A style and method of design and construction of buildings and other physical structures.

A wider definition may comprise all design activity, from the macro-level (urban design, landscape architecture) to the micro-level (construction details and furniture). Architecture is both the process and product of planning, designing and constructing form, space and ambience that reflect functional, technical, social, and aesthetic considerations. It requires the creative manipulation and coordination of material, technology, light and shadow. Architecture also encompasses the pragmatic aspects of realising buildings and structures, including scheduling, cost estimating and construction administration. As documentation produced by architects, typically drawings, plans and technical specifications, architecture defines the

structure and/or behaviour of a building or any other kind of system that is to be or has been constructed.

Architectural works are often perceived as cultural and political symbols and as works of art. Historical civilizations are often identified with their surviving architectural achievements.

Architecture sometimes refers to the activity of designing any kind of system and the term is common in the information technology world.

The Architect

Architects plan, design and review the construction of buildings and structures for the use of people. Architects also coordinate and integrate engineering design, which has as its primary objective the creative manipulation of materials and forms using mathematical and scientific principles.

Theory of Architecture

Historic Treatises

The earliest surviving written work on the subject of architecture is *De architectura*, by the Roman architect Vitruvius in the early 1st century CE. According to Vitruvius, a good building should satisfy the three principles of *firmitatis utilitatis venustatis*, which translates roughly as-

- Durability-it should stand up robustly and remain in good condition.
- Utility-it should be useful and function well for the people using it.
- Beauty-it should delight people and raise their spirits.

According to Vitruvius, the architect should strive to fulfill each of these three attributes as well as possible. Leone Battista Alberti, who elaborates on the ideas of Vitruvius in his treatise, De Re Aedificatoria, saw beauty primarily as a matter of proportion, although ornament also played a part. For Alberti, the rules of proportion were those that governed the idealised human figure, the Golden mean. The most important aspect of beauty was therefore an inherent part of an object, rather

than something applied superficially; and was based on universal, recognisable truths. The notion of style in the arts was not developed until the 16th century, with the writing of Vasari. The treatises, by the 18th century, had been translated into Italian, French, Spanish and English.

In the early nineteenth century, Augustus Welby Northmore Pugin wrote Contrasts (1836) that, as the titled suggested, contrasted the modern, industrial world, which he disparaged, with an idealized image of neo-medieval world. Gothic architecture, Pugin believed, was the only "true Christian form of architecture."

The 19th century English art critic, John Ruskin, in his *Seven Lamps of Architecture*, published 1849, was much narrower in his view of what constituted architecture. Architecture was the "art which so disposes and adorns the edifices raised by men... that the sight of them" contributes "to his mental health, power, and pleasure".

For Ruskin, the aesthetic was of overriding significance. His work goes on to state that a building is not truly a work of architecture unless it is in some way "adorned". For Ruskin, a well-constructed, well-proportioned, functional building needed string courses or rustication, at the very least.

On the difference between the ideals of "architecture" and mere "construction", the renowned 20th C. architect Le Corbusier wrote: "You employ stone, wood, and concrete, and with these materials you build houses and palaces: that is construction. Ingenuity is at work. But suddenly you touch my heart, you do me good. I am happy and I say: This is beautiful. That is Architecture".

Contemporary Concepts of Architecture

The great 19th century architect of skyscrapers, Louis Sullivan, promoted an overriding precept to architectural design: "Form follows function".

While the notion that structural and aesthetic considerations should be entirely subject to functionality was met with both popularity and skepticism, it had the effect of introducing the concept of "function" in place of Vitruvius' "utility". "Function"

came to be seen as encompassing all criteria of the use, perception and enjoyment of a building, not only practical but also aesthetic, psychological and cultural.

Nunzia Rondanini stated, "Through its aesthetic dimension architecture goes beyond the functional aspects that it has in common with other human sciences. Through its own particular way of expressing values, architecture can stimulate and influence social life without presuming that, in and of itself, it will promote social development.'

To restrict the meaning of (architectural) formalism to art for art's sake is not only reactionary; it can also be a purposeless quest for perfection or originality which degrades form into a mere instrumentality".

Among the philosophies that have influenced modern architects and their approach to building design are rationalism, empiricism, structuralism, poststructuralism, and phenomenology.

In the late 20th century a new concept was added to those included in the compass of both structure and function, the consideration of sustainability. To satisfy the contemporary ethos a building should be constructed in a manner which is environmentally friendly in terms of the production of its materials, its impact upon the natural and built environment of its surrounding area and the demands that it makes upon non-sustainable power sources for heating, cooling, water and waste management and lighting.

History

Architecture first evolved out of the dynamics between needs (shelter, security, worship, etc.) and means (available building materials and attendant skills). As human cultures developed and knowledge began to be formalized through oral traditions and practices, architecture became a craft.

Here there is a process of trial and error, and later improvisation or replication of a successful trial. What is termed Vernacular architecture continues to be produced in many parts of the world. Indeed, vernacular buildings make up most of the built world that people experience every day.

Early human settlements were mostly rural. Due to a surplus in production the economy began to expand resulting in urbanization thus creating urban areas which grew and evolved very rapidly in some cases, such as that of Çatal Höyük in Anatolia and Mohenjo Daro in the Indian Subcontinent.

In many ancient civilizations, like the Egyptians' and Mesopotamians', architecture and urbanism reflected the constant engagement with the divine and the supernatural, while in other ancient cultures such as Persia architecture and urban planning was used to exemplify the power of the state.

The architecture and urbanism of the Classical civilizations such as the Greek and the Roman evolved from civic ideals rather than religious or empirical ones and new building types emerged. Architectural styles developed.

Texts on architecture began to be written in the reinassence period. These became canons to be followed in important works, especially religious architecture. Some examples of canons are found in the writings of Vitruvius, the *Kao Gong Ji* of ancient China and Vaastu Shastra of ancient India and Manjusri vasthu vidya sastra of Sri Lanka.

The architecture of different parts of Asia developed along different lines from that of Europe, Buddhist, Hindu and Sikh architecture each having different characteristics. Buddhist architecture, in particular, showed great regional diversity. In many Asian countries a pantheistic religion led to architectural forms that were designed specifically to enhance the natural landscape.

The Medieval Builder

Islamic architecture began in the 7th century CE, developing from a blend of architectural forms from the ancient Middle East and from Byzantium but also developing features to suit the religious and social needs of the society. Examples can be found throughout the Middle East, North Africa and Spain, and were to become a significant stylistic influence on European architecture during the Medieval period.

In Europe, in both the Classical and Medieval periods, buildings were not attributed to specific individuals and the

names of the architects frequently unknown, despite the vast scale of the many religious buildings extant from this period.

During the Medieval period guilds were formed by craftsmen to organize their trade and written contracts have survived, particularly in relation to ecclesiastical buildings. The role of architect was usually one with that of master mason, or *Magister lathomorum* as they are sometimes described in contemporary documents.

Over time the complexity of buildings and their types increased. General civil construction such as roads and bridges began to be built. Many new building types such as schools, hospitals, and recreational facilities emerged.

Renaissance and the Architect

With the Renaissance and its emphasis on the individual and humanity rather than religion, and with all its attendant progress and achievements, a new chapter began. Buildings were ascribed to specific architects-Brunelleschi, Alberti, Michelangelo, Palladio-and the cult of the individual had begun.

There was still no dividing line between artist, architect and engineer, or any of the related vocations, and the appellation was often one of regional preference. At this stage, it was still possible for an artist to design a bridge as the level of structural calculations involved was within the scope of the generalist.

Early Modern and the Industrial Age

With the emerging knowledge in scientific fields and the rise of new materials and technology, architecture and engineering began to separate, and the architect began to concentrate on aesthetics and the humanist aspects, often at the expense of technical aspects of building design.

There was also the rise of the “gentleman architect” who usually dealt with wealthy clients and concentrated predominantly on visual qualities derived usually from historical prototypes, typified by the many country houses of Great Britain that were created in the Neo Gothic or Scottish Baronial styles.

Formal architectural training in the 19th century, for example at Ecole des Beaux Arts in France, gave much emphasis

to the production of beautiful drawings and little to context and feasibility. Effective architects generally received their training in the offices of other architects, graduating to the role from draughtsmen or clerks.

Meanwhile, the Industrial Revolution laid open the door for mass production and consumption. Aesthetics became a criterion for the middle class as ornamented products, once within the province of expensive craftsmanship, became cheaper under machine production.

Vernacular architecture became increasingly ornamental. House builders could use current architectural design in their work by combining features found in pattern books and architectural journals.

Modernism and Reaction of Architecture

The dissatisfaction with such a general situation at the turn of the twentieth century gave rise to many new lines of thought that served as precursors to Modern Architecture. Notable among these is the Deutscher Werkbund, formed in 1907 to produce better quality machine made objects. The rise of the profession of industrial design is usually placed here.

Following this lead, the Bauhaus school, founded in Weimar, Germany in 1919, redefined the architectural bounds prior set throughout history, viewing the creation of a building as the ultimate synthesis—the apex—of art, craft, and technology.

When Modern architecture was first practiced, it was an avant-garde movement with moral, philosophical, and aesthetic underpinnings. Immediately after World War I, pioneering modernist architects sought to develop a completely new style appropriate for a new post-war social and economic order, focused on meeting the needs of the middle and working classes. They rejected the architectural practice of the academic refinement of historical styles which served the rapidly declining aristocratic order.

The approach of the Modernist architects was to reduce buildings to pure forms, removing historical references and ornament in favor of functionalist details. Buildings that displayed their construction and structure, exposing steel beams

and concrete surfaces instead of hiding them behind traditional forms, were seen as beautiful in their own right.

Architects such as Mies van der Rohe, Philip Johnson and Marcel Breuer worked to create beauty based on the inherent qualities of building materials and modern construction techniques, trading traditional historic forms for simplified geometric forms, celebrating the new means and methods made possible by the Industrial Revolution, including steel-frame construction, which gave birth to high-rise superstructures. By mid-century, Modernism had morphed into the International Style, an aesthetic epitomized in many ways by the Twin Towers of New York's World Trade Center.

Many architects resisted Modernism, finding it devoid of the decorative richness of ornamented styles. Yet as the founders of that movement lost influence in the late 1970s, Postmodernism developed as a reaction against the austerity of Modernism. Robert Venturi's contention that a "decorated shed" (an ordinary building which is functionally designed inside and embellished on the outside) was better than a "duck" (a building in which the whole form and its function are tied together) gives an idea of this approach.

Architecture Today

Part of the architectural profession, and also some non-architects, responded to Modernism and Postmodernism by going to what they considered the root of the problem. They felt that architecture was not a personal philosophical or aesthetic pursuit by individualists; rather it had to consider everyday needs of people and use technology to give a livable environment.

The *Design Methodology Movement* involving people such as Christopher Alexander started searching for more people-oriented designs. Extensive studies on areas such as behavioral, environmental, and social sciences were done and started informing the design process.

As the complexity of buildings began to increase (in terms of structural systems, services, energy and technologies), architecture started becoming more multi-disciplinary.

Architecture today usually requires a team of specialist professionals, with the architect being one of many, although usually the team leader.

During the last two decades of the twentieth century and into the new millennium, the field of architecture saw the rise of specializations by project type, technological expertise or project delivery methods. In addition, there has been an increased separation of the 'design' architect from the 'project' architect.

Moving the issues of environmental sustainability into the mainstream is a significant development in the architecture profession. Sustainability in architecture was pioneered in the 1960s by architects such as Sim Van der Ryn, in the 1970s Ian McHarg in the US and Brenda and Robert Vale in the UK and New Zealand. There has been an acceleration in the number of buildings which seek to meet green building sustainable design principles. Sustainable practices that were at the core of vernacular architecture increasingly provide inspiration for environmentally and socially sustainable contemporary techniques. The U.S. Green Building Council's LEED (Leadership in Energy and Environmental Design) rating system has been instrumental in this. An example of an architecturally innovative green building is the Dynamic Tower which will be powered by wind turbines and solar panels.

Civil Engineering

Civil engineering is a professional engineering discipline that deals with the design, construction and maintenance of the physical and naturally built environment, including works such as bridges, roads, canals, dams and buildings. Civil engineering is the oldest engineering discipline after military engineering, and it was defined to distinguish non-military engineering from military engineering. It is traditionally broken into several sub-disciplines including environmental engineering, geotechnical engineering, structural engineering, transportation engineering, municipal or urban engineering, water resources engineering, materials engineering, coastal engineering, surveying, and construction engineering. Civil engineering takes place on all levels: in the public sector from

municipal through to federal levels, and in the private sector from individual homeowners through to international companies.

History of the Civil Engineering Profession

Engineering has been an aspect of life since the beginnings of human existence. The earliest practices of Civil engineering may have commenced between 4000 and 2000 BC in Ancient Egypt and Mesopotamia (Ancient Iraq) when humans started to abandon a nomadic existence, thus causing a need for the construction of shelter. During this time, transportation became increasingly important leading to the development of the wheel and sailing.

Until modern times there was no clear distinction between civil engineering and architecture, and the term engineer and architect were mainly geographical variations referring to the same person, often used interchangeably. The construction of Pyramids in Egypt (circa 2700-2500 BC) might be considered the first instances of large structure constructions. Other ancient historic civil engineering constructions include the Parthenon by Iktinos in Ancient Greece (447-438 BC), the Appian Way by Roman engineers (c. 312 BC), the Great Wall of China by General Meng T'ien under orders from Ch'in Emperor Shih Huang Ti (c. 220 BC) and the stupas constructed in ancient Sri Lanka like the Jetavanaramaya and the extensive irrigation works in Anuradhapura. The Romans developed civil structures throughout their empire, including especially aqueducts, insulae, harbours, bridges, dams and roads.

In the 18th century, the term civil engineering was coined to incorporate all things civilian as opposed to from military engineering. The first self-proclaimed civil engineer was John Smeaton who constructed the Eddystone Lighthouse. In 1771 Smeaton and some of his colleagues formed the Smeatonian Society of Civil Engineers, a group of leaders of the profession who met informally over dinner. Though there was evidence of some technical meetings, it was little more than a social society.

In 1818 the Institution of Civil Engineers was founded in London, and in 1820 the eminent engineer Thomas Telford

became its first president. The institution received a Royal Charter in 1828, formally recognising civil engineering as a profession. Its charter defined civil engineering as 'the art of directing the great sources of power in nature for the use and convenience of man, as the means of production and of traffic in states, both for external and internal trade, as applied in the construction of roads, bridges, aqueducts, canals, river navigation and docks for internal intercourse and exchange, and in the construction of ports, harbours, moles, breakwaters and lighthouses, and in the art of navigation by artificial power for the purposes of commerce, and in the construction and application of machinery, and in the drainage of cities and towns'.

The first private college to teach Civil Engineering in the United States was Norwich University founded in 1819 by Captain Alden Partridge. The first degree in Civil Engineering in the United States was awarded by Rensselaer Polytechnic Institute in 1835. The first such degree to be awarded to a woman was granted by Cornell University to Nora Stanton Blatch in 1905.

History of the Science of Civil Engineering

Civil engineering is the application of physical and scientific principles, and its history is intricately linked to advances in understanding of physics and mathematics throughout history. Because civil engineering is a wide ranging profession, including several separate specialized sub-disciplines, its history is linked to knowledge of structures, materials science, geography, geology, soils, hydrology, environment, mechanics and other fields. Throughout ancient and medieval history most architectural design and construction was carried out by artisans, such as stone masons and carpenters, rising to the role of master builder. Knowledge was retained in guilds and seldom supplanted by advances. Structures, roads and infrastructure that existed were repetitive, and increases in scale were incremental.

One of the earliest examples of a scientific approach to physical and mathematical problems applicable to civil engineering is the work of Archimedes in the 3rd century BC,

including Archimedes Principle, which underpins our understanding of buoyancy, and practical solutions such as Archimedes' screw. Brahmagupta, an Indian mathematician, used arithmetic in the 7th century AD, based on Hindu-Arabic numerals, for excavation (volume) computations.

The Civil Engineer

Education and Licensure

Civil engineers typically possess an academic degree with a major in civil engineering. The length of study for such a degree is usually three to five years and the completed degree is usually designated as a Bachelor of Engineering, though some universities designate the degree as a Bachelor of Science. The degree generally includes units covering physics, mathematics, project management, design and specific topics in civil engineering.

Initially such topics cover most, if not all, of the sub-disciplines of civil engineering. Students then choose to specialize in one or more sub-disciplines towards the end of the degree. While an Undergraduate (BEng/BSc) Degree will normally provide successful students with industry accredited qualification, some universities offer postgraduate engineering awards (MEng/MSc) which allow students to further specialize in their particular area of interest within engineering.

In most countries, a Bachelor's degree in engineering represents the first step towards professional certification and the degree program itself is certified by a professional body. After completing a certified degree program the engineer must satisfy a range of requirements (including work experience and exam requirements) before being certified. Once certified, the engineer is designated the title of Professional Engineer (in the United States, Canada and South Africa), Chartered Engineer (in most Commonwealth countries), Chartered Professional Engineer (in Australia and New Zealand), or European Engineer (in much of the European Union). There are international engineering agreements between relevant professional bodies which are designed to allow engineers to practice across international borders.

The advantages of certification vary depending upon location. For example, in the United States and Canada "only a licensed engineer may prepare, sign and seal, and submit engineering plans and drawings to a public authority for approval, or seal engineering work for public and private clients.". This requirement is enforced by state and provincial legislation such as Quebec's Engineers Act. In other countries, no such legislation exists. In Australia, state licensing of engineers is limited to the state of Queensland. Practically all certifying bodies maintain a code of ethics that they expect all members to abide by or risk expulsion. In this way, these organizations play an important role in maintaining ethical standards for the profession. Even in jurisdictions where certification has little or no legal bearing on work, engineers are subject to contract law. In cases where an engineer's work fails he or she may be subject to the tort of negligence and, in extreme cases, the charge of criminal negligence. An engineer's work must also comply with numerous other rules and regulations such as building codes and legislation pertaining to environmental law.

Careers

There is no one typical career path for civil engineers. Most engineering graduates start with jobs of low responsibility, and as they prove their competence, they are given more and more responsible tasks, but within each subfield of civil engineering, and even within different segments of the market within each branch, the details of a career path can vary. In some fields and firms, entry-level engineers are put to work primarily monitoring construction in the field, serving as the "eyes and ears" of more senior design engineers; while in other areas, entry-level engineers end up performing the more routine tasks of analysis or design and interpretation. More senior engineers can move into doing more complex analysis or design work, or management of more complex design projects, or management of other engineers, or into specialized consulting, including forensic engineering.

Sub-disciplines

In general, civil engineering is concerned with the overall

interface of human created fixed projects with the greater world. General civil engineers work closely with surveyors and specialized civil engineers to fit and serve fixed projects within their given site, community and terrain by designing grading, drainage, pavement, water supply, sewer service, electric and communications supply, and land divisions. General engineers spend much of their time visiting project sites, developing community consensus, and preparing construction plans. General civil engineering is also referred to as site engineering, a branch of civil engineering that primarily focuses on converting a tract of land from one usage to another. Civil engineers typically apply the principles of geotechnical engineering, structural engineering, environmental engineering, transportation engineering and construction engineering to residential, commercial, industrial and public works projects of all sizes and levels of construction.

Coastal Engineering

Coastal engineering is concerned with managing coastal areas. In some jurisdictions the terms sea defence and coastal protection are used to mean, respectively, defence against flooding and erosion. The term coastal defence is the more traditional term, but coastal management has become more popular as the field has expanded to include techniques that allow erosion to claim land.

Construction Engineering

Construction engineering involves planning and execution of the designs from transportation, site development, hydraulic, environmental, structural and geotechnical engineers. As construction firms tend to have higher business risk than other types of civil engineering firms, many construction engineers tend to take on a role that is more business-like in nature: drafting and reviewing contracts, evaluating logistical operations, and closely-monitoring prices of necessary supplies.

Earthquake Engineering

Earthquake engineering covers ability of various structures to withstand hazardous earthquake exposures at the sites of their particular location.

Earthquake engineering is a sub discipline of the broader category of Structural engineering. The main objectives of earthquake engineering are:

- Understand interaction of structures with the shaky ground.
- Foresee the consequences of possible earthquakes.
- Design, construct and maintain structures to perform at earthquake exposure up to the expectations and in compliance with building codes.

Earthquake engineering structure does not necessarily mean “extremely strong” or “expensive”, e.g., El Castillo pyramid at Chichen Itza shown above.

Now, the most powerful and budgetary tool in earthquake engineering is base isolation which pertains to the passive structural vibration control technologies.

Environmental Engineering

Environmental engineering deals with the treatment of chemical, biological, and/or thermal waste, the purification of water and air, and the remediation of contaminated sites, due to prior waste disposal or accidental contamination. Among the topics covered by environmental engineering are pollutant transport, water purification, waste water treatment, air pollution, solid waste treatment and hazardous waste management. Environmental engineers can be involved with pollution reduction, green engineering, and industrial ecology. Environmental engineering also deals with the gathering of information on the environmental consequences of proposed actions and the assessment of effects.

Environmental engineering is the contemporary term for sanitary engineering, though sanitary engineering traditionally had not included much of the hazardous waste management and environmental remediation work covered by the term *environmental engineering*. Some other terms in use are public health engineering and environmental health engineering.

Geotechnical Engineering

Geotechnical engineering is an area of civil engineering

concerned with the rock and soil that civil engineering systems are supported by. Knowledge from the fields of geology, material science and testing, mechanics, and hydraulics are applied by geotechnical engineers to safely and economically design foundations, retaining walls, and similar structures. Environmental concerns in relation to groundwater and waste disposal have spawned a new area of study called geoenvironmental engineering where biology and chemistry are important.

Some of the unique difficulties of geotechnical engineering are the result of the variability and properties of soil. Boundary conditions are often well defined in other branches of civil engineering, but with soil, clearly defining these conditions can be impossible. The material properties and behaviour of soil are also difficult to predict due to the variability of soil and limited investigation. This contrasts with the relatively well defined material properties of steel and concrete used in other areas of civil engineering. Soil mechanics, which define the behaviour of soil, is complex due to stress-dependent material properties such as volume change, stress–strain relationship, and strength.

Water Resources Engineering

Water resources engineering is concerned with the collection and management of water (as a natural resource). As a discipline it therefore combines hydrology, environmental science, meteorology, geology, conservation, and resource management. This area of civil engineering relates to the prediction and management of both the quality and the quantity of water in both underground (aquifers) and above ground (lakes, rivers, and streams) resources. Water resource engineers analyze and model very small to very large areas of the earth to predict the amount and content of water as it flows into, through, or out of a facility. Although the actual design of the facility may be left to other engineers. Hydraulic engineering is concerned with the flow and conveyance of fluids, principally water. This area of civil engineering is intimately related to the design of pipelines, water distribution systems, drainage facilities (including bridges, dams, channels, culverts, levees, storm

sewers), and canals. Hydraulic engineers design these facilities using the concepts of fluid pressure, fluid statics, fluid dynamics, and hydraulics, among others.

Materials Engineering

Another aspect of Civil engineering is materials science. Material engineering deals with ceramics such as concrete, mix asphalt concrete, metals Focus around increased strength, metals such as aluminum and steel, and polymers such as polymethylmethacrylate (PMMA) and carbon fibers.

Materials engineering also consists of protection and prevention like paints and finishes. Alloying is another aspect of material engineering, combining two different types of metals to produce a stronger metal.

Structural Engineering

Structural engineering is concerned with the structural design and structural analysis of buildings, bridges, towers, flyovers, tunnels, off shore structures like oil and gas fields in the sea, and other structures. This involves identifying the loads which act upon a structure and the forces and stresses which arise within that structure due to those loads, and then designing the structure to successfully support and resist those loads.

The loads can be self weight of the structures, other dead load, live loads, moving (wheel) load, wind load, earthquake load, load from temperature change etc. The structural engineer must design structures to be safe for their users and to successfully fulfill the function they are designed for (to be *serviceable*). Due to the nature of some loading conditions, sub-disciplines within structural engineering have emerged, including wind engineering and earthquake engineering.

Design considerations will include strength, stiffness, and stability of the structure when subjected to loads which may be static, such as furniture or self-weight, or dynamic, such as wind, seismic, crowd or vehicle loads, or transitory, such as temporary construction loads or impact. Other considerations include cost, constructability, safety, aesthetics and sustainability.

Surveying

Surveying is the process by which a surveyor measures certain dimensions that generally occur on the surface of the Earth. Surveying equipment, such as levels and theodolites, are used for accurate measurement of angular deviation, horizontal, vertical and slope distances. With computerisation, electronic distance measurement (EDM), total stations, GPS surveying and laser scanning have supplemented (and to a large extent supplanted) the traditional optical instruments. This information is crucial to convert the data into a graphical representation of the Earth's surface, in the form of a map. This information is then used by civil engineers, contractors and even realtors to design from, build on, and trade, respectively. Elements of a building or structure must be correctly sized and positioned in relation to each other and to site boundaries and adjacent structures. Although surveying is a distinct profession with separate qualifications and licensing arrangements, civil engineers are trained in the basics of surveying and mapping, as well as geographic information systems. Surveyors may also lay out the routes of railways, tramway tracks, highways, roads, pipelines and streets as well as position other infrastructures, such as harbors, before construction.

Land Surveying

In the United States, Canada, the United Kingdom and most Commonwealth countries land surveying is considered to be a distinct profession. Land surveyors are not considered to be engineers, and have their own professional associations and licencing requirements. The services of a licenced land surveyor are generally required for boundary surveys (to establish the boundaries of a parcel using its legal description) and subdivision plans (a plot or map based on a survey of a parcel of land, with boundary lines drawn inside the larger parcel to indicated the creation of new boundary lines and roads).

Construction Surveying

Construction surveying is generally performed by specialised technicians. Unlike land surveyors, the resulting plan does not

have legal status. Construction surveyors perform the following tasks:

- Survey existing conditions of the future work site, including topography, existing buildings and infrastructure, and even including underground infrastructure whenever possible;
- Construction surveying (otherwise "lay-out" or "setting-out"): to stake out reference points and markers that will guide the construction of new structures such as roads or buildings for subsequent construction;
- Verify the location of structures during construction;
- As-Built surveying: a survey conducted at the end of the construction project to verify that the work authorized was completed to the specifications set on plans.

Transportation Engineering

Transportation engineering is concerned with moving people and goods efficiently, safely, and in a manner conducive to a vibrant community. This involves specifying, designing, constructing, and maintaining transportation infrastructure which includes streets, canals, highways, rail systems, airports, ports, and mass transit. It includes areas such as transportation design, transportation planning, traffic engineering, some aspects of urban engineering, queueing theory, pavement engineering, Intelligent Transportation System (ITS), and infrastructure management.

Municipal or Urban Engineering

Municipal engineering is concerned with municipal infrastructure. This involves specifying, designing, constructing, and maintaining streets, sidewalks, water supply networks, sewers, street lighting, municipal solid waste management and disposal, storage depots for various bulk materials used for maintenance and public works (salt, sand, etc.), public parks and bicycle paths. In the case of underground utility networks, it may also include the civil portion (conduits and access chambers) of the local distribution networks of electrical and telecommunications services. It can also include the optimizing

of garbage collection and bus service networks. Some of these disciplines overlap with other civil engineering specialties, however municipal engineering focuses on the coordination of these infrastructure networks and services, as they are often built simultaneously, and managed by the same municipal authority.

House Types

Boarding House

A boarding house, is a house (often a family home) in which lodgers rent one or more rooms for one or more nights, and sometimes for extended periods of weeks, months and years. The common parts of the house are maintained, and some services, such as laundry and cleaning, may be supplied. They normally provide "bed and board", that is, at least some meals as well as accommodation. A "lodging house", also known in the United States as a "rooming house", may or may not offer meals. Lodgers legally only obtain a licence to use their rooms, and not exclusive possession, so the landlord retains the right of access.

A fictional example is Sherlock Holmes's shared rooms at 221b Baker Street, of which the landlady Mrs Hudson provided some domestic service.

Years ago boarders would typically share washing, breakfast and dining facilities; in recent years it has become common for each room to have its own washing and toilet facilities. Such boarding houses were often found in English seaside towns (for holidaymakers) and college towns (for students). It was not unusual for there to be one or two elderly long-term residents.

Boarders can often arrange to stay bed-and-breakfast (bed and breakfast only), half-board (bed, breakfast and dinner only) or full-board (bed, breakfast, lunch and dinner). Especially for families on holiday with children, boarding (particularly on a full-board basis) was an inexpensive alternative and certainly much cheaper than staying in all but the cheapest hotels. In the United Kingdom, boarding houses were typically run by landladies, some of whom maintained draconian authority in their houses: the residents might not be allowed to remain on

the premises during the daytime and could be subject to rigorous rules and regulations, stridently enforced.

Bed and breakfast accommodation (B&B), which exists in many countries in the world (e.g. the UK, the USA, Canada, and Australia), is a specialised form of boarding house in which the guests or boarders normally stay only on a bed-and-breakfast basis, and where long-stay residence is rare.

However some B&B accommodation is made available on a long-term basis to UK local authorities who are legally obliged to house persons and families for whom they have no social housing available.

Some such boarding houses allow large groups with low incomes to share overcrowded rooms, or otherwise exploit people with problems rendering them vulnerable, such as those with irregular immigration status. Such a boarding-house may well cease to be attractive to short-term lodgers, and the residents may remain in unsatisfactory accommodation for long periods. Much old seaside accommodation is so used, since cheap flights have reduced demand for their original seasonal holiday use.

Apart from the worldwide spread of the concept of the B&B, there are equivalents of the British boarding houses elsewhere in the world. For example, in Japan, minshuku are an almost exact equivalent although the normal arrangement would be the equivalent of the English half-board. In Hawaii, where the cost of living is high and incomes barely keep pace, it is common to take in lodgers (who are boarders in English terminology) that share the burden of the overall rent or mortgage payable.

Earth Sheltering

Earth sheltering is the architectural practice of using earth against building walls for external thermal mass, to reduce heat loss, and to easily maintain a steady indoor air temperature. Earth sheltering is popular in modern times among advocates of passive solar and sustainable architecture, but has been around for nearly as long as humans have been constructing their own shelter.

Background

Living within earth shelters has been a large part of human history. The connection to earth shelter dwellings began with the utilization of caves, and over time evolving technologies led to the construction of customized earth dwellings. Today, earth shelter construction is a rare practice, especially in the U.S.A. During the energy crisis and the 1973 Oil Crisis, along with the back-to-the-land movement, there was a surge of interest in earth shelter/underground home construction in an effort toward self-sufficient living.

However, progress has been slow, and earth shelter construction is often viewed by architects, engineers, and the public alike as an unconventional method of building. Techniques of earth sheltering have not yet become common knowledge, and much of society still remains unaware of the process or benefits of this type of building construction.

Types of Construction

- Earth berming: Earth is piled up against exterior walls and packed, sloping down away from the house. The roof may, or may not be, fully earth covered, and windows/openings may occur on one or more sides of the shelter. Due to the building being above ground, fewer moisture problems are associated with earth berming in comparison to underground/fully recessed construction.
- In-hill construction: The house is set into a slope or hillside. The most practical application is using a hill facing towards the equator (south in the Northern Hemisphere and north in the Southern Hemisphere). There is only one exposed wall in this type of earth sheltering, the wall facing out of the hill, all other walls are embedded within the earth/hill.
- Underground/fully recessed construction: The ground is excavated, and the house is set in below grade. It can also be referred to as an Atrium style due to the common atrium/courtyard constructed in the middle of the shelter to provide adequate light and ventilation.

Benefits

The benefits of earth sheltering are numerous. They include: taking advantage of the earth as a thermal mass, offering extra protection from the natural elements, energy savings, providing substantial privacy, efficient use of land in urban settings, shelters have low maintenance requirements, and earth sheltering commonly takes advantage of passive solar building design.

The Earth's mass absorbs and retains heat. Over time, this heat is released to surrounding areas, such as an earth shelter. Because of the high density of the earth, change in the earth's temperature occurs slowly. This is known as 'thermal lag.' Because of this principle, the earth provides a fairly constant temperature for the underground shelters, even when the outdoor temperature undergoes great fluctuation. In most of the United States, the average temperature of the earth once below the frost line is between 55 and 57 degrees Fahrenheit (13 to 14 degrees Celsius). Frost line depths vary from region to region. In the USA frost lines can range from roughly 20 inches to more than 40 inches. Thus, at the base of a deep earth berm, the house is heated against an exterior temperature gradient of perhaps ten to fifteen degrees, instead of against a steeper temperature grade where air is on the outside of the wall instead of earth. During the summer, the temperature gradient helps to cool the house.

The reduction of air infiltration within an earth shelter can be highly profitable. Because three walls of the structure are mainly surrounded by earth, very little surface area is exposed to the outside air. This alleviates the problem of warm air escaping the house through gaps around windows and door. Furthermore, the earth walls protect against cold winter winds which might otherwise penetrate these gaps. However, this can also become a potential indoor air quality problem. Healthy air circulation is key.

As a result of the increased thermal mass of the structure, the thermal lag of the earth, the protection against unwanted air infiltration and the combined use of passive solar techniques, the need for extra heating and cooling is minimal. Therefore,

there is a drastic reduction in energy consumption required for the home compared to homes of typical construction.

Earth shelters also provide privacy from neighbours, as well as soundproofing. The ground provides acoustic protection against outside noise. This can be a major benefit in urban areas or near highways. In urban areas, another benefit of underground sheltering is the efficient use of land. Many houses can sit below grade without spoiling the habitat above ground. Each site can contain both a house and a lawn/garden.

Potential Problems

Problems of water seepage, internal condensation, bad acoustics, and poor indoor air quality can occur if an earth shelter has not been properly designed.

Issues also include the sustainability of building materials. Earth sheltering often requires heavier construction than conventional building techniques, and many construction companies have limited or no experience with earth sheltered construction, potentially compromising the physical construction of even the best designs.

The threat of water seepage occurs around areas where the waterproofing layers have been penetrated. Vents and ducts emerging from the roof can cause specific problems due to the possibility of movement. Precast concrete slabs can have a deflection of 1/2 inch or more when the earth/soil is layered on top of it. If the vents or ducts are held rigidly in place during this deflection, the result is usually the failure of the waterproofing layer. To avoid this difficulty, vents can be placed on other sides of the building (besides the roof), or separate segments of pipes can be installed. A narrower pipe in the roof that fits snugly into a larger segment within the building can also be used. The threat of water seepage, condensation, and poor indoor air quality can all be overcome with proper waterproofing and ventilation.

The building materials for earth sheltered construction tend to be of non-biodegradable substances. Because the materials must keep water out, they are often made of plastics. Concrete is another material that is used in great quantity.

More sustainable products are being tested to replace the cement within concrete (such as fly ash), as well as alternatives to reinforced concrete. The excavation of a site is also drastically time-and labour-consuming. Overall, the construction is comparable to conventional construction, because the building requires minimal finishing and significantly less maintenance.

Condensation and poor quality indoor air problems can be solved by using earthtubes, or what is known as a geothermal heat pump-a concept different from earth sheltering. With modification, the idea of earthtubes can be used for underground buildings. Instead of looping the earthtubes, leave one end open downslope to draw in fresh air using the chimney effect by having exhaust vents placed high in the underground building.

Landscape and Site Planning

The site planning for an earth sheltered building is an integral part of the overall design; investigating the landscape of a potential building site is crucial. There are many factors to assess when surveying a site for underground construction. The topography, regional climate, vegetation, water table and soil type of varying landscapes all play dynamic roles in the design and application of earth shelters.

Topography

On land that is relatively flat, a fully recessed house with an open courtyard is the most appropriate design. On a sloping site, the house is set right into the hill. The slope will determine the location of the window wall; a south facing exposed wall is the most practical in the Northern hemisphere (and north facing in the southern hemisphere) due to solar benefits.

Regional Climate

Depending on the region and site selected for earth sheltered construction, the benefits and objectives of the earth shelter construction vary. For cool and temperate climates, objectives consist of retaining winter heat, avoiding infiltration, receiving winter sun, using thermal mass, shading and ventilating during the summer, and avoiding winter winds and cold pockets. For

hot, arid climates objectives include maximizing humidity, providing summer shade, maximizing summer air movement, and retaining winter heat. For hot, humid climates objective include avoiding summer humidity, providing summer ventilation, and retaining winter heat.

Regions with extreme daily and seasonal temperatures emphasize the value of earth as a thermal mass. In this way, earth sheltering is most effective in regions with high cooling and heating needs, and high temperature differentials. In regions such as the south eastern United States, earth sheltering may need additional care in maintenance and construction due to condensation problems in regards to the high humidity. The ground temperature of the region may be too high to permit earth cooling if temperatures fluctuate only slightly from day to night. Preferably, there should be adequate winter solar radiation, and sufficient means for natural ventilation. Wind is a critical aspect to evaluate during site planning, for reasons regarding wind chill and heat loss, as well as ventilation of the shelter. In the Northern Hemisphere, south facing slopes tend to avoid cold winter winds typically blown in from the north. Fully recessed shelters also offer adequate protection against these harsh winds. However, atriums within the structure have the ability to cause minor turbulence depending on the size. In the summer, it is helpful to take advantage of the prevailing winds. Because of the limited window arrangement in most earth shelters, and the resistance to air infiltration, the air within a structure can become stagnant if proper ventilation is not provided. By making use of the wind, natural ventilation can occur without the use of fans or other active systems. Knowing the direction, and intensity, of seasonal winds is vital in promoting cross ventilation. Vents are commonly placed in the roof of bermed or fully recessed shelters to achieve this effect.

Vegetation

The plant cover of the landscape is another important factor. Adding plants can be both positive and negative. Nearby trees may be valuable in wet climates because their roots remove water. However a prospective builder should know

what types of trees are in the area and how large and rapidly they tend to grow, due to possible solar-potential compromise with their growth. Vegetation can provide a windbreak for houses exposed to winter winds. The growth of small vegetation, especially those with deep roots, also helps in the prevention of erosion, on the house and in the surrounding site.

Soil and Drainage

The soil type is one of the most essential factors during site planning. The soil needs to provide adequate bearing capacity and drainage, and help to retain heat. With respects to drainage, the most suitable type of soil for earth sheltering is a mixture of sand and gravel. Well graded gravels have a large bearing capacity (about 8,000 pounds per square foot), excellent drainage and a low frost heave potential. Sand and clay, however, do not compact well and can be susceptible to erosion as a result. Clay soils, while least susceptible to erosion, often do not allow for proper drainage, and have a higher potential for frost heaves. Clay soils are more susceptible to thermal shrinking and expanding. Being aware of the moisture content of the soil and the fluctuation of that content throughout the year will help prevent potential heating problems. Frost heaves can also be problematic in some soil. Fine grain soils retain moisture the best and are most susceptible to heaving. A few ways to protect against capillary action responsible for frost heaves are placing foundations below the freezing zone or insulating ground surface around shallow footings, replacement of frost sensitive soils with granular material, and interrupting capillary draw of moisture by putting a drainage layer of coarser material in the existing soil.

Water can cause potential damage to earth shelters if it ponds around the shelter. Avoiding sites with a high water table is crucial. Drainage, both surface and subsurface, must be properly dealt with. Waterproofing applied to the building is essential.

Atrium designs have an increased risk of flooding, so the surrounding land should slope away from the structure on all sides. A drain pipe at the perimeter of the roof edge can help collect and remove additional water. For bermed homes, an

interceptor drain at the crest of the berm along the edge of the roof top is recommended. An interceptor drainage swale in the middle of the berm is also helpful or the back of the berm can be terraced with retaining walls. On sloping sites runoff may cause problems. A drainage swale or gully can be build to divert water around the house, or a gravel filled trench with a drain tile can be installed along with footing drains.

Soil stability should also be considered, especially when evaluating a sloping site. These slopes may be inherently stable when left alone, but cutting into them can greatly compromise their structural stability. Retaining walls and backfills may have to be constructed to hold up the slope prior to shelter construction.

Construction Methods

Current Methods

In earth sheltered construction there is often extensive excavation done on the building site. An excavation several feet larger than the walls' planned perimeter is made to allow for access to the outside of the wall for waterproofing and insulation. Once the site is prepared and the utility lines installed, a foundation of reinforced concrete is poured. The walls are then installed.

Usually they are either poured in place or formed either on or off site and then moved into place. Reinforced concrete is the most common choice. The process is repeated for the roof structure. If the walls, floor and roof are all to be poured in place, it is possible to make them with a single pour. This can reduce the likelihood of there being cracks or leaks at the joints where the concrete has cured at different times.

On the outside of the concrete a waterproofing system is applied. The most frequently used waterproofing system includes a layer of liquid asphalt onto which a heavy grade waterproof membrane is affixed, followed by a final liquid water sealant which may be sprayed on. It is very important to make sure that all of the seams are carefully sealed. It is very difficult to locate and repair leaks in the waterproofing system after the building is completed.

One or more layers of insulation board or foam are added on the outside of the waterproofing. If the insulation chosen is porous a top layer of waterproofing is added. After everything is complete, earth is backfilled into the remaining space at the exterior of the wall and sometimes over the roof to accommodate a green roof. Any exposed walls and the interior are finished according to the owners' preferences.

Materials

Structural

Reinforced concrete is the most commonly used structural material in earth shelter construction. It is strong and readily available. Untreated wood rots within five years of use in earth shelter construction. Steel can be used, but needs to be encased by concrete to keep it from direct contact with the soil which corrodes the metal. Bricks and CMUs (concrete masonry units) are also possible options in earth shelter construction but must be reinforced to keep them from shifting under vertical pressure unless the building is constructed with arches and vaults.

Unfortunately, reinforced concrete is not the most environmentally sustainable material. The concrete industry is working to develop products that are more earth-friendly in response to consumer demands. Products like Grancrete and Hycrete are becoming more readily available. They claim to be environmentally friendly and either reduce or eliminate the need for additional waterproofing. However, these are new products and have not been extensively used in earth shelter construction yet.

Some unconventional approaches are also proposed. One such method is a PSP method proposed by Mike Oehler. The PSP method uses, wooden posts, plastic sheeting and non-conventional ideas that allow more windows and ventilation. This design also reduces some runoff problems associated with conventional designs. The method uses wood posts, a frame that acts like a rib to distribute settling forces, specific construction methods which rely on fewer pieces of heavy equipment, plastic sheeting, and earth floors with plastic and carpeting.

Waterproofing

Several layers are used for waterproofing in earth shelter construction. The first layer is meant to seal any cracks or pores in the structural materials, also working as an adhesive for the waterproof membrane. The membrane layer is often a thick flexible polyethylene sheeting called EPDM. EPDM is the material usually used in water garden, pond and swimming pool construction. This material also prevents roots from burrowing through the waterproofing. EPDM is very heavy to work with, and can be chewed through by some common insects like fire ants. It is also made from petrochemicals, making it less than perfect environmentally.

There are various cementitious coatings that can be used as waterproofing. The product is sprayed directly onto the unprotected surface. It dries and acts like a huge ceramic layer between the wall and earth. The challenge with this method is, if the wall or foundation shifts in any way, it cracks and water is able to penetrate through it easily.

Bituthene (Registered name) is very similar to the three coat layering process only in one step. It comes already layered in sheets and has a self adhesive backing. The challenge with this is the same as with the manual layering method, in addition it is sun sensitive and must be covered very soon after application.

Eco-Flex is an environmentally friendly waterproofing membrane that seems to work very well on foundations, but not much is known about its effectiveness in earth sheltering. It is among a group of liquid paint-on waterproofing products. The main challenges with these are they must be carefully applied, making sure that every area is covered to the right thickness, and that every crack or gap is tightly sealed.

Bentonite clay is the alternative that is closest to optimum on the environmental scale. It is naturally occurring and self-healing. The drawback to this system is that it is very heavy and difficult for the owner/builder to install.

Insulation

Unlike conventional building, earth shelters require the

insulation on the exterior of the building rather than inside the wall. One reason for this is that it provides protection for the waterproof membrane against freeze damage, another is that the earth shelter is able to better retain its desired temperature. There are two types of insulation used in earth shelter construction. The first is close-celled extruded polystyrene sheets. Two to three inches glued to the outside of the waterproofing is generally sufficient. The second type of insulation is a spray on foam. This works very well were the shape of the structure it unconventional, rounded or difficult to get to. Foam insulation requires an additional protective top coat such as foil to help it resist water penetration.

In some low budget earth shelters, insulation may not be applied to the walls. These methods rely on the U factor or thermal heat storage capacity of the earth itself below the frost layer. These designs are the exception however and risk frost heave damage in colder climates. The theory behind no insulation designs relies on using the thermal mass of the earth to store heat, rather than relying on a heavy masonry or cement inner structures that exist in a typical passive solar house. This is the exception to the rule and cold temperatures may extend down into the earth above the frost line making insulation necessary for higher efficiencies.

Conventional above ground passive solar house designs often rely on high R factor insulation outer walls with high U thermal mass structures inside the house. Most earth sheltered houses take this approach as well. With conventional passive solar designs, the inner thermal mass may be composed of brick, compressed earth block, masonry or other heat storing materials. Even heavy wood structures or “phased change sap nano-particles” in Energie(Trademark) housing can be used for thermal storage. In cold weather designs, the thermal mass will warm up from low sunlight during winter months which strikes the thermal mass objects inside the house. During the evening the thermal mass will give off that heat to add heat inside the highly insulated shell. During the summer months, the shaded thermal mass is not hit by direct sunlight. By planning to have the mass inside the house away from windows, summer sunlight will not hit the thermal mass. The thermal

mass will provide a cooling effect absorbing heat from the air. Thermal mass provides both heating and cooling effects in a properly designed passive solar house. The amount of thermal mass and solar exposure necessary for direct gain solar designs is dependent on the local climate. Sometimes thermal mass is a liability, if a structure is heated only on weekends via air flow or wood stoves, a highly insulated shell and less thermal mass might be preferable for winter climates. This to avoid the need to heat up cold mass at the beginning of the weekend and leaving the structure just as the cabin warms up at the end of the weekend. Some designs avoid the sea saw effects of massive thermal mass temperature variations by having thermal mass under the frost line of the earth.

Design for Energy Conservation

Earth sheltered homes are often constructed with energy conservation and savings in mind. Specific designs of earth shelters allow for maximum savings. For bermed or in-hill construction, a common plan is to place all the living spaces on the side of the house facing the equator. This provides maximum solar radiation to bedrooms, living rooms, and kitchen spaces. Rooms that do not require natural daylight and extensive heating such as the bathroom, storage and utility room are typically located on the opposite (or in hill) side of the shelter. This type of layout can also be transposed to a double level house design with both levels completely underground. This plan has the highest energy efficiency of earth sheltered homes because of the compact configuration as well as the structure being submerged deeper in the earth. This provides it with a greater ratio of earth cover to exposed wall than a one story shelter would.

With an atrium earth shelter the living spaces are concentrated around the atrium. The atrium arrangement provides a much less compact plan than that of the one or two story bermed/inhill design; therefore it is commonly less energy efficient, in terms of heating needs. This is one of the reasons why atrium designs are classically applied to warmer climates. However, the atrium does tend to trap air within it which is then heated by the sun and helps reduce heat loss.

Earth Sheltering with Solar Heating

Earth sheltering is often combined with solar heating systems. Most commonly, the utilization of passive solar design techniques is used in earth shelters. A south facing structure with the north, east, and west sides covered with earth, is the most effective application for passive solar systems. A large double glazed window, triple glazed or Zomeworks beadwall (vacuum/blower pumps that filled your double pane solar windows with styrofoam balls at night for extra insulation and vacuumed the beads out in the morning, patent now expired), spanning most of the length of the south wall is critical for solar heat gain. It is helpful to accompany the window with insulated drapes to protect against heat loss at night. Also, during the summer months, providing an overhang, or some sort of shading device, is useful to block out excess solar gain. Combining solar heating with earth sheltering is referred to as “annualized geo solar design”, “Passive annual heat storage”, or sometimes as an “Umbrella house.” In the umbrella house, Polystyrene insulation extends around 23 feet radius from underground walls. A plastic film covers the insulation (for waterproofing), and soil is layer on top. The materials slope downward, like an umbrella. It sheds excess water while keeping the soil temperature warm and dry.

Passive cooling which pulls air with a fan or convection from a near constant temperature air into buried Earth cooling tubes and then into the house living space. This also provides fresh air to occupants and the air exchange required by ASHRAE.

Earth Shelter Construction: History and Examples

Berming

Historically, earth berming was a common building practice that combined heavy timber framing and rough stone work with stacking thick layers of sod or peat against the walls and on the roof. This served as excellent protection from the elements. In a relatively short period of time the earth layers grow together leaving the structure with an appearance of a hill with a door.

In these early structures, the heavy timber framing acted as structural support and added comfort and warmth to the interior. Rough stone was often stacked along the outer walls with a simple lime mortar for structural support and often serves as an exterior facing wall and foundation. There is a greater use of stone work in earth shelter structures in areas where timber is scarce.

These are the most sustainable of the earth shelters as far as materials go because they are able to decompose and return to earth. This is why there are few remaining example like Hvalsey Church in Greenland where only the stacked stones remain. One of the oldest examples of berming, dating back some 5,000 years, can be found at Skara Brae in the Orkney Islands off northern Scotland.

Today's bermed earth structures are built quite differently from those of the past. Common construction employs large amounts of steel reinforced concrete acting as structural support and building shell. Bulldozers or bobcats are used to pile earth around the building and on the roof instead of stacking earth in place. A community of 5 bermed earth structures can be found in Hockerton in Nottinghamshire,UK.

In-hill

One historical example of in-hill earth shelters would be Mesa Verde, in the southwest United States. These building are constructed directly onto the ledges and caves on the face of the cliffs. The front wall is built up with local stone and earth to enclose the structure. Similarly today, in-hill earth shelter construction utilizes the natural formation of a hillside for two to three of the exterior walls and sometimes the roof of a structure. Alternative builders craft a type of in-hill structure known as an Earthship. In Earthship construction, tires rammed with earth are used as structural materials for three of the walls and generally have a front façade of windows to capture passive solar energy.

The most famous and probably the largest earth-sheltered home is the residence of Bill Gates, who had it built over a period of several years on a heavily wooded site on the shore of Lake Washington. It is an excellent example of the lack of

obtrusiveness of this kind of home, since it appears much smaller than it actually is, when seen from the lake.

Underground

Though underground construction is relatively uncommon in the US, successful examples can be found in Australia where the ground is so hard that there is little to no need for structural supports and a pick ax and shovel are the tools of the builder/ remodeler.

In the early 1970s, China undertook the construction of Dixia Cheng, a city underneath Beijing. It was primarily a complex of bomb shelters that could house 40% of the population at that time. It was a response to the fear of Soviet attack. Parts of it are now used in more commercial ventures.

Home Automation

Home automation (also called domotics) designates an emerging practice of increased automation of household appliances and features in residential dwellings, particularly through electronic means that allow for things impracticable, overly expensive or simply not possible in recent past decades. The term may be used in contrast to the more mainstream "building automation", which refers to industrial uses of similar technology, particularly the automatic or semi-automatic control of lighting, doors and windows, Heating, Ventilation and Air Conditioning, and security and surveillance systems.

The techniques employed in home automation include those in building automation as well as the control of home entertainment systems, houseplant watering, pet feeding, changing the ambiance "scenes" for different events (such as dinners or parties), and the use of domestic robots.

Typically, it is easier to more fully outfit a house during construction due to the accessibility of the walls, outlets, and storage rooms, and the ability to make design changes specifically to accommodate certain technologies. Wireless systems are commonly installed when outfitting a pre-existing house, as they obviate the need to make major structural changes. These communicate via radio or infrared signals with a central controller.

Home Wiring History

Traditionally, homes have been wired for four systems: electrical power, telephones, TV outlets (cable or antenna), and a doorbell. Typically, components and wiring for these are kept within a closet, power metering box or a patch panel.

A remote control for moving vessels and vehicles was first patented by Nikola Tesla in 1898, and he announced wireless control of boats in 1909. With the invention of the electronic microcontroller and the widespread uptake of digital communication technology, the cost of electronic control fell rapidly and reliability improved. Remote and intelligent control technologies were adopted by the building services industry and appliance manufacturers worldwide, as they offer the end user easily accessible and/or greater control of their products.

Overview and Benefits

As the amount of controllable fittings and domestic appliances in the home rises, the ability of these devices to interconnect and communicate with each other digitally becomes a useful and desirable feature. The consolidation of control or monitoring signals from appliances, fittings or basic services is an aim of Home automation.

In simple installations this may be as straightforward as turning on the lights when a person enters the room. In advanced installations, rooms can sense not only the presence of a person inside but know who that person is and perhaps set appropriate lighting, temperature, music levels or television channels, taking into account the day of the week, the time of day, and other factors. Other automated tasks may include setting the air conditioning to an energy saving setting when the house is unoccupied, and restoring the normal setting when an occupant is about to return. More sophisticated systems can maintain an inventory of products, recording their usage through an RFID tag, and prepare a shopping list or even automatically order replacements.

Home automation can also provide a remote interface to home appliances or the automation system itself, via telephone line, wireless transmission or the internet, to provide control

and monitoring via a Smart Phone or Web browser An example of a remote monitoring implementation of home automation could be when a smoke detector detects a fire or smoke condition, then all lights in the house will blink to alert any occupants of the house to the possible fire. If the house is equipped with a home theatre, a home automation system can shut down all audio and video components to display the alert or make an audible announcement. The system could also call the home owner on their mobile phone to alert them, or call the fire brigade or alarm monitoring company to bring it to their attention.

Standards and Bridges

There have been many attempts to standardise the forms of hardware, electronic and communication interfaces needed to construct a home automation system. Specific domestic wiring and communication standards include:

- BACnet
- INSTEON
- X10
- KNX
- LonWorks
- C-Bus
- CEBus
- SCS BUS with OpenWebNet
- Universal powerline bus (UPB)
- ZigBee and,
- Z-Wave

Some standards use additional communication and control wiring, some embed signals in the existing power circuit of the house, some use radio frequency (RF) signals, and some use a combination of several methods. Control wiring is hardest to retrofit into an existing house. Some appliances include USB that is used to control it and connect it to a domotics network. Bridges translate information from one standard to another (e.g. from X10 to European Installation Bus).

System

The elements of a domotics system are:

- hardware controllers or software controllers
- sensors
- actuators

Architecture

From the point of view of where the intelligence of the domotic system resides, there are three different architectures:

Centralized Architecture: a centralized controller receives information of multiple sensors and, once processed, generates the opportune orders for the actuators.

Distributed Architecture: all the intelligence of the system is distributed by all the modules that are sensors or actuators. Usually it is typical of the systems of wiring in bus.

Mixed Architecture: systems with decentralized architecture as far as which they have several small devices able to acquire and to process the information of multiple sensors and to transmit them to the rest of devices distributed by the house.

Interconnection

By wire:

1. optical fiber
2. cable (coaxial and twisted pair), including:
   xDSL
3. powerline, including:
   INSTEON
   X10

Wireless:

1. radio frequency, including:
   INSTEON
   Wi-Fi
   GPRS and UMTS
   Bluetooth

DECT
ZigBee
Z-Wave
ONE-NET
EnOcean

2. infrared, including:

Consumer IR

Both Wireless and Wire;

1. INSTEON

Classifications of Domestic Network Technologies

- Device interconnection:
  - FireWire
  - Bluetooth
  - USB
  - IrDA
- Control and automation nets:
  - C-Bus (protocol)
  - Universal Powerline Bus
  - Konnex
  - Lonworks
  - X10
  - ONE-NET
  - EIB
  - EHS
  - BatiBUS
  - ZigBee
  - EnOcean
  - SCS BUS-OpenWebNet
- Data nets:
  - Ethernet
  - Homeplug

- HomePNA
- WiFi

Tasks

HVAC

Heating, Ventilation and Air Conditioning (HVAC) solutions include temperature and humidity control. This is generally one of the most important aspects to a homeowner. An Internet-controlled thermostat, for example, can both save money and help the environment, by allowing the homeowner to control the building's heating and air conditioning systems remotely.

Lighting

Lighting control systems can be used to control household electric lights in a variety of ways:

- Extinguish all the lights of the house
- Replace manual switching with Automation of on and off signals for any or all lights
- Regulation of electric illumination levels according to the level of ambient light available
- Change the ambient colour of lighting via control of LEDs or electronic dimmers

Natural Lighting

Natural lighting control involves controlling window shades, LCD shades, draperies and awnings. Recent advances include use of RF technology to avoid wiring to switches and integration with third party home automation systems for centralized control.

Audio

This category includes audio switching and distribution. Audio switching determines the selection of an audio source. Audio distribution allows an audio source to be heard in one or more rooms. This feature is often referred to as 'multi-zone' audio.

- There are three major components that allow listen to audio throughout your home, or business:

- CAT 5e/CAT6 cable from a central audio unit.
- A keypad to control volume and sources.
- 2 sets of speaker cabling (4ply from amplifier, and 2 ply from key pad to the speakers).

Video

This includes video switching and distribution, allowing a video source to be viewed on multiple TVs. This feature is often referred to as 'multi-zone' video. Integration of the intercom to the telephone, or of the video door entry system to the television set, allowing the residents to view the door camera automatically.

Security

Control and integration of security systems. With Home Automation, the consumer can select and watch cameras live from an Internet source to their home or business. Security cameras can be controlled, allowing the user to observe activity around a house or business right from a Monitor or touch panel. Security systems can include motion sensors that will detect any kind of unauthorized movement and notify the user through the security system or via cell phone.

This category also includes control and distribution of security cameras.

- Detection of possible intrusion:
  - sensors of detection of movement
  - sensors of magnetic contact of door/window
  - sensors of glass breaking
  - sensors of pressure changes
- Simulation of presence.
- Detection of fire, gas leaks, water leaks.
- Medical alert. Teleassistance.
- Precise and safe closing of blinds.

Intercoms

An intercom system allows communication via a microphone and loud speaker between multiple rooms.

- Ubiquity in the external control as much internal, remote control from the Internet, PC, wireless controls, electrical equipment.
- Transmission of alarms.
- Intercommunications.

Robotics

- Control of home robots, using if necessary domotic electric beacon.
- Home robot communication (i.e. using WiFi) with the domotic network and other home robots.

Other Systems

A homemade Internet-enabled cat feeder.

Using special hardware, almost any device can be monitored and controlled automatically or remotely.

Including:

- Coffee pot
- Garage door
- Pet feeding and watering
- Plant watering
- Pool pump(s) and heater, Hot tub and Spa
- Sump Pump

Costs

An automated home can be a very simple grouping of controls, or it can be heavily automated where any appliance that is plugged into electrical power is remotely controlled. Costs mainly include equipment, components, furniture, and custom installation.

Smart Grid

In 2009 President Barack Obama asked the United States Congress "to act without delay" to pass legislation that included doubling alternative energy production in the next three years and building a new electricity "smart grid". On April 13, 2009, George W. Arnold was named the first National Coordinator

for Smart Grid Interoperability. In June 2009, the NIST announced a smart grid interoperability project via IEEE P2030.

Home automation technologies like Zigbee, INSTEON and Zwave are viewed as integral additions to the Smart Grid. The ability to control lighting, appliances, HVAC as well as Smart Grid applications (load shedding, demand response, real-time power usage and price reporting) will become vital as Smart Grid initiatives are rolled out.

Housing Estate

A housing estate is a group of buildings built together as a single development. The exact form may vary from country to country. Accordingly, a housing estate is usually built by a single contractor, with only a few styles of house or building design, so they tend to be uniform in appearance. Generally housing estates are monotenure.

In Asian cities such as Singapore, Hong Kong and Seoul, an estate may range from detached houses to high density tower blocks with or without commercial facilities; in Europe and America, these may take the form of town housing, or the older-style rows of terraced houses associated with the industrial revolution, detached or semi-detached houses with small plots of land around them forming gardens, and are frequently without commercial facilities.

Housing estates are the usual form of residential design used in new towns, where estates are designed as an autonomous suburb, centred around a small commercial centre. Such estates are usually designed to minimise through-traffic flows, and to provide recreational space in the form of parks and greens.

This word usage may have arisen from an area of housing being built on what had been a country estate as towns and cities expanded in and after the 19th century. Reduction of the phrase to mere “estate” is common in Britain, especially when prefigured by the specific name, but is not so called in America.

Hong Kong

Due to the dense population, the most common form of residential housing in Hong Kong is the high-rise housing

estate, which may be publicly owned, privately owned, or semi-private. Due to the oligopoly of real-estate developers in the territory, and the economies of scale of mass developments, there is the tendency of new private tower block developments with 10 to over 100 towers, ranging from 30-to-70-storeys high.

Public housing provide affordable homes for those on low incomes, with rents which are heavily subsidised, financed by financial activities such as rents and charges collected from car parks and shops within or near the estates. They may vary in scale, and are usually located in the remote or less accessible parts of the territory, but urban expansion has put some of them in the heart of the urban area. Although some units are destined exclusively for rental, some of the flats within each development are earmarked for sale at prices which are lower than for private developments.

A private housing estate is usually characterised by a cluster of high-rise buildings, often with a shopping centre or market of its own in the case of larger developments. Mei Foo Sun Chuen, built by Mobil, is the earliest (1965) and largest (99 blocks) example of its kind. Since the mid 1990s, private developers have been incorporating leisure facities which incorporate clubhouse facilities : namely swimming pools, tennis courts, function rooms in their more up-market developments. The most recent examples would also be equipped with cinemas, dance studios, cigar-rooms.

There is currently some controversy over the “wall effect” caused by uniform high-rise developments which adversely impact air circulation. In-fill developments will tend to done by smaller developers with less capital. These will be smaller in scale, and less prone to the wall effect.

United Kingdom

In the UK, housing estates have become prevalent since World War II, as a more affluent population demanded larger and more widely spaced houses coupled with the increase of car usage for which terraced streets were unsuitable.

Housing estates were produced by either local corporations or by private developers. The former tended to be a means of

producing public housing leading to monotenure estates full of council houses and therefore known as “council estates”.

In addition, the problems incurred by the early attempts at high density tower-block housing turned people away from this style of living. The resulting demand for land has seen many towns and cities increase enormously in size for only moderate increases in population. This has been largely at the expense of rural and greenfield land. Recently, there has been some effort to address this problem by banning the development of out-of-town commercial developments, and encouraging the reuse of brownfield or previously developed sites for residential building. Nevertheless the demand for housing continues to rise, and in the UK at least has precipitated a significant housing crisis.

In the UK, some of the post war New towns were constructed en masse from housing estates rather than as organic growth from a population centre.

Housing in Japan

Housing in Japan includes modern and traditional styles. Two patterns of residences are predominant in contemporary Japan: the single-family detached house and the multiple-unit building, either owned by an individual or corporation and rented as apartments to tenants, or owned by occupants. Additional kinds of housing, especially for unmarried people, include boarding houses (which are popular among college students), dormitories (common in companies), and barracks (for members of the Self-Defence Forces, police and some other public employees).

Housing statistics

Figures from the 2003 Housing and Land Survey conducted by the Ministry of Internal Affairs and Communications indicate that Japan had 53,890,900 housing units at the time. Of these, 46,862,900 (86.9%) were occupied and 7,027,900 (13.0%) unoccupied. Of the occupied units, 28,665,900 (61.2%) were owned by the resident household. The average number of rooms per unit of housing was 4.77, the average total floor area in was 94.85 square meters (28.69 tsubo; 1,021.0 sq ft) and the

average number of people per room was 0.56. 45,258,000 units (96.6%) were used exclusively for living and 1,605,000 units (3.4%) were used both for living and commercial purposes. Of the units used exclusively for living, 10,893,000 (24.1%) were equipped with an automatic smoke detector. As of 2003, 17,180,000 housing units (36.7%) are classified by the Japan Ministry of Internal Affairs and Communication as being located in urban areas while 27,553,000 housing units (58.8%) are located in rural areas.

Interior Design

Traditional Homes

Traditional Japanese housing does not have a designated use for each room aside from the entrance area, kitchen, bathroom, and toilet. Any room can be a living room, dining room, study, or bedroom. This is possible because all the necessary furniture is portable, being stored in *oshiire*, a small section of the house used for storage. It is important to note that in Japan, living room is expressed as *i-ma*, living "space". This is because the size of a room can be changed by altering the partitioning. Large traditional houses often have only one ima (living room/space) under the roof, while kitchen, bathroom, and toilet are attached on the side of the house as extensions.

Somewhat similar to modern offices, partitions within the house are created by *fusuma*, sliding doors made from wood and paper, which are portable and easily removed. Fusuma seal each partition from top to bottom so it can create a mini room within the house. On the edge of a house are *rôka*, wooden floored passages, that are similar to hallways. Rôka and ima are partitioned by shôji, sliding and portable doors that are also made from paper and wood. Unlike fusuma, paper used for shôji is very thin so outside light can pass through into the house. This was before glass was used for sliding doors. Rôka and outside of the house are either partitioned by walls or portable wooden boards that are used to seal the house at night. Extended roofs protect the rôka from getting wet when it rains, except during typhoon season where the house gets sealed completely. Roofs of traditional houses in Japan are made of wood and clay, with tiles or thatched areas on top.

For large gatherings, these partitions are removed to create one large meeting room. During a normal day, partitions can create much smaller and more manageable living spaces. Therefore, kitchen, bathroom, toilet, and genkan with one multipurpose living space create one complete Japanese housing unit. However, the bathroom, toilet, and even kitchen can be communal. Therefore, the minimum Japanese housing arrangement, which is still possible to find if one is looking for the cheapest room to rent, consists of just genkan and one living room/space.

Modern Homes

Housing is typically listed in Real estate advertisements in the format of a number of rooms plus letter designators indicating the presence of common room areas, for example: 1R or 2LDK. R designating room, L for living room, D for dining room, and K for kitchen. In this format, the bathroom and toilet are not mentioned but are included with the exception of some very small 1R or 1K's. L, D and K are not really separate and are part of or next to the kitchen. An LDK is bigger than a DK. The number before the letters indicates the number of additional multipurpose rooms. Often the rooms are separated by removable sliding doors, fusuma, so large single rooms can be created.

Additionally, advertisements quote the sizes of the rooms—most importantly, the living room—with measurements in *tatami* mats (*jô* in Japanese, traditional mats woven from rice straw that are of a standard size: 180 cm by 90 cm in the Tokyo region, and 191 cm by 95.5 cm in western Japan): "2DK; one six-*tatami* Japanese-style room, one six-*tatami* Western-style room" is an example.

Though commonly accepted standards for description exist, this is not a legal requirement, therefore descriptions may not be entirely accurate.

Genkan

One characteristic of a Japanese home is the *genkan*, or entryway. It includes a small area, at the same level as the outside, where arriving people remove their shoes. As they

take off their shoes, people step up onto a raised floor. They point the tips of their shoes to the outside. The rest of the residence is at the raised level of this floor. Adjacent to the lower floor is a shelf or cabinet called a *getabako* in which people may place their shoes. Slippers for wear in the home are also stored there.

Toilet

The toilet in Japanese housing is located away from the bathroom and separate from it. It usually is in a small stall-like room with only the toilet in it. When entering the bathroom, one traditionally replaces their house slippers with plastic "toilet" slippers, swapping back when exiting the bathroom.

Kitchen

The modern Japanese kitchen features appliances such as a stove, a narrow fish grill (broiler), and an electric refrigerator. The stovetop may be built-in or may be a self-contained unit on a counter-top, and it is usually gas-burning, although recently induction heating (IH) stovetops have become popular. Common units of all types of stoves include two or three burners. Broilers designed for cooking fish are usually part of the stove and are located below, and unlike many Western-style grills, are not full width. Built-in ovens large enough to bake or roast are uncommon; in their place, work-top multifunction microwave ovens are used. Many kitchens have electric exhaust fans. Furnishings commonly include microwave ovens, hot water boilers, and electric toaster ovens. Built-in dishwashers are rare, although some kitchens may have small dishwashers or dishdryers. The kitchen includes running water, typically with hot and cold faucets.

Bathroom

Japanese housing typically has multiple rooms for what in Western housing is the bathroom. Separate rooms for the toilet, sink, and *of uro* (bathing room) are common. Small apartments, however, frequently contain a tiny single bathroom called a *unit bath* that contains all three fixtures. The room with the sink, which is called a "clothes changing room", usually includes a space for a clothes-washing machine. The room containing

the bathtub is waterproof with a space for washing, and often for showering, adjacent to (rather than in) the tub. As a result, bathwater is neither soapy nor dirty, and can be reused. Many washing machines in Japan come with an extension pipe to draw water from the tub for the wash.

Hot water usually comes from a gas or kerosene heater. The heater is usually located outdoors (at least in warm climates). Its gas supply may be from a municipal utility or from tanks on site. The typical Japanese water heater is tankless and heats water on demand. One heater may supply both bath and kitchen however many homes have two or more heaters.

Washitsu

Many homes include at least one traditional Japanese styled room, or *washitsu*. It features *tatami* flooring, *shoji* rather than draperies covering the window, *fusuma* (opaque sliding vertical partitions) separating it from the other rooms, an *oshiire* (closet) with two levels (for storing futon), and a wooden ceiling. It might be unfurnished, and function as a family room during the day and a bedroom at night. Many *washitsu* have sliding glass doors opening onto a deck or balcony.

Other bedrooms, as well as living rooms, dining rooms, and kitchens, are in a Western style. They usually have modern synthetic floor coverings. Ceilings are typically also synthetic, and might be white or beige. Windows usually open by sliding laterally, although many kitchen windows open by tilting, with the bottom slanting outwards.

One Room Mansion

A one room mansion is a Japanese apartment style in which there is only one small room (10 m²/3.0 tsubo; 110 sq ft in many cases) and usually a compact bathroom. This is equivalent to the western style studio apartment. These styles of units are most often rented by single individuals due to their extremely small size which make it hard for more than one person to reside in them. Most of Japan's city apartments have rooms such as these although family units (around 60 to 90 m²/ 18 to 27 tsubo; 650 to 970 sq ft in size) are more common, especially in Japan's suburbs.

Utilities

Heating

Space heating, rather than central heating, is normal in Japanese homes. Kerosene, gas, and electric units are common. Dwellings are commonly sold and rented without heating or cooling equipment. Occupants purchase appliances and take them when they move.

The simplest kerosene burner has a tank for fuel, a mantle, and a control dial. Battery-operated electric ignition is a popular step up. The next rank has an electric fan to circulate hot air through the room. Many such units feature computer control of temperature. The computer can also turn them on and off on schedule.

Gas heaters are also popular, and many homes have gas outlets in various rooms to accommodate portable units. Windows in many homes have vents to open to protect the occupants from excessive exhaust gas. Kerosene and gas units have safety features to turn off the fire and cut off the fuel supply when the heater receives a shake, whether from an accident or due to earthquake. These units also usually shut off automatically after two or three hours to prevent carbon monoxide fumes from building up while the resident is sleeping.

Another type of kerosene heater functions similar to a radiator, and consists of two parts. Kerosene fuel is stored in a tank and burned outside the home, and the flame is used to heat a fluid which is circulated into the second unit inside the house. In this unit, fans blow across the tubes carrying the heated fluid, and the room is warmed as a result. This type of heater is popular since it reduces the fumes significantly, and also virtually eliminates the chance of a small child or pet accidentally injuring themselves.

Electric heat is typically delivered through units mounted on the walls, such as above the doors to the deck or balcony, rather than through baseboards. These heaters often do double duty as air-conditioners. Thermostatic control and timers are available in most lines. The manufacturers of electric and electronic appliances produce these heaters.

In northern Japan, *yukadanbô* is a type of radiating heater beneath the floor in some rooms of newer houses, where heated fluids are circulated to provide warmth. The cost is expensive, so sometimes this type of heater is only installed in small rooms like the “clothes changing room”. Electric carpets have become popular in recent years.

Finally, a traditional type of heater known as a *kotatsu* is also still widely used today. The kotatsu can come in multiple forms, but the more common is as an electric heating element attached to the underside of a low table: the table is typically surrounded by a light duvet-like cloth to keep the heat in. This type of table is common in the *washitsu*.

Electricity

Japanese dwellings connected to the nation’s power grid have 100 V AC electricity at outlets throughout the home. The line frequency is 50 Hz in eastern Japan, and 60 Hz in the western part of the country. Service of 30 or 50 A is typical. Many domestic appliances operate properly at either frequency. Outlets resemble those formerly used in the United States, with two vertical slots.

The slots are usually of equal width and many sockets lack earthing capability. Outlets in the kitchen, toilet, and bathroom, as well as those supplied by the ceiling for air-conditioning units do usually have earthing, either in the form of an extra round hole or a covered binding post. Devices designed for use with water, such as clothes washers and heated toilet seats, often have a separate earth wire or earth pin. Adapters are readily available to convert such plugs and so allow their use in all types of sockets.

Lighting equipment, like heaters, is normally the provenance of the occupant. Many homes do not include lights in the living, dining, and bedrooms. Instead, they have receptacles that provide both electrical connection and mechanical support for lighting equipment. There are four common types of ceiling connectors and these will generally also support the weight of the light fitting. Kitchens, bathrooms, corridors and genkan are likely to have built-in ceiling fixtures.

Security

The “interphone”, or intercom, is a common sight in Japanese homes. It provides telephone-like connection between the interior and exterior. The doorbell is frequently part of the interphone, and when it rings, the occupant can pick up a handset to talk with the visitor before opening the door. Models with video cameras are available, but a peephole in the door is sufficient for most homes.

In Japan the usual custom is for visitors to wait at the gate of the house before entering, and thus in houses the interphone speaker is placed at the gate of the house rather than directly before the front door. Nowadays there is very often an electrical lock on the gate which can be controlled from inside by the home owner, and camera equipped interphones are also common.

Automobiles

Outside of the downtown areas of large cities, many Japanese people park their cars at or near their homes. Some single-family houses have built-in garages; others have carports or unsheltered spaces on the grounds. Apartment and condominium buildings frequently have parking lots, some occupying the first floor of the building, others outdoors. Elevator parking allows double use of limited space: one car parks below ground level, with an elevator raising it when needed; the other parks at ground level. More elaborate elevator arrangements are also in use. Residents also lease parking spaces at vacant lots in the neighborhood.

Construction

Many single-family residences are constructed by nationwide manufacturers such as Matsushita (under the name PanaHome), Misawa Home, Mitsui, and Sumitomo Forestry. Some such companies maintain parks with model homes to show to prospective buyers. The builders of a condominium may open a unit to show prospective buyers; alternatively, they may construct a separate model room elsewhere. Makers of appliances similarly operate showrooms to display their products.

Construction Materials

For freestanding houses, wood frames are popular. Two-by-four construction is an alternative to the native style. Houses may be clad in siding or faced with ceramic tile. Interiors often have drywall, painted or with a wall covering. Tile is a common roofing material; it may be fired clay or concrete. Clay tiles often bear a color and a glaze.

Large buildings are typically constructed of reinforced concrete. Roofs coverings include asphalt and synthetics.

Housing Regulations

The usual maximum allowed height of a wooden building in Japan is two stories. Some wooden houses may have lofts, but these may not be used as bedrooms, only for storage space. Steel and concrete buildings may have more stories, but usually they only have two. Basements are uncommon in private homes but common in high-rise buildings.

The ratio of built-upon area is regulated according to a system called kenpeiritsu involving the floor area of the house and the area of land the house is built upon. The area is restricted to being, for example, 80% of the area of the land. The *kenpeiritsu* varies according to the location of the land.

The taxable value of a house is controlled by its building material. Wooden houses are considered to have a lifespan of twenty years, and concrete ones to have a lifespan of thirty years, and the assessed price depreciates each year contrary to housing markets in other nations. Most real estate agents also use this pricing policy as a rough guide.

Living Patterns

Many young Japanese adults choose to live with their parents, rather than seeking a separate residence, a phenomenon known as parasite singles. A 1998 survey by the Ministry of Health and Welfare indicated that about 60% of single Japanese men and 80% of single women between the ages of 20 and 34 lived with their parents.

After marriage, the young couple often live in the same house as their parents. A desire for some separation between

the generations has led to the phenomenon of *nisedaijûtaku*, literally "two generation housing", a single house which contains two complete separate living areas, one for the parents and one for the younger generation.

Conversely, in large metropolitan areas of Japan, it is no longer uncommon for young couples to co-habit in an apartment before they marry.

Traditionally, the elderly also continue to live with their children rather than being put into homes for the elderly. The responsibility for the parent usually falls onto the oldest male child or *atotsugi*. The number of elderly people living at home has led to a great demand for care products for home use, and also the so-called "barrier-free" housing, which contains fewer steps and obstacles for the elderly.

Apartment sharing between strangers is rare in Japan, most single people preferring to live in small sized individual apartments. However, in recent years, as Japan is undergoing demographic and socioeconomic change, it is becoming more common for young people to share apartments. Apartment designs are many and varied. An older pattern for single occupancy is a long thin, shoe-box shaped apartment, with a kitchen area and bathroom located often near the genkan and a living space/bedroom at the opposite end where a small balcony may be located.

Japanese companies and organizations often send their male employees to various locations throughout Japan. It is not always possible or desirable for the entire family unit to move near to the employees new job site. In this case, small apartments are rented by married men who then travel to the family home on the weekends.

Home Ownership

Because of the high cost of housing in major Japanese cities, many urban families and individuals rent apartments rather than owning their own home. In 2003, less than half of the living units in Tokyo were owned by the resident. On the other hand, rural areas tend to have much higher ownership rates. The highest rate in the country is Toyama Prefecture,

with around 80% of all living units being owned by the resident. The living space of houses and condominiums is larger than apartments. The average size of an owned residence in Japan is 121.7□m² (36.8 tsubo; 1,310□sq□ft). This varies wildly between major urban areas (Tokyo: 91.0□m²/27.5 tsubo; 980□sq□ft) and rural areas (Toyama Prefecture: 178.4□m²/54.0 tsubo; 1,920□sq□ft). The area of homes that are advertised for sale or rental is commonly listed in the Japanese unit *tsubo* (jW), which is approximately the area of two tatami mats (3.3□m²/36□sq□ft). On diagrams of the house, individual room sizes are usually measured in tatami, as described above in the interior design section.

In recent years, condos/mansions have become more and more popular. Compared to 1983, when 64% of owned homes were single family dwellings, and only 27% were condos, more recent statistics show that the latter make up around 40% of the category now.

As houses age, owners replace them. A common pattern is to rebuild on the same site. To accomplish this, the occupants move to a temporary residence. A contractor demolishes the old structure and builds a new one on the grounds. The residents can then return to the location. Not having moved, they enjoy the convenience of keeping the same address, telephone number, and utility accounts, as well as avoid the cost of purchasing new land. Because of the wooden construction and relatively short lifespan of Japanese houses, this is often considered cheaper than maintaining the old structure.

Home and Apartment Rental

To rent an apartment in Japan, would-be tenants visit real estate agents located in every neighborhood and browse through copies of apartments for rent. These usually have the layout of the apartment for rent and the costs to rent this apartment. If a would be tenant is interested in a particular apartment, the agent contacts the landlord to see if the apartment is still available and whether a visit could be arranged. Typically, a renter cannot rent an apartment on her or his own, but is required to have a guarantor who promises to pay the rent if problems arise.

Traditionally, Japanese landlords collect both a damage deposit and "key money" before the renter takes occupancy, and the real estate agent is also paid a month's rent for services provided. Key money is a non-refundable payment to the landlord. In major cities like Tokyo and Osaka, key money is often a major investment in itself: up to six months' rent in many cases. In recent years many landlords have begun demanding smaller amounts of key money, equal to two or three months' rent or none at all. An industry of no-deposit apartments, called *monthly mansion* and *weekly mansion*, has also sprouted up in major cities: these generally charge higher rents than traditional leases, and may offer some hotel-style amenities such as linen service.

In Tokyo, a typical rental agreement is for one year. Each year, this agreement is re-negotiated, and the renter pays an additional month's rent as a fee. In many other cities, however, the one-year agreement is regarded simply as a minimum length of stay, and the rent does not change over the years.

Guest Houses

Foreigners in Japan renting apartments on their own often face discrimination from real estate agents or landlords who refuse to rent to foreigners.[1] Some agents will explain to foreigners directly that it is *difficult* to rent to them. Finding a guarantor is also difficult for many foreigners. Living in a Guest Houses is one way to circumvent these problems. Sometimes referred to as "Gaijin Houses" (meaning foreign persons' house), Guest Houses come in a variety of shapes and sizes. They are designed to provide short-term accommodation at reasonable prices with a minimum of hassle. Usually aimed at foreign visitors, they are becoming increasingly popular with young Japanese seeking to break with the tradition of living with parents until, and sometimes after, marriage. While deposits are payable in most cases they tend to be low and the famous Japanese key money is not charged for these properties. A guest house will provide one room for sleeping, a shared kitchen and shared bathroom. Facilities like washing machines are usually coin operated but due to intense competition many landlords are seeking to provide as many free utilities as they

can; free internet is almost a given in Tokyo these days. Typically, foreigners and Japanese are finding it harder to find guest houses and have been opting for small apartments (Aparto).

Company Housing

Many Japanese companies also maintain their own apartment buildings (called *shataku*) where young employees live when they first start working. Sometimes, the shataku is located near the company's office building. In other cases, the company may not own its own apartment complex, but hold an exclusive lease over one or more independent apartment buildings. In 2003, there were nearly 1.5 million shataku units in Japan.

Traditional Housing

In premodern Japan, commoners typically lived either in free-standing houses, now known as *minka*, or, predominantly in cities, in *machiya* or row-houses called *nagaya*). Examples are still visible in Kyoto. Additional dwelling patterns included the samurai residence, the homes of wealthy farmers (such as the village headmen), and the residences of Buddhist temples.

Wood was the material of choice for structures, while roofs could be thatch, cypress bark, tile, or bare wood. Raised floors were of wood, and might be covered with straw mats in places. Kitchens usually had dirt floors.

Homelessness

The Ministry of Health, Labour and Welfare reported in 2003 that Japan had 25,296 homeless people. Osaka, Tokyo, and Aichi were the prefectures with the highest homeless populations, while the city of Osaka, the 23 special wards of Tokyo, and the city of Nagoya had 1750 or more (no other city had 850). The ministry found that about 41% lived in urban parks and 23% along river banks; streets and railway stations also had significant numbers.

Hurricane Proof House

Tornadoes, cyclones, and other strong winds damage or

destroy many buildings. However, with proper design and construction, the damage to buildings by these forces can be greatly reduced. Over time, a variety of methods have been studied and tested (both formally and incidentally by actual storms) that can help a building survive strong winds and storm surge. Local building departments may mandate their use in high velocity hurricane zones, or areas where buildings are likely to have to withstand a hurricane in their lifetime.

Storm Surge Considerations

A common problem for buildings during hurricanes is storm surge. Flooding occurs frequently in coastal areas and waves contain a tremendous amount of energy which can literally batter a building to pieces. Beach front buildings should be able to withstand the ocean rising 20 or more feet, with large waves on top of that. They should preferably be built on high ground where possible, in order to avoid waves knocking the building down.

If waves can reach the building site, the building should be elevated on steel, concrete, or wooden pilings and/or anchored to solid rock. Whether it is intended or not, walls on the first floor are often built with sheetrock, which can completely deteriorate when wet and/or exposed to lateral forces, leaving structural members in place, and allowing water (or high winds) to pass through. This “gutting” occurs frequently in storm surge areas. Designing so as to “sacrifice” the walls of the first floor in this way can save the rest of the building from destruction, although it is not an ideal solution. Building contents left on that level will be lost, and considerable damage to the building could still result in costly repairs such as mold, rot, and termite problems.

Wind Loading Considerations

The Foundation

Wind acting on the roof surfaces of a building can cause negative pressures that tend to create a lifting force. This is one of the most common ways a building can be destroyed during a storm. Gravity alone may not be sufficient to prevent the roof from lifting, or “peeling,” off the rest of the building.

Once this occurs, the building is weakened considerably and the rest of the building will likely fail as well. To minimize this, the upper structure should be securely anchored through the walls to the foundation.

Several methods can be used to securely anchor the roof. Traditionally, roof trusses were simply "toenailed" into the top of the walls. These nails provide little to no actual structural advantage; they're mainly used to hold the trusses in place while the rest of the roof is being built. Gravity and friction then ensure the roof stays put. Various products have been developed that can actually anchor the roof to the walls, which should then be anchored to a solid foundation. Metal straps that nail into the wall and wrap over the trusses are one method. Other methods, including temporary straps made of a special low-elongation material, have successfully been used and have an advantage, in that a building built before 1993 which may not be constructed to withstand wind loading can be quickly and temporarily strapped to the foundation to ensure structural stability. Hurricane harness strapping can easily be applied and removed after the storm to ensure the highest level of protection in extreme high wind storms.

Mobile Home Tie Down to the Foundation

In the bulk of instances when interlocking metal pan roof systems installed on mobile homes are exposed to extreme high winds, such as hurricanes and the outer band winds of a tornado, irreparable damage occurs to the overall building structure once the fasteners attaching the metal roof panels to the structural frame begin to tear or rip through the aluminum metal pan base, under the pressure differential (lift) created by the high velocity winds passing over the surface plane of the roof. This event becomes compounded by the high velocity of wind entering the carport or other building add-on, which causes a mode of wind capture: transfer of the kinetic energy of the wind lifts the underside of the roof panels, resulting in complete devastation of the roof system and the roof line/siding section.

To mitigate this pressure differential, pre-installed aluminum tabular channels can permanently be fastened

perpendicularly across the top of the interlocking ribs of the metal roof system without disturbing the flow of rainwater at the eaves, mid-span, and ridge locations of the building. Variable lengths of an extremely strong, low elongation, hurricane harness strap are cut to length, placed over the channels and fastened into ratchets which are attached to a variety of anchoring methods on opposite sides of the building. This engineered design provides an uninterrupted continuous load path between anchors. The ratchets apply a uniform counteractive load throughout the channel systems and throughout the roof assembly. The structure literally becomes sandwiched within the strapping and the anchors with addition to providing a positive active dead load to the outer wall systems and column supports, increasing the resistance to the lateral wind force being applied to the main structure during a storm event. In addition, this secondary measure of protection will visually alleviate any unforeseen building deficiencies within the structural confines of the building, or rusted or inadequate earth support ties to the lower frame chassis of the structure.

Earth Sheltering

Earth sheltered construction is generally more resistant to strong winds and tornadoes than standard construction. It is for this reason that cellars, and other earth sheltered components of other buildings, can provide safe refuge during tornadoes.

Dome Homes

The physical geometry of a building affects its aerodynamic properties and how well it can withstand a storm. Geodesic dome roofs or buildings made from wood, steel, or concrete have low drag coefficients and can withstand higher wind forces than a square building of the same area. Even stronger buildings result from monolithic dome construction.

Building Components

Garages, Windows, Doors, and other Openings

These are generally the weak points susceptible to breakdown by wind pressure and blowing debris. Once failure

occurs, wind pressure builds up inside the building and in seconds, may lift the roof off a building. Hurricane shutters can also provide effective protection.

Doors

An inward opening door can be blown into the house by wind causing potential structural failure. Various companies offer new doors that comply with the local building codes. Some companies offer retro-fit devices that can be professionally installed. These kits are often just as expensive as a new door. A good source for products include the Miami-Dade building code website [1]. It shows how the products are to be installed to withstand the most punishing of winds. Some of the companies are local and many products were in use prior to Hurricane Andrew.

Windows

It is usually a requirement to install 150 miles per hour tested windows in hurricane prone areas. These windows should have plastic panes, shatter-proof glass or glass with protective membranes (Impact Glass). The panes have to be more firmly attached than normal window panes (possibly even using screws or bolts through the edges of larger panes).

Windows protected by steel or heavy aluminum shutters may be best in some hurricane prone areas.

Building Materials

The choice of building materials can affect the ability of a building to withstand high winds. Although it is not always possible to use different materials, if the area is extremely susceptible to high winds, it is good practice to use the most resistant materials available.

Wood

Wood is the most common building material as it is readily available, relatively inexpensive, and has a degree of flexibility which can be beneficial in certain high stress situations. However, termite and dry rot are frequent problems in timber buildings located in areas susceptible to hurricanes, particularly

in warm, humid climates. Weakened buildings cannot withstand wind loads as well as intact buildings can. To combat this, certain building codes require the use of pressure-treated wood for all structural elements of the building, which is designed to prevent rot and deterioration.

Also, wood and paper backed sheetrock provide food for black mold which can grow if the inside of the building gets wet during a storm. The mold can then be costly to remove and must be considered as a factor when deciding which building materials to use.

A building constructed with wood can effectively be built to withstand fairly high wind loads. However, flying debris-furniture, trees, parts of other buildings which are common in such a storm-can still damage or destroy a well-designed wood building even if the wind isn't sufficient to do so itself.

Concrete

Reinforced concrete is a strong, dense material that, if used in a building that is designed properly, can withstand the destructive power of very high winds, pounding waves, and even high-speed debris. Concrete used in home construction must be reinforced with steel (commonly known as "rebar"). While the rebar can rust in wet or humid environments, there are various effective means to retard or prevent rebar corrosion due to moisture.

Lodging

Lodging (or a holiday accommodation) is a type of residential accommodation. People who travel and stay away from home for more than a day need lodging for sleep, rest, safety, shelter from cold temperatures or rain, storage of luggage and access to common household functions.

Lodgings may be *self catering* in which case no food is laid on but cooking facilities are available.

Lodging is done in a hotel, hostel or hostal, a private home (commercial, i.e. a bed and breakfast, a guest house, a vacation rental, or non-commercially, with members of hospitality services or in the home of friends), in a tent, caravan/camper

(often on a campsite). In addition there are make-shift solutions. Sleeping is typically done lying in a bed, or more generally on a soft surface, such as an air mattress, a couch, etc. Some trains have sleeping cars.

Sometimes people sleep sitting, because lying is not possible, such as in a train (if not in a sleeping car), a bus, a seat in a waiting room or a bench on the street or in a park. Inclinable seats allow something between sitting and lying. Whether lying on a row of seats is possible and comfortable depends on the presence of arm rests, and whether they can be moved up. In some public places, lying would be possible, but is not permitted.

Lustron House

Lustron houses are prefabricated enameled steel houses developed in the post-World War II era United States in response to the shortage of houses for returning GIs. The low maintenance enamel finish was expected to attract modern families who might not have the time or interest in repairing and painting conventional wood and plaster houses.

Development

In January 1947, the newly formed Lustron Corporation announced that it had received a $12.5-million Reconstruction Finance Corporation loan to manufacture mass-produced prefabricated homes that featured enamel-coated steel panels. Led by Chicago industrialist and inventor Carl Strandlund, who had worked with constructing prefabricated gas stations, Lustron offered a home that would "defy weather, wear, and time."

Strandlund's Lustron Corporation, a division of the Chicago Vitreous Enamel Corporation, set out to construct 15,000 homes in 1947 and 30,000 in 1948. From its plant in Columbus, Ohio (the former Curtiss-Wright factory), the corporation eventually constructed around 3,000 Lustron homes between 1948 and 1950. The houses sold for between $8,500 and $9,500, according to a March 1949 article in the *Columbus Dispatch*—about 25 percent less than comparable conventional housing. By November 1949, however, a Lustron's average selling price had come up to $10,500.

Most of the known Lustron houses were constructed in 36 of the United States including Alaska. However, some were constructed in Venezuela, South America for families of oil industry employees. Billed as a way to maximize pleasure and minimize work, Lustron advertising contended that the Lustron home would create a "new and richer experience for the entire family," where "Mother... has far more hours," the "youngsters... have fewer worries," and there would be "far more leisure for Dad." How this would be accomplished with just a choice of housing was not clarified.

Models

Arguably the most popular of the Lustron homes was the two bedroom, 1,085 square feet (100.8 m^2) "Westchester Deluxe" model. In total, there were three "lines" of Lustrons: the Westchester, Newport, and Meadowbrook. With the exception of the Esquire (which had been the prototype's name) each Lustron type was available as either a two-or three-bedroom model.

Design Features

Prefabricated housing had existed before the Lustron home came on the market. However, it was Lustron's promises of assembly-line efficiency and modular construction that set it apart from its competitors. The homes were designed by Morris Beckman of Chicago firm Beckman and Blass, and may have been loosely based on designs for the Cemesto houses in Oak Ridge, Tennessee. With enameled steel panels inside and out, as well as steel framing, the homes stood out next to more traditional dwellings made of wood and plaster.

Lustron homes were usually built on concrete slab foundations with no basement. However, about 40 Lustron homes have been reported to have basements. Their sturdy steel frame was constructed on-site by a team of local workers who assembled the house piece-by-piece from a special Lustron Corporation delivery truck. The assembly team, who worked for the local Lustron builder-dealer followed a special manual from Lustron, and were supposed to complete a house in 360 man-hours.

Color Options

The Ohio Historic Preservation Office recognizes eight exterior colors: “Surf Blue,” “Blue-green,” “Dove Gray,” “Maize Yellow,” “Desert Tan,” Green, Pink, and White. Window surrounds were primarily ivory-coloured.

Interiors

The interiors were designed with an eye toward the modern age, space-saving, and ease of cleaning. All Lustrons had metal-paneled interior walls that were most often gray. To maximize space, all interior rooms and closets featured pocket doors. All models featured metal cabinetry, a service and storage area, and metal ceiling tiles. In the Westchester Deluxe models, the living room and master bedrooms featured built-in wall units. As an added option, customers were presented with the unique Thor-brand combination clothes-and dish-washer, which incorporated the kitchen sink.

Window Types

There were two major window types in Lustron homes: “tripartite” and casement. The tripartite consisted of a central light flanked by two four-light casement windows. Three-light and/or square aluminum casements with interior screens were standard on all Lustrons. Add-on storm windows were available for residents in colder climates. Westchester Deluxe two-and three-bedroom models were unique in that they boasted a tripartite bay window in the living room area: no other Lustron line included this feature. In Westchester Deluxe two-bedroom models, additional tripartite windows were located in the dining area and bedrooms. For Westchester Deluxe three-bedroom models, tripartite windows were found in the dining area and two of the bedrooms, as well as the living room bay. Though the Westchester Standard line had no bay windows, it had tripartite windows in the same rooms as the Westchester Deluxe two-bedroom model. Newport two-and three-bedroom models, which had no bay windows, offered tripartite windows in the dining/living room area. A model of the Meadowbrook home shows that the design would have provided two tripartite windows, both in the dining/living room area, similar to those in the Newport line.

Roof, Flooring, and other Details

The roof likewise consisted of enameled-steel tiles, which were installed shingle-style. The front and rear doors featured a single light of translucent, rippled glass. As seen in the chart above, floors in the Westchester Deluxe models were asphalt tile, but in other models (Westchester Standard, Newport, and Meadowbrook), floors were installed as a "builder's option."

Temperature Control

In most models, the homes were heated with an oil burning furnace that directed hot air into an enclosed space above the metal ceilings. The walls contained a one inch blanket of fiberglass wool insulation.

Identifying Marks

Perhaps the most notable Lustron feature is the zig-zag downspout accent on the buildings' front and rear corners. In the two-bedroom Westchester models, the downspout pillar doubles as a support for the open porch, yet—for various reasons—the downspout accent was removed by many owners.

Additions

Lustron offered two garage models, the "G-1" and "G-2," which were available in the same colors as the houses. The garage was most often constructed with wood framing, Lustron panel siding, and Lustron steel roof tiles. Lustron also provided carports and awnings.

Demise of the Lustron Corporation

The Lustron Corporation declared bankruptcy in 1950, despite being an extremely well-funded, well-publicized, government-supported enterprise manufacturing a desperately needed product. Production delays, the lack of a viable distribution strategy, and the escalating prices for the finished product all contributed to the failure. Additionally, local zoning codes also played a part: in Columbus, for example, an ordinance prohibited homes with steel chimneys. Some accounts suggest an organized effort from the existing housing industry to stop Strandlund, comparing him to Preston Tucker (ironic, because

Strandlund's first choice for the Lustron factory building, the Dodge Chicago Aircraft Engine Plant in Illinois) was actually granted to Tucker to build his automobiles).

Lustrons on a Marine Base?

The largest assembly of Lustrons in one geographic location was in Quantico, Virginia, where 60 were installed at the U.S. Marine Corps military base. All Westchester Deluxe models, they came in "Surf Blue," "Maize Yellow," and pink, the last of which was decidedly unpopular among some military families. In January 2006, it was announced that the homes, which had grown "too small for most families," would be eliminated from base housing and would be given away. Fifty-eight of Quantico's Lustrons were offered for free (with an application and $8,000 deposit) in 2006, yet only one individual came forward and acquired a home, which was disassembled and moved to storage in Delaware. Twenty-three of Quantico's Lustrons were demolished in 2006, and an additional thirty-four homes were razed in 2007. The two remaining homes at the base are on the National Register of Historic Places, and are currently used as maintenance buildings.

Preservation

About 2,000 Lustron homes are still in existence in 36 states. Many have been modified with additions, remodeled kitchens, vinyl windows, composite roofs, new heating systems, sheet rock interior walls, painted exteriors, and siding. A small group of Lustron owners are preserving the original condition of their homes and are urging others to do the same, though very few entirely original Lustron homes exist. Over time, Lustron owners often removed the "Thor" brand combination washing machine/dish washer, and in cold regions, the ceiling's radiant heat systems were often replaced.

In 2006, a Lustron home from Arlington, Virginia, was painstakingly disassembled, labeled and put into storage.

Threats

Demolition continues to threaten Lustrons where rising property values attract buyers who desire larger homes of

modern construction. Other major threats to Lustron homes' integrity include: severe weather (tornadoes, hurricanes), vehicular or other impact, and lack of local zoning/preservation/ aesthetic legislation.

Conclusion

The promise of a home that never needs painting or maintenance has been somewhat validated after over 55 years of service. The enamel steel roof "shingles" are still keeping many Lustron residents in the dry after five decades of no maintenance. Several homes feature exterior wall panels that never needed painting are intact and rust-free. Historically, enamel metal objects have been known to survive over one hundred years.

Mobile Home

Mobile homes or static caravans (also informally called "caravans" or "trailers") are prefabricated homes built in factories, rather than on site, and then taken to the place where they will be occupied. They are usually transported by tractor-trailers over public roads to sites which are often in rural areas or high-density developments. In some countries they are used for temporary accommodation on campsites. While these homes are usually placed in one location and left there permanently, they do retain the ability to be moved as this is a requirement in many areas. Behind the cosmetic work fitted at installation to hide the base, there are strong trailer frames, axles, wheels and tow-hitches. The two major sizes are single-wides and double-wides. Single-wides are 18 feet (5.5 m) or less in width and 90 feet (27 m) or less in length and can be towed to their site as a single unit. Double-wides are twenty feet or more wide and are 90 feet in length or less and are towed to their site in two separate units, which are then joined together. Triple-wides and even homes with four, five, or more units are also built, although not as commonly. They also differ from site built homes in that it is not uncommon for owners of singlewides to "trade up", as one might with a car.

While site-built homes are rarely moved, singlewide owners often "trade", or sell their home to a dealer in the form of the

reduction of the purchase of a new home. These “used” homes are either re-sold to new owners, or to park owners who use them as inexpensive rental units. Single wides are more likely to be traded than double wides since removing them from the site is easier. In fact only about 5% of all double wides will ever be moved.

History

This form of housing goes back to the early years of cars and motorized highway travel. It was derived from the travel trailer, a small unit with wheels attached permanently, often used for camping. Larger units intended to be used as dwellings for several months or more in one location came to be known as home trailers. The first trailer home originated from England where they are called caravans.

The original rationale for this type of housing was its mobility. Units were initially marketed primarily to people whose lifestyle required mobility. However, beginning in the 1950s, the homes began to be marketed primarily as an inexpensive form of housing designed to be set up and left in a location for long periods of time, or even permanently installed with a masonry foundation. Previously, units had been eight feet or less in width, but in 1956, the 10-foot (3 m) wide home (“ten-wide”) was introduced, along with the new term “mobile home.” The homes were given a rectangular shape, made from pre-painted aluminium panels, rather than the streamlined shape of travel trailers, which were usually painted after assembly. All of this helped increase the difference between these homes and home/travel trailers. The smaller, “eight-wide” units could be moved simply with a car, but the larger, wider units (“ten-wide”, and, later, twelve-wide”) usually required the services of a professional trucking company, and, often, a special moving permit from a state highway department. During the 1960s and ’70s, the homes were made even longer and wider, making the mobility of the units more difficult. Nowadays, when a factory-built home is moved to a location, it is usually kept there permanently and the mobility of the units has considerably decreased. In some states, mobile homes have been taxed as personal property if the wheels remain

attached, but as real estate if the wheels are removed. Many people who could not afford a traditional site-built home or did not desire to commit to spending a large sum of money on housing began to see factory-built homes as a viable alternative for long-term housing needs.

The units were often marketed as an alternative to apartment rental. However, the tendency of the units of this era to depreciate rapidly in resale value made using them as collateral for loans much riskier than traditional home loans. Terms were usually limited to less than the thirty year term typical of the general home-loan market, and interest rates were considerably higher. In other words, mobile home loans resembled motor vehicle loans more than traditional home mortgage loans.

Regulation

In the United States, these homes are regulated by the U.S. Department of Housing and Urban Development (HUD), via the Federal National Mfd. Housing Construction and Safety Standards Act of 1974. It is this national regulation that has allowed many manufacturers to distribute nationwide, since they are immune to the jurisdiction of local building authorities. By contrast, producers of modular homes must abide by state and local building codes. There are, however, windzones adopted by HUD that home builders must follow.

For example, state-wide, Florida is at least windzone 2. South Florida is windzone 3, the strongest windzone. After Hurricane Andrew in 1992, new standards were adopted for home construction. The codes for building within these windzones were significantly amended, which has greatly increased their durability. During the 2004 hurricanes in Florida, these standards were put to the test, with great success. Yet, older models continue to face the exposed risk to high winds because of the attachments applied such as carports, porch and screen room additions. These areas are exposed to “wind capture” which apply extreme force to the underside of the integrated roof panel systems, ripping the fasteners through the roof pan causing a series of events which destroys the main roof system and the home.

Legal Complications

The popularity of the factory built homes caused complications the legal system was not prepared to handle. Originally, factory built homes tended to be taxed as vehicles rather than real estate, which resulted in very low property tax rates for their inhabitants. This caused local governments to reclassify them for taxation purposes.

However, even with this change, rapid depreciation often resulted in the home occupants paying far less in property taxes than had been anticipated and budgeted. The ability to move many factory built homes rapidly into a relatively small area resulted in strains to the infrastructure and governmental services of the affected areas, such as inadequate water pressure and sewage disposal, and highway congestion. This led jurisdictions to begin placing limitations on the size and density of developments.

As noted above, early homes, even those that were well-maintained, tended to depreciate in value over time, much like motor vehicles, rather than appreciate in value, as with site-built homes. The arrival of these homes in an area tended to be regarded with alarm, in part because of devaluation of the housing potentially spreading to preexisting structures.

This combination of factors has caused most jurisdictions to place zoning regulations on the areas in which factory built homes are placed, and limitations on the number and density of homes permitted on any given site. Other restrictions, such as minimum size requirements, limitations on exterior colors and finishes, and foundation mandates have also been enacted. There are many jurisdictions that will not allow the placement of any additional factory built homes. Others have strongly limited or forbidden all single-wide models, which tend to depreciate in value more rapidly than modern double-wide models.

Apart from all the practical issues described above, there is also the constant discussion about legal fixture and chattels-meaning that the legal status of a trailer is, or could be, affected by its incorporation to the land or not. This sometimes involves such factors as whether or not the wheels have been removed.

Financing

Financing for manufactured homes can be very difficult to arrange. Most banks won't finance manufactured homes when there is no land included in the loan. There are some companies that specialize in mobile home loans and mobile home financing. They can finance and refinance mobile homes in parks. The United States Department of Agriculture has rural development guaranteed loan and direct loan programs for low-income individuals living in small towns and rural areas who currently have inadequate housing. The restrictions on loans involving manufactured homes require that the unit be brand-new, located on a relatively small lot and sold to the new occupant as a package deal. The biggest problem with this program is that once the unit has been occupied, new buyers will not be able to qualify for the same type of loan, as the home is no longer new, making it difficult for the current occupant to "trade up" to a larger or better property.

Mobile Home Parks

Mobile homes are often sited in land lease communities known as trailer parks. Also referred to as trailer courts, mobile home parks, mobile home communities, manufactured home communities, and factory built home communities, these communities allow home owners to rent space on which to place a home. In addition to providing space, the community can provide basic utilities such as water, sewer, electricity, or natural gas and other amenities such as community rooms, pools, and playgrounds.

There are over 35,000 trailer parks in the United States ranging in size from 5 to over 1,000 home sites. Although most parks appeal to meeting basic housing needs, some communities specialize towards certain segments of the market. One subset of mobile home parks, Retirement Communities, restrict residents to those age 55 and older. Another subset of mobile home parks, Seasonal Communities, are located in popular vacation destinations or are used as a location for summer homes.

Newer homes, particularly double-wides, tend to be built to much higher standards than their predecessors and meet

the building codes applicable to most areas. This has led to a reduction in the rate of value depreciation of most used units.

Additionally, modern homes tend to be built from materials similar to those used in site-built homes rather than inferior, lighter-weight materials. They are also more likely to physically resemble site-built homes. Often, the primary differentiation in appearance is that factory built homes tend to have less of a roof slope so that they can be readily transported underneath bridges and overpasses.

The number of double-wide units sold exceeds the number of single-wides, which is due in part to the aforementioned zoning restrictions. Another reason for higher sales is the spaciousness of double-wide units, which are now comparable to site-built homes. Single-wide units are still popular primarily in rural areas, where there are fewer restrictions. They are frequently used as temporary housing in areas affected by natural disasters, when restrictions are temporarily waived.

Another recent trend has been parks in which the owner of the mobile home owns the lot on which his unit is parked. Some of these communities simply provide land in a homogeneous neighborhood, but others are operated more like condominiums with clubhomes complete with swimming pools and meeting rooms which are shared by all of the residents, who are required to pay membership fees and dues.

Modulars

Modular built homes are transported on flatbed trucks rather than being towed, and lack axles and an automotive-type frame. However, some of these homes are towed behind a semi-truck or toter on a frame similar to that of a trailer. The home is usually in two pieces and is hauled by two separate trucks. Each frame has five or more axles, depending on the size of the home. Once the home has reached its location, the axles and the tongue of the frame are then removed, and the home is set on a concrete foundation by a large crane.

Both styles are commonly referred to as factory built housing, although its technical use is restricted to a class of homes regulated by the Federal National Mfd. Housing

Construction and Safety Standards Act of 1974. Most zoning restrictions on the homes have been found to be inapplicable or only applicable to modular homes. This occurs often after considerable litigation on the topic by affected jurisdictions and by plaintiffs failing to ascertain the difference. Most modern modulars, once fully assembled, are indistinguishable from site-built homes. Their roofs are usually transported as separate units. Newer modulars also come with roofs than can be raised during the setting process with cranes. There are also modulars with 2 or 3 stories. As the legal differentiation between the two becomes more codified, the market for modular homes is likely to grow.

Mobile Homes and Severe Weather

While an F1 tornado might cause minor damage to a site-built home, it could do significant damage to a factory built home, especially an older model or one that is not properly secured. Also, structural components (such as windows) are typically weaker than those in site-built homes. 70 mile per hour (113 kilometers per hour) winds can destroy a mobile home in a matter of minutes. Many brands offer optional hurricane straps, which can be used to tie the home to anchors embedded in the ground.

Homes in Europe

The phrase, with or without the hyphen, is used in many European campgrounds to refer to fixed caravans, purpose-built cabins and even large tents, which are rented by the week or even year-round as cheap accommodation, similar to the US concept of a trailer park. Like many US loanwords, this term is not used widely in Britain.

United Kingdom

In the United Kingdom there are three main types of caravans: touring caravans and static caravans and mobile homes. A touring caravan is towed behind a car to its site and parked, often for only a brief period. Touring caravans are usually no larger than 8' wide and can have 1 or 2 axles (2 or 4 wheels respectively). Static caravans aren't towed, as they are too large to tow and have a rudimentary chassis with no

suspension or brakes, and therefore are transported on the back of large flatbed lorries. The axle and wheels are used for movement to the final location when the static caravan is moved by tractor or 4x4. A static caravan will normally stay on a single plot for many years, and have many of the modern conveniences one would normally find in a home.

Static holiday caravans generally have sleeping accommodation for 6 to 8 people in 2 to 3 bedrooms and on convertible seating in the lounge. They tend towards a fairly "open-plan" layout, and while some units are insulated and centrally heated for year-round use, cheaper models without double glazing or central heating are available for mainly summer use. Holiday homes are intended for leisure use and are available in 10'and 12' widths, a small number in 13' and 14' widths, and a few 16' wide, consisting of two 8' wide units joined together. Generally holiday homes are clad in painted steel panels. Static caravans are sited on caravan parks where the owner of the site leases a plot to the caravan owner. Many of these parks are sited in areas that are prone to flooding and anyone considering buying a sited static caravan needs to take particular care in checking that their site is not liable to flooding. Some park owners used to have unfair conditions in their lease contracts but the Office of Fair Trading has produced a guidance document available for download called Unfair Terms in Holiday Caravan Agreements which aims to stop unfair practices.

Mobile Homes are deigned and constructed to be transportable by road in one or two sections. Once assembled you must be able to move the building around site in one section and the structure must also remain divisible for road transport in no more than two sections. Mobile Homes are no larger than 20 x 6.8m (that's 65 x 23FT) with an internal maximum height of 305cms. Legally mobile homes can still be defined as 'Caravans'.

Caravilla

In 2005, a neighborhood of about 500 homes was established in Nitzan. This was a temporary community set up north of Ashkelon, Israel, to home those evicted from their homes in Gush Katif as part of Israel's unilateral disengagement plan.

These homes were named *caravillas*, which is a portmanteau of the words caravan, and villa. The building is composed of several prefabricated sections that are joined on a foundation. This is akin to the Israeli concept of a villa, or single-family home. The caravilla is more spacious than a regular factory built home, and was instrumental in pacifying objections to the disengagement plan.

Modular Home

Modular buildings and modular homes are sectional prefabricated buildings or houses that consist of multiple modules or sections which are manufactured in a remote facility and then delivered to their intended site of use. The modules are assembled into a single residential building using either a crane or trucks.

Modular buildings are considerably different from mobile homes. Off-frame modular dwellings differ from mobile homes largely in their absence of axles or a frame, meaning that they are typically transported to their site by means of flat-bed trucks; however, some modular dwellings are built on a steel frame (on-frame modular), which can be used for transportation to the site. Many modular homes are of multi-level design, and are often set in place using a crane.

Uses

Modular buildings have a wide variety of uses. They will either be used for long-term temporary or permanent facilities. Such uses include construction camps, schools and classrooms, civilian and military housing needs, and industrial facilities. Modular buildings are a perfect solution in remote and rural areas where conventional construction may not be reasonable or even possible. Other uses have also been found for modular buildings including churches, health care facilities, sales and retail offices, fast food restaurants and cruise ship construction.

Construction Process

Modular components are typically constructed within a large indoor facility on assembly lines much like Henry Ford originally instituted with his automobile company. Such facilities

use an assembly line track to move the modules from one workstation to the next. Independent building inspectors are on site to supervise the construction and ensure that all building codes are adhered to during assembly.

The modules that will combine to form the house are assembled off-site in a factory. These modules can take one to three months to be constructed but often take as little as 10 days actually to construct when they are first started. Then they are transported to the building site where a crane is brought in to assemble the modules together. The placement of the modules together generally takes several hours or days. Once assembled, modular buildings are essentially indistinguishable from typical site-built homes. While mobile manufactured buildings often decrease in value over time, a well-built modular should have the same longevity as its site-built counterpart, increasing in value over time.

Advantages

Modular buildings are very affordable because of the factory construction of these buildings. They are very cost effective compared to conventional construction. These units are typically constructed in an enclosed facility, therefore weather is not a factor in the construction time line. Material delivery fees are also out of the equation because an ample amount of material will always be available at the facility, as opposed to being delivered in limited quantities to the job site, nearly eliminating construction delays, and theft of building materials from the site.

Such dwellings are often priced lower than their site-built counterparts and are typically more cost-effective to builders and consumers. These new homes can be constructed in less time than it takes to build a home “on-site”. Manufacturers cite the following reasons for the typically lower cost/price of these dwellings:

- Speed of Construction/Faster Return on Investment-modular construction allows for the building AND the site work to be completed simultaneously, reducing the overall completion schedule by as much as 50%.

- Indoor construction. Assembly is independent of weather which increases work efficiency and avoids damaged building material.
- Favorable pricing from suppliers. Large-scale manufacturers can effectively bargain with suppliers for discounts on materials.
- Ability to service remote locations. Particularly in countries such as Australia there can be much higher costs to build a site-built house in a remote area or an area experiencing a construction boom such as mining towns. Modular homes can be built in major towns and sold to regional areas.
- Low waste. With the same plans being constantly built, the manufacturer has records of exactly what quantity of materials are needed for a given job. While waste from a site-built dwelling may typically fill several large dumpsters, construction of a modular dwelling generates much less waste.
- More environmentally friendly construction process-modular construction generates less materials waste and less site disturbances than comparable site built structures.

Market Acceptance

Some home buyers and some lending institutions resist consideration of modular homes as equivalent in value to site-built homes. While the homes themselves may be of equivalent quality, entrenched zoning regulations and psychological marketplace factors may create hurdles for buyers or builders of modular homes and should be considered as part of the decision-making process when exploring this type of home as a living and/or investment option. In the UK & Australia modular homes have become quite accepted in regional areas however are not commonly built in major cities. Some modular building manufacturers have begun to refer to modular buildings as “off-site construction” to combat the negative image of modular which is due to portables or trailer stereotypes. Recent innovations allow modular buildings to be indistinguishable from site built structures.

Modular Homes vs. Mobile Homes

Differences include the building codes that govern the construction, types of material used and how they are appraised by banks for lending purposes. The codes that govern the construction of modular homes are the exact same codes that govern the construction of any site constructed home. In the United States, all modular homes are constructed according the International Building Code (IBC), IRC, BOCA or the code that has been adopted by the local jurisdiction.

Mobile homes (manufactured homes) are constructed according to the HUD Code and are generally considered lesser quality. The materials are the same as site constructed homes. Wood frame floors, walls and roof is the most typical. Some modulars even included brick or stone exteriors, granite counters and steeply pitched roofs. All modulars are designed to sit on a perimeter foundation or basement. Mobile homes are constructed with a steel chassis that is integral to the integrity of the floor system. Mobile homes often require special lenders. Most companies have standard plans. However, all modular buildings can be custom built to a clients specifications. Today's designs include multi-story units, multi-family units and entire apartment complexes. The negative stereotype commonly associated with mobile homes and has prompted some manufacturers to start using the term Off-Site Construction.

ECo-Friendly Construction

Not only widely renowned and accepted for its cost effective construction, but modular homes also have continually found favor worldwide for its green credentials.

Over years of consistently development, modular homes are now being well-considered as homes build for environment responsibility apart from its sustainability, longevity and price shaving. Modular construction will generate less materials waste and less site disturbances than comparable conventional construction system. Using prefabricated materials and recyclability in the construction, numerous of homes would be accessible and adjustable to use the same substances for one another. This will dramatically help decreasing the unfavorable wastes of materials as well as controlling the entire budget. On

the contrary, traditional building construction tends to increase more unexpected cost and troubles during the processing time since there are some specific legal regulations, controls or unimagined factors to be considered.

However, by using less space and materials, modular homes have very high energy value. Using stronger and tighter sealing system in the house will increase perfect earth friendliness while shortening the risk of increasing the heat and formaldehyde which consequently will gradually poison its surrounding.

However, with the high growth of skilled workers as well as better heating and cooling systems in the house, these will minify many unpleasant damages.

Standards and Zoning Considerations

Typically, modular dwellings are built to local state or council code, so dwellings built in a given manufacturing facility will have differing construction standards depending on the final destination of the modules. Steel and/or wood framing are common options for building a modular homes. Modular home designs can be customized for local zoning codes. For example, homes built for final assembly in a hurricane prone area can have additional bracing built-in to meet local building codes.

Some US courts have ruled that zoning restrictions applicable to mobile homes do not apply to modular homes since modular homes are often assembled with a permanent foundation. Additionally, in the US, valuation differences between modular homes and site built homes are often negligible in real estate appraisal practice; thus, modular homes can in some market areas (depending on local appraisal practices per Uniform Standards of Professional Appraisal Practice) be evaluated the same way as traditionally built dwellings of similar quality. In Australia Manufactured Home Parks are governed by additional legislation that does not apply to permanent modular homes. Possible developments in equivalence between modular and site-built housing types for the purposes of real estate appraisals, financing and zoning may increase the sales of modular homes over time.

Building Strength

According to manufacturers, modular homes are generally designed to be initially stronger than traditional homes by, for example, replacing nails with screws and adding glue to joints. This is supposed to help the modules maintain their structural integrity as they are transported on trucks to the construction site. Despite manufacturer claims that the modular home is initially built to be stronger than a traditional home, it is difficult to predict the final building strength since it needs to endure transportation stresses that traditional homes never experience.

When FEMA studied the destruction wrought by Hurricane Andrew in Dade County Florida, they concluded that modular and masonry homes fared best compared to other construction.

Typically, a modular home contains about 10% to 20% more lumber compared to traditional stick-built homes. This is because modules need to be transported to the job site and the additional lumber helps keep them stable.

Surfaces and Finishes

Modular buildings can be assembled on top of multiple foundation surfaces, such as a crawl space, stilts (for areas that are prone to flooding), full basements or standard slab at grade. They can also be built to multi-story heights. Motels and other multi-family structures have been built using modular construction techniques. The height that a modular structure can be built to depends on jurisdiction but a number of countries, especially in Asia, allow them to be built to 24 floors and possibly even more.

Exterior wall surfaces can be finalized in the plant production process or in the case of brick/stone veneers field applications may be the builders choice. Roof systems also can be apart of – separate from – applied in the field after the basic installation is completed.

Prefabricated Home

Prefabricated homes, often referred to as prefab homes, are dwellings manufactured off-site in advance, usually in standard

sections that can be easily shipped and assembled. Some current prefab home designs include architectural details inspired by postmodernism or futurist architecture.

Consumer Issues

Prefab homes have not been particularly marketable, when compared to standard manufactured housing or existing housing stock.

There are well known reasons for these marketing and consumer uptake problems:

- Homes are not currently produced cost-effectively enough for current demand.
- Homes are not considered a realistic housing solution by the average consumer.
- The consumer is either not familiar with the concept, or does not desire it.
- Social stigmas exist because of low quality mass produced designs used in the past.
- Difficulties obtaining finance due to stricter guidelines being used by lenders to assess prefab home loans.

Current market state

Prefab homes are becoming popular in Europe, Canada and United States as they are relativity cheap when compared to many existing homes on the market. The 2007 finance crisis has however deflated the cost of housing in North America and Europe, so not all prefab homes should be assumed to be cheaper than existing housing.

Modern architects are experimenting with prefabrication as a means to deliver well-designed and mass-produced modern homes. Modern architecture forgoes referential decoration and instead features clean lines and open floor plans.

Because of the design simplifications modern architecture provides (coupled with the cost savings that tend go with design simplification) many in the manufactured housing sector generally feel that modern architecture designs are better suited for prefab home construction.

Word Origin

The word “Prefab” is not an industry term like modular home, manufactured home, panelized home, or site-built home. The term is an amalgamation of panellized and modular building systems, and can mean either one.

In today’s usage the term “Prefab” is more closely related to the style of home, usually modernist, rather than to a particular method of home construction.

Zoning Issues

Manufactured homes are not permitted in some communities and therefore, one should check from their local city to find about prefab building and construction laws regarding prefab homes before considering purchase.

Europe

In the United Kingdom the word “Prefab” is often associated with a specific type of prefabricated house built in large numbers after the Second World War as a temporary replacement for housing that had been destroyed by bombs, particularly in London.

Despite the intention that these dwellings would be a strictly temporary measure, many remained inhabited for years and even decades after the end of the war. A small number are still in use in the 21st Century.

Beyond the British Isles

There is no pan-EU housing standard for this kind of home construction, as regulation has historically been at the national government level.

There are however many EU directives that do apply to housing construction and design, but these directives do not directly affect the inter-EU modular home sector due to inter-EU *free trade* considerations.

However, each modular home is legally expected or obliged to be integrated into the local building code once the final construction is finished.

North America

The prefab home or house requires much less labour as compared to conventional houses or homes. Most of the companies are selling complete pre-manufactured prefab modular homes or houses called “mobile homes” or “manufactured homes”.

Local building codes in North America typically do not apply to prefab homes or houses; instead, these houses are built according to specialized guidelines (Federal HUD regulations, or their Canadian equivalents) for manufactured housing.

Australasia

There is a small number of prefab home builders in Australasia. In the overall housing sector, prefab housing construction is very small as the overall rate of housing construction has been very low due to slow population growth.

The prefab sector in Australasia is more optimised for exporting its product, as domestic consumption is limited.