




WAVE BREAK DESIGN

SERVICE GUIDE

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1.

EXTERIOR AND INTERIOR DESIGN

Exterior and interior DESIGN is a complex activity that involves multiple levels of knowledge, communication, and production, even on a small project. Architectural designers often speak their own language, both in terminology and through conventions of drawings, models, and diagrams. Moreover, to make a piece of architecture requires following countless rules of which an able practitioner must remain ever knowledgeable: building codes, human dimensions, drawing standards, material properties, and relevant technologies.

1.1. WHAT IS EXTERIOR AND INTERIOR DESIGN?

The Interior is defined as a surface that is within the limiting boundaries of a structure. Exterior and interior design encompass not just the architectural structure. It also encompasses the furniture, its flooring, the paint and the decorative elements that are suitable for outdoor or indoor use.

The exterior design includes the designing of a garden, a deck, or a patio, while interior designing includes everything that is inside a home or a structure such as bedrooms, kitchen, or bathrooms.

Exterior Architecture Vs Interior Design

Exterior Architecture Vs Interior Design

For many people, owning a home specifically designed to their taste is the ultimate goal – nobody wants to live in a cookie-cutter house, and we all have dreams of that amazing architecture we wish to be surrounded by. Architecture should reflect client's expectations and inner character.

Interior design

Interior design is the art and science of understanding people's behaviour to create functional spaces within a building. The decoration is the furnishing or adorning of a space with decorative elements, sometimes complemented by advice and practical assistance.

More of an emphasis on planning, functional design and the effective use of space, as compared to interior decorating. We can undertake projects that include arranging the basic layout of spaces within a building as well as projects that require an understanding of technical issues such as window and door positioning, acoustics, and lighting. Although we may create the layout of a space, we may not alter load-bearing walls without having their designs stamped for approval by a structural engineer.

To create interior environments we must know about functionality, safety, and adhere to building codes, regulations and ADA requirements. We go beyond the selection of colour palettes and furnishings and apply our knowledge to the development of construction documents, occupancy loads, healthcare regulations and sustainable design principles, as well as the management and coordination of professional services including mechanical, electrical, plumbing, and life safety—all to ensure that people can live, learn or work in an innocuous environment that is also aesthetically pleasing.

We do specialize and develop technical knowledge specific to different areas or types of interior design, such as residential design, commercial design, hospitality design, healthcare design, universal design, exhibition design, furniture design, and spatial branding.



Exterior design

Exterior design provides a sophisticated complement to the architecture of a dwelling, or space. By integrating nature and man-made structures, the home can be expanded into the outdoors. The functional outcome must blend effectively with surrounding greenery, fountains or features in order to create an environment that is suitable and comfortable for quality outdoor time and family or home entertainment functions. We love earthy tones and colourful accents, the interplay of wood, bark, stone, metal, glass in functional and decorative aspects. Masculine and feminine, contrasts and complementary tones, textures, form, flow and colour. Style Council integrates Architecture and nature, brings life to space and space to life.

Our clients include:

- homeowners,
- property developers,
- hotels and guest houses,
- special development planners
- architects, engineers, builders.

Designs vary based on several important factors:

- The Lifestyle of the Person's or Family.
- The Architecture of the house and the existing Environment.
- Specific Challenges on the property, such as erosion, privacy and so on.
- Regulatory Requirements (by municipalities, homeowner associations etc.)
- Special Structures and Activity centres.
- Significant Features and Landscape Psychology

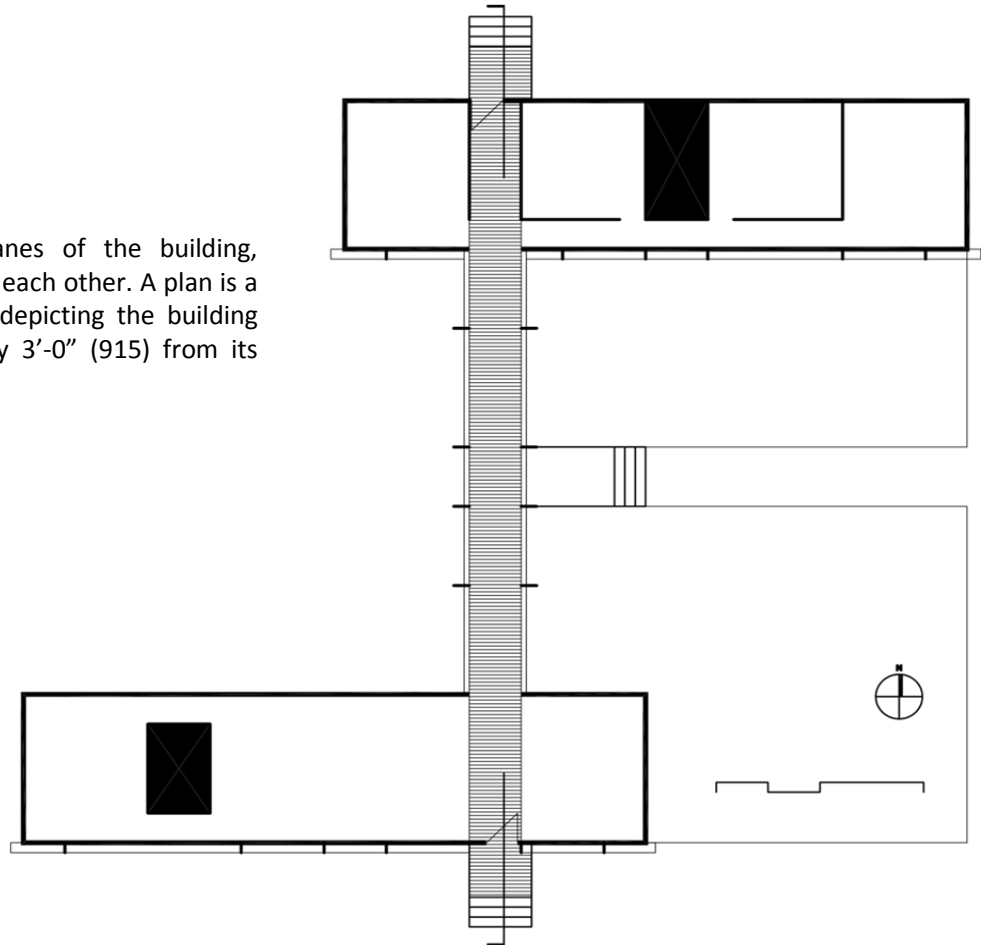


1.2. EXTERIOR DRAWINGS TYPES

We use eight basic drawing types within the drawing set to most completely describe the design of a building.

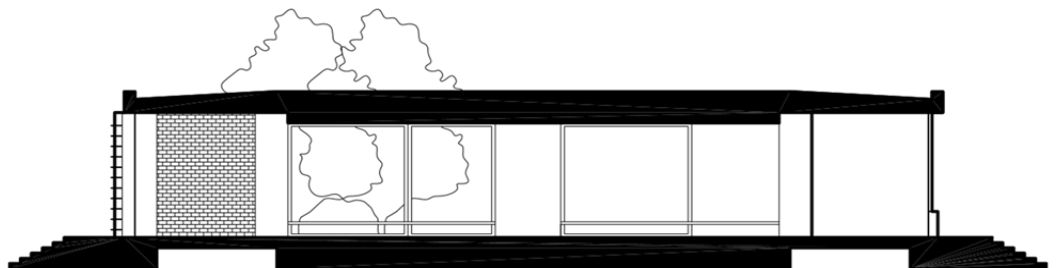
PLAN

View of the horizontal planes of the building, showing their relationship to each other. A plan is a horizontal section, typically depicting the building as though cut approximately 3'-0" (915) from its floor.



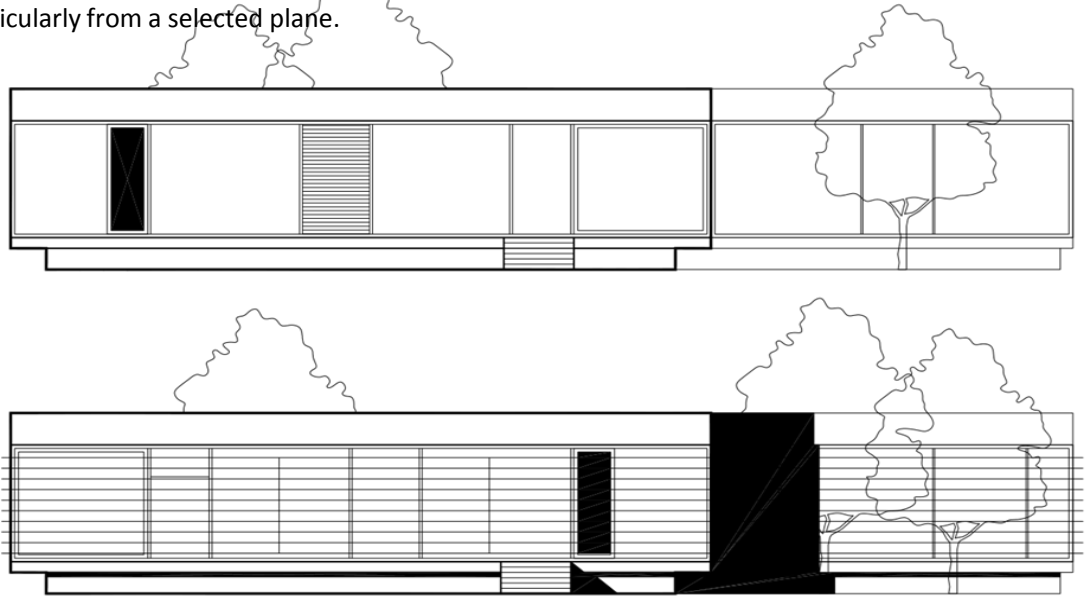
SECTION

View of a vertical cut through the building's components. A section acts as a vertical plan and often contains elevational information, such as doors and windows. This information is shown with a lighter line weight than the section cuts.



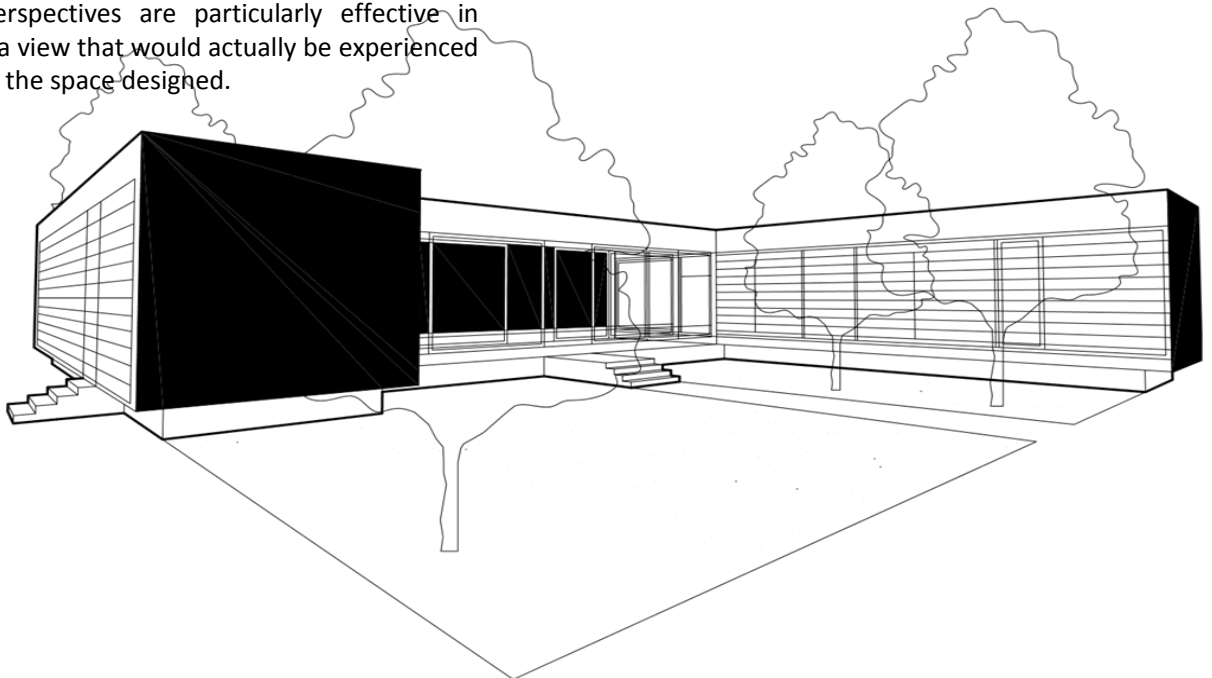
ELEVATION

View of the vertical planes of the building, showing their relationship to each other. An elevation is viewed perpendicularly from a selected plane.



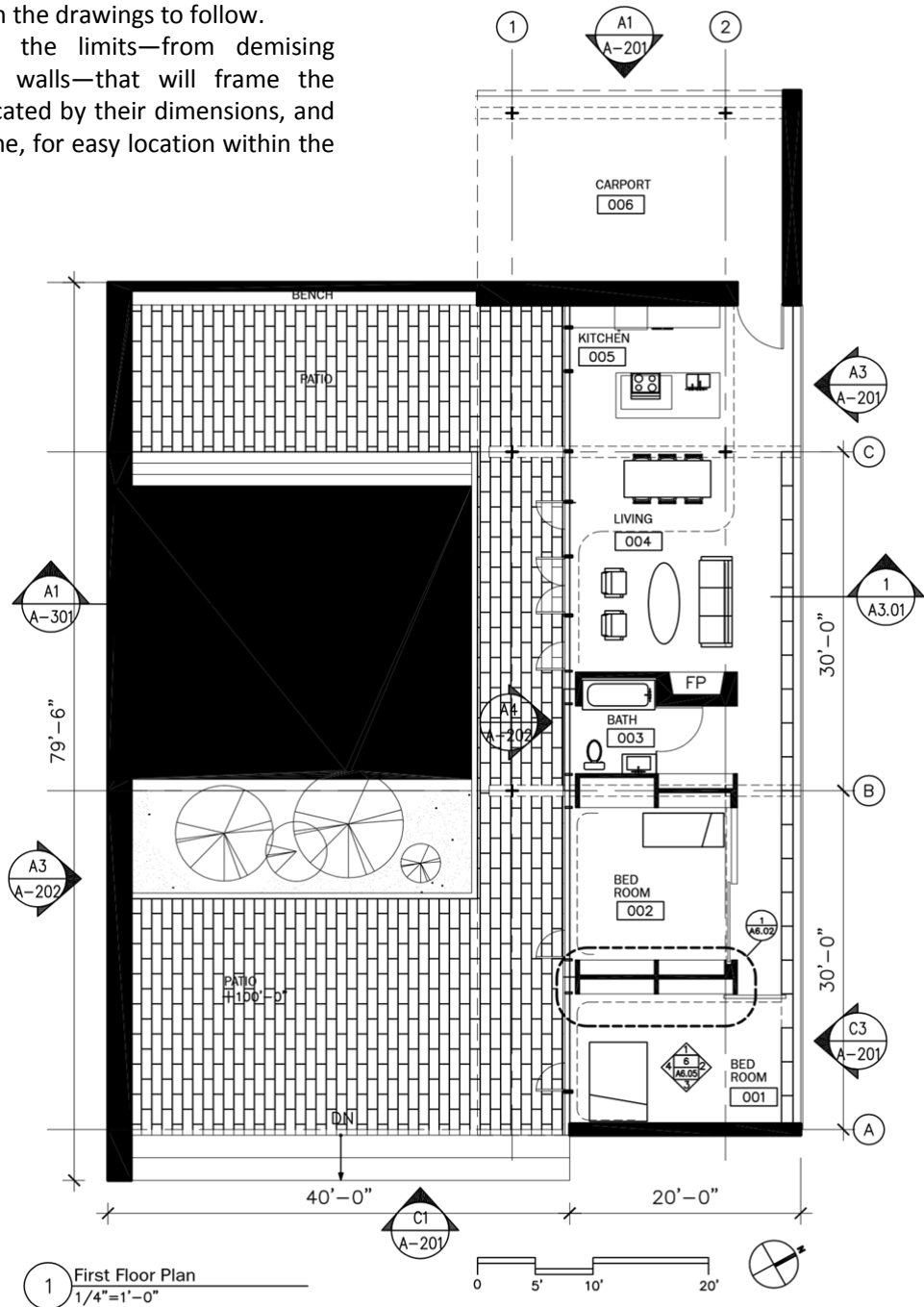
THREE – DIMENSIONAL REPRESENTATIONS

Perspectives (not scaled), axonometric, and isometrics describe the building or space in a way that conventional plans, elevations, and sections cannot. Perspectives are particularly effective in producing a view that would actually be experienced by being in the space designed.



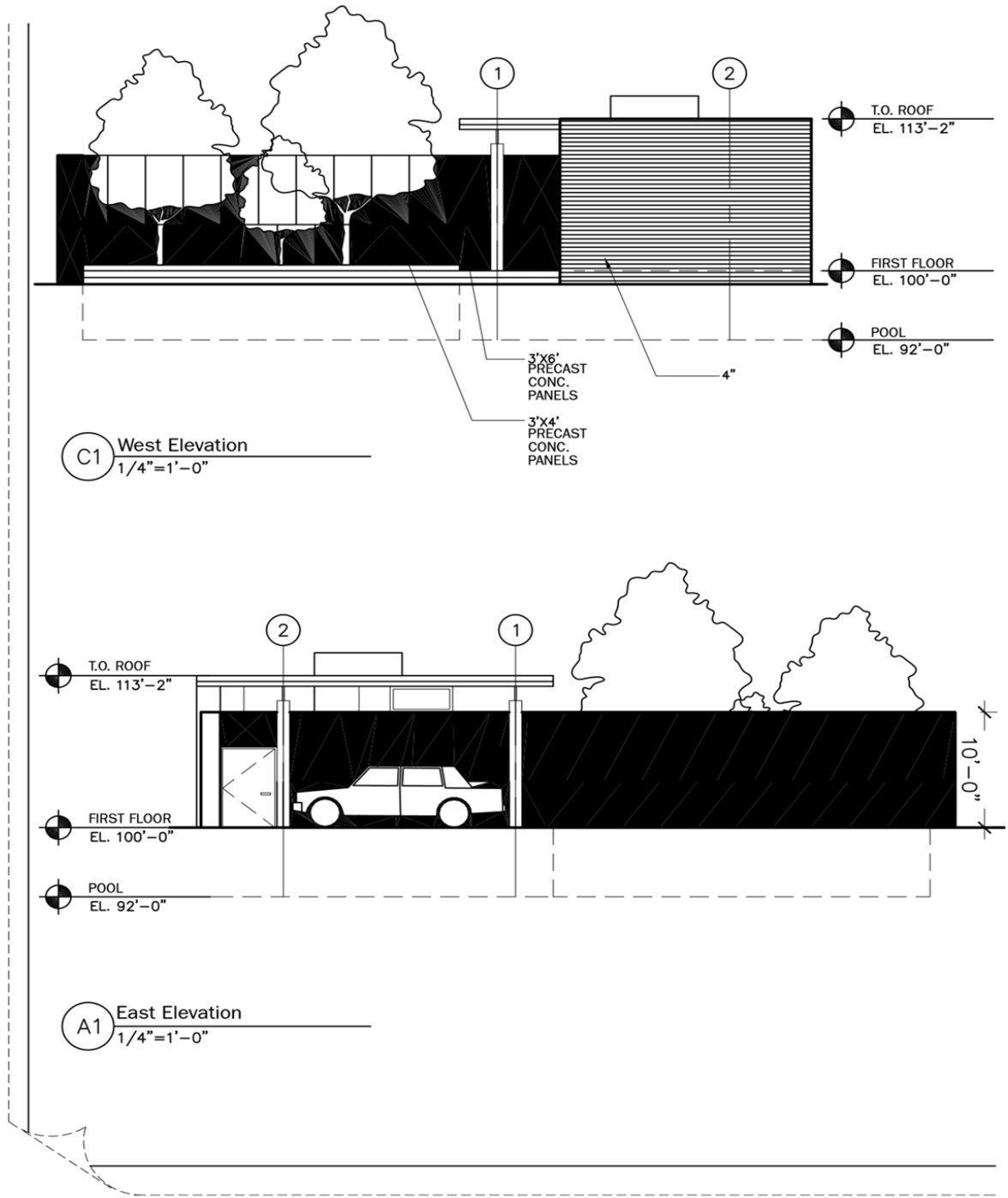
FLOOR PLANS

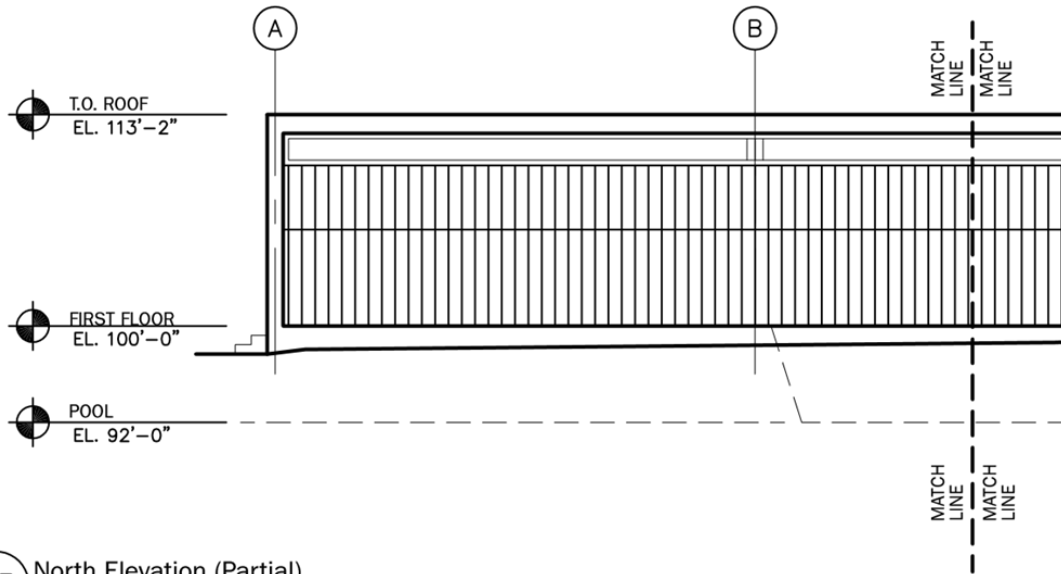
Overall building plans are usually drawn at a scale that enables one to see the whole plan. Most elements of the overall plan are keyed to other drawings in the set, as in the case of larger-scale plans, details, sections, and elevations. Some information may be keyed and cross-referenced among multiple drawings. The keys shown on the plan below reappear on the drawings to follow. Floor plans establish the limits—from demising partitions to exterior walls—that will frame the project. Walls are indicated by their dimensions, and doors by their centerline, for easy location within the floor plate.



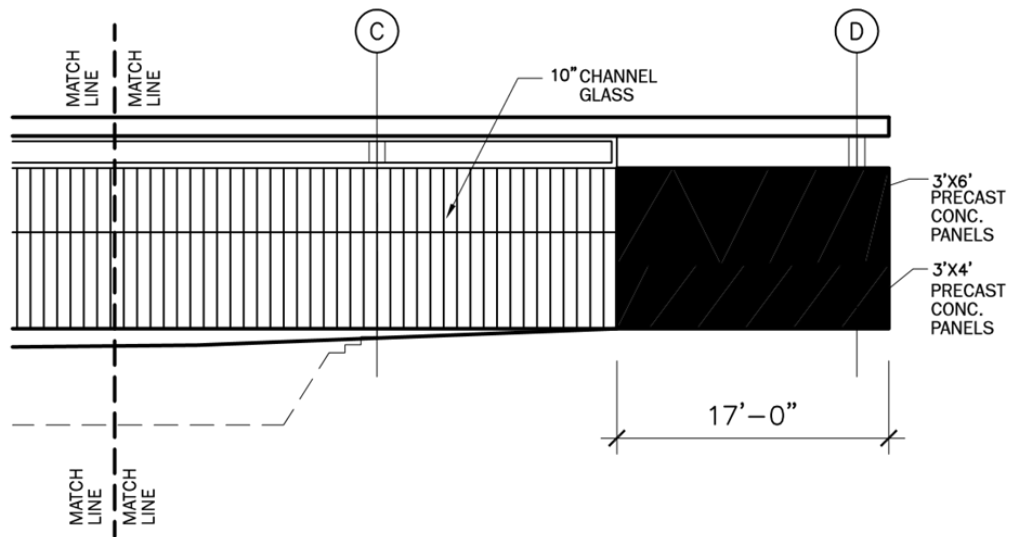
BUILDINGS ELEVATIONS

Building elevations depict the exterior conditions of the building, describing materials and important vertical dimensions. In instances where a drawing is too large to fit on a standard sheet, it must be broken apart and continued on the same sheet or another sheet, requiring the use of match lines for alignment.





C3 North Elevation (Partial)
 1/4" = 1'-0"



A3 North Elevation (Partial)
 1/4" = 1'-0"

EXTERIOR
 BUILDING
 ELEVATIONS

A-201

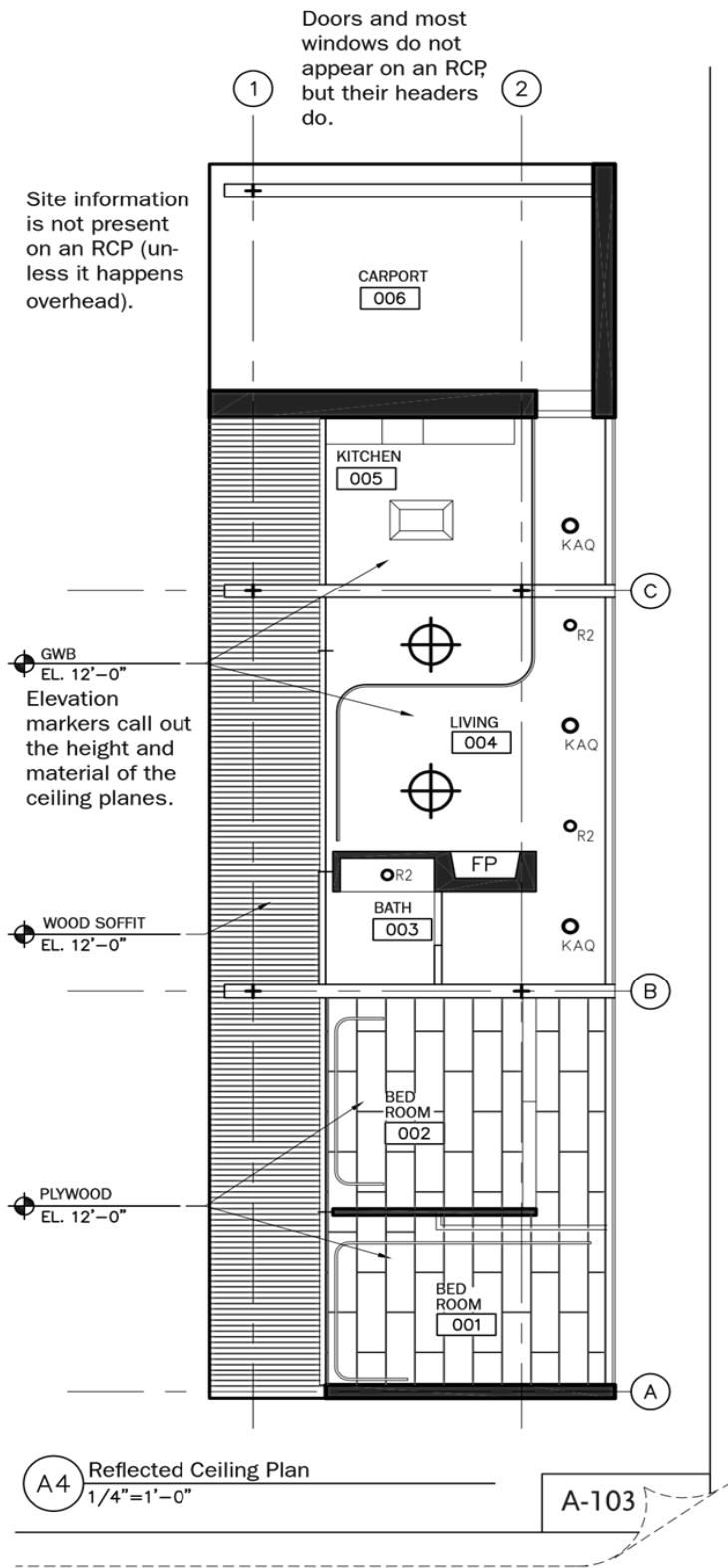
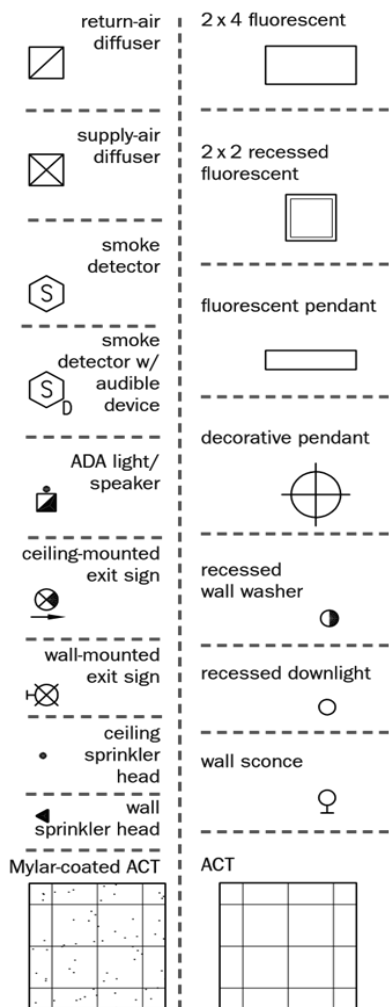
REFLECT CEILING PLANS

Reflected ceiling plans (RCPs) may be thought of as upside-down floor plans, for they are literally a plan of the ceiling.

They are used to describe light fixture placement and types, ceiling heights and materials, and anything else found on the ceiling plane.

RCPs employ standard keys and symbols as well as some specific to the ceiling plan.

Light fixtures often bear tags that refer to their descriptions in the lighting specifications.

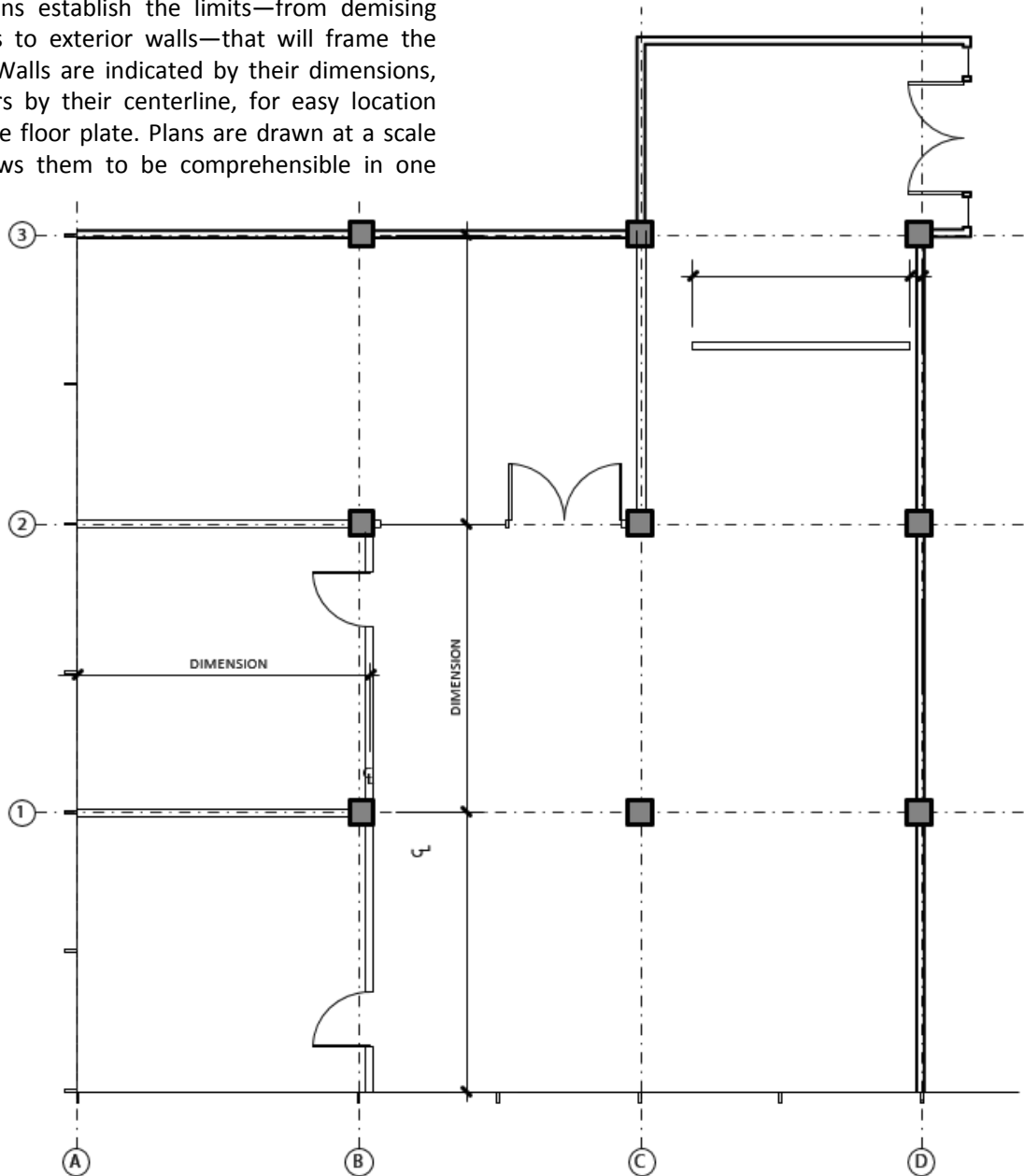


1.3. INTERIOR DRAWING TYPES

Drawings are the main communicative tool in our arsenal. Some drawing types will overlap with those of other disciplines, such as architecture or electrical engineering. The following pages demonstrate the typical drawings with which customers should be familiar.

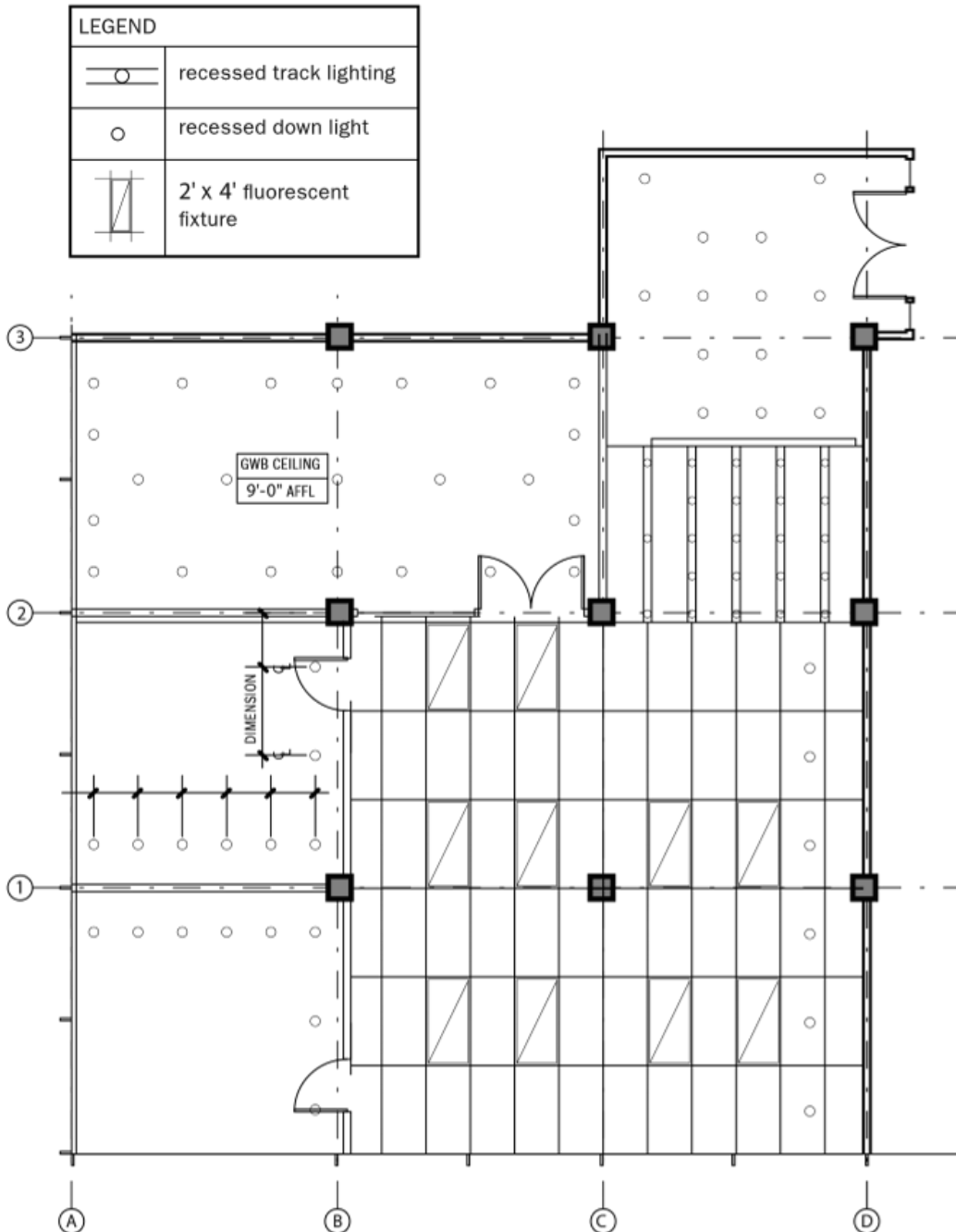
FLOOR PLANS

Floor plans establish the limits—from demising partitions to exterior walls—that will frame the project. Walls are indicated by their dimensions, and doors by their centerline, for easy location within the floor plate. Plans are drawn at a scale that allows them to be comprehensible in one view.



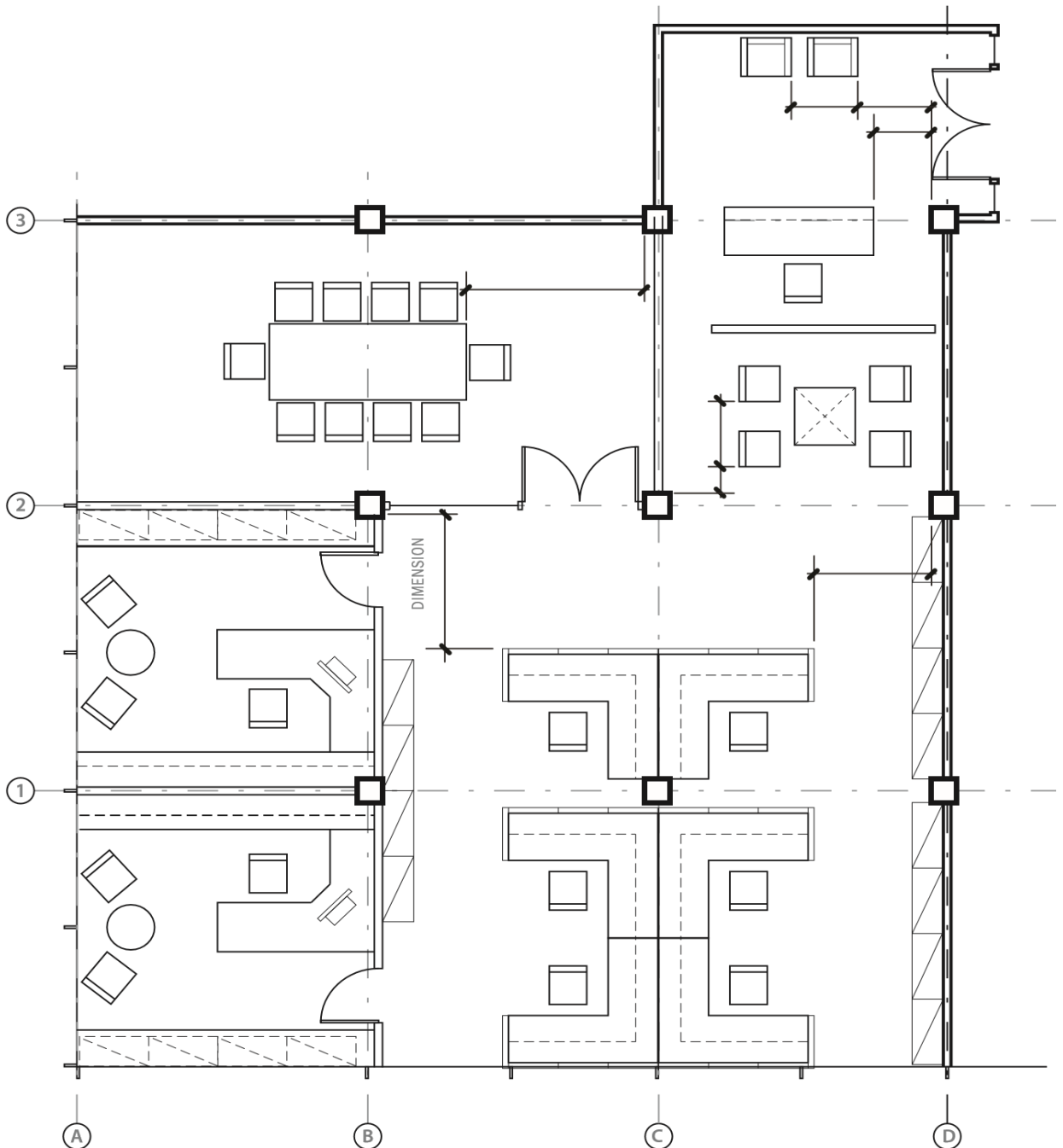
REFLECTED CEILING PLANS

Reflected ceiling plans (RCPs) depict the upper surface of a room as viewed through a mirror. All light fixtures, soffits, transoms, and other ceiling data such as heights and materials are noted on RCPs. Standard symbols are used to describe fixture types and locations and are keyed to a legend on the drawing sheet.



FURNITURE LOCATION PLANS

We often specify furniture—both custom and purchased—for their projects. These items are indicated on many other plans, but furniture location plans specifically dimension their placement within the project.

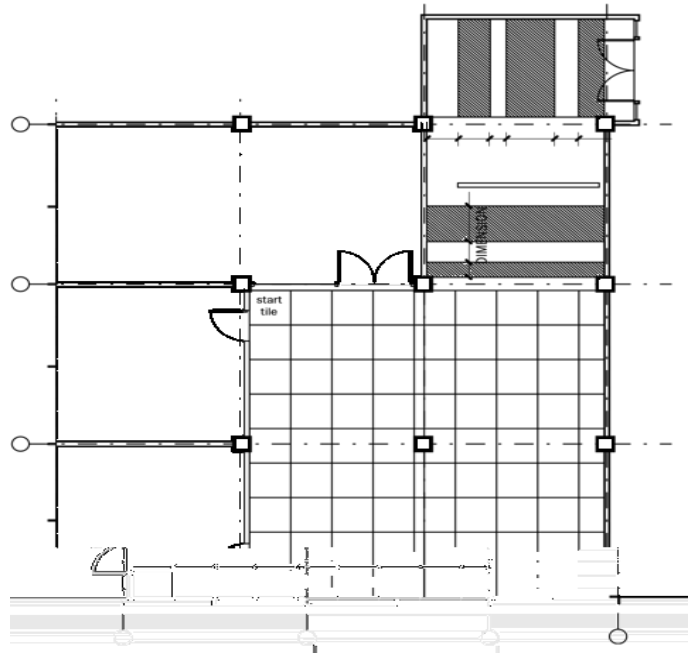


FINISHES PLANS

Interior finishes encompass all materials and surfaces that can be seen or touched. The choice of materials and the methods of construction should be based on the function of the space, the anticipated volume of traffic, acoustical effects, fire-resistance ratings, and aesthetic appearance.

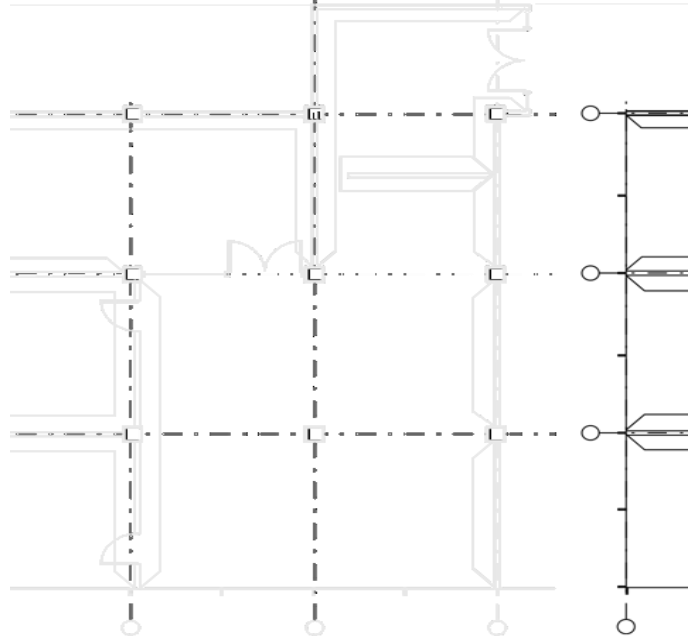
- Floor finish plan

Floor finish plans set the type, location, and dimensions of any pattern that is within the scope of the design, including, if necessary, a start tile.



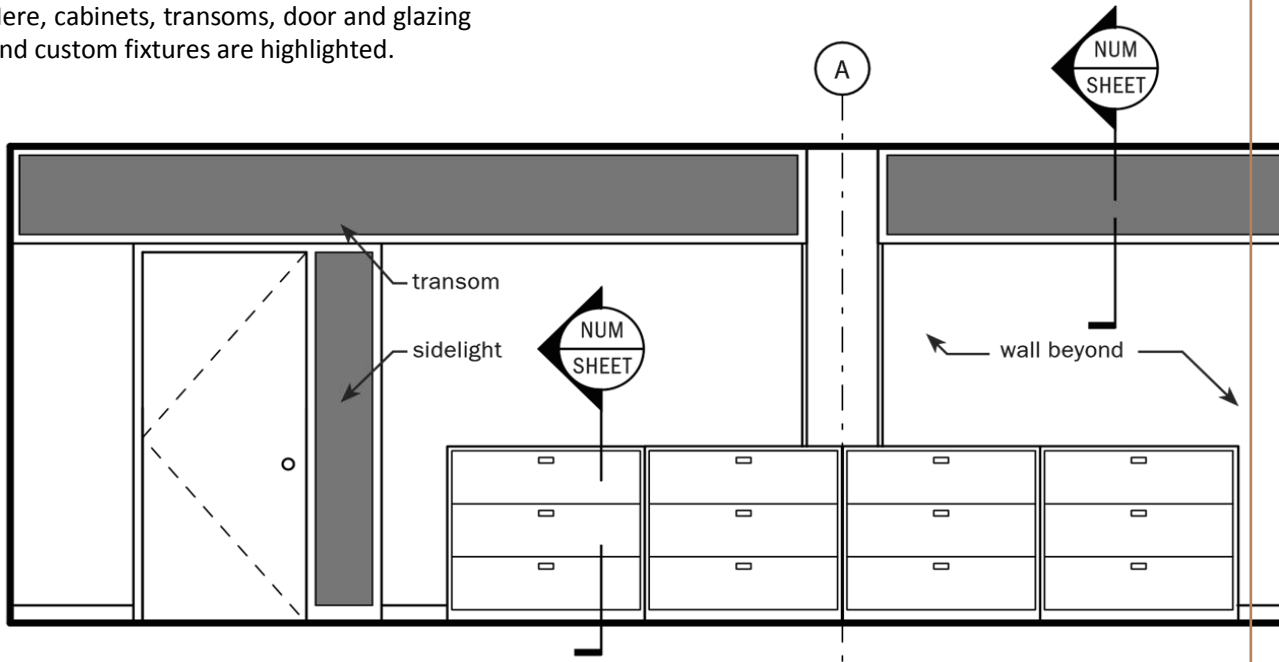
- Wall finish plan

Wall finish plans, with a simple tagging system, provide the data for start and stop points of colour, for materials such as wallpapers and other wall coverings like wood paneling, and for acoustic treatments.



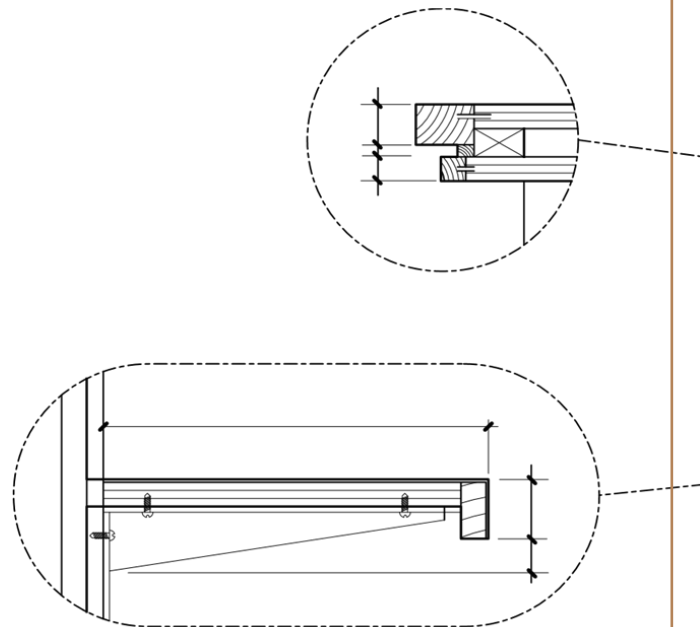
INTERIOR ELEVATIONS

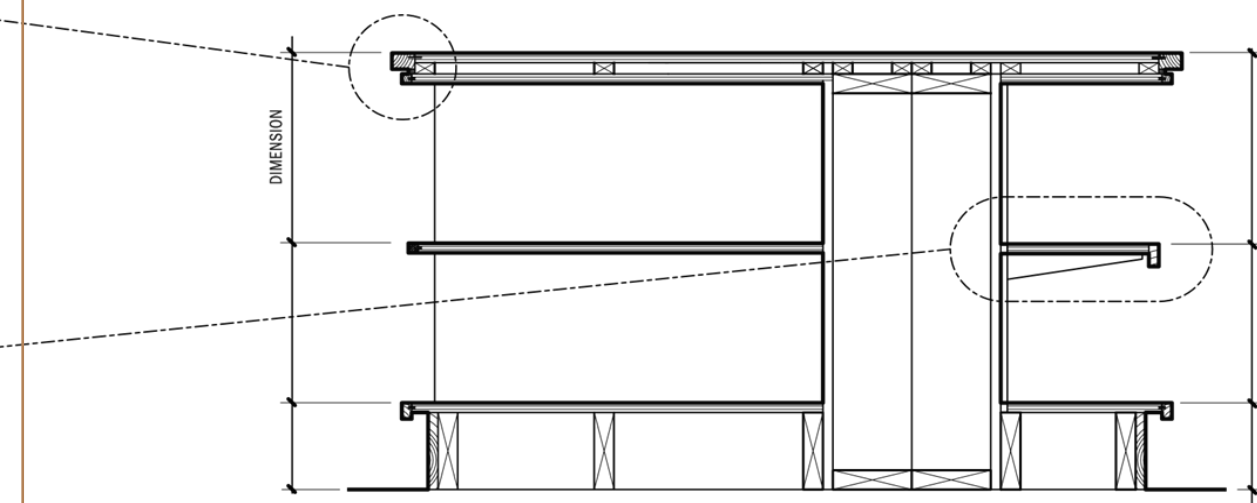
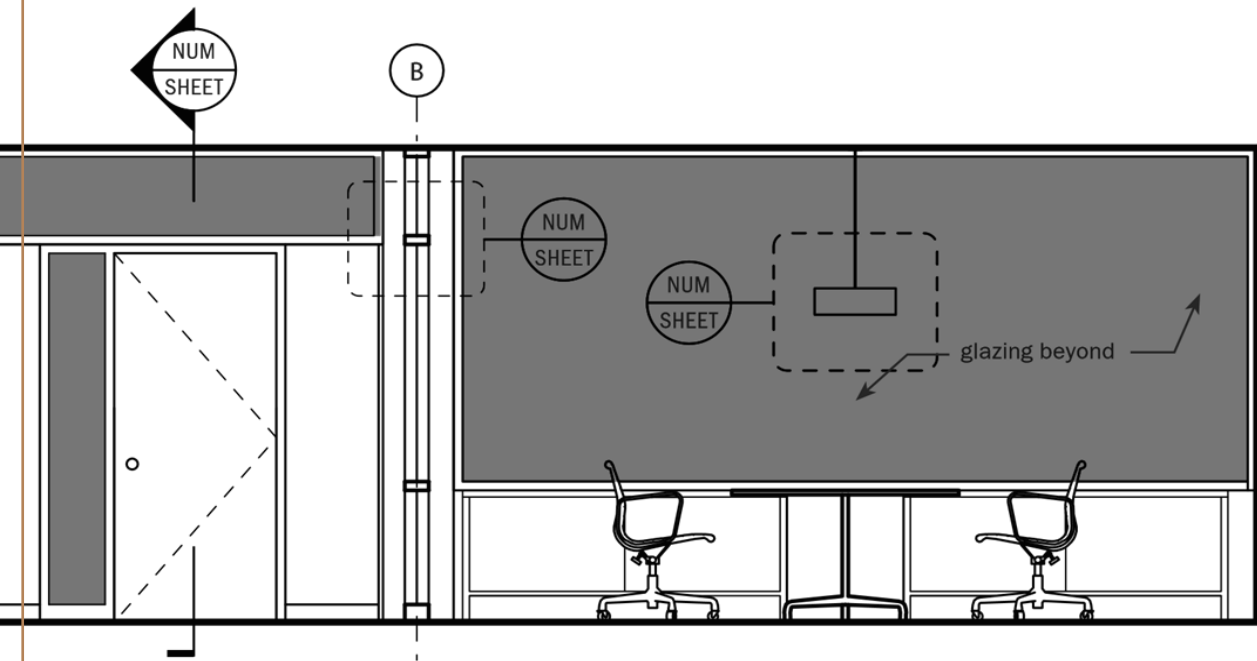
Elevations are typically drawn at a larger scale than the plans of a project. This allows for the inclusion of more detail, such as specific information about the dimensional and material qualities of objects in the interior. Elements on elevational drawings are cross-referenced to section and plan details that further develop the design. Here, cabinets, transoms, door and glazing details, and custom fixtures are highlighted.



DETAILS

Details indicate how the design is to be fabricated and range from wall sections to mechanical coordination details to millwork construction. They are produced at a larger scale than all other drawings in the set. Scales for details can be as small as $1/4" = 1"$ (1:4) through to full scale. Occasionally, details are drawn at larger than the full scale to transmit clearly the intent of the designer to the fabricator or contractor. In detail drawings, materials are rendered symbolically, and annotations specify the material and fabrication methods to be used.





1.4. READING THE DRAWING SET

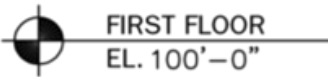
Drawing Symbols and reference markers are necessary for navigating the drawing set. They tell whoever is looking at a drawing where to go to find out more information about certain elements.



interior elevation



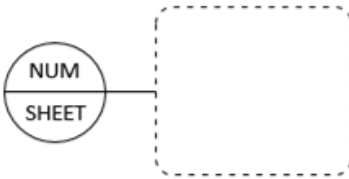
building section



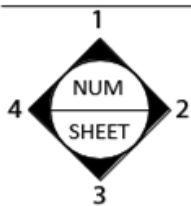
elevation target



standard drawing identifier



enlarged detail reference



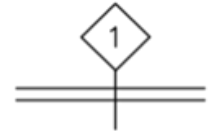
interior elevation



north arrow



ceiling height



partition type



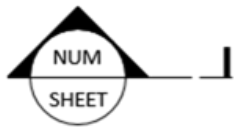
window type



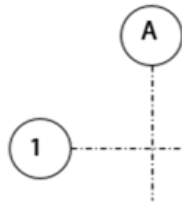
door type



wall type



wall or detail section



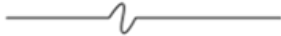
column grid



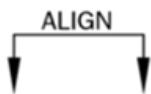
drawing label



revision cloud and number



break line

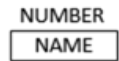


align note

centerline



room tag



wall coverings



floor coverings



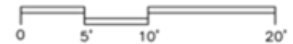
wall finishes



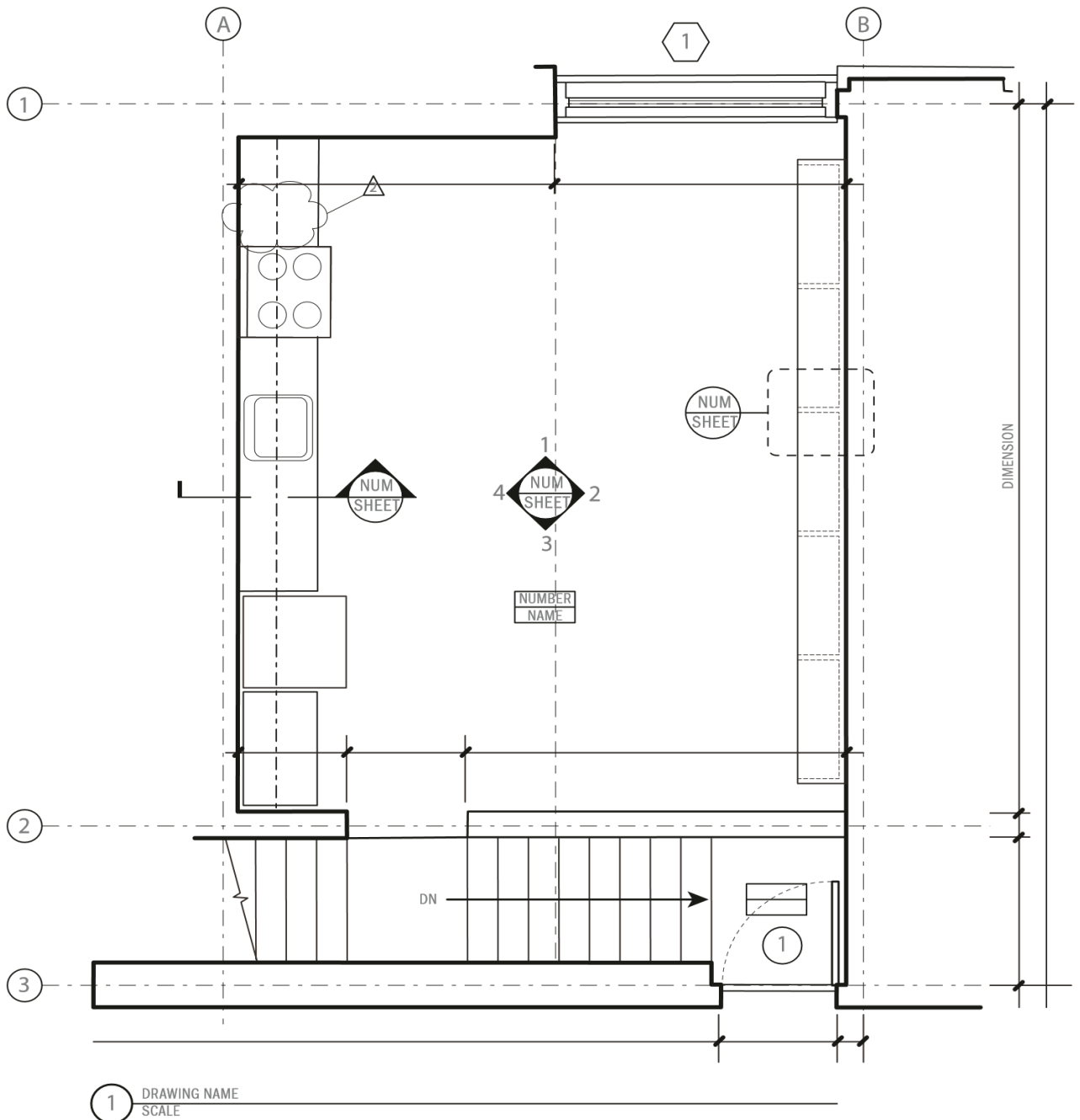
lighting fixture



graphic scale



Symbols on a plan drawing are keyed to other drawings in the set, including reflected ceiling plans, elevations, sections, and details. Elements needed to implement a design are thus easily read from drawing to drawing, and revisions are readily coordinated. Dimensions are indicated in strings around the plan, or in some cases, within the plan itself. Legibility of text and numbers is crucial to reading a plan.



1.5. ARCHITECTURE AND DESIGN PRODUCTS

Earth, Water, Fire, Air. All the elements of nature designed into our living environments enhance a sense of well being, peace and timeless beauty in our lives.

Exterior design provides a sophisticated complement to the architecture of a dwelling, or space. By integrating nature and man-made structures, the home can be expanded into the outdoors. The functional outcome must blend effectively with surrounding greenery, fountains or features in order to create an environment that is suitable. and comfortable for quality outdoor time and family or home entertainment functions. We love earthy tones and colorful accents, the interplay of wood, bark, stone, metal, glass in functional and decorative aspects. Masculine and feminine, contrasts and complementary tones, textures, form, flow and color.



FACADES

A Façade is an exterior wall of a building, usually the front. It is often the most important aspect from a design standpoint, as it sets the tone for the rest of the building. The facades of a building play an important role in contributing to the amenity and attractiveness of an area. A common building line creates a continuity of building frontages and provides definitions and enclosure of the street. A building façade is the most integral piece to the overall design of the structure, as it adds a unique personality and character to it.

From conventional to contemporary, facades are of many types and empower us to literally play around and bring to life an extraordinary look to the building structure. By smartly linking the exterior to the interiors of the building, a façade controls light penetration or filtration, regulates heat, minimizes solar gain which leads to more energy-efficient buildings allowing solar shading and passive cooling automatically

Facades are the face of a building that shields against the damage resulting from high winds and rains and even protects against extreme temperatures and humidity. A façade system plays a huge role in improving energy efficiency in a building structure. When it comes to sustainable material solutions, metal and glass have numerous advantages. Both are sustainable and recyclable materials, so there is little waste or resource depletion. When used as a building's facade, these eco-friendly materials offer a multitude of options with environmental, functional and aesthetic benefits.

Façade is often called the external skin of the building, and the protection provided by the external skin ensures natural ventilation. To assist in architectural vision, building facade solutions in perforated metal, expanded metal and architectural glass are in demand these days. These materials offer us, the flexibility to create buildings that combine architectural and aesthetic impact with sustainability.



Facade claddings

- Concrete cladding
- Stone cladding
- Composite materials
- Metal meshes cladding
- Plastic cladding
- Exterior finishes
- 3D Wall Claddings



Facade systems

- Living walls
- Concrete facades
- Continuous facade systems
- Sun protection
- Curtain walls
- Facade support structures

WINDOWS AND DOORS

A window is an opening in a wall, door or roof which allows the passage of light, sound and air. Usually, windows are glazed or covered with some transparent material like a sash set in a frame. Windows often have a latch to lock the window shut or to hold it open as they allow ventilation or exclude inclement weather. A door is a hinged movable barrier or a panel that fits into the building, room to provide security by controlling access to the portal. Doors are commonly attached by hinges that can be moved by slides or counterbalancing.

There are various types of windows such as eyebrow windows, fixed windows, single-hung and double-hung sash windows, sash windows, casement windows, awning windows, tilt and slide windows transom windows, sidelight windows, skylights, roof windows, roof lanterns, bay windows, available on the market. Single-hung windows have a classic style and take up little space. They're great near patios or on porches since they open from the bottom for ventilation. Double-hung windows are also excellent for letting more air in. Casement windows are ideal for difficult to reach areas hinged on the side and open outward right or left, usually using a crank handle.



Window profiles

- Aluminum windows
- Wooden windows
- PVC windows
- Aluminum-wooden windows
- PVC-aluminum windows
- Other windows

Window systems

- Frames
- Sills
- Lintels
- Outdoor railing systems
- Window accessories
- Security bars



Rooflights

- Roof windows
- Continuous rooflights
- Dome rooflights
- Sun pipes



Doors

- Interior doors
- Exterior doors
- Garage doors
- Door handles



Architectural glass

- Insulating glass and double glazing
- Tempered glass
- Decorative glass
- Satin-finished glass
- Solar control glass
- Safety glass
- Other glass



Sunshade blinds and sunblinds

- Blinds
- Shutters
- Opening system for blinds
- Curtains
- Curtain rods
- Curtain tracks
- Solar shadings
- Skylight shades
- Window and door films

INNER WALLS AND CEILINGS

The beauty of any structure is nowhere complete if the walls and ceilings are not designed in a harmonious confluence with each other. A home or an office that lacks a proper semblance between the various aspects inside will always lack in creative appeal. Inner walls and ceilings enhance the overall beauty of the interior of any home or office, but it is also a far more convenient approach than choosing to design the interior with furnishings and other accessories intricately.

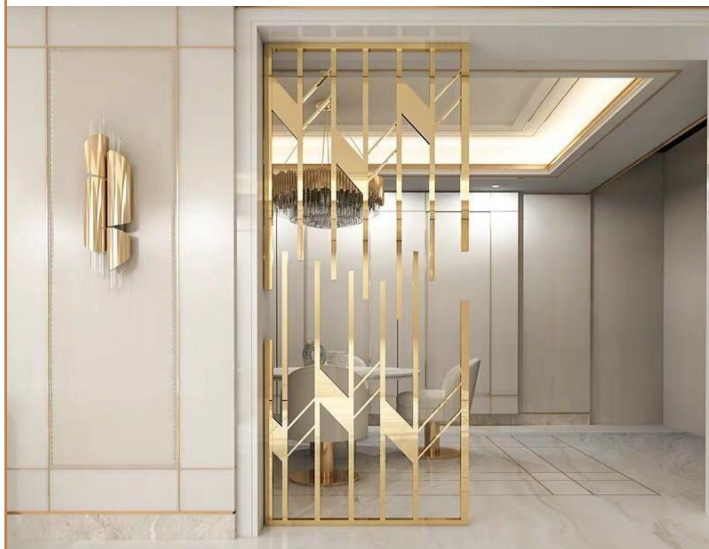
Inside walls and ceilings come in numerous combinations of colors, patterns, and designs. This makes it easy for one to choose a different look for every room and space and also make the area way more exciting and well designed. The interior walls and ceilings do not always need to be made of plasters and drywall. Wood, environment-friendly plastic and variety of other materials are available that can help in creating exciting looks and designs for the walls and ceilings.

It is important to remember that before beginning the process of designing the interior of any given space, the plans and layout of the type of walls and ceilings one needs should be finalized. It is not a compulsory aspect to have regular everyday boring whitewashed walls and ceilings at all times.

Incorporating unique elements like alloys, ceramics, rustic designs with a colorful platter, and 3D models are possible while choosing the designing of the walls and ceilings. The best features of the materials used in designing the interiors can also be extended for usage on the outer walls.

Known for their robust structure along with the ability to withstand various elements like heat, cold, moisture, etc., the materials used for the inner walls and ceilings can last for decades together without losing its finesse and look. Ceilings are often left plain and white. It is believed to promote a broader and more spacious look, aside from improving the brightness of the space. However, smart technology can be added to these boring ceilings in the form of auto controllable bright lights with false ceilings and walls.

These extra additions not only improve the aesthetic appeal of the space but also make it look way more interesting. In fact, designing any space regardless of the size and purpose is often much more interesting and beautiful, if there is a correct usage of patterns and designs of 'Inner walls and ceilings.'



Partitions

- Partitions
- Glazed partitions



Ceilings

- Suspended ceilings
- Ceiling Accessories



Tiles

- Ceramic wall tiles
- Porcelain wall tiles
- Terracotta wall tiles
- Stone wall tiles
- Mosaic wall tiles



Wall covering

- Wall panels and cladding
- Decorative wall cladding
- Laminates and veneers
- Wallpapers
- Indoor green walls
- Column covers
- Decorative architectural elements



Paints & plasters

- Paints
- Plasters
- Coatings
- Varnishes
- Primers

SIGNAGE

Signage displays are widely used for building brand awareness, advertising and conveying messages about a business's products and services. Many businesses utilize the tremendous potential of signage products to deliver product descriptions, comprehensive announcements, emergency information and timetables in real time.

Deeply ingrained in the collective minds of viewers, signage directs, reminds and inspires people to make decisions each day. It offers priceless benefits and helps a business establish a unique identity. Signage draws people in on impulse and assists a business in winning customers.

In addition to creating a profound impact on viewers, signage solutions offer many other advantages. These products are extensively used to enhance safety in risk environments such as swimming pools. Digital sign boards are also utilized as wayfinding and signpost solutions, along with several other marketing purposes. Highly affordable, digital signage technology lowers the cost of printing materials such as conventional posters, billboards and brochures.

There are many different types of digital signage. The most popular types of signage solutions include business signage, trade show displays, and custom banners. Moreover, signage is available in different colors, styles, shapes and sizes. Furthermore endless finishes and designs can be chosen.

Signage products made using wood offer excellent ease of installation and appreciable sustainability credentials. Other types of materials employed to make signage are corrugated plastic, PVC foam, polystyrene, foamcore, acrylic and Plexiglass, aluminum, polymer glass laminate and fiberglass.

Wayfinding displays with natural geo-finishes are an exclusive alternative to conventional signage materials. These types of products are commonly used by establishments such as airports, shopping centers, hotels, resorts and many other entertainment facilities. Interior signage solutions like acrylic mirror sheets not only convey the message effectively to the customers, but also enhance the aesthetic appeal of an office or business space.

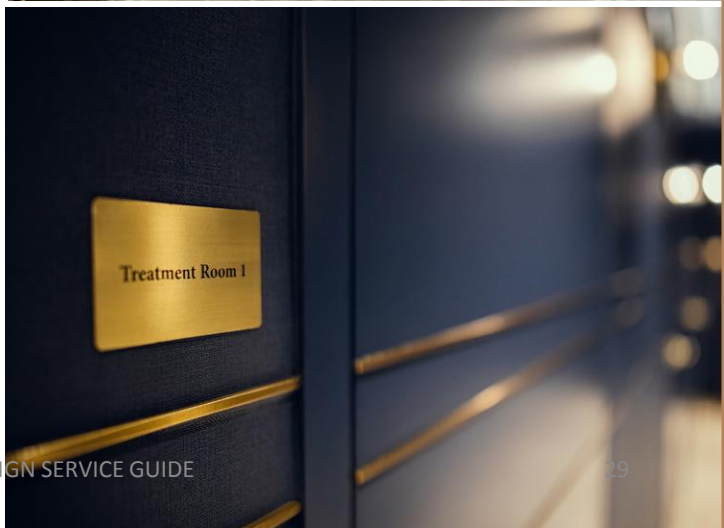
Creativity is the only limitation when it comes to designing digital signage and the sky is the limit in terms of selecting graphic elements. Several businesses make use of digital wall graphics to inspire clients and improve staff morale. The impact on the existing interior undergoes tremendous transformation and easily draws attention to the targeted area.

Exterior signage helps a business show off a product and create a striking impression on prospective clients. An eye catching signage solution makes wayfinding easy and enjoyable. There are also exclusive products that display painting and artworks with an extra-theft delaying bracket. Other popular options include concrete-cut razor sharp logos, polished aluminum petals, aluminum box profile with blindly mounted text panels and many more. Signage is available in many more different forms with trusted manufacturers. Customized solutions are also available to fulfill the exact needs of different customers.



Pablo Blau

Aesthetic Treatments



FLOORS AND STAIRS

A floor is the bottom surface of a room available in many-layered surfaces. Floors may be stone, wood, bamboo, metal or any other material that can support the expected load. It typically consists of a subfloor for support and a floor covering gives a good walking surface. A staircase is a construction designed to bridge a large vertical distance by dividing it into smaller vertical distances called steps. Stairs may be straight, round, or may consist of two or more straight pieces connected at angles. There are special types of stairs which include escalators, ladders, elevators, stairlifts and inclined moving walkways.

Flooring is a permanent covering of a floor, or for the work of installing such a floor covering. Floor covering is a term to generically describe any finish material applied over a floor structure to provide a walking surface. Moreover, stairs are provided for convenience to access floors, roofs, levels and walking surfaces not accessible by other means.

Flooring materials are classified as flooring includes carpet, laminate, tile, and vinyl. The choice of material for floor covering is affected by factors such as cost, endurance, noise insulation, comfort, and cleaning effort. Carpet is a soft floor covering made of bound carpet fibers or stapled fibers. Carpeting refers to wall-to-wall coverage, whereas a rug is simply used to cover a space. This type of flooring is typically used indoors and can be used in both high and low traffic areas. Cork flooring is considered to be eco-friendly and comes in both tiles and planks, and can have glue or glue-less installation. Laminate is a floor covering that appears similar to hardwood but is made with plywood with a plastic laminate top layer.

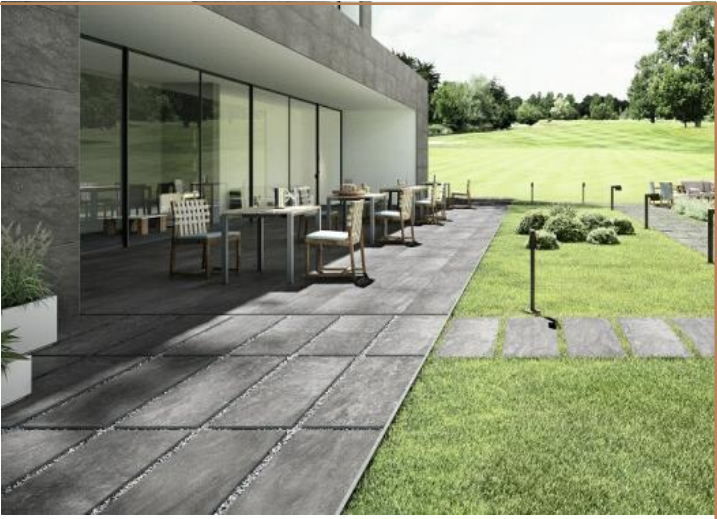


Wood flooring

- Solid wood flooring
- Engineered wood flooring
- Wood laminate flooring
- Solid wood floor medallions

Tile flooring

- Ceramic floor tiles
- Terracotta floor tiles
- Stone floor tiles
- Concrete floor tiles
- Flexible floor tiles
- Edge trim
- Kitchen floor tiles
- Bathroom floor tiles
- Pool floor tiles
- Border floor tiles
- Listellos
- Porcelain stoneware floor tiles



Floor covering

- Linoleum flooring
- Resin flooring
- PVC flooring
- Cork flooring
- Rubber flooring
- Concrete flooring
- Synthetic grass
- Raised Floors

Pavers

- Ceramic pavers
- Terracotta pavers
- Stone pavers
- Concrete pavers
- Other pavers



Baseboard and skirtings

- Underlay
- Stairs
- Elevators
- Escalators
- Moving walkways
- Joists

Stairs

- Straight staircases
- Spiral Staircases
- Retractable Stairs
- Indoor Stairs
- Outdoor staircases
- Fire Escapes
- Other staircases
- Railings
- Steps nosings
- Staircase components
- Staircase claddings
- Entrance ramps
- Suspended walkways
- Stairlifts
- Lifting platforms



Elevators, escalators and moving walkways

- Commercial elevators
- Home elevators
- Car elevators
- Moving walkways
- Escalators

Carpets

- Entrance mats
- Carpets
- Carpet tiles

ROOFS

The basic purpose of any roof is to provide protection to persons inside a structure from the elements. This purpose is necessary in every part of the world as the roof provides shelter against something as basic as bright sunshine, rain, snow and high winds. Most of all, it provides a sense of safety and privacy to the people living inside a roof.

There are a variety of roof types to choose from including slate, which is one of the longest-lasting roof materials, it is a natural rock that is mined and cut to become a form of 'shingle' (a thin, tapered piece of material used as a roof and wall covering). Slate roofs are also relatively heavy. Canopies, tile and even solar where green roofs covered with plants and asphalt shingles are the most popular choice for roofing because asphalt shingles are lower in cost, readily available and come in a variety of colors and styles.

Metal roofs are another option but, Metal roofs can be as much as two or three times more expensive than other roofing materials. Metal roofs can be noisy, especially during heavy rain or hailstorm, expansion and contraction problem, the inconsistency of color match.

Roof ventilation is very important when it's hot outside. It simply helps to flow air through a system of intake and exhaust. There are different waterproofing methods available in construction which makes it water-resistant so that it remains relatively unaffected. Liquid waterproofing membrane, bituminous coating and cementitious waterproofing are some of the easiest ways to protect the roof from leaking.

Maintaining a roof is incredibly important. Not just for the integrity of the roof but the entirety of home as well. Maintaining a roof is vital for appearances, ensuring it is structurally sound and preventing possible problems. While checking for openings, the integrity of the materials is important. Roofing products deteriorate over time through the natural ageing process, hence excessive granule loss, blisters, or physical damage to the roofing material might occur over time. It is easier to deal with the problem before it shows up on the interior.



Roof Tiles

- Ceramic roof tiles
- Metal roof tiles
- Concrete roof tiles
- Photovoltaic roof tiles
- Other roof tile materials



Roof slates



Roof structure

- Metal trusses and structures
- Wood trusses and structure
- Prefabricated structural roof elements



Roof panels



Roof systems



Roof edges



Patio columns



Gutters and downpipes



Roof shingles



Canopies

BEAM AND COLUMN

Beams and columns are two important types of structural elements that play a key role in creating a safe load path to transfer the weight and forces on a structure to the foundations and into the ground. Beams are usually horizontal structural elements that carry loads perpendicular to their longitudinal direction.



Patio columns



Porch columns



Exterior columns



Pergola columns



Interior columns

SANITAR AND KITCHENS

We use the Kitchen Planning Guidelines with Access Standards to provide customers with good planning that considers the needs of a range. The code references for the Kitchen Planning Guidelines are based on the analysis of the 2012 International Residential Code® (IRC®) and the International Plumbing Code®. The code references for the Access Standards are based on ICC A117.1–2017 Accessible and Usable Buildings and Facilities. We sure to check local, state, and national laws that apply to design and follow those legal requirements.

The purpose of the guidelines is to serve as the basis for:

- Ensuring building code compliance.
- Recognizing the importance of consumer health, safety, and welfare in kitchen and bath design.



Bathtubs

- Bathtubs
- Bath screens



Showers

- Showers
- Shower heads
- Shower columns
- Shower Trays
- Shower cubicles
- Shower screens



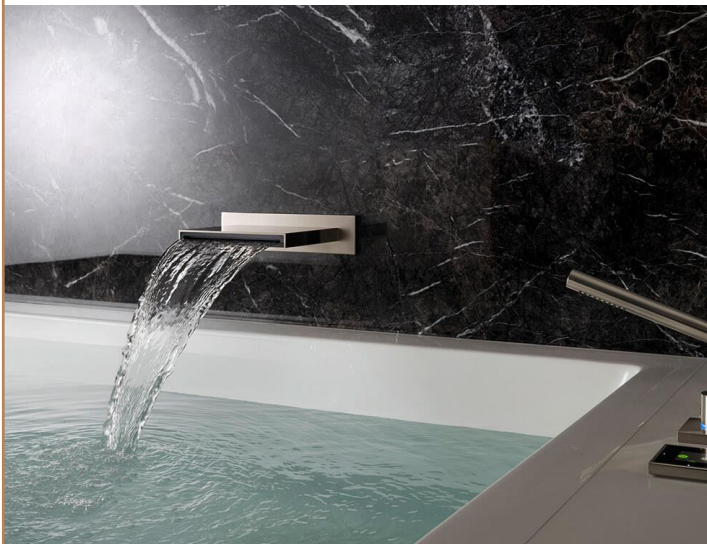
Toilets

- Toilets
- Toilet seats
- Toilet flushes
- Urinals
- Bidets
- Hand basins



Washbasins

- Washbasins
- Washbasin cabinets



Bathroom taps

- Washbasin taps
- Washbasin double-handle mixer taps
- Shower taps
- Shower double-handle mixer taps
- Bathtub taps
- Bidet taps
- Bathtub double-handle mixer taps
- Double-handle bidet mixer taps
- Diverters
- Flush plates
- Other bathroom taps



Bathroom countertops

- Bathroom shelves and cabinets
- Bathroom shelves
- Bathroom cabinets
- Medicine cabinets



Bathroom accessories

- Bathroom mirrors
- Towel radiators
- Bathroom hooks
- Towel racks
- Hand dryers
- Soap dishes
- Soap dispensers
- Toilet paper dispensers
- Toothbrush holders
- Laundry baskets
- Grab bars
- Bathroom trash cans
- Other - Accessories



Accessible bathrooms

- Accessible showers
- Accessible bathtubs
- Accessible toilets
- Shower Seats
- Bathtub seats
- Bath lifts
- Accessible toilet seats
- Accessible washbasins
- Accessible grab bars



Kitchens

- Wooden kitchens
- Laminate kitchens
- Stainless steel kitchens
- Compact kitchens
- Hidden kitchens
- Island kitchens
- Kitchenettes
- Other kitchens



Kitchen elements

- Kitchen taps
- Double-handle kitchen mixer taps
- Kitchen sinks
- Kitchen countertops
- Cooker Hoods
- Kitchen furniture
- Kitchen appliances



Swimming pools and equipment

- Indoor swimming pools
- Swimming pool covers
- Swimming pool safety
- Swimming pool heating
- Pool liners
- Pool edging
- Pool equipment

Sports and wellness

- Hot tubs
- Hydromassage tubs
- Turkish baths
- Saunas
- Ice caves
- Steam rooms
- Spa showers
- Salt caves
- Spa equipment

LIGHTING

Lighting or illumination is the deliberate use of light to achieve practical or aesthetic effects. Lighting includes the use of both artificial light sources like lamps and light fixtures, as well as natural illumination by capturing daylight. Daylighting (using windows, skylights, or light shelves) is sometimes used as the main source of light during daytime in buildings. This can save energy in place of using artificial lighting, which represents a major component of energy consumption in buildings. Proper lighting can enhance task performance, improve the appearance of an area, or have positive psychological effects on occupants.

Indoor lighting is usually accomplished using light fixtures and is a key part of interior design. Lighting can also be an intrinsic component of landscape projects.

Lighting fixtures come in a wide variety of styles for various functions. The most important functions are as a holder for the light source, to provide directed light and to avoid visual glare. Some are very plain and functional, while some are pieces of art in themselves. Nearly any material can be used, so long as it can tolerate the excess heat and is in keeping with safety codes.

An important property of light fixtures is the luminous efficacy or wall-plug efficiency, meaning the amount of usable light emanating from the fixture per used energy, usually measured in lumen per watt.

A fixture using replaceable light sources can also have its efficiency quoted as the percentage of light passed from the "bulb" to the surroundings. The more transparent the lighting fixtures are, the higher efficacy. Shading the light will normally decrease efficacy but increase the directionality and the visual comfort probability.

Color temperature for white light sources also affects their use for certain applications. The color temperature of a white light source is the temperature in kelvins of a theoretical black body emitter that most closely matches the spectral characteristics of the lamp. An incandescent bulb has a color temperature around 2800 to 3000 kelvins; daylight is around 6400 kelvins. Lower color temperature lamps have relatively more energy in the yellow and red part of the visible spectrum, while high color temperatures correspond to lamps with more of a blue-white appearance.



Interior Lighting

- Ceiling Lamps
- Wall lamps
- Pendants
- Table lamps
- Floor lamps
- Linear lighting
- Track lights
- Modular lighting systems
- Spotlights
- LED
- Neon
- Other - Lamps

Outdoor Lighting

- Outdoor pendant lights
- Outdoor wall lights
- Outdoor ceiling lights
- Outdoor floor lights
- Facade lights
- In-ground lights
- Bollard lights
- Outdoor LED
- Street lights
- Garden lights
- Outdoor step lights

LIVING SPACE FURNITURE

Furniture refers to movable objects intended to support various human activities such as seating (e.g., chairs, stools, and sofas), eating (tables), and sleeping (e.g., beds). Furniture is also used to hold objects at a convenient height for work (as horizontal surfaces above the ground, such as tables and desks), or to store things (e.g., cupboards and shelves). Furniture can be a product of design and is considered a form of decorative art. In addition to furniture's functional role, it can serve a symbolic or religious purpose. It can be made from many materials, including metal, plastic, and wood. Furniture can be made using a variety of woodworking joints which often reflect the local culture.

Furniture, household equipment, usually made of wood, metal, plastics, marble, glass, fabrics, or related materials and having a variety of different purposes. Furniture ranges widely from the simple pine chest or stick-back country chair to the most elaborate marquetry work cabinet or gilded console table. The functional and decorative aspects of furniture have been emphasized more or less throughout history according to economics and fashion. Chairs are always for sitting in, but some are more comfortable or highly ornamented than others. Accessory furnishings are smaller subsidiary items such as clocks, mirrors, tapestries, fireplaces, panelling, and other items complementary to an interior scheme.



Chairs

- Armchair
- Armchairs with footrest
- Folding chairs
- Stacking chairs
- Turning chairs
- Dining chairs
- Indoor chaise longue
- Stools
- Rolling chairs
- Rocking chairs
- Bar chairs
- Poufs & bean bags
- Barstools

Sofas

- Benches
- Other - Sofas
- Straight sofas
- Corner sofas
- Modular sofas
- Sofa beds
- Indoor daybeds
- Upholstered benches



Tables

- Coffee Tables
- Other - Tables
- Dining tables
- High bar tables
- Side tables
- Nesting tables
- Trestles
- Sideboard tables
- Residential desks
- Computer desks
- Dressing tables
- Pool tables
- Ping pong tables
- Table bases

Beds and bedside tables

- Other Beds
- Single beds
- Double beds
- Canopy beds
- Pull-out beds
- Loft beds
- Wall beds
- Headboards
- Bed accessories
- Bunk beds



Textiles

- Wall fabrics
- Upholstery fabrics
- Upholstery leather
- Other fabrics



Children's furniture

- Cribs
- Child's beds
- Child's chairs
- Child's tables
- Child's wallpaper
- Other children's furniture



Interior accessories

- Rugs
- Cushions
- Wall-mounted mirrors
- Free-standing mirrors
- Table mirrors
- Room Dividers
- Wall-mounted coat racks
- Floor coat racks
- Coat hooks
- Clocks
- Decorative paintings
- Residential sculptures
- Vases
- Other interior accessories
- Other - Mirrors



Storage and shelving

- TV / Multimedia units
- Shelves
- Wardrobes
- Cupboards and cabinets
- Wall Units
- Chests of Drawers
- Bookcases
- Sideboards
- Clothes racks
- Display cases
- China cabinets
- Entrance wardrobes and cabinets
- Shoe racks
- Chests
- Storage boxes
- Furniture handles and knobs
- Furniture hinges

OFFICE FURNITURE

Office furniture any furnishing that is free-standing and does not require installation with component parts. Examples are desks, chairs, file cabinets, tables, lounge seating, and computer desks.

Systems furniture is a modular furniture solution that provides the various parts needed to create workstations; conceptually, it's like a Lego kit for office workstations. You may also hear of systems furniture referred to as modular furniture.

The modular style allows the office to be set up and adjusted according to its own unique needs. For companies that are experiencing rapid growth or want to create a flexible floorplan, systems furniture is a great solution that allows the office to adapt much more quickly to a changing work environment.



Office furniture

- Office desks
- Office workstations
- Office chairs
- Executive chairs
- Office accessories
- Office stools
- Visitor's chairs
- Office booths
- Office partitions
- Office Storage units
- Office shelving
- Workstation dividers
- Office drawer units
- Other office chairs
- Meeting tables
- Filing Cabinets
- Office reception desks

PUBLIC BUILDINGS FURNITURE

Museums, conference halls, schools, public offices all these sectors and many others need an attentive organization of space and design in compliance with current regulations. Designing and setting up a public building means keeping in mind the users' needs like architectural barriers for disabled people, clear and complete signalling, organized and safe service rooms and all this without forgetting design and new trends.



Public buildings furniture

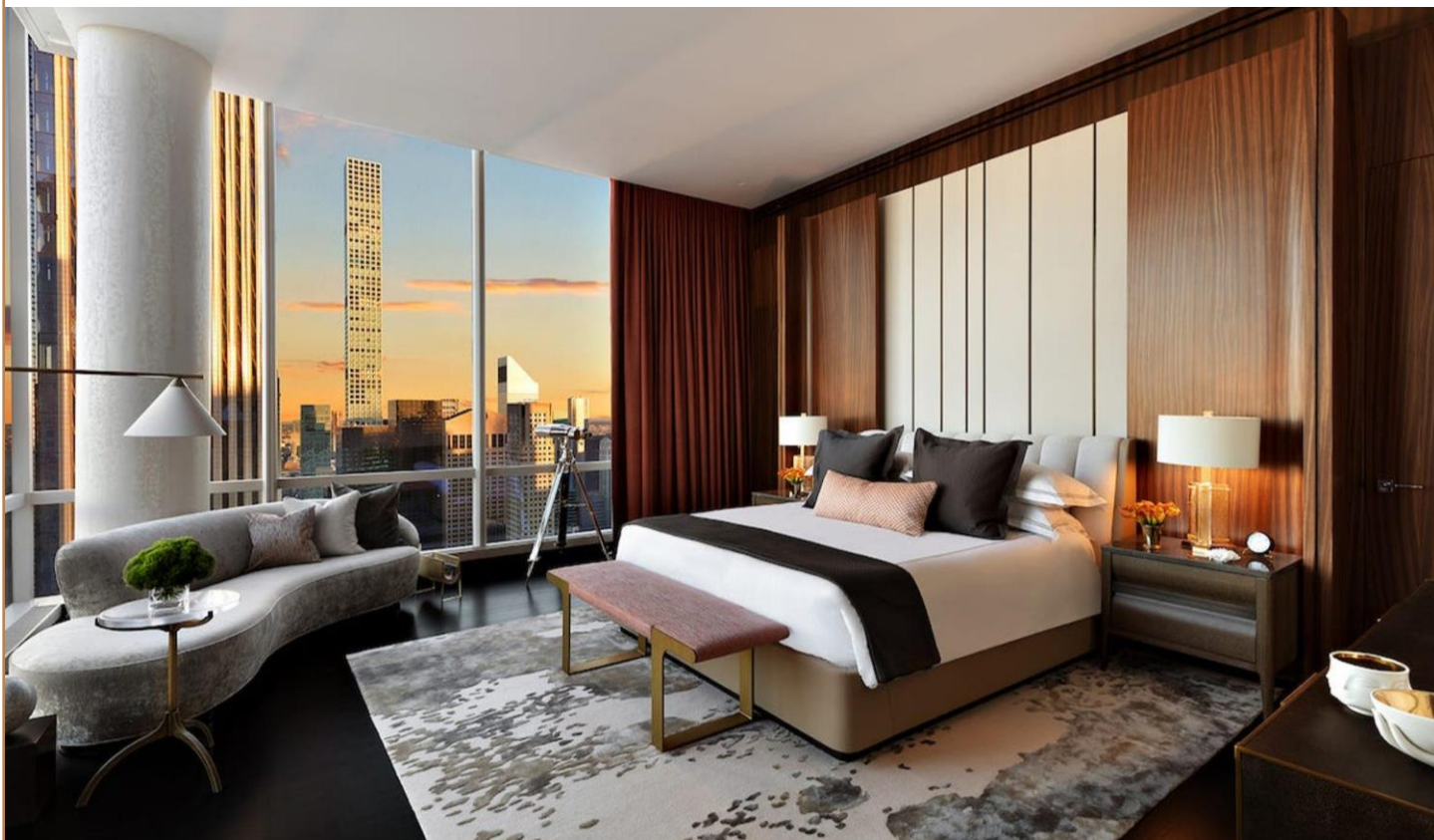
- Lounge chairs
- Bench seatings
- Beam seatings
- Waiting room sofas
- Waiting room chairs
- Lounge tables
- Desks
- Reception desks
- Auditorium seats
- Classroom chairs
- Crowd control barriers
- Turnstiles
- Changing rooms
- Platform lifts
- Stairlifts
- Safe-deposit boxes
- Public place signs
- Retail display cases
- Structures for stands and fairs

HOSPITALITY FURNITURE

Hospitality furniture (a.k.a. commercial furniture) is a product you will find in a hotel, restaurant or commercial setting within high-traffic areas. Examples of this include, but are not limited to; headboards, nightstands, coffee tables, vanities, entertainment units, dining tables, chairs, etc. Hospitality furniture, unlike residential furniture, is known for its ability to resist wear and tear from constant use for long periods of time.

Most importantly, it must undergo stability, durability, and weight testing to meet commercial-grade standards.

Hospitality furniture is also designed to be easily maintained and has long-lasting resilience. Many major brands with the hospitality industry will require owners to upgrade their hotel furniture every 8-10 years (Note: this also happens so designs within the hotel room are kept current).



Hospitality

- Other hospitality furniture
- Restaurant chairs
- Restaurant tables
- Bar counters
- Barstools
- Restaurant booths
- High tables
- Hotel bedrooms
- Hotel beds
- Hotel sofas
- Hotel desks
- Hotel bedside tables
- Hotel wardrobes
- Monoblock kitchens
- Hotel furnishing
- accessories

OUTDOOR

Outdoor furniture

From chairs to patio dining sets, outdoor furniture is designed to withstand the elements. However, some outdoor furniture materials may hold up better in warm, dry climates rather than cold, wet climates.

Aluminum is by far the most popular contemporary patio furniture material (even resin wicker is typically woven over an aluminum frame). It resists rust and moisture damage better than other metals and a powder coated finish will offer added protection against the elements. Also known as all-weather wicker, resin wicker is a longer-lasting, weather-resistant synthetic fiber weave wrapped over a metal frame. While plant material such as cane and rattan are the traditional materials used to make wicker furniture.

Pine, cedar, or fir are softer woods with some degree of natural weather resistance; hardwoods such as shorea and teak boast exceptional durability and performance. In both style and performance, recycled plastic patio furniture ranks at or near the top. Recycled plastic is extraordinarily strong and extremely durable. It's resistant to moisture, rotting, and cracking and is impervious to saltwater and stains. It also resists fading, because its color is intrinsic to the material. And best of all, most recycled plastic is made to resemble wood but requires none of the care wood does.

It's heavier than aluminum, and in its natural state is more vulnerable to the elements. However, the best contemporary wrought iron patio furniture is specially treated with weather-resistant finishes that help seal out moisture and prevent rust.

Lighter than wrought iron but heavier than aluminum, steel provides strength, stability, and endurance in extreme temperatures. Powder-coated finishes aid in rust resistance. Typically used for framing high-end modern chairs and bistro-style seats, steel is also often used for retro designs and zero-gravity loungers. Mosaic patio dining sets feature decorative tabletop patterns created using hand-laid tiles of slate, terra cotta, marble, or other natural materials. Incredibly heavy yet beautifully delicate, mosaics bring rich color and intricate designs to outdoor living and dining.

Street furniture

Street furniture is a term for items or objects which are installed in streets and roads for various purposes.

It includes equipments such as benches, traffic benches, bollards, post boxes, street lamps, traffic lights, taxi stands, fountains, benches, traffic barriers, bollards, post boxes, phone boxes, street lamps, traffic signs, bus stops, tram stops, taxi stands, public lavatories, fountains, watering troughs, memorials, public sculptures, and waste receptacles. etc. The furniture is designed according to aesthetics, visual identity, function, pedestrian mobility and road safety. These items when added to streets and roads help direct traffic, inform road users, and help pedestrians. The popularity of street furniture has become so much that one can easily recognize the location by its design. The design and placement of furniture should take into account aesthetics, visual identity, function, pedestrian mobility and road safety.

Outdoor flooring

Probably the most versatile in terms of appearance, composite wood-look decking can give your outdoor patio flooring a rustic, homey feel or a chic, polished, modern look. As we know, wood never goes out of style, making composite wood-look decking a choice that won't go out of style. Composite wood decking gives you the best of both worlds. With modern technology, you can achieve a gorgeous, realistic wood look without the challenges of traditional wood. Composite decks, like vinyl floors, bring you realistic wood looks without any of the hassle. Most of those "stone" or "wood" patios you see aren't really stone or wood at all, but tile. Patio floor tiles, and specifically, porcelain exterior tiles, are often even more durable than natural materials like stone and wood, depending on the PEI rating.

Plastic drainage tiles are like the ultimate outdoor flooring. They're mold- and mildew-resistant and designed specifically to prevent slipping when they get wet. The vented surface allows water to drain under the tile, so there aren't any standing puddles after a rain.

The hard plastic of the tiles is UV stable, which means the color won't fade even after extended exposure to sunlight. Drainage tiles work great for decks and patios, as well as around pools, outdoor showers, and anywhere that moisture might cause some challenges.

Fences and perimeter enclosures

Garden fences allow to demarcate the outdoor perimeter to heighten the sense of intimacy and safety, while contributing to furnish the outdoor area. Outdoor fences are made of different materials and are available in a variety of models with a versatile design and different heights, lengths and colors. The traditional wooden fence – or picket fence – can be varnished in to order to best integrate with the outdoor context. Iron fences are the best options for modern looking environments, although wrought iron is more recommended to forge shapes and decorations suitable to a backyard furnished in liberty style. A functional solution is represented by prefabricated fences. Easy and practical to be mounted, they are composed of modular panels to be joint to each other as to compose the perfect fence.

A garden natural and classic-style furniture can play as an alternative to metal fences or plastic decorative grids. Installing dry-stone walls along the perimeter, or wooden fences like picket fences allows to reproduce a typical rural environment. Moreover, wooden fences can be varnished with treated paints, resistant to the action of atmospheric agents, to fit the requirements of an outdoor context to a maximum extent.

Enclosures and iron gates for a modernly furnished garden.

Iron fences are the most commonly used to mark off the perimeter of an outdoor space. As a material, iron is especially appropriate for the outdoor, since it does not warp as it ages and can stand any temperature. On top of that, iron fences come in modern design models, featuring different shapes and heights to best fit in a garden modern furniture style. Compared with pvc enclosures, iron demands basic maintenance and can be combined with gates for the outdoor entrance.

Outdoor fireplaces and heaters

The outdoor stoves, braziers and garden fireplaces allow you to comfortably enjoy outdoor space in any season.

Actually, outdoor stoves and fireplaces allow us to heat in a localized way a portion of the garden or terrace and make it usable even in the coldest seasons. Many types of outdoor stoves are available on the market, which often has the same shape and size of an indoor stove. The gas stove is still the most popular model, but the outdoor radiant stove is a solution that is rapidly gaining ground.

It does not heat the air, but the surface of objects and people, without dissipating heat. Outdoor fireplaces can be freestanding or built-in, table-top or suspended, and should be chosen according to the available space and personal needs.

There are many outdoor heaters available on the market and among these the most common is the outdoor gas stove, which is fed by gas cylinders. In the case of mushroom heaters, on the other hand, the fuel is distributed by a fixed installation. The radiant outdoor heater does not heat the air but distributes heat evenly over the surface of objects and people. The heating is immediate and therefore the time frames are reduced, compared to those needed by a traditional garden stove to light and heat. As for the shape, in addition to the mushroom shape, there are outdoor tower stoves and outdoor table stoves.

The outdoor fireplace is a fixed solution that not only allows you to heat but, depending on the model, also to cook. Before choosing the design of the model, however, it is important to evaluate the space available and make a careful design. The stone fireplace is a suitable solution for a space in rustic style. A fireplace with a wood-burning oven offers the possibility of cooking and for this reason, it is often installed to complete the outdoor dining area.

Swimming pools

A swimming pool represents an added value for any outdoor space. However, before proceeding with the planning it is necessary to pay attention to the procedure for the construction of an in-ground swimming pool or a basement pool.

Once realized, it is also important to think about an outdoor furniture able to create the right atmosphere for a suggestive location, to be exploited at the most during the day and also in the evening. From the classic rectangular shape to compact, square and round proposals, the pool is an element that can now be inserted in a series of outdoor contexts, from the largest to the least spacious, offering pleasant moments of relaxation and contributing to the aesthetics of the environment with products from the design attention to detail. The most desired model is the hydromassage swimming pools, for pleasant moments of relaxation. When creating a swimming pool it is necessary to evaluate the space available and the shape of the garden, which are fundamental when choosing the design of the model. A swimming pool on site does not have standard shapes and can follow the creativity and lines of the land on which it is built. Choosing a harmonious shape with the surrounding environment makes it easier to manage. As far as depth is concerned, there are no regulatory requirements for swimming pools for domestic use, but we refer to the good design rules and the experience of the operators in the sector, always taking into account the specific needs of the client. Depending on the type of water recirculation you can choose between skimmer and infinity swimming pool. The infinity pool is equipped with an overflow channel, visible or hidden, along the entire perimeter of the pool, and is considered the most elegant solution thanks to the characteristic design of this product. As an alternative to infinity pools, there are skimmer pools in which recirculation is ensured by a series of wall openings ("skimmers"), the number and size of which depends on the surface of the pool. The skimmers have the task of sucking up the surface water and conveying it to the filtration group, while the inlets, always placed on the wall, support the movement of the water towards the skimmers. The pool is considered a real design product and there are several types, from PVC pool to tile coverings. If the pool is located outdoors, it should be placed as far away from trees or hedges as possible in the full sun. For an indoor swimming pool, on the other hand, a room heating and air dehumidification system must be provided, in order

to avoid the formation of condensation and the consequent onset of unsightly and unhygienic stains on the walls and ceiling.

In both cases, a technical room must be provided to accommodate the circulation pump, the filter, the collectors and the electrical panel, as well as the automatism for water treatment and heating. The technical rooms can be built in masonry or by means of a fibreglass box to be buried in the ground, equipped with walk-on lids. The area surrounding the pool must also be adequately equipped with sunbeds for relaxation, umbrellas and tables.

Outdoor showers

Outdoor showers are an essential component of gardens with swimming pools as well as for sun decks in summer.

They are practical, convenient, stylish and they are also easily installable even in narrow spaces. Solar showers can work with thermal energy or solar panel energy. In the first case, the shower should be placed in a sunlit area to let the water heat up this way you will be able to use it until the reservoir runs out of the water (30-40 lt). In the photovoltaic panel versions, there's a coil in the reservoir powered by the solar panel. The advantage of this is that water heats up faster and lets more people have a shower. In both cases, water is kept in a hidden reservoir which is filled up by a tube connected to the water system. You can mix the reservoir's water with that of the water system to get water at an ideal temperature (about 30°C). The showers come with a mixer that lets you adjust water flow and temperature.

Outdoor showers are beautiful, elegant and refined. They're made of different materials that determine their final looks. The columns can be made of stainless steel or perforated aluminum to enhance heat exchange. Or they can be made of polyethylene or iroko and teak wood. They can be mounted on special platforms or they can come with matching shower trays. Since their outdoor use, water system components like mixers, rain showers, feet washing taps are made of weather-resistant and anti-corrosion materials.



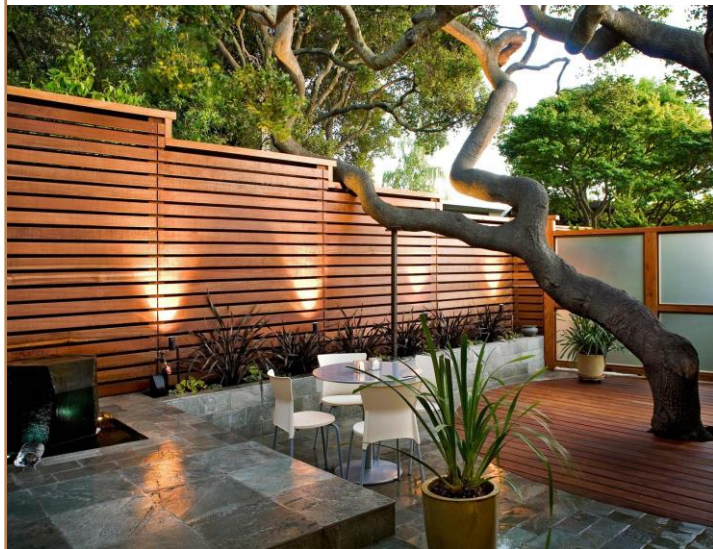
Outdoor flooring

- Decking
- Outdoor floor tiles
- Hard Surfaces
- Paving blocks
- Garden paths
- Grilles
- Synthetic grass surfaces
- Lawn edging
- Other outdoor floorings



Outdoor Furniture

- Garden armchairs
- Garden chairs
- Deck chairs
- Hanging chairs
- Swing seats
- Outdoor kitchens and barbecues
- Garden sofas
- Garden benches
- Garden stools
- Garden tables
- Garden side tables
- Garden daybeds
- Hammocks
- Garden poufs
- Outdoor cushions
- Lanterns
- Garden partitions
- Other outdoor furniture



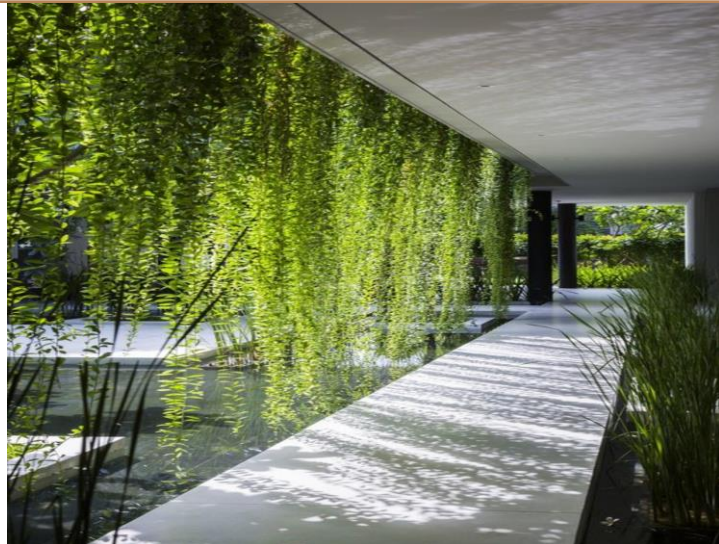
Fences and perimeter enclosures

- Fences
- Gates
- Railings and guardrails
- Elements for perimeter enclosures



Outdoor fireplaces and heaters

- Outdoor fireplaces
- Outdoor heaters
- Fire baskets



Garden awnings

- Awnings
- Parasols
- Garden gazebos
- Pergolas
- Winter gardens

Gardening and accessories

- Planters
- Vertical gardening trellises
- Outdoor green walls
- Landscape Edging
- Curbs
- Garden sheds
- Greenhouses
- Ponds



Swimming pools, hot tubs and outdoor showers

- Swimming pools
- Outdoor hot tubs
- Outdoor showers

Street furniture

- Street benches
- Outdoor chairs
- Tables for public areas
- Street Lamps
- Vases for public areas
- Sculptures
- Waste Bins
- Street Clocks
- Bollards
- Information stands
- Advertising totems
- Advertising
- Flower pots
- Pedestrian barriers
- Bicycle racks
- Notice boards
- Display panels

1.6. MATERIALS AND MOOD

The presentation of each design element poses a challenge to us, as their representation conveys important ideas about the project. Typically prepared during design development, sample and mood boards both physical and digital function as a representative palette of the materials that will be used as a reference during the development of an interior project.

Materials always are proportionally represented to give the client a clear understanding of the ambiance, fixtures, furniture, and finishes that comprise the elements of a proposal.

Regardless of type, presentations include material samples for each of the major elements in a project. Such presentations not only serve as a reflection of our ideas for space, but they also represent the care and attention that will be taken throughout the project.

Also, any digital presentation about materials and furnishings we always are supplemented with physical samples so that consistency of color, variations in presentation mediums, and approval can be controlled.

INTERIOR MOOD BOARD

NEUTRAL PALETTE

We love a classic bathroom that stays on trend for years to come. The timeless appeal of white shows little sign of waning but for those in search of alternative tones, the softest shades of grey or creams via fittings or wall coverings can add an extra interest. To keep it feeling modern use a monochromatic element throughout the space. You can still stay neutral and make it something really special.

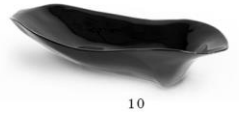
- 1 KIEV APARTMENT BY IRENA POLIAKOVA
- 2 CLIFTON HILL
- 3 ILSE OF WATER BY FIVE AM DESIGN STUDIO
- 4 REKA BATHROOM
- 5 OAK ARROW STUDIO
- 6 DIAMOND TOWEL RACK BY MAISON VALENTINA
- 7 KOI RECTANGULAR BY MAISON VALENTINA
- 8 SYMPHONY VESSEL SINK BY MAISON VALENTINA
- 9 NEWTON BATHTUB BY MAISON VALENTINA
- 10 BURJ PENDANT BY LUX XU

BLACK FINISHES

Black is an increasingly popular finish in bathrooms, it is naturally modern but it works well as a complementary accent too. To meet consumers' suddenly demand for ebony colors, entire collections of light fixtures, vanities and mirrors with black finishes are appearing in the market. These days it's all about bold, dark, sultry bathroom designs that evoke an indulgent high-end experience.



- 1 VETRINA BLACK STONE BY LUSO STONE
- 2 DIAMOND TOWEL RACK BY MAISON VALENTINA
- 3 ELEMENTI MIRROR 2017 BOFFI GRAPH BY TOMMASO SARTORI
- 4 SIDNEY HARBOURFRONT HOME
- 5 COCOON BLACK BATHROOM
- 6 FRAMA STORE IN COPENHAGEN
- 7 FAUCET HEPTIC IN BLACK BY RITMONIO
- 8 STILLETTO BENCH BY MAISON VALENTINA
- 9 METROPOLITAN WASHBASIN BY MAISON VALENTINA
- 10 LAPIAZ VESSEL SINK BY MAISON VALENTINA
- 11 DARIAN BLACK MIRROR BY LUXXX



MIXING METALS

Anodized surfaces and more natural-looking metals like chrome and brushed gold are having a moment in bathroom hardware right now. An ensemble of metal accents (no more than a mix of two to three) used throughout a bathroom is a tasteful way to create balance and definition in the space.



- 1 GROOVE WALL MIXER TAP BY MAISON VALENTINA
- 2 LAPIAZ VESSEL SINK BY MAISON VALENTINA
- 3 KOI BATHTUB BY MAISON VALENTINA
- 4 CATCHPOLE & RVE
- 5 PH HOUSE BY NORM ARCHITECTS
- 6 DANISH BRAND MENU
- 7 PROJECT BY LENE ORVIK
- 8 PIET BOON DESIGNKRANEN
- 9 METAL BATHTUB AT CRUG GLAS COUNTRY HOUSE
- 10 CLOSSEUM FLOOR MIRROR BY MAISON VALENTINA

EXTERIOR MOOD BOARD

OCEAN

FUTURISTIC JUNGLE

This sophisticated home presents as both futuristic and established, all at the same time. This 600m² family home achieves its luxury through soaring sculptural volumes and guards its privacy by making the most of the established "Jungle".



- 1. PROJECT BY ROBERT SILKE & PARTNERS
- 2. AN ALUMINUM CASEMENT SYSTEM BY PANORAMAH
- 3. THE MINIMAL FRAME WINDOWS BY PANORAMAH
- 4. RESIDENCIAL CONCRETE BY HARD ROCK DEVELOPMENTS
- 5. THE CLASSIC IRON SPIRAL STAIRCASE BY STAIRWAY SHOP
- 6. WRAP AROUND BRAAI TERRACE
- 7. OUTDOOR POOL BY TREVI POOLS & SPAS
- 8. BLACK METAL TERRACE HANDRAILS BY IRONWOOD MOTIF
- 9. OUTDOOR STAIRS
- 10. FRONT HOUSE FENCE AND GATES
- 11. VERTICAL ALUMINUM BLADE SLAT FENCING BY FENCE SPOT
- 12. SALA GRAPHITE DINING CHAIR BY ARTICLE
- 13. TULIP TABLE OVAL - CARRARA BY ROVEC CONCEPTS
- 14. OTIO MIST WALNUT LOUNGE CHAIR BY ARTICLE
- 15. ARCA VINTAGE BROWN SOFA BY ARTICLE
- 16. BREEZ SUNBED BY TALENTI
- 17. BREEZ COFFEE TABLE BY TALENTI
- 18. ROUND NON-TAPER COLUMNS
- 19. GREY GLAZED PORCELAIN OUTDOOR FLOOR TILES BY FOSHAN HANSE INDUSTRIAL
- 20. ARTIFICIAL GREEN OUTDOOR WALL

1.7. OUR EXTERIOR & INTERIOR DESIGN DEVELOPMENT PROCESS

Whatever the scale of the project, four basic elements must be considered from the beginning: project site, program, schedule, and budget. These four items are seldom determined exclusively by the client or us, but usually by both in collaboration. The fewer the variables, the more efficient the process will be.

We must address the standard phases of the design process. The table below identifies the duration and goals for each phase of a small-to-medium-sized exterior and interior design project. Depending on the circumstances of a particular project, the timeline can vary greatly; however, the project goals we adhering to for each design phase.

Preliminary stage (before signing a contract)



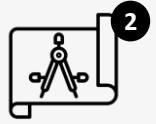
Defining a style of the future interior, drawing up technical specifications for exterior and interior design based on the wishes and taste preferences of the customer. This becomes the basis for evaluating design solutions in the subsequent phases.

Period of execution: 2 weeks¹

¹ the stage 1 lasts until complete approval and compliance with the wishes of the customer, the number of edits is unlimited

Documentation included in the stage: Layout plan with the arrangement of furniture and equipment (2-3 options).

Design concept



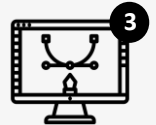
The goal is to gain client approval for a single design concept that will be further developed as the project progresses and to agree on a direction for the character and aesthetic intent of the project. Layout plan drawing. Selection of materials, textures, facades & roofs, beam & columns, windows & doors, inner walls & ceilings, signage, floors & stairs, sanitary & kitchen, lighting, furniture (living space, office, public, hospitality, outdoor). Creation of realistic 3D-images of the future interior.

Period of execution: 3 weeks¹

¹ the stage 2 lasts until complete approval and compliance with the wishes of the customer, the number of edits is unlimited

Documentation included in the stage: Volumetric-spatial solution of space: stylistic solution of interiors in 3D computer graphics (optional).

Architectural drawings



Development of architectural drawings (intended for construction and finishing works) based on design concept approved by the customer.

Period of execution: 2 months

Documentation included in the stage:

- Interior drawings - measured plan; Plan of the installation of structures and partitions; Layout of doorways; Plan of arrangement of furniture and equipment; Plan of the floorings; Plan of underfloor heating; Plan of ceilings; Layout of lighting fixtures; Layout of switches; Layout of sockets and power terminals; Layout of sanitary equipment; Layout of elevation of rooms' walls with specifying of decorative elements and dimensions; List of decorative materials; Specification of furniture and equipment; Specification of lighting fixtures; The Finish Plans
- Exterior drawings - House Plan; Foundation plan; 4 side elevation view; 2 Section plan; Site plan; Roof plan; Electrical plan; Plumbing plan; HVAC plan; Door and window schedule; Framing plan including roof; Three-dimensional building drawings; Others

2. 3D MODELING

You will learn some important concepts about 3D modeling as well as some of the popular techniques used to generate any 3D model.

We have written this section in a way that minimizes jargon and is easy-to-understand even if you have never heard of 3D modeling. We will cover almost everything in short about 3D modeling.

Why you need to know about 3D visualization? Because if you don't have a good model, your rendering won't look great.

2.1. WHAT IS 3D MODELING?

3D modeling is generally defined as the process of developing a representation of a real or inanimate object in the three-dimensional world with the aid of 3D software. The resulting 3D object is defined via location, rotation and scale. It letting manipulate the location, rotation and scale of the 3D object as part of the process of 3D modeling. To explain it simply, 3D modeling is the process of creating a real-world object (like a car) or an imaginary object (like a UFO) in a 3D virtual world. The resulting 3D object that we create looks like, or at the very least, can be visualized, as the real or imaginary object.

When we say visualized, we mean that people will be able to relate 3D model to the thing that we trying to create even if it doesn't really 100% like the real thing. For example, if we envision to create a 3D model with human-esque qualities, we could, in its simplest form, create a box with eyes and a mouth and be done. That's just a simple example. We could create a tree with a cylinder as the trunk and spheres as bunches of leaves. Of course, a real-world tree would not look like this, but we as humans would be able to relate to it as a tree.

There are 2 main types of 3D models



Stylistic



Photorealistic

Stylized modeling is what we just talked about in the last few paragraphs. A box with eyes or our cylinder-sphere tree. This is when 3D modelers purposely go out of their way to make 3D objects a lot different to the real world in order to fulfill some purpose. The purpose may be to appeal in an artistic way, to create a sense of style, or create some form of emotion. They play on the human's ability to recognize real-world objects from abstract images. Just then, I spoke of humans as if they were a different species.

Photorealistic modeling aims to simulate eye-for-eye a 3D object that looks exactly like the real-world object. This can serve many purposes.

We can do 3D modeling for the medical or dental field, or perhaps even architecture, accurate and photorealistic modeling skills are very much essential. Photorealistic modeling is also becoming very popular in filmmaking and game development. There is just something cool about making a video that appears to be from a video camera but you later have your mind blown when you realize it's all CGI. It's as if the real-world is a boring and mundane place that we have to simulate the exact same thing using computers and our own skills. Nevertheless, it is undeniably exciting though.

It's important that whichever type of 3D modeling you choose (Stylized or Photo-real), that we stick with that throughout your project.

Nearly all industries need 3D modeling in some form or another.

Here is a short list of industries where 3D modeling may come in handy:

- Architectural Visualization
- Film Production/VFX
- Game Development
- Virtual Reality/Augmented Reality
- TV
- Advertising Agencies
- Hospitals Dentists
- Real Estate
- Schools/Colleges
- Mathematics
- FBI and Crime Units
- Event Organizations
- Government
- YouTubers
- Goods/Product Suppliers
- Science and Research
- Freelancers

2.2. WHY USE 3D?

2D plans and schematics are diagrams that represent an object by reducing it to a simpler form. For example, two parallel lines are easily recognized as the symbol for a wall, although they are not actually a wall. However, a 3D model is a complete object in all its dimensions. A complete 3D model of a wall can include all interior framing, the drywall, baseboards, etc. At the very least, it would display the height, length, and width of the wall. Likewise, a three-view 2D stairs drawing is a symbolic representation of an object from various directions.

If we want to view the object from another angle, we must draw another 2D view.

A 3D model:

- Can be viewed from any direction.
- Can be used to generate 2D views as required.
- Can be rendered to create photo-realistic images of the finished model.

However, a 3D house model is a single object that can be viewed from many directions as shown in Figure 1–1.

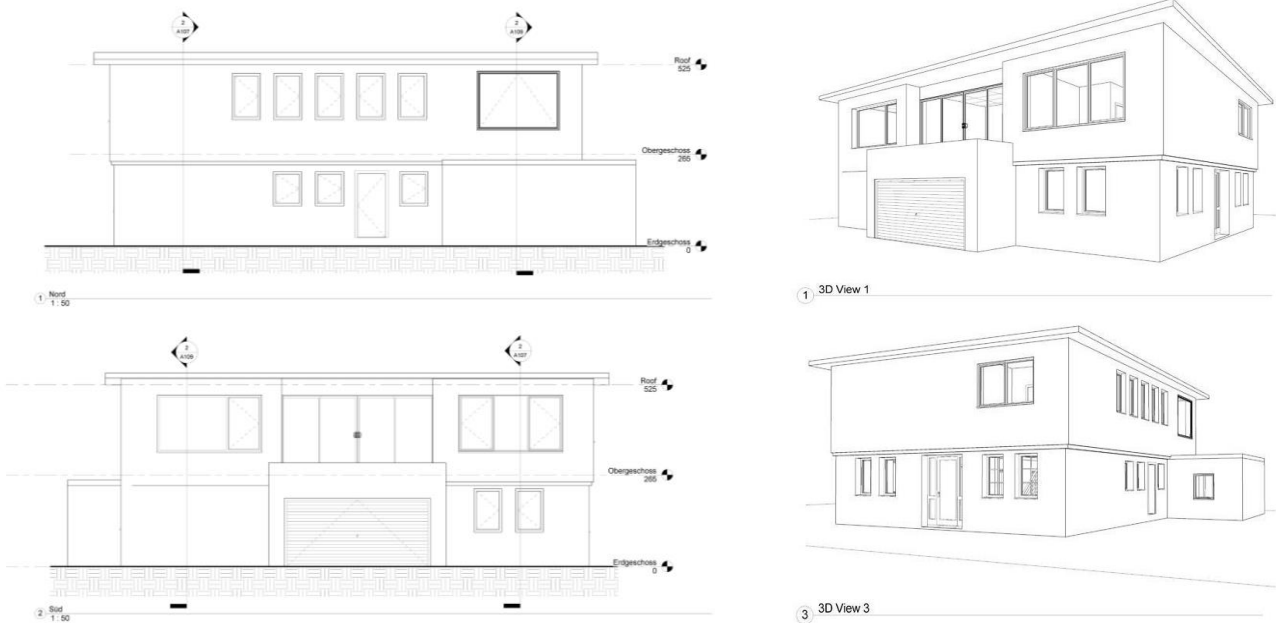


Figure 1–1

2.3. TYPES OF 3D MODELS

We can create four types of 3D models with the modeling software wireframe, surface, mesh, and solid, as shown in Figure 1–2.

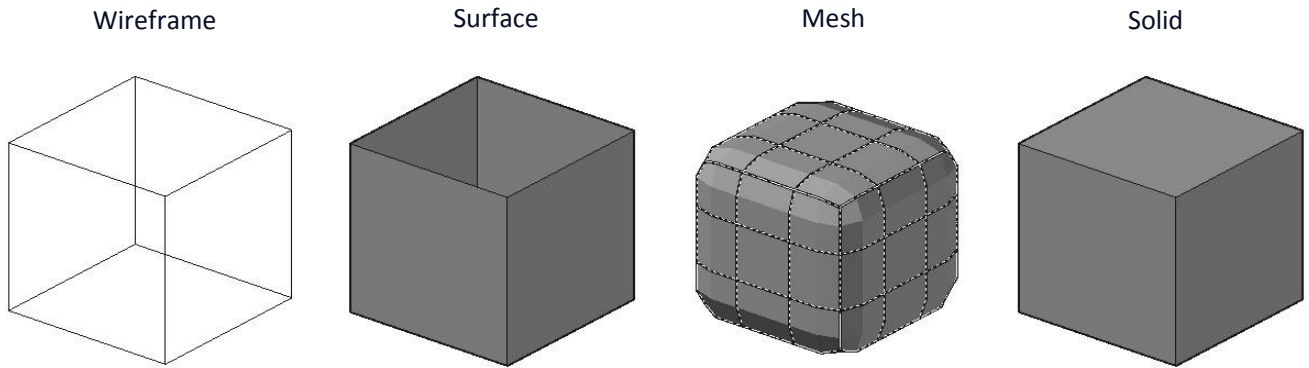


Figure 1-2

Wireframe models: It let us represent the 3D object by indicating its edges. There are no surfaces between the edges. Therefore, we can see through the object. For example, we can use a wireframe drawing to display a plumbing riser diagram. We can also use wireframe objects as paths or frameworks for other 3D objects.

Surface models: Consist of infinitely thin surfaces that represent the shell of an object. Since the surfaces are opaque, the edges behind them can be hidden. However, the model cannot be used for mechanical or thermal analysis because the thin surfaces do not have a mass. We can use surfaces to create contour maps or other complex geometry, such as a car body or cell phone design. We can also use surfaces to cut solids and apply complex geometry to them.

Mesh models: Consist of polygons that form edges, faces, and vertices. They do not have mass and can be used to create complex shapes that can be creased, split, and deformed as required. They can be shaded and rendered without having a mass and can be a useful alternative to solids of material, rather than hollow.

Solid models: A solid model has mass and can be used for mechanical and thermal analysis, and renderings. Solids can be used to create anything from a doorknob, to a large machine, or to a massing study for a new high-rise.

2.4. HARD SURFACE MODELING

What Are Hard-Surfaced Models? Quite simply put, hard-surfaced models are models of objects that have a hard surface and usually don't have much roundedness. They also don't have much (if not, any) life. There are many examples of hard-surfaced objects.

Hard surfaced models are generally easier to model compared to organic models like characters. But having said that, the complexity level also varies on the type of hard surface model make. For example, a table would be far easier to model compared to a car.

3D Hard surface models examples



Tables



Chairs



Shelves



Cupboards



Bed



Alarm clock



TV Screen



Sofa



Vases



Doors



Computer set



Kitchen set



Vehicles



Phones



Roads



Buildings

2.5. ORGANIC MODELING

What Are Organic Models? Organic models are different to hard-surfaced models. We saw that hard-surfaced models were models that had a hard-surface and were generally lifeless and flat. Organic models tend to have life in them. They tend to also be naturally rounded and soft. Due to this, the modeling of organic models can be quite complex compared to hard-surfaced models.

While they are all mostly rounded and curved, they can still have a hard surface. Like dragons for example.

Or we could be creating a statue of a human. Our own intuition should be able to differentiate between a hard-surface model and an organic model. Just think of organic as having life and hard-surface as rigid and still. Yes, even fruits and vegetables have (or had) life in them.

3D organic models examples



Humans



Animals



Trees



Grass



Beasts



Plants



Fruits



Vegetables

2.6. ENVIRONMENT MODELING

Environmental modeling deals with the representation of processes that occur in the real world in space and time. What Are Environment Models? The world where our hard-surfaced and organic models live in. We could have our 3D models float around in 3D space. But maybe for artistic purposes or some other purposes, we will want to give our 3D objects an environment to live in. The environments we create are we, environment models. Perhaps we want to have our 3D objects in a park, or a mountain, or near the sea. We will create your park/mountain/sea using environment models. The environments models themselves can be either hard-surfaced models (like a house) or an organic model (like trees and plants).

There's literally millions of different examples we can probably come up with. Unfortunately, we are 3D software that will not have a "3D World" inbuilt that we can just import and add 3D objects in. We will need to create your world manually.

Techniques With environment modeling, the technique used really depends on the type of scene we are working with. One way would be to create each element of your environment one at a time and then combine them together and organize them in one file. We will document the process that we generally use.

Environment 3D models examples



A room



A hall



A corridor



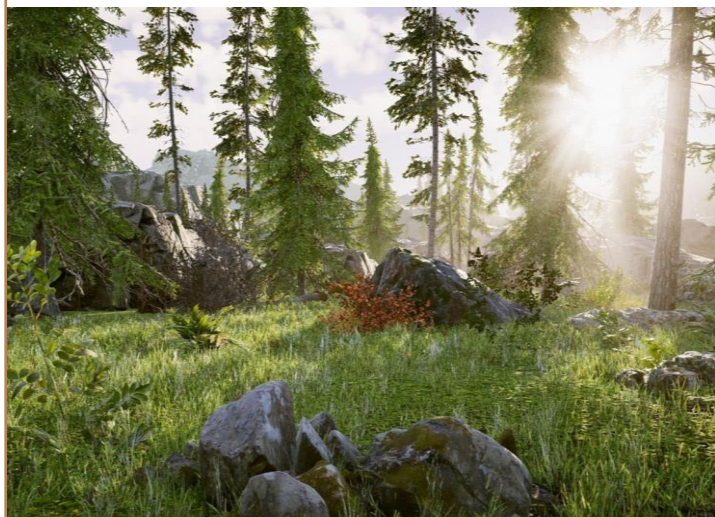
The streets



A cityscape



A mountain landscape



A forest



A desert



Outer space



Iconic locations of the world

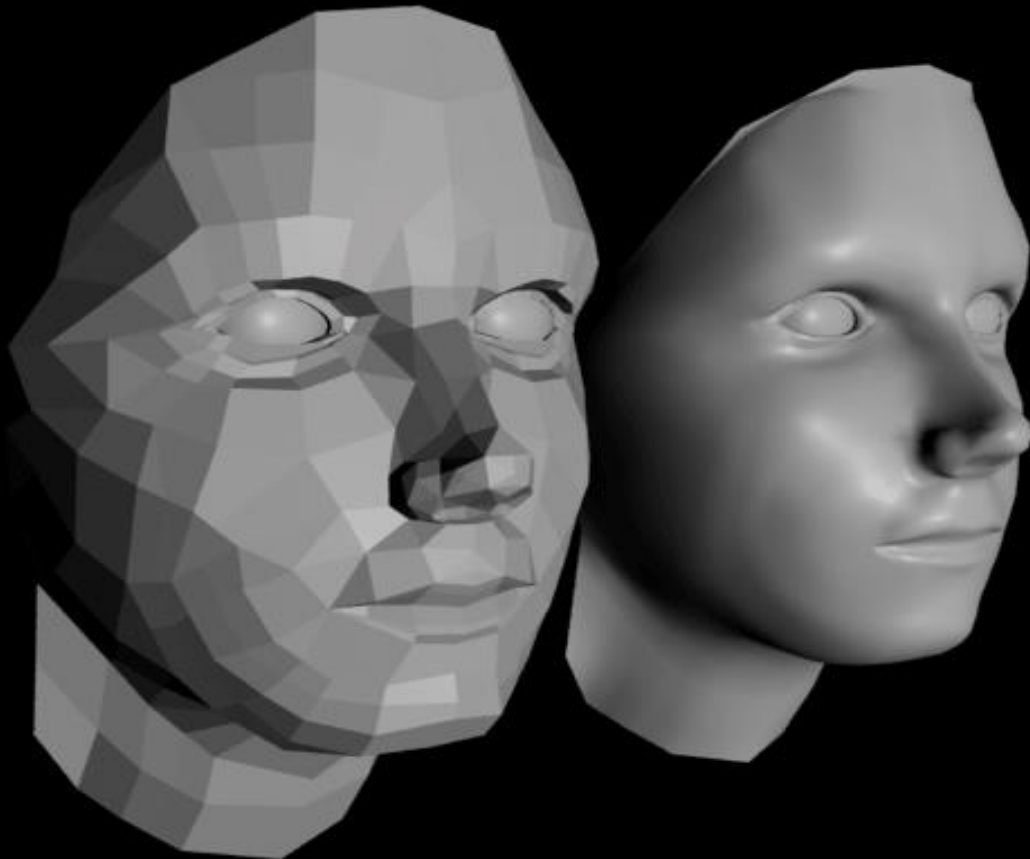


A plain square

2.7. HIGHT-POLY VS LOW-POLY MODELING

Low-poly models are models that have a low amount of polygons, or in other words, a low amount of vertices, edges and faces. The model can appear as having a lack of detail and the edges quite rough, sharp and clearly showing. Whereas, high-poly models are models that have a large number of polygons, or a large number of vertices, edges and faces. There are various advantages to this. There's literally millions of different examples we can probably come up with. Unfortunately, we are 3D software that will not have a "3D World" inbuilt that we can just import and add 3D objects in.

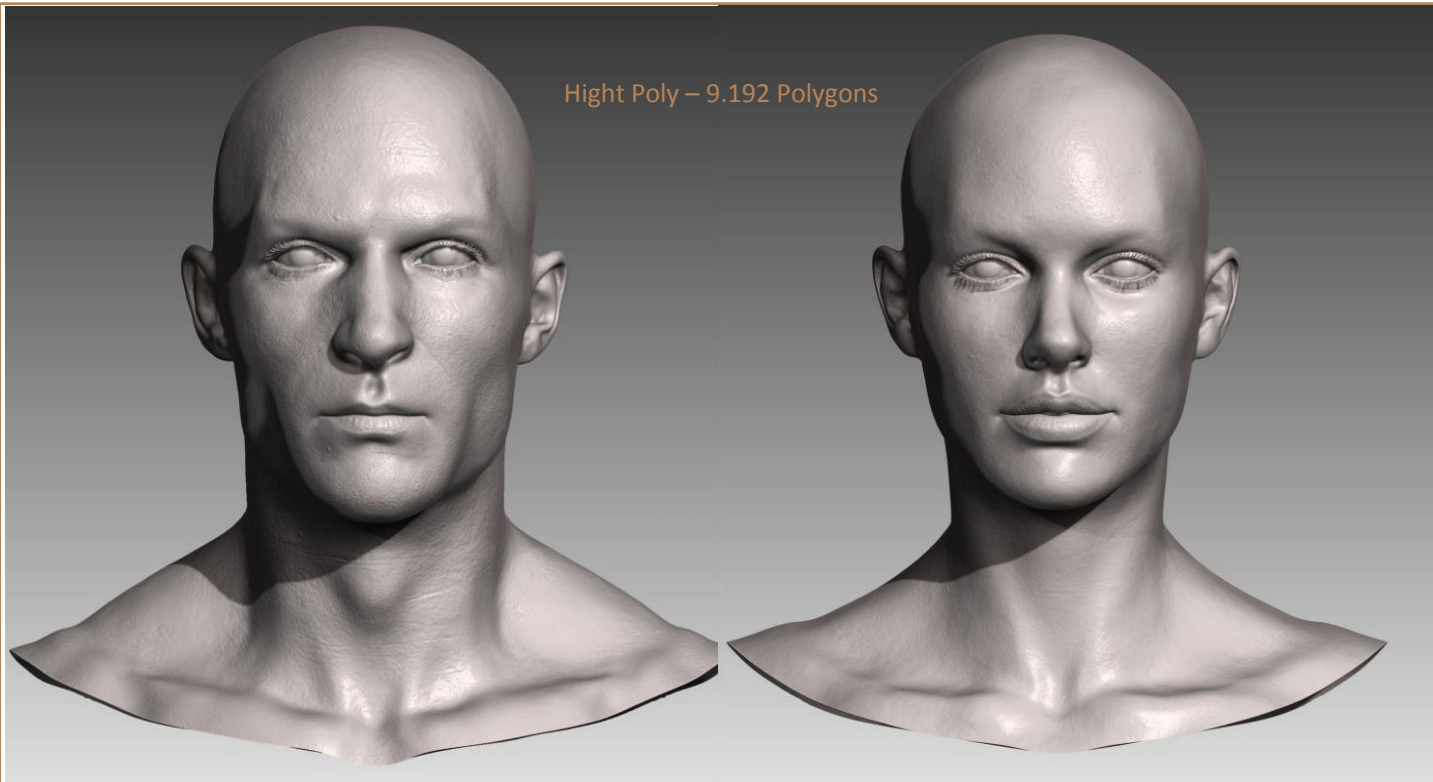
We will need to create your world manually. Techniques With environment modeling, the technique used really depends on the type of scene we are working with. One way would be to create each element of your environment one at a time and then combine them together and organize them in one file. We will document the process that we generally use. The low-poly and high-poly examples are shown below in Figure 1-3, 1-4, 1-5.



Low Poly - 830 Polygons

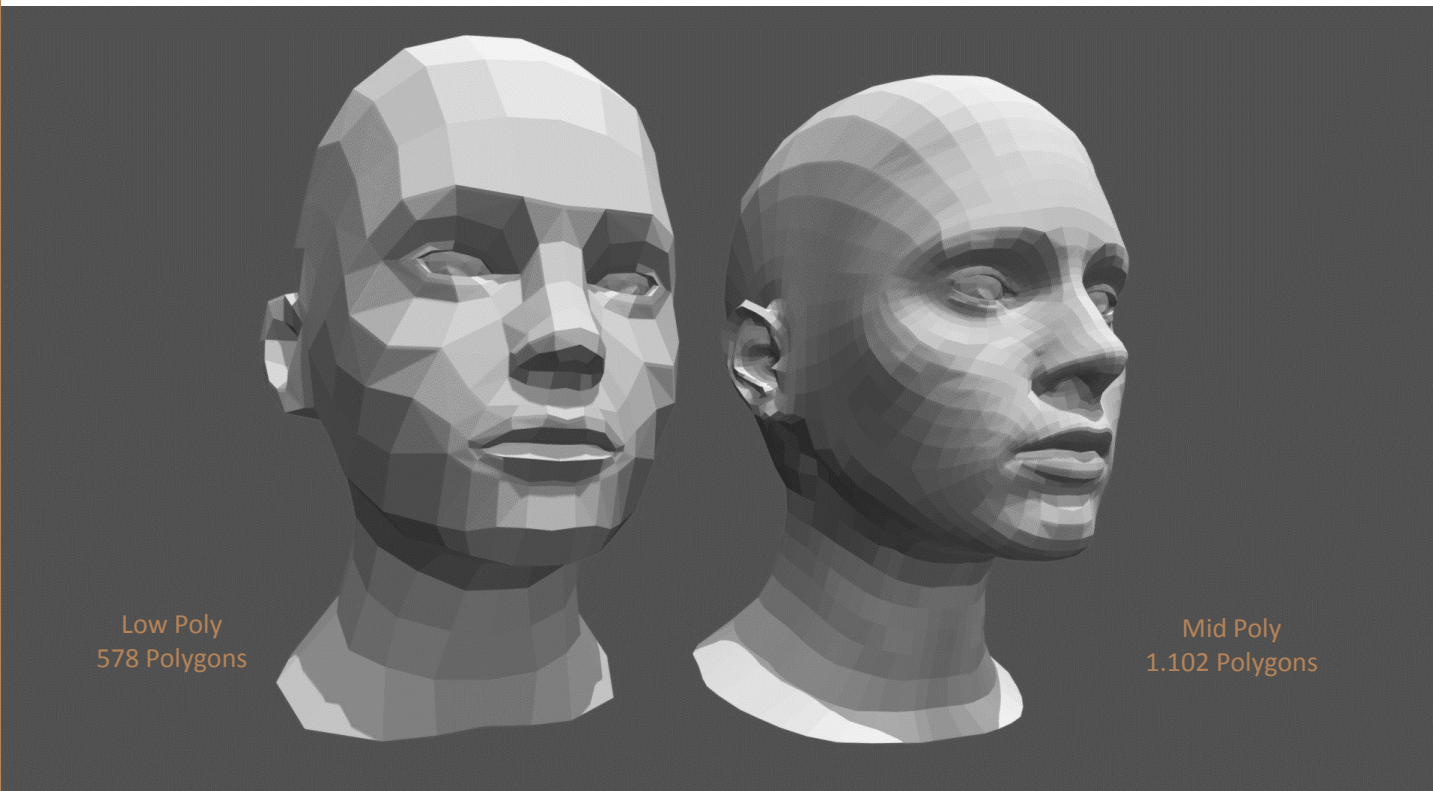
Hight Poly - 3048 Polygons

Figure 1-3



Hight Poly – 9.192 Polygons

Figure 1-4



Low Poly
578 Polygons

Mid Poly
1.102 Polygons

Figure 1-5

LOW-POLY MODEL

There's literally millions of different examples we can probably come up with. Unfortunately, we are 3D software that will not have a "3D World" inbuilt that we can just import and add 3D objects in. We will need to create your world manually.

Techniques With environment modeling, the technique used really depends on the type of scene we are working with. One way would be to create each element of your environment one at a time and then combine them together and organize them in one file. We will document the process that we generally use.

Advantages

There are various advantages of utilizing low poly models in project.

Some of these include the following:

- **Save memory:** This allows to work with models smoothly without lag and provide a smoother experience compared to modeling high poly models.
- **Save Storage:** Due to the low amount of polygons, the model won't take up too much space in your hard drive. Having more storage space is always good as it allows you room to fit in more models in comparison to high poly models (which tends to hog up storage space).
- **Can look stylistic:** It seems, nowadays, that low-poly art is all the rage. This growing trend seems to be up there with the latest in modern, contemporary art. Even TV ads are starting to use low-poly models to showcase their products. Must be that simplistic, minimal design look that everyone is into these days.

Disadvantages

There are also a number of disadvantages in using low-poly models:

Lacks detail: Since there aren't so many polygons, the lack of detail will be quite obvious. The sharp edges may be visible and won't look really convincing. It is very obvious that it looks CGI.

Not as popular yet: High-poly models still seem to be more popular still. As more and more people strive to reach photorealism, low-poly modeling tends to get overlooked.

When To Use?

Low-poly art – As you may have guessed, low-poly models will suit low-poly art. Since it seems to be one of the more trending types of art today, it will be advantageous to get on the bandwagon and create some yourself.

VR | AR | MR – Low-poly models perfectly suit program development. It's pretty much necessary that the models in VR | AR | MR are low poly unless it's one of those monster-powered PCs. VR | AR | MR requires low-poly models since the extra memory and storage will provide a smoother experience for users. Rarely ever use high-poly models unless if it's absolutely necessary.

HIGHT-POLY MODEL

High-poly models are models that have a high amount of polygons. High-poly modeling can also apply to all types of models, including hard-surfaced, organic and environment models. The models appear smooth, highly-detailed and just plain awesome if done right! Photorealistic models tend to leverage high-poly models as it's pretty much necessary. While there are awesome advantages, there are also disadvantages to high-poly models.

Advantages

There are a number of advantages of leveraging high-poly models in your work. They are as follows:

- **Exquisite and detailed models:** High-poly models, if done well, can look beautiful and highly detailed. For example, a character with a million polygons might be a strain on the PC, but you will be able to see not just a nice, smooth and realistic-looking character, but even micro-details like the pores on his skin, or the wrinkles on her face. None of which would look as convincing on low-poly models.
- **Realism:** Realistic models tend to be high-poly. A low-poly model rarely ever looks realistic unless you are creating something as basic as a table for example. Great for realistic animation: With the high amount of vertices available, your animations will tend to deform nice and smoothly and this can look pretty realistic. Low-poly models also bend smoothly and perhaps easier to control for the animator, but is far from deforming realistically. Subdivision is one of the modeling tools use to increase poly count in a model and allows you to add further details to your models

Disadvantages

There are some disadvantages to using high-poly models. Here are a few:

- **Hogs up memory:** Due to the high amount of polygons in a high poly model, you may find that

working with your model may be a slow, laggy experience. If you have super details with tons of polygons, you may even experience frequent crashing, since your PC can't keep up with the memory requirements needed to load your model on screen. Just one model alone, may contribute to most of your PC's memory being used up and the best option would be to simply get a stronger PC.

- **Hogs up storage:** Since there are so many polygons in high-poly models, it will take up a lot of storage space. If you're working on a film project which requires high amounts of detail, you will be surprised how much storage space you've used up quarter way through your production. High-poly models may not be a good idea if you have very limited storage space. It may be better to utilize some type of Cloud storage service if you plan to make a ton of high-poly 3D models.

When To Use?

Films & Animation – High-poly models are almost a necessity for animated films. Just to be able to see the intricate details will add immensely to the film experience. Since animated films require animated models, good deformation should be possible. Thus, high poly modeling suits films greatly.

Architectural visualization – Some architectural visualizers require high-poly models. Architecture in general may not require that many polygons but by utilizing higher-poly models for bumps and details as well as improving the smoothness of edges can contribute to the final "wow" factor of these models.

3D furniture

The concept of 3D designing is gaining momentum in the furnishing industry being one of the major areas of application today. 3D Furniture drawing and its growing importance in the AEC Industry Prospective buyers today, expect to see their furniture, its look, and finish even before they place an order. After all, it's easy to change the design than change the wood.

2.8. TEXTURING

The realism of the finished model depends on texture for materials development and the very technique selected. The texture is a pixel image, which is laid on the ready polygonal model (on UV map) made in the graphics program with can give it a color, reflection parameter, refraction parameter, specify the index of refraction (if you need), and relief or fake relief.

Thus, texturing or mapping is one of the main stages of three-dimensional model creation, on which the modeled object should get some specific properties in order to make the model more realistic.

MATERIALS

The concept of materials may be new to you but shouldn't be too hard to grasp.

A material is a substance or mixture of substances that constitutes an object. Materials can be pure or impure, living or non-living matter. Materials can be classified based on their physical and chemical properties, or on their geological origin or biological function. Raw materials can be processed in different ways to influence their properties, by purification, shaping or the introduction of other materials.

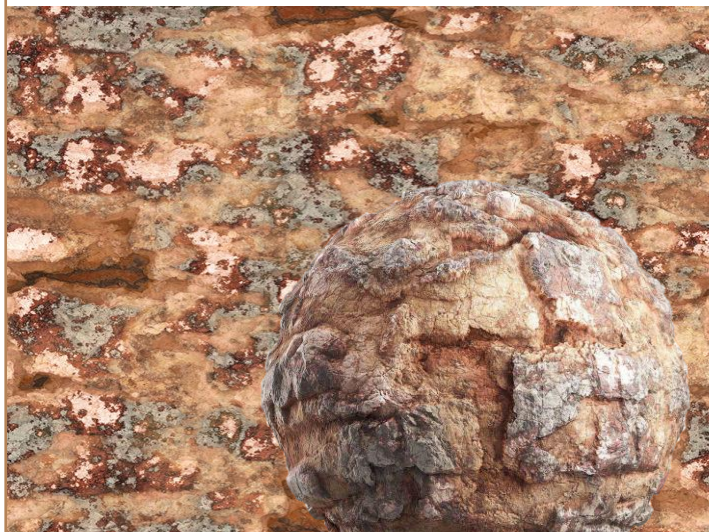
New materials can be produced from raw materials by synthesis. In industry, materials are inputs to manufacturing processes to produce products or more complex materials.

Materials simply give 3D models color, look and feel. Materials are what your 3D model is made of. For instance, you could model a human character, but without giving the human a material, it would be a little hard to guess what the human is made of. Is it made of concrete or fleshy skin?

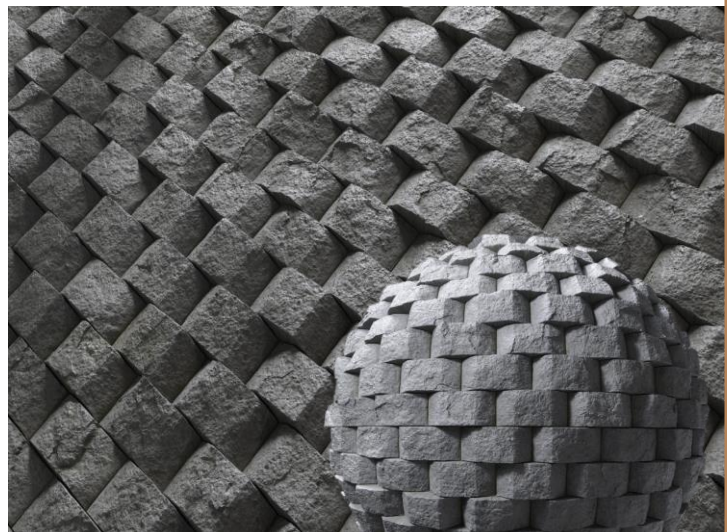
Materials don't just define color and texture. It defines how the object feels like, and whether light can penetrate through it, or bounce off of it. Knowing a bit about texturing can also make your opinion or decision during projects.

We say that since, as a customer, you can setup your 3D models in a way that will be efficient for Texture Artists' to go in and texture your models. This goes back to good topology. Good topology plays a strong part in this as well. With good topology, the texturing process will be smooth and the end result will look nicer. A model with bad topology may reflect in the texturing as you may get a textured model with some parts overstretched and some parts a little wonky looking.

Examples below show a few natural and man-made 3D materials, respectively, which could be met in daily life.



Rock



Stone



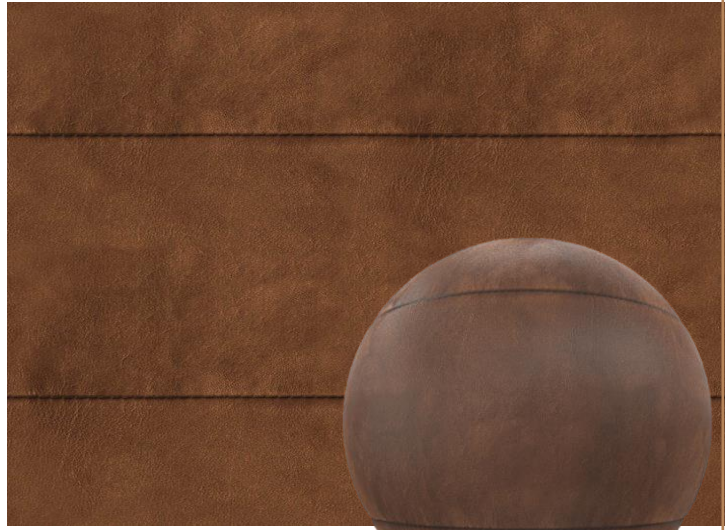
Marble Tiles



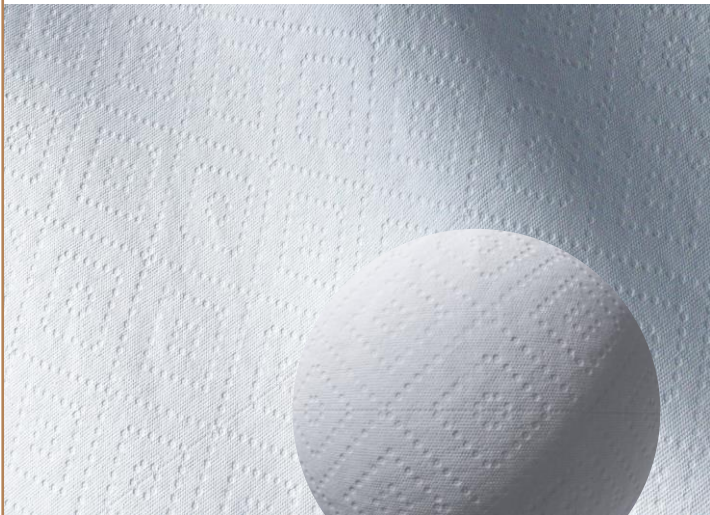
Marble



Concrete



Leather



Paper



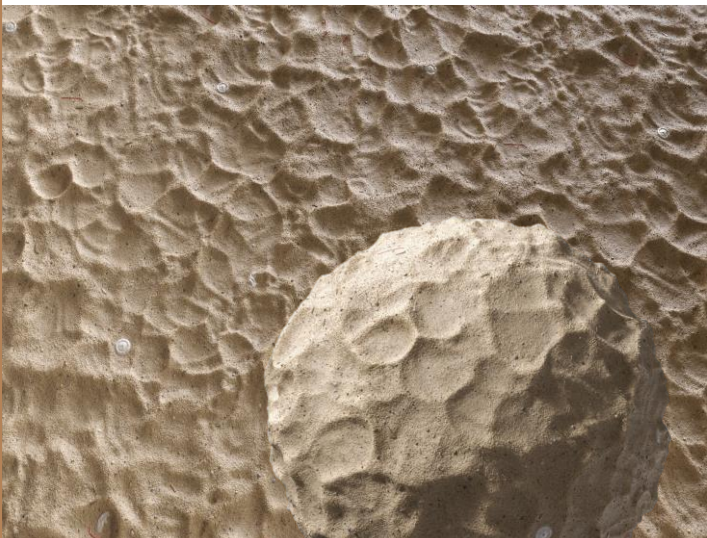
Fabric



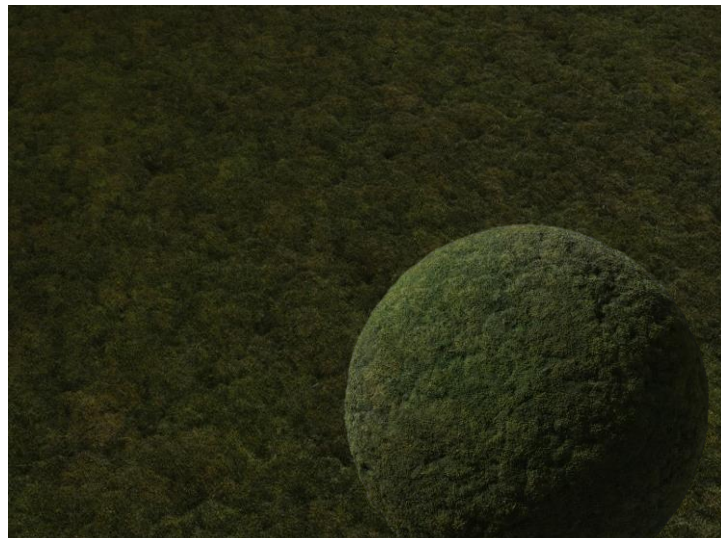
Gold



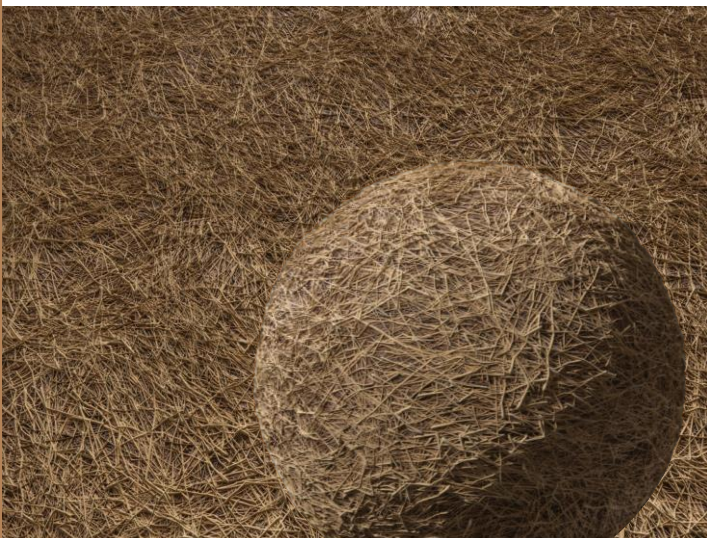
Metal



Beach Sand



Moss



Hay



Cracked Ice



Snow



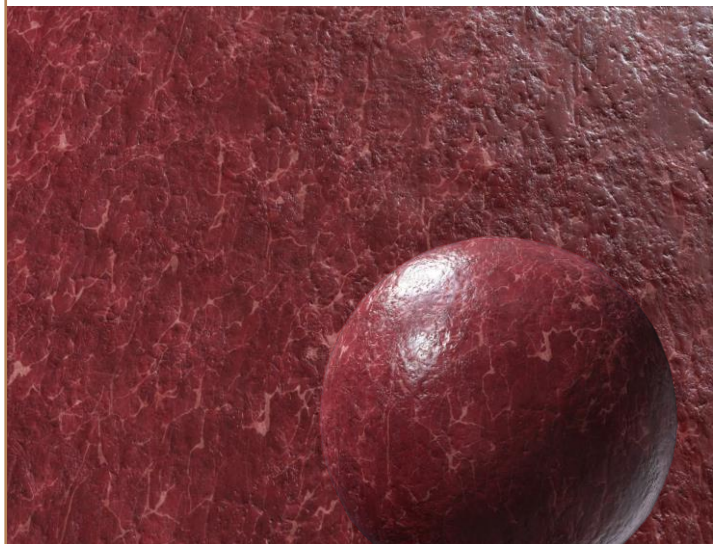
Bamboo



Rope



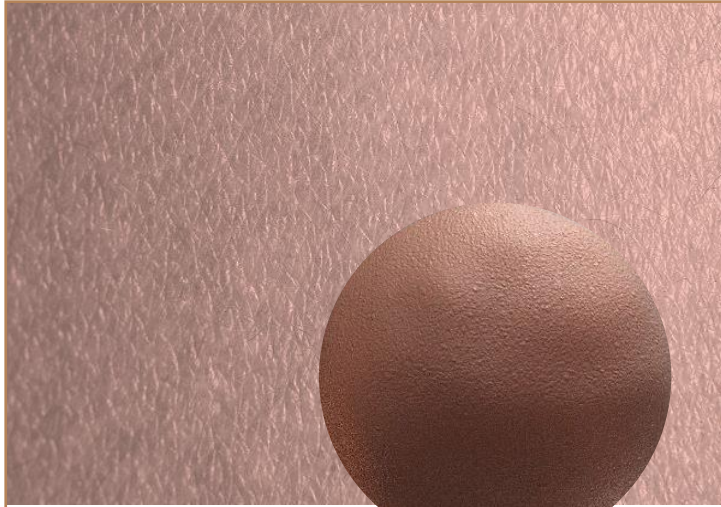
Steel Cable



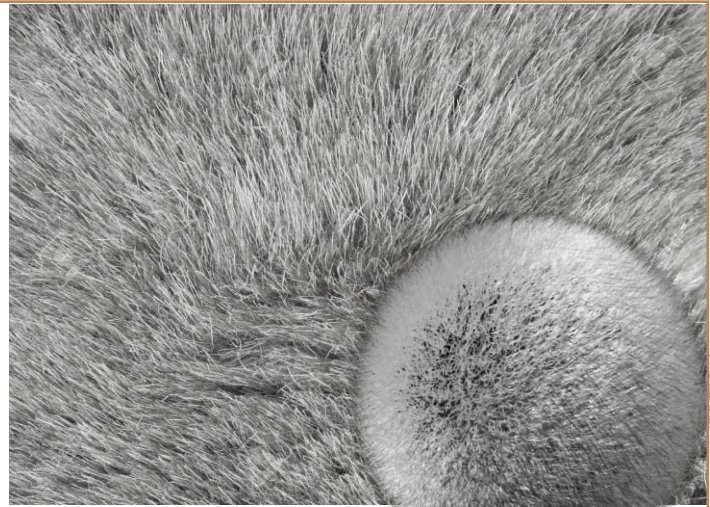
Raw Meat



Pavement



Skin



Fur

TEXTURES

The natural world is rich in texture: the surface of any visible object is textured at certain scale. A wealth of textures are observed on both artificial and natural objects such as those on wood, plants, materials and skin. In a general sense, the word texture refers to surface characteristics and appearance of an object given by the size, shape, density, arrangement, proportion of its elementary parts. A texture is usually described as smooth or rough, soft or hard, coarse or fine, matt or glossy, and etc.

Textures might be divided into two categories, namely, tactile and visual textures. Tactile textures refer to the immediate tangible feel of a surface. Visual textures refer to the visual impression that textures produce to human observer, which are related to local spatial variations of simple stimuli like colour, orientation and intensity in an image. This thesis focuses only on visual textures, so the term 'texture' thereafter is exclusively referred to 'visual texture' unless mentioned otherwise.

Textures examples



Glossy Texture



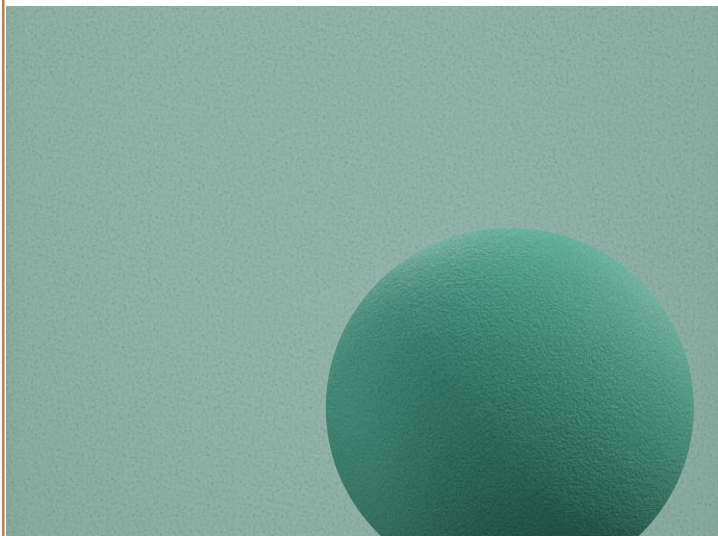
Warm Texture



Soft Texture



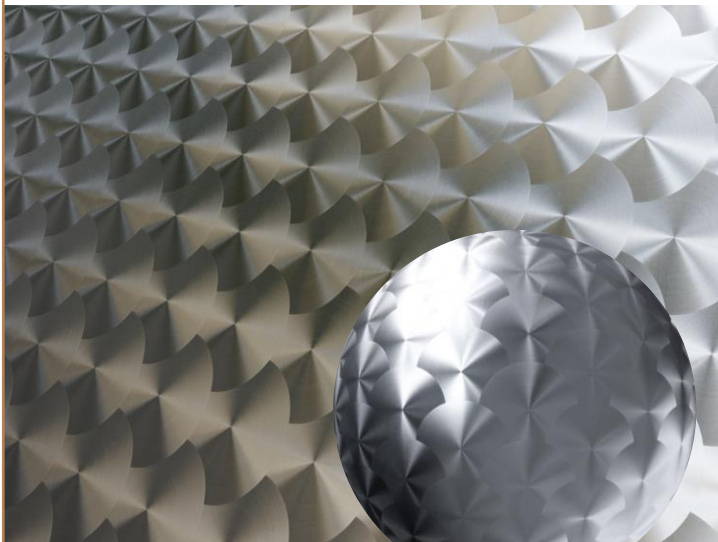
Hard Texture



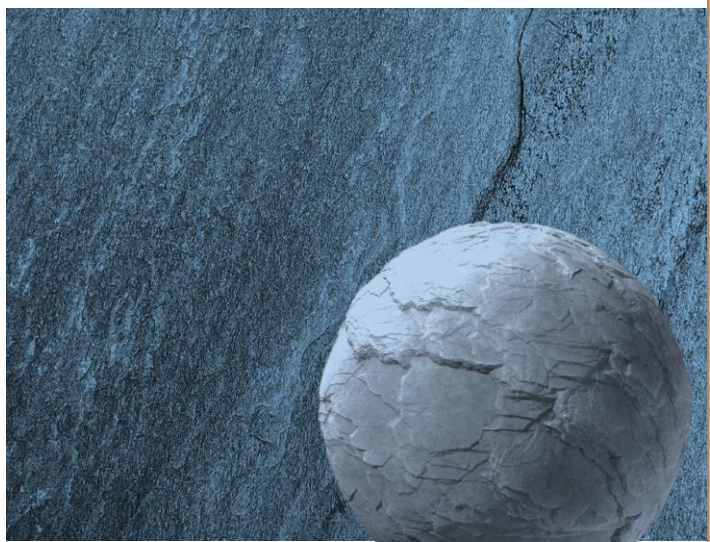
Matt Texture



Liquid Texture



Shiny Texture



Rough Texture

UV MAPPING

UV mapping is the 3D modeling process of projecting a 2D image onto a 3D model's surface. The term "UV" refers to the bidimensional (2D) nature of the process: the letters "U" and "V" denote the axes of the 2D texture because "X", "Y" and "Z" are already used to denote the axes of the 3D model. So if we want to define (or paint) 3D models, we need to use image textures. This process is called UV unwrapping. The idea is that the vertices, faces and edges (coordinates) will be arranged in a 2D mapping grid. When we place our own image on top of the 2D grid, the coordinates in the grid containing the image will copy over the image to the corresponding coordinates on the 3D model.

Let's look at below figure 1-3 what mapping looks like, using the common example of a simple cube.

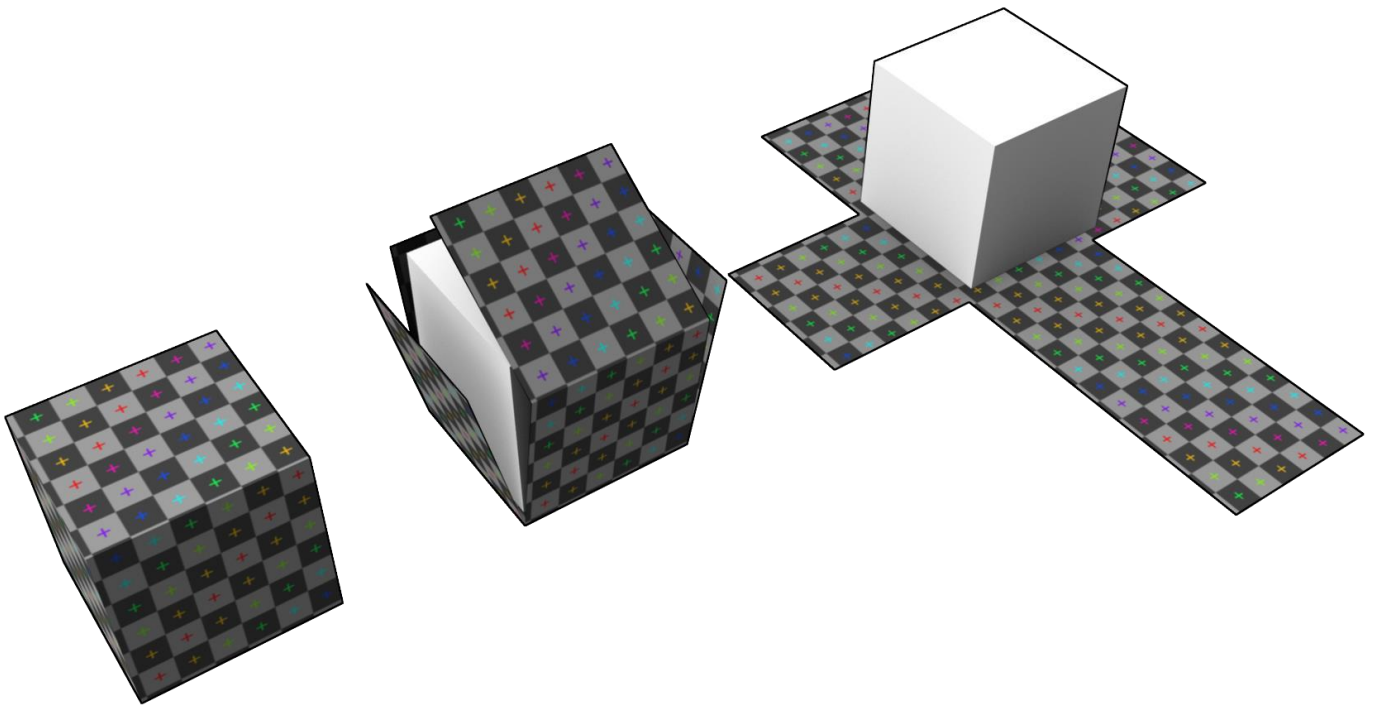
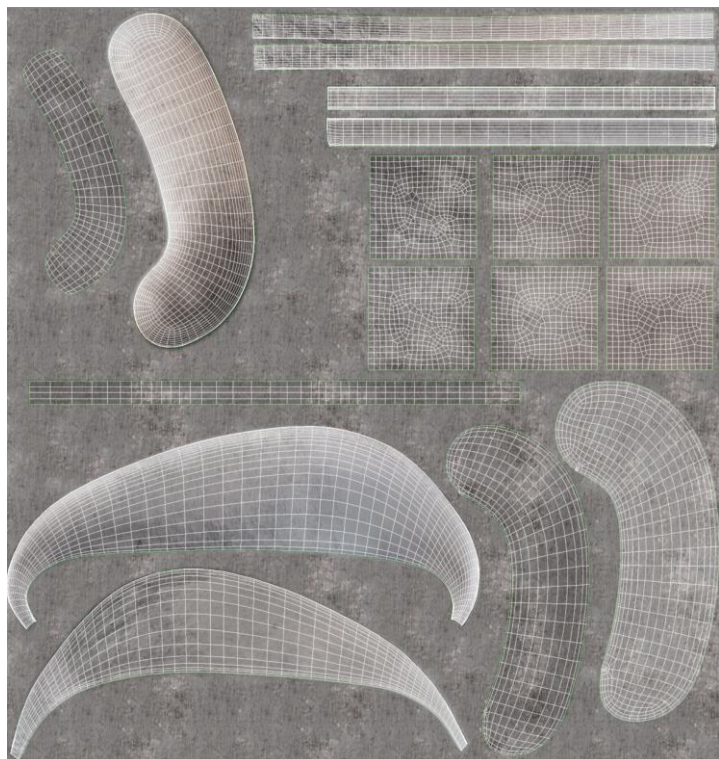
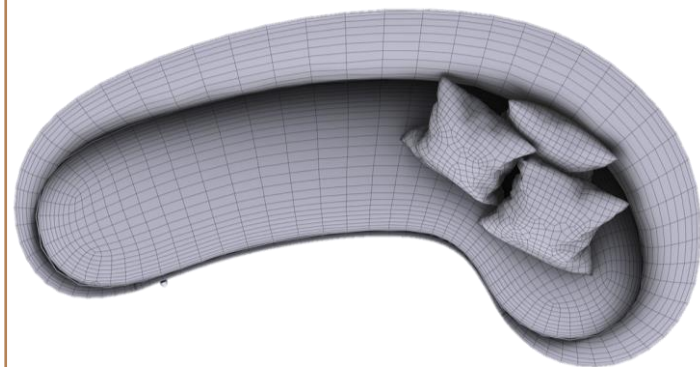
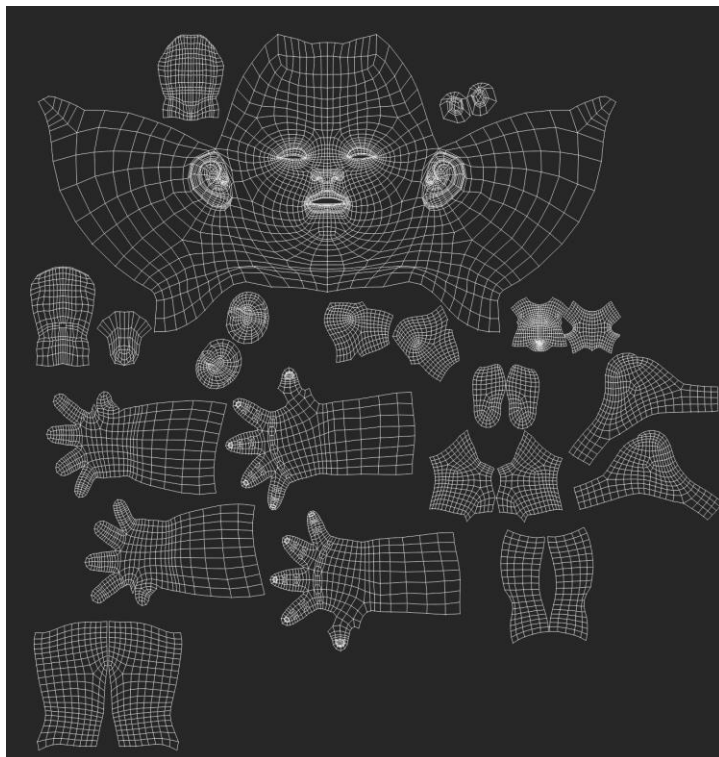
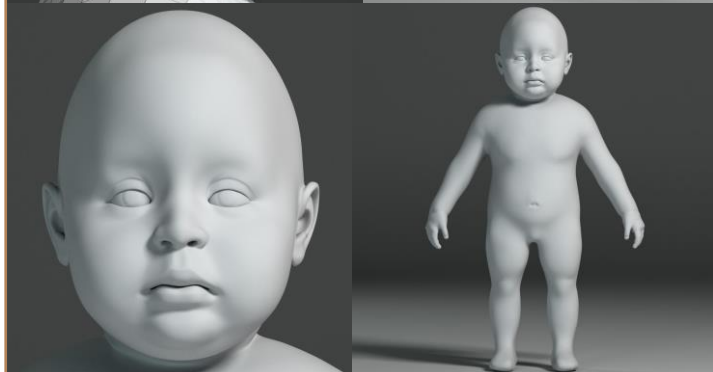
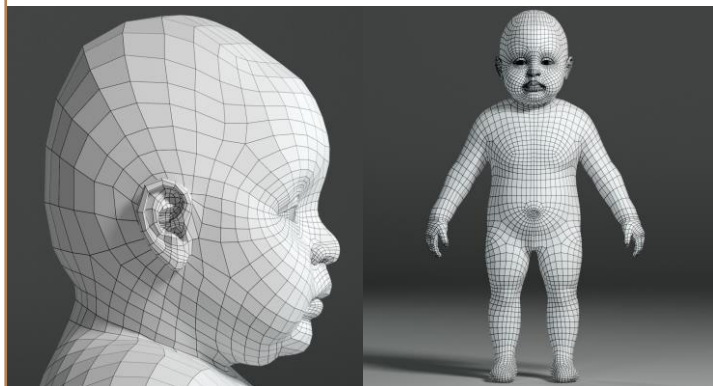


Figure 1-3

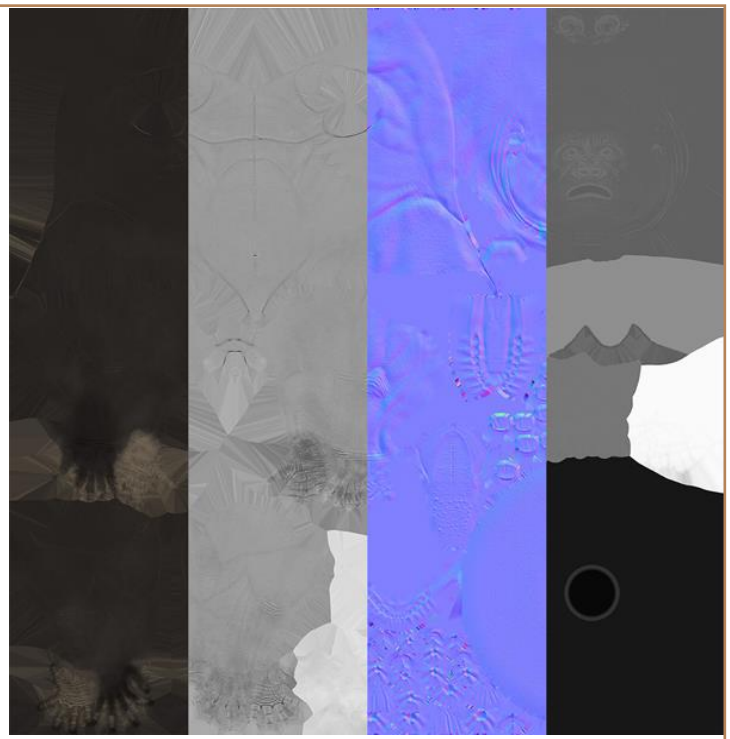
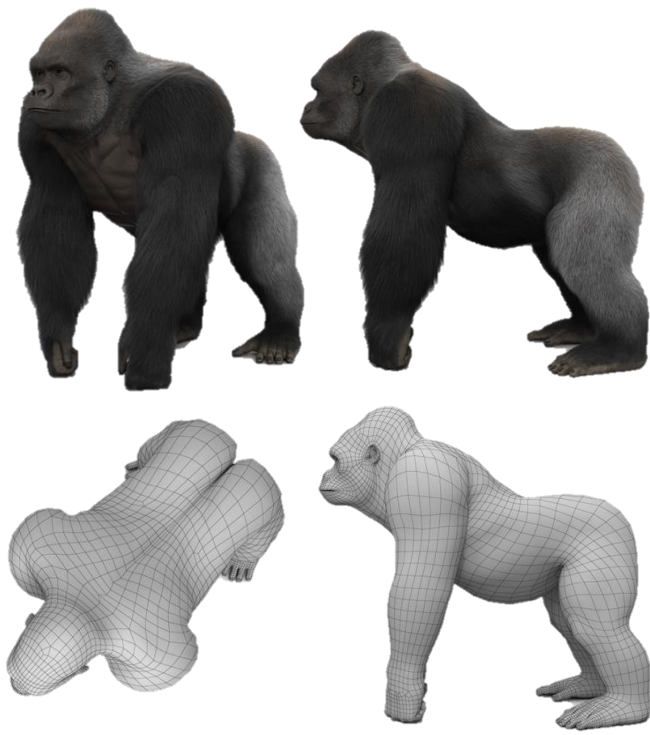
UV MAPPING EXAMPLES



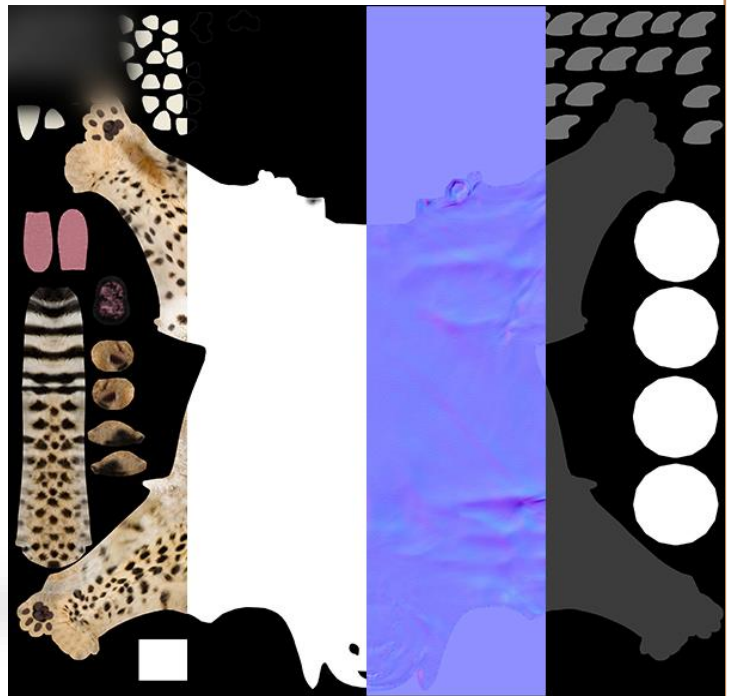
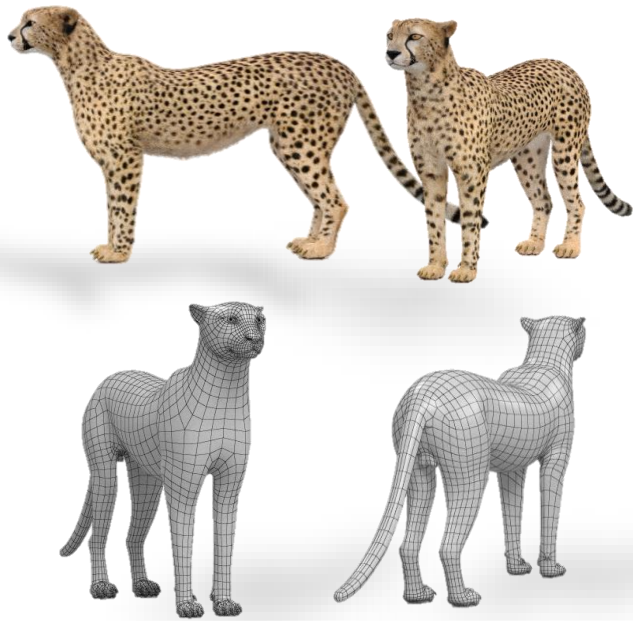
Sofa



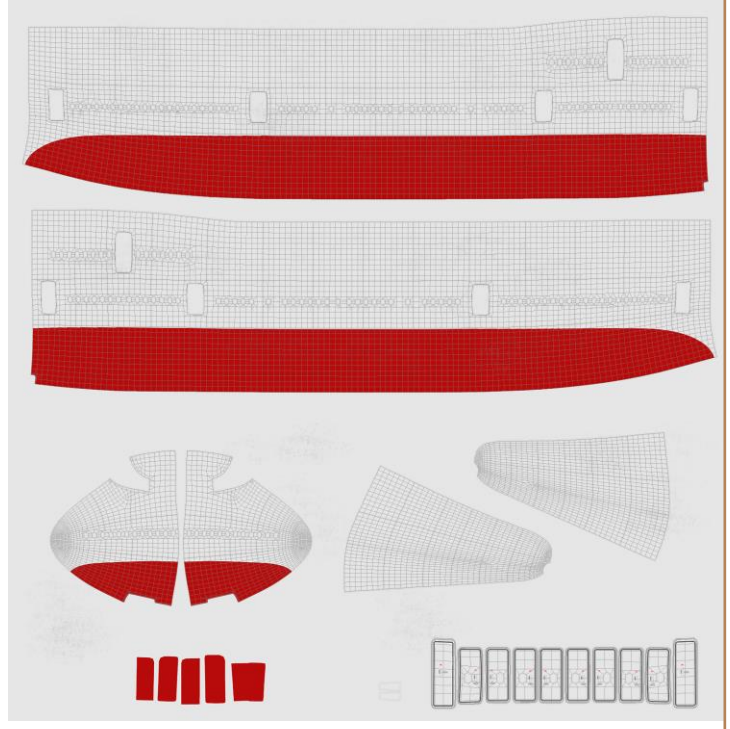
Kid



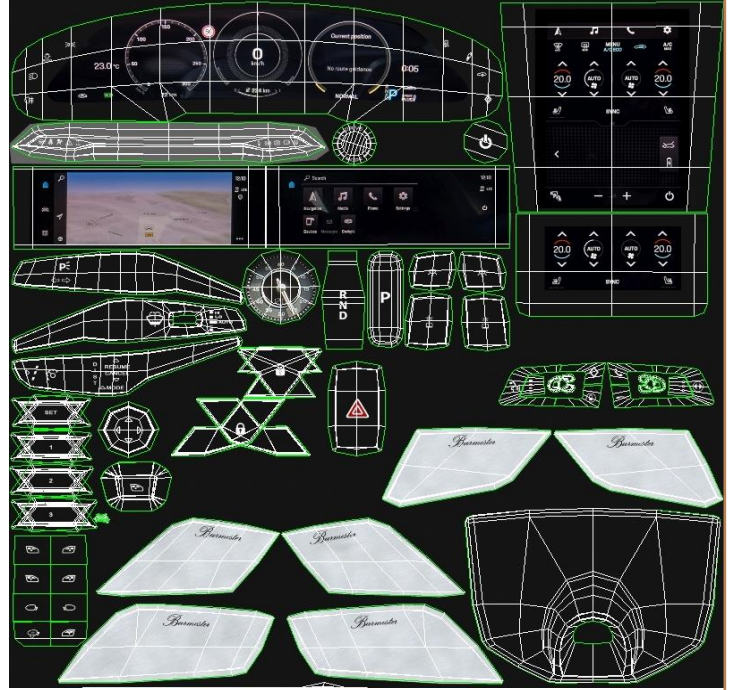
Gorilla



Jaguar



Plane



Car

2.9. CREATE A 3D MODEL OF PRODUCT: HOW LONG DOES IT TAKE?

Now, 3D models are widely used by manufacturers to advertise and sell their products. Hence we need for the businesses to know the basics of CGI creation. Otherwise, it will be impossible to achieve the best productivity when working with customers.

For instance, if we do not know the time frame of creating 3D models of products, miscommunication with customers will probably occur, deadlines will be pushed further, and the schedule of a planned marketing campaign will be ruined.

As professionals of 3D modeling, we care about our customers and want to help them prevent these troubles. Join us as we explore how long does it take to create a 3D model of a product, and what can influence the timescale.

The amount of time needed to create a 3D model of a product depends on many factors. If a manufacturer needs something relatively simple to be visualized, like a chair or a table on a white background, it can take only a couple of hours to make.

But if something more complex is needed, like highly-detailed objects, lifestyles, 360-degree views or a 3D animation — that would take quite a while. To plan ahead, a business should always consult with us to accurately determine how long would it take to finish the order in question.

Level of details

3D models can be roughly separated into “simple” and “complex” ones based on their level of detail. Have a look at these two products of 3D modeling. Both of them are made with photoreal quality and superb attention to detail, and yet, the former was made within 20 hours, and the latter — within a whopping 56 hours! What caused this difference? The answer is the complexity of a 3D model of a product.



Simple Modeling



Complex Modeling

Image resolution

It is not enough to just create a 3D model of a product to make marketing materials. After that, a digital object has to be rendered and converted into 2D visuals. But there comes a question — what image resolution does one need? By default, most companies provide images in HD. But what if a client needs a higher quality? Larger dimensions mean longer rendering time. As a rule of thumb, everything above HD adds a few hours more to visualize. For example, rendering a CG picture in Ultra 4K HD will take four times longer than in regular HD. And if there are multiple POVs or several 3D product models to be rendered — a customer would probably have to wait for a couple of days for the final results.

CG model's background

It is possible to create a 3D model of a product on a mono-colored background or in the context. The latter option, which is called lifestyle imagery, is a great marketing tool. A product shown within an appropriate scene looks more desirable for potential buyers. However, when it comes to creating lifestyles with CGI, it increases production time, in comparison to mono-colored background images. This is because in this case, digital space has to feature not only the 3D model of a product itself, but also a fleshed-out scene, and contextual elements.

Adding each of those details means a few more hours of work. Sure, decor and other paraphernalia can be of lower quality than the 3D product model — if they are blurred out to focus attention on the centerpiece. And yes, it's not always necessary to make them from scratch — 3D modeling studios have vast libraries of premade assets. But still, we carefully placing lifestyle details and making sure that they seamlessly blend in is a whole lot of work. On top of that, each of those elements casts a shadow, there may be several different light sources — and all that has to be accounted for. So, even a simple lifestyle image may take a day or two to make, and the more complex the order is, the longer it would take.

Interactivity

The final product of 3D modeling and rendering may come in different forms, including interactive 360 views. Such a 3D model of a product can be rotated, so the viewers will be able to examine it thoroughly from all sides. 360-degree views are an impressive type of commercial product rendering for marketing — but their creation is time-consuming. Essentially, a 360 product view is a visualization of one digital model from different POVs combined into one piece. For making such a CGI material, each shot has to be rendered separately and then combined into an interactive image. To create a 3D model of a product like this, we would need a 5 days, so clients should plan their marketing campaigns accordingly.

Animation

Speaking of the most impressive 3D visuals — CGI can come in a fully-animated form, too. If businesses want to present their new merchandise as stellar, 3D animation is perfect for the job. But how long would it take to create a 3D model of a product in the animated form? Let's see.

To animate CGI, we would have to not only create a 3D model of a product, but also a digital environment for it. Then, we will need to move the camera around the scene to get multiple POVs that will showcase an item from every angle. It will be needed to render every POV and combine them in a particular order to create an illusion of movement. This way, even a short 3D animation, less than 10 seconds, can take about a week or more to make. And if the final 3D video has to be longer and requires some complex post-production effects, and the object has lots of moving parts that have to be shown in action — we can add a few weeks to a project timeline.

When we are creating a 3D model we need to know where it will be used. A lot depends on this factor, for instance, what rules and limits you should look out for designing the model. Creating a model for videos or movies is drastically different from creating a model for a VR app or a mobile game. After all, in cinema all we care about is how realistic our model is, that's why there are difficult and detailed models used. On the other hand, when designing a 3D model for a VR app or a game, we are restricted by the game engine, limits of the console or a mobile platform. In this case, we are considering the interactivity and stability of the model, the visual aspect is moved to a second place.

As professionals of 3D modeling, we care about our customers and want to help them prevent these troubles.

MODELING

First of all, let's define the basic elements that form a 3D model:

- Vertex – this is the highest point of a dimensional shape. It possesses a set of attributes, such as three-dimensional (x,y,z) and two-dimensional (U, V) coordinates
- Edge – the line that is defined by two vertexes or a connection between two vertexes. This element has two sets of vertex coordinates and one set of coordinates of itself, that is the sum of vertex coordinates.
- Polygon – this is a basic component of any 3D model. The most primitive polygon is basically a single triangle. More complex shapes can be broken down into a collection of triangles, this process is called triangulation. The polygon consists of vertexes connected by edges.

When we are creating a model for a mobile app, or AR/VR software, our main goal is to achieve a high-quality look using the minimal possible number of polygons. Most of the time, we can use up to 70 000 polygons per scene. However, there are exceptions, for example when developing for HTC Vive, we can create much more detailed 3D models with up to 400 – 600 thousand polygons per scene.

We are recommending to use from 300 to 1500 polygons per mesh(object) for a mobile device app, and from 1500 to 4000 for desktop software. Also, if there is a possible situation that there would be a lot of objects in one scene, you should lower the number of polygons per object.

In order to create a simpler model, usually part of the environment or some other object, we are using low polygon modeling (low poly).

The general idea is that the number and density of polygons should be proportional to how close can user bring the camera to it. If the object is really small or far away then fewer polygons are needed to create it. Another important point is, that the model shouldn't contain vertexes that aren't creating its form.

When we are creating characters or other complex models, that will be viewed from short distances, we use models with high polygon count(high poly). Usually, it is done by creating a very difficult and heavy model at first, then cutting and simplifying it down to a necessary level.

In order to create low poly 3D models we are using:

- Autodesk Maya
- Autodesk 3Ds Max
- Cinema 4D
- Modo
- Blender

Talking about high poly model creation, it comes down to a personal preference of the user. Basically, all of the previously mentioned software is capable of doing that. However, there is software that was created especially for the high poly creation and for digital sculpting:

- ZBrush
- Autodesk Mudbox
- 3D Coat

So, how much does it cost to create a 3d model?

Well, the modeling process, which is described above, takes from 40 to 60 hours. This is the time period, that is needed to create a model for the animation process.

TEXTURING

After the modeling process is over, we create a two-dimensional(UV) version of an object. In the UV layout, the XYZ coordinates of a model are corresponding with UV coordinates version. This version is necessary for a precise placing of a raster image, in other words, texture, on a 3D model.

To create a UV version of an object we can use the same software that we used to create a 3D model, but usually, it is more convenient to use UVLayout.

After the UV layout modelers create sets of textures, that consist of:

- Color map – this is self-explanatory, the colors used in the texture
- Bump map – this map shows all of the parts of the texture that meant to be not flat
- Normal map – this technique is used in order to fake the lighting effects of uneven surfaces
- Displacement – creates actual uneven surface
- Specular – adds glare effect to the texture
- Alpha – adds transparency to some parts of the texture

Material – is a set of properties used for displaying the model or its elements. The material can differ based on the next parameters:

- Specular level
- Glossiness
- Self-illumination
- Opacity
- Diffuse Color
- Ambient

There is a wide selection of available apps, but we use:

- Substance Painter 2
- Substance Designer
- Autodesk Mudbox
- 3D Coat
- Mari
- Adobe Photoshop

After a texture is applied, 3D model is finished.

Of course, it all depends on the difficulty and nature of the model. However, here is a rough estimate from for our, the process of texturing a complex model takes about 10 – 30 hours.

2.10. OUR 3D MODELING PROCESS

Understanding the customer



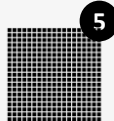
To start communicating with a customer, initially, we focus on the briefing stage and create a document that describes the basic scope requested by our customer. This document contains some questions the customer must answer so you can obtain the necessary background to develop the 3D art. If you need to model a character, for example, you'll need information on physical features and behavior (the physical and behavioral persona). Sometimes, a customer may provide us with a Concept Art or Model Sheet. If that's not the case, we ask them to show you some reference pictures that illustrate their ideas. Next, they get a Semantic Panel containing the references the modeling artist created based on the briefing.

Topology and Retopology



A good 3D model needs a good topology. In other words, the polygons need to be organized and aligned correctly and logically so that the future animation may perform well. Retopology, as its name implies, is the process of redrawing the topology of an object. Retopology aims to transform a High Poly model into a Low Poly one, i.e. it decreases the polygon count of the model. To achieve this, the Low Poly object we need to receive a 2D texture containing all the High Poly detail information (Normal Map Technique). Normal Map is a technique used to simulate the relief on a surface by calculating the angle of the shadows on a texture, consequently, creating the impression of greater depth and a high polygonal rate. This transfer provides the Low Poly object, which contains fewer polygons and requires less graphic processing, with a result that is identical to the High Poly model, which has more polygons and requires more resources.

UV Mapping



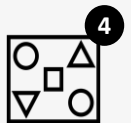
The last modeling step is opening the UV Map, which is the process of transforming 3D model information into 2D. A good example that helps understand that process is when we print paper toys on a sheet and, as we follow the assembly instructions, the 2D surface becomes a three-dimensional object. This is the modeling stage at which we apply textures to objects, i.e. we apply the texture to create clothes on characters, rocks, wood, etc.

Before we start modeling



It's good practice to look first for references for what you have decided to model. In most cases of 3D production modeling, whether it is applied to games, an agency or product, a visual concept of the model called Concept Art is used. Depending on what will be produced, it may be used with another important document called Model Sheet, which provides the patterns for all sides of the 3D model.

Choose Modeling types



To create a simple object, we start with a Basic geometric model that fits the final shape of our object. To create a cup, for example, we start with a cylinder and resize its sides to make it look like the final object. This is called Box Modeling and the most commonly used software programs include Maya, and Blender, among others. On the other hand, Subdivision Modeling or Sculpt Modeling is more complex, as subdivision modeling may be based on box modeling. In other words, we may start with a simple, basic geometry model, but you will need more subdivisions and your object is going to end up with a higher polygon rate (high poly). Software programs include, e.g. Zbrush.



3. 3D VISUALIZATION

This section helps you build a solid foundation of knowledge about 3D visualization. This is key because if you understand what is 3D visualization, it will allow us and you to focus on things like storytelling, composition, mood and lighting and more.

3.1. WHAT IS 3D VISUALIZATION?

3D Visualization or 3D visualization is defined as “any technique for creating images or animations to communicate a message”. So it is not a surprise that 3D visualization through visual imagery has been an effective way to communicate ideas since the dawn of man, from cave paintings and Egyptian hieroglyphs to Leonardo da Vinci's technical drawings for engineering warcraft machines. What is surprising though, is the speed at which the advancements in 3D modeling and 3D rendering technology is happening and how this is affecting the buildings we build and live in.

We focus on two of 3D visualization types:

- Still images
- 3D movies/animation

Architectural rendering or architectural visualization is the art of creating two-dimensional and three-dimensional images showing the attributes of a proposed architectural design. This technology is changing the way we design, in a way that simply wasn't possible 15 years ago. 3D rendering and architectural visualization software enable architects and designers to evaluate “proportions” and “scales” using intuitive interactive 3D modelling and simulate the effects of lighting, ventilation and acoustics in internal environments.



3.2. ARCHITECTURAL & INTERIOR VISUALIZATION STYLES

Architectural visualization has been constantly evolving since the development of computer-generated three-dimensional objects in the '70s. The 3D architectural visualizations we see today evolved through technological advancements and new generations of artists. Computer-generated architectural visualization, in its earlier form, was only capable of replicating buildings in three-dimensional models. Today, we are capable of adding life to the renderings through intelligent color combinations, detailed textures, beautiful lighting, and by the addition of true-to-life scenarios.

The process of visualization has evolved into a combination of modeling and dramatization of architectural elements of the buildings and its environment to produce astonishing images of the proposed building as though it was already built. The techniques used in 3D architectural visualization is the same with the fashion and film industry. These two industries create visually appealing scenes and stage atmospheres and try to mimic dramatic and sensational environments.

Some architectural still image types we use

1) The photo-realistic

The photo-realistic style of rendering allowing clients to have the best estimation of how their project would look like once construction is done. Using natural lighting cues, shadowing, and coloring, this style gives the client the essence of what the design would be like to be lived in, or around.



2) Whodunnit

The Whodunnit uses low saturation, cold tones and high contrast to add emphasis to strong design features, angular shapes, and modern materials. Descended from the gritty, high violence of the noir detective genre, this style of architectural visualization lends itself to urban developments, large-scale projects, and modern minimalism.



3) Architectural Watercolors

A watercolor rendering has the ability to charm and engage audiences in ways no other medium can. This technique is a simple duplication of the processes in sketching by using pencil drawing styles in creating structures and the processes of painting by adding colors, lighting, and shading like the watercolor method.



4) The Architectural Elevation

The Interior Elevation usually shows the areas from the kitchen through to the balcony. This type of image is typical of smaller residential projects and is a great way of showing different areas in just one image.



5) The Cutaway

A cutaway drawing, also called a cutaway diagram is a 3D graphics, drawing, diagram and or illustration, in which surface elements of a three-dimensional model are selectively removed, to make internal features visible, but without sacrificing the outer context entirely.





6) The Living room view

The Living image is a really great way to showcase space and market a lifestyle. In many cases, the furniture fit-out is dictated by styling chosen for branding documents or display rooms and the 3d image must reflect this style to maintain consistency.

7) The Bathroom view

The Bathroom, just like the Kitchen image is a crucial part of the marketing of a new space. It takes a skilled 3d artist to maximize this space, especially if it is void of natural light. Towels and other toiletries add that humans feel as well as adding personal warmth and character to space.



8) The Kitchen view

The Kitchen render is a given for the architectural render collection. Benchtops, fixtures, and fittings are usually accompanied by some carefully styled decor items to add a human touch. These touches are vital to this image and assist in selling a lifestyle or allowing the viewer to imagine themselves in the environment.

9) The Vignette / Close Up

We love these image types. A close up of an area or an aspect of your design. Simple. Beautiful.



10) The Photomontage

These images are an amalgamation of photography and 3d renders. Often used for Town Planning but also useful if there's a specific landmark to be highlighted. A Photomontage involves merging a photograph with a computer-generated image (CGI) to create a perspective that shows a new building in the context of its surroundings.

11) Architectural Visualization Masterplans

Aerial overviews of entire masterplans show prospective buyers/stakeholders the entire community vision. They provide spectacular context to a neighborhood and allow a better understanding of the overall layout.





12) Streetscapes

3D Architectural Streetscapes enable potential buyers to get a feeling for the neighborhood they are buying in to. For most buyers, the community they are getting into plays a very important part of the purchasing decision.

13) Public Open Space

Architectural renderings of parks, playgrounds, urban centers, shopping centers, and all public open spaces are valuable tools in communicating design intent and are emotive marketing images for larger-scale projects.



Some architectural animation types we use

1) CGI Loop Animation

This is a combination of static CGI and 3D Animation where the result is loop-animation. It's great for showcasing functions of certain movable parts, welcome website pages and social marketing videos, where the goal is to have a motion.

2) 3D Camera Tracking

Camera tracking is an integral part of CGI animations where a combination of live footage and CGI is combined. For full immersive user experience with CGI animations, camera tracking involves compositing 3D animated models into video footage.

Birdseye – fly, Human Sight and Walkthrough compositions are the most convenient approaches for quality results. The service is widely used by construction companies showcasing a proposed real estate scheme sitting in a current environment. For the full cinematic experience, camera tracking involves compositing an animated rendering of a proposed scheme into pre-shot video footage. The animation is playing an increasingly central role in our services. Constantly developing technology in this area is now making this an affordable way to raise the quality, engagement and professionalism of many projects.

3) Full CGI Animation

CGI Animation is like a movie. A CGI project at its most elegant form, engaging and constantly evolving tool which we strive to master at perfection.

This method of animation is generated in exactly the same way as the full CGI still service above providing great efficiency. Animations can be generated from a previously generated still image or increasingly in the age of internet-based marketing with this method of working, animations form the basis of the graphic collateral from which still images can later be extracted for print media if required.

4) Timelapse

This is kind of photographic compositing where a timelapse sequence is shot followed by a recreation of this in an animated 3d environment. The animated object is then composited into timelapse photography. Similar to the cinemagraphs above these are typically shot from a static position. Timelapses are often used to quickly and effectively convey a number of conditions that would otherwise require several different images or animations; dawn, day, golden hour, magic hour, nighttime city lights etc.

5) Cinemagraph

In technical terms, this is simply another form of animation created in the same way as above, functionally this can be so much more as it bridges the gap between still images and full-motion animation breathing life into any image. Cinemagraphs are a really compelling take on the traditional animated GIF, only showing motion in a portion of the frame to focus on a specific movement. This results in a very compelling looped animation. Our cinemagraphs use as backdrops to teaser websites, holding pages for upcoming web pages, inserts in full marketing films accompanying narration and extensively in social media. The power of motion is significant in the evocation of emotion.

3.3. 3D PRODUCT VISUALIZATION STYLES

3D product rendering is effectively used for marketing purposes by many manufacturers. For instance, CGI helps lower expenses for launching a campaign, show products in the best light, and thus increase sales. Also, brands that imply 3D rendering avoid the long and troublesome process of product photo sessions.

So, there is no wonder why the companies that don't use photorealistic visualization yet consider starting to do so. However, to take all the possible benefits from 3D rendering for product design, you should know the main types of 3D visuals. It'll help understand what kind of CGI will work best for your project. .

Some 3D product still image types we use

1) Technical Visualization

Exploded views and deconstructed perspectives provide a unique view of your product's hard-to-see features. The perfect solution to explain difficult technical elements. Some types of shots are simply not possible using traditional photography methods and break-apart renderings are just one example.



2) Photorealistic 3D Product images

The ability to control every single element with absolute precision; the lighting never changes unless we want it to change; design changes can be made easily in 3d without having to set up another photo shoot and we can change colors, materials, and lighting on your product.

3) Studio background 3D rendering

Because our photoshoots are in the virtual world we can tweak every element quickly. We have full control over every aspect of the shoot for an unlimited timeframe.



4) Closeup product images

Quality is about the details. This is why website visitors love when there is a possibility to zoom in on the furniture piece, examine the materials, see the joints and seams. This experience provides e-shoppers with much-needed information about the quality and thus alleviates the fear of buying online.

Some 3D product animation types we use

1) Product Info & Feature Animations

There's no better way to demonstrate your product than with a 3D animation. Whether you want to showcase the detail, materials, highlight specific product features, or simply show off what makes your product better than everyone else's, a 3D animation can convey all of that and much more!

2) Spin 360 & Break-Apart Animations

Spin 360 and Break-Apart 3D animations help convey every detail of your product to your customers. Give your customers the ability to view your products from every angle and, if you want, even offer the ability to showcase the internal components.

3) Promo & Product Showcase Animations

Getting ready to launch a new product or just want to update your marketing material? We can create high quality promotional 3D animations that will showcase your product at a photo-realistic level of quality and attract new customers.

4) 3D Product Explainer Animations

3d animation video is often a preferred choice for marketers due to its ability to render objects with real-life precision. With 3d style animation, you can depict and explain situations that are not possible in real life. You can even create product models and show them from different angles when the product does not even exist.

3.4. WHAT IS 3D RENDERING?

3D rendering refers to adapting the likeness of an object in the form of an image. 3D rendering—both technical and artistic—employs the use of 3D software to help create images to help better explain or advertise concepts and designs. The use of technical drawings or CAD designs is common in the creation of 3D models. After creating the 3D model, we add lights, textures and cameras. The final step in the process referred to as "Rendering" is where the 3D software computes all inputs to create a two-dimensional image.

These images can be used as a single image still rendering, stitched together into an animation or created on-the-fly in real-time programs such as video games. Some of the more common applications of 3D rendering include; architectural renderings of real estate, interior renders of rooms and spaces, and product renderings. 3D Renderings are also standard in visualizing prototypes for entrepreneurs. 3D modelling and rendering are highly flexible, so it is possible to create a 3D render of just about anything imaginable.

A few of the most common industries 3D rendering is being used

- Architectural Rendering
- CGI in Movies
- Medical Imaging
- Safety Training
- Environment Simulations
- Product Prototyping
- Engineering
- Virtual Reality
- Video Games



3.5. WHAT IS IMAGE & ANIMATION RESOLUTION?

Rendering resolution is the most important specification of the quality of an image. Furthermore, digital images are a grid of tiny colored squares called pixels. Every digital image has a dimension (or resolution), which is, a fancy way of saying a number of pixels tall by a number of pixels wide.

If the resolution is too low, you will see the individual color squares, and the image will look grainy or blurry. When it comes to 3D rendering and 3D animation, you want higher resolution. Below are examples of very low and high-resolution versions of the same image. Note the exaggerated quality differences.

Low-resolution 45px X 25px



High-resolution 4000px X 2250px



UNDERSTANDING IMAGE RESOLUTION

The image resolution is often a confusing subject when it comes to preparing it for print. Image scale, DPI and file formats are not things commonly thought about by those who are not in the industry. Fortunately, we have broken down the resolutions needed for typically desired sizes for optimal quality at 300 DPI (DPI is an outdated and inaccurate term which refers more to analog printing instead of digital media. PPI, or pixels per inch, are more accurate when talking about images viewed on a screen)

Image resolution for the web

When optimizing a website, it is best practice to use as few resources as necessary without compromising quality.

This improves your site load time, and as a result, your user's experience is improved, which Google likes!

When you're adding images to a website, it is best to make the file sizes precisely the size you need. If your image is being displayed at 700x500 @ 72 PPI it doesn't make sense to display it as a 6000x6000 300 DPI image. It can be time-consuming to compress your images properly, but it is definitely worth it in the long run. We are using the program to compress our images when we are doing web design.

PHYSICAL IMAGE SIZE (INCHES)	IMAGE SIZE IN PIXELS @72 PPI (IDEAL FOR WEB)	IMAGE SIZE @ 300 PPI (IDEAL FOR PRINT)
4" x 6"	334x432	1391x1800
5" x 7"	360x466	1500x1941
8" x 10"	576x745	2400x3106
8.5" x 11"	612x792	2550x3300
11" x 14.235"	792x1025	3300x4271
18.544" x 24"	1335x1728	5563x7200

Image resolution for creating billboard

When creating a billboard image, it is important to realize a couple of factors:

Billboards are typically not viewed up close, and creating a resolution of 72000 x 93182 pixels at 300 PPI is not practical for several reasons:

- Most rendering engines will cap out around 10000 x 10000 pixels
- Design programs like Photoshop may run out of memory at such a size
- The final file size will be around 20 gigs

All of this makes the previously mentioned standards for print impossible. With this, the question arises, what is the best file resolution for large-scale printing projects?

The answer to this is working in high PPI and scaling that back once the image is ready for print.

For example, you would start by creating an image in as high of a resolution as practicable, like 8000 x 8000 @ 400 PPI.

This would technically give you excellent quality at 20 inches x 20 inches, which can be used for proofing or alternate marketing material.

Once the image has been finalized, you scale the PPI from 400 to 40.

The image should now be suitable for 20' x 20' at 40 PPI, which is an acceptable resolution for a billboard-sized image. Because billboards are likely to be viewed from further away, your need for a tighter pixel grid is reduced.

Image resolution for texturing 3D objects

When it comes to texturing a three-dimensional object, it is essential to consider what the final resolution will be in relation to where the object will sit compared to the camera. For example, if the resolution of the image will be 1028x1028 pixels and the texture of the object takes up 100% of the screen, you would want at the very least 1028x1028 texture size. With that in mind, it is relatively easy to estimate the appropriate texture size you will need based on this. (Final image resolution x (screen % or estimated proximity to camera).

Keep in mind textures occupy a 3D space, so you must factor in the closest element of the texture to the camera when considering the texture resolution to avoid a drop in texture quality.

UNDERSTANDING ANIMATION RESOLUTION

What is the best resolution for animation?

Much like image resolution, animation resolution will depend on the medium on which it will be displayed. If your animation is going to be projected on a cinema screen, the required resolution will be very high. If the animation is going to be shown online or on a TV, consider what the highest resolution may be. Generally, 1080P is the standard in architectural animation at this time(2020). That being said, 4K TV's and even 8K TV's are becoming increasingly popular. We can render video at any resolution, but the standard resolutions are:

- 480p = 640 x 480 (standard definition tv).
- 720p = 1280 x 720 (web or old high definition tv).
- 1080p = 1920 x 1080 (high definition and current standard).
- 4K = 3840 x 2160 (highest practical resolution at this time).
- 8K = 7680 x 4320 (still unsupported by many mediums).

Effects of resolutions on the render time

Every time the resolution of an image doubles, the surface area quadruples. As well as, render times and file sizes go up fourfold. These relationships are particularly relevant to video, where the render times are already very long. It is important to agree upon the resolution prior to the start of a project so neither party involved is taken advantage of.

One thing to consider with animation resolution is the fact that it is comprised of around 30 images each second. This means that an increase in animation resolution is going to take exponentially longer to render as each image now requires longer to process.

3.6. FILE FORMATS

STILL IMAGES

Common file formats are jpg and PNG. PNG has the advantage of supporting transparency but has larger file sizes. Transparency means the image can allow for portions of the image to be see-through.

Product renderings may use transparency to place a rendering over another image using software such as Adobe Photoshop. Both jpg and PNG formats are great for drafts and revisions, but when you request your final images you should make sure you receive EXR or another HDRI format.

An HDRI format allows much more information to be stored and can produce much better results when printed. Although, generally, differences between HDRI and formats such as jpg and PNG only become apparent if you plan on making modifications to the images it can be great to have.

Requesting the PSD (Adobe Photoshop) file in addition to the final image file can be useful if you ever foresee yourself needing to alter the image in the future. A PSD file allows to separate out layers, effects, and backgrounds for easier manipulation.

If you're planning on printing your house render or any image for that matter, be sure your file is the insufficient resolution for the required print. Additionally, be sure to check on the printer's requirements for the file type. One of the safer file formats for printing purposes is PDF format. Be sure to get this information directly from your printing company to ensure you can request exactly what is needed ahead of time.

ANIMATIONS

Video formats can get a lot more complicated than still images.

- *Frame rate:* At its most basic form, a video is just a set of images played quickly enough that you cannot see the transition between frames. The rate at which they are shown is called the frame rate: the higher the frame rate, the smoother the video will be during fast movements. Standard frame rates are 24p, 25p, 30p, 60p, and 120p. However, there are many variations of frame rates. Wikipedia has an excellent article on frame rates.
- *Animation compression:* Raw or uncompressed video files are very large. A minute of footage can take up several gigabytes. Raw footage is the best quality but is difficult to transfer or play. If you are going to have the footage edited, you should ask for us a raw video, but plan for plenty of time to transfer it.
- *Animation codec:* Finished videos are usually compressed using a codec (a compression-decompression standard). Picking a codec is a matter of balancing compatibility, file size, and quality. We offer animation services and generally provide our clients with WMV files for Windows and MOV files for Mac. If a client is going to post the video online, we provide an H.264 MP4 file. All these can still be edited, but generally, you will only experience a small decrease in video quality. It is good practice to request the raw footage for us just in case.
- *Converting raw to compressed:* As mentioned, the uncompressed footage created in animation can often be unmanageable and needs to be compressed. On average, a 1-minute animation file in 1080P is around 55 gigs (often much too large to be transferred). We typically use Adobe's Media Encoder with H.264 in good quality to bring that file down to about 87MB, often seeing no visible compression artifacts.

3.7. 3D RENDERING PRICING GUIDE

The single most significant factor when it comes to determining the cost of your 3D Rendering project is determining the type. There is a big difference between rendering a small home vs a High Rise Tower.

If you are a potential buyer, you will need to express your priorities to our company in order to get a quote from us and you will also need to look into our previous work to identify if your needs will be met. Not all rendering companies produce high quality renders and hence their prices might come across as cheap and affordable. The reality of the rendering world is generally that better the quality, higher the prices.

THE MAIN FACTORS THAT AFFECT 3D RENDERING PRICING

1) 3D rendering job

The main cost of a 3D rendering is the labor required. Three professionals are generally involved in a 3D rendering project:

- Project Manager
- 3D Artist
- Post Processing / Photoshop Artist

By far, the most significant component of the labor cost is the 3D Artist so that we are focused primarily on the 3D Artist's role.

What does the 3D artist do in the 3D rendering process?

To create a render, a 3D artist needs to:

- Understand the plans and clients vision
- Create the model using 3d software
- Texture the model
- Set up the lighting
- Set up the camera

What increases the 3D artists labor costs?

The labor involved in a 3D render is not as straight forward as one might think. Our skilled 3D artists can create what can appear to be an extremely detailed scene in a short amount of time using the tools at

their disposal. On the other hand, seemingly simple scenes might take much longer.

For example, one could create a large and very accurate aerial view of a forest very quickly using public topographical data and several automated processes.

However, it could take several days or weeks to model a single piece of equipment, according to exacting standards, such as an electronic device with complex circuit boards and wiring.

In many cases, the process can be sped up using items from our libraries, such as furniture, cars, people, and finishes. The main factors that affect labor are the level of detail and the number of unique elements required.

Post processing 3D renders labor costs

Once a 3D render has computed, a photoshop artist / graphic designer touch up the image. Post-production can be a minor or major part of the process. Our studio renders a fundamental scene then do most of the detailing in photoshop. We take a more minimal approach to post-processing. A studio could do no post-processing, but almost always is there some color tweaking or touch-ups required.

2) Rendering time

Rendering time is the amount of time that it takes a computer to create your image. Rendering time is directly related to how realistic the image is, and how much detail you require. However, there are many tricks to create detail without adding much rendering time.

We provide the information below to help you understand why some projects cost more and take longer, then others.

What increases rendering time?

Depending on the rendering software, the number of light sources can sometimes significantly affect rendering times – thus, exterior scenes can render quite quickly.

Another factor is the detail of the scene. The industry term for this is poly-count, which refers to the number of polygons used to model the scene. For more information, you can check out Wikipedia's 3D modelling page.

A common element that significantly increases detail, and therefore rendering time, is foreground vegetation, background vegetation should be optimized with a technique of using billboards or sprites. Additionally, curved surfaces tend to require much more detail.

Hardware and software on rendering time

With the constant improvements in computer hardware and the changes in rendering software, rendering time for still images is becoming a minor factor in price. However, the rendering time for animations is still a very relevant factor in their production cost.

Reducing rendering times

The biggest single thing you can do to reduce rendering time is to reduce the number of required revisions by giving detailed plans and specific feedback. Every time you require a revision, some or all of the image needs to be re-rendered, so fewer revisions results in less total rendering time. Reducing revisions may save you money in the long run. The other largest factor in rendering times is resolution. This comes into play much more when creating animations, however, it can still be a factor when creating still images.

Hardware and software on rendering time

With the constant improvements in computer hardware and the changes in rendering software, rendering time for still images is becoming a minor factor in price. However, the rendering time for animations is still a very relevant factor in their production cost.

The point here is that rendering high-quality large-sized images for a billboard takes a very powerful computer and it takes a long time. The reason for this is that the computer has to compute more data, polygons and pixels to produce the final image.

The files the client submits is key to keeping the costs down. If you submit a very clear brief with a 3d model, reference images and style of render you want, obviously the price will be much lower as less work is involved. However, if your brief is not clear the designers expect the worst and that changes will be plentiful and they have to calculate this in to the cost.

3) Timelines

There is no organization without timing, and timing is everything in architectural rendering.

The timeline determines how long it takes to complete a 3D rendering project. If the 3D team has to work overtime to complete the render prices will increase. Additionally, deadlines are important not only for cost but also for the quality of your render. If the job needs to be done in 72 hours, the labour invested in the project will be less. This can result in lower quality.

It depends on the specifications, requirements, skills, technology use, the overall scope of the project and the expected time:

- rush (2-7 days)
- standard (7-14 days)
- not urgent (30-60 days)

4) Resolution

Standard, print, billboard.

- Animation: 480p; 720p; 1080p; 4K; 8K
- Image size:
 - Image size in pixels 72PPI: 334×432; 360×466; 576×745; 612×792; 792×1025; 1335×1728
 - Image size in pixels 300PPI: 1391×1800; 1500×1941; 2400×3106; 2550×3300; 3300×4271; 5563×7200; 72000 x 93182; 10000 x 10000 pixels

5) File format

- Animation: WMV files for Windows; MOV files for Mac; H.264; MP4;
- Image: JPG; PNG; PSD; PDF; EXR; another HDRI format and etc.

6) Context

Animations are generally made up of a moving 3D camera, moving people, moving vehicles with a

stationary set. The more complex the moving parts become, the more you can expect to pay for a render.

- Without texture
- Accurate with texture
- Landscape
- DB Catalog
- Customer
- Camera Option
- Time of Day
- Vegetation
- Moving parts
- People
- Vehicle
- Site Accessories
- Furniture inside

7) Animation / Image types

- Architectural images style: The photo-realistic; Whodunnit; Architecture presentation images; Architectural Watercolors; The Elevation; The Kitchen; The Living; The Bathroom; The Cutaway; The Vignette / Close Up; The Photomontage; Streetscapes; Public Open Space; Architectural Visualization Masterplans; "Hand-drawn look" with the outline effect
- 3D Product Images style: Technical Visualization; Photorealistic 3D Product images; Studio photography 3D images; Closeup product images
- Architectural & Interior animation types: CGI Loop Animation; 3D Camera Tracking; Full CGI Animation; Timelapse; Cinemagraph.
- 3D product animation types: Product Info & Feature Animations; Spin 360 & Break-Apart Animations; Promo & Product Showcase Animations; 3D Product Explainer Animations

3.7. THE 5 THINGS YOU MUST REMEMBER

1) Standard pricing is impossible in this industry, so beware of whoever tries to lure you with high rates and hasn't seen your project files yet.

2) Provide as much clear information when seeking a quote and even more after you have agreed to work with a 3d company. This will allow the team to be able to create your visual exactly as you imagine.

3) With enormous competition, companies attempting to mislead clients are rampant. If you find a company that tries to sell you a decent looking image at impossibly cheap prices, try cross-questioning them or asking for previous records. Many overseas companies tend to have stock images that they use to mislead customers into buying their services.

4) Picking a company that has good customer service and communication skills is a must. This will relieve you of the repeated revisions that you might have to make if you end up choosing the cheaper options.

5) The difference between \$700 USD and \$2000 USD might not be visible to the naked eye initially, but when you dig deeper, factors like communication, quality control, skill levels, frequency of revisions and perfection of the end product emerge as the answers to your query. Below you can see the difference between high and low-quality architectural renders.



High quality 3D render



Low quality 3D render

3.8. OUR THE 3D RENDERING PROCESS

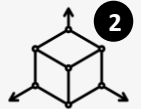
The method below describes the 3D rendering of 2D images. Although the process is broken down into steps, we do not always follow this order and may jump between processes. For example, understanding the client's vision is a continual task throughout a project.

Understanding the client's vision



In order to build a model, we need to understand the project. Using plans, sketches, and reference images provided by the client, we start by visualizing the project. From this point, camera angles are typically agreed upon based on the 2-dimensional plans.

3D modeling



We use specialized 3D modeling software to create a digital model.

This phase is analogous to building the structure of a physical model, except that the model only exists digitally.

Materials and texturing



We apply images to the 3D models to make them look as realistic as possible.

This step is analogous to painting a physical model or gluing materials and photographs onto it. In most cases, there is also material setup. This refers to the settings that control if something is matte or glossy. We can also modify the roughness of surfaces and many other parameters depending on the software used.

Lighting



We set up lights in the 3D scene to replicate real-world lighting. This process is similar to the way a photographer or videographer would set up lighting before shooting with the addition that we need to set up the sunlight and or ambient room lighting.

Rendering

Rendering is when the computer generates the 2D image or images from the scene created in the steps above. It is analogous to taking a photo in the physical world.

Rendering can take anywhere from a fraction of a second to several days. Rendering time is depending on the complexity of the scene and the quality desired. This process is completed solely by the computer. In some cases, images are rendered on large clusters of computers called render farms.



Refining

During the refining, process drafts are provided to the client for feedback, usually in a low-resolution format to speed up the revision process. We make the requested revisions to the scene, textures, and lights until the desired results are achieved. Generally, changes can be made independently: for example, most changes to the model do not require the texturing to be updated.



Final delivery

The agreed-upon final 2D image or images are provided to the client. Depending on the desired resolution, the images will be provided in a specific format to support and size. For web, images are generally optimized medium size jpg, while for print images are high-resolution raw files.



4 XR TECHNOLOGIES

XR is an emerging umbrella term for all the immersive technologies. The ones we already have today—augmented reality (AR), virtual reality (VR), mixed reality (MR) and apps that aren't so strictly placed in one AR or VR category versus another. We remain flexible and evolve with the types of XR that emerge, rather than being stifled by committing to a single form.

All immersive technologies extend the reality we experience by either blending the virtual and “real” worlds or by creating a fully immersive experience. Recent research revealed that more than 60% of respondents believed XR will be mainstream in the next five years.

One industry that can particularly profit from reality technologies is the construction industry.

Computer-aided design software (CAD-software) has been used to plan new projects for years, and with the rise of Building Information Modeling all over the world, the uses for reality technologies are numerous. When it comes to the technology that is most promising to use for construction projects, there is no patent remedy. Depending on the size and orientation of business, different reality technologies might fit needs best. Everyone needs a solid understanding of the differences between Virtual, Augmented, and Mixed Reality to know which one is most suitable for business.

4.1. WHAT IS XR?

Extended Reality (XR) is an umbrella term encapsulating Augmented Reality (AR), Virtual Reality (VR), Mixed Reality (MR), and everything in between. XR is generally used as an umbrella term and is frequently used as a casual shorthand to group technologies such as VR, AR and MR together.

Technology-mediated experiences that combine virtual and real-world environments and realities.

XR covers the hardware, software, methods, and experience that make virtual reality, mixed reality, augmented reality, cinematic reality and others a reality. Most definitions of XR encompass platforms and content where the user can take digital objects into reality, or, conversely, see physical objects as present in a digital scene.

Our XR technologies



Virtual Reality



Augmented Reality



Mixed Reality



Interactive Applications



Hologram

4.2. WHAT DO YOU NEED TO KNOW ABOUT XR?

XR has gone from a science fiction concept to a broad market of consumer devices in just a short span of years: It's no surprise some of us have whiplash. Now that XR technology is everywhere, you may have some questions. We're going to answer them! Here's everything you need to know about XR.

THE BASICS OF VR

Virtual reality technology seeks to create a realistic three-dimensional image or environment that a human can perceive as real, and even interact with in realistic ways. Obviously we aren't at holodeck levels of realism yet, but consumers do have easy access to VR headsets and controllers.

VR in devices like headsets is created entirely by a mixture of hardware and software. That makes it different from AR (augmented reality), which uses an overlay of the real world and adds objects to it, like the Microsoft HoloLens.

VR tends to be a more difficult prospect: In AR, there are solid fixed points of reference that your eyes can use to track and navigate. In VR, the full environment is simulated and realism is harder to attain.

Cutting edge VR projects are working with tactile sensation and even smells, but in the consumer market VR is typically limited to vision, hearing, and handling simple objects: But you'd be amazed what can be done with just these senses.

The most ubiquitous VR product is undoubtedly the VR headset: We have seen many versions from top tech brands like Google and Sony, each with their own unique approach.

These headsets are easy to divide into categories based on the hardware they are designed to work with. Larger, high-end headsets are typically designed to work with PCs that have been enabled to run VR software. Close behind them are headsets designed for other machines like game consoles, notably PlayStation VR. Lately we are also seeing the rise of stand-alone headsets that include all necessary hardware onboard.

Then come along somewhat cheaper headsets that are designed to work with smartphones, with a slot in the headset to position the smartphone screen at the right distance from the eyes.

The WebXR Device API provides access to input (pose information from headset and controllers) and output (hardware display) capabilities commonly associated with Virtual Reality (VR) and Augmented Reality (AR) devices. It allows you develop and host VR and AR experiences on the web.

- For phones - lets to enable VR by providing pose information and allowing the WebGL scene to be rendered side by side to be placed in a headset like the Cardboard
- For Desktops - desktop computers can make use of tethered VR hardware such as the Oculus Rift or HTC Vive to display the VR scene
- For standalone VR Headsets - lets to enable VR by rendering the scene using the platforms VR capabilities.

We are creating VR experience for different VR hardware systems:

1) VR Headsets for Mobile

Most recently this category has become split in two, lead by the Oculus Go headset and the Oculus Quest headset. Main advantage of mobile VR is that you get a similar experience with PC VR but with no cables or external PC required. The deliverable is a .apk Android app which can be installed locally or via Oculus Store non-public channel. Doesn't require an internet connection. Oculus Go, GearVR or similar headsets can feature a point-and-click panorama tour, highly realistic but not very interactive.

Oculus Quest is a mobile VR headset with motion tracking which supports interactive experiences such as PC VR can deliver but at a slightly lower level of realism. Recommended for when you carry the headset to the end users or when you want to target a larger number of users - the set-up and space requirements are minimal and you can purchase more headsets on a budget.

Headsets:

- Oculus Go - The Oculus Go is a standalone virtual reality headset developed by Facebook Technologies in partnership with Qualcomm and Xiaomi. The Oculus Go improves on the Gear VR in one big way: you don't need a high-end Samsung phone to use it, so the headset is convenient for people with iPhones or other Android phones. The Go is an all-in-one headset, meaning it contains all the necessary components to provide virtual reality experiences and doesn't need to be tethered to an external device to use, and the headset uses the Android mobile operating system. The headset and controller utilise non-positional 3-degrees-of-freedom tracking, making it capable of seated or static-standing activities but unsuitable for roomscale applications.



- Google Daydream - Daydream is a discontinued virtual reality (VR) platform which was developed by Google, primarily for use with a headset into which a smartphone is inserted. It is available for select phones running the Android mobile operating system (versions "Nougat" 7.1 and later) that meet the platform's software and hardware requirements. To use the platform, users place their phone into the back of a headset, run Daydream-compatible mobile apps, and view content through the viewer's lenses. A standalone headset with integrated hardware, the Lenovo Mirage Solo, does not require a phone to use.



- Samsung Gear VR - The Samsung Gear VR is a virtual reality headset developed by Samsung Electronics, in collaboration with Oculus VR, and manufactured by Samsung. When in use, a compatible Samsung Galaxy device acts as the headset's display and processor, while the Gear VR unit itself acts as the controller, which contains the field of view, as well as a custom inertial measurement unit, or IMU, for rotational tracking, which connects to the smartphone via USB-C or micro-USB. Works with Samsung Galaxy Note5, Galaxy S6 Edge Plus, Galaxy S6, Galaxy S6 edge. Lightweight, so you can play and watch more comfortable and easy to use the touchpad.

- Pansonite - The Pansonite 3D Virtual Reality Mobile Headset is a thoughtful accessory for phone-based VR experiences, but it won't match the quality of more costly standalone headsets. The Pansonite VR Headset offers a myriad of critical headset features, such as interpupillary distance adjustment and built-in on-ear headphones, that lets you enjoy mobile VR as it was intended to.



2) VR Headsets for PC

The most immersive experience type available. Immersive means the user can explore everything in the most realistic way available and which allows for the maximum amount of interactivity.

Requires a connected PC to a VR headset such as an Oculus Rift S, HTC Vive, Valve Index VR or similar.

Deliverable is a Windows-only .exe file, locally stored on your machine. Recommended for on-location VR set-ups (non mobile) either in a showroom or at a conference booth, for high end residential units. Can be run in multi-user scenarios and can communicate with a database feeding real-time information if needed. PC-connected VR has the best experience but requires an expensive system. The best VR experience comes from headsets that you tether to a PC.

But a VR-ready experience PC starts at around \$900 for a laptop, or a couple hundred less if you build your own PC. For more wallet-friendly VR, consider standalone HMDs that don't connect to any system or alternatives that connect to your smartphone.

Before buying a VR headset that relies on a PC, you should ensure your device meets the headset's minimum requirements. Steam has a free test for checking if your PC can handle VR, and we also test this from laptop reviews.

If your PC doesn't meet the headset's requirements, you might want to increase your budget or buy a standalone HMD instead.

When it comes to specs, bigger is better. In general, the greater the headset's refresh rate, field of view (FOV), total resolution and pixel density (measured in pixels per inch or PPI), the smoother and sharper experience will look.

You can usually wear glasses in VR, but some HMDs make this more comfortable than others. Check the headset's IPD (interpupillary distance, the distance between the pupils in millimeters), which may be adjustable. Better yet, opt for an headset with a glasses spacer, like the Oculus Go or Rift S. The HP Reverb G2 and XRSpace Mova are coming out this year. We're still waiting for the HTC Vive Cosmos Play, a cheaper version of the HMD, to arrive this spring

And at CES 2020 in January, we saw upcoming HMDs hardcore enthusiasts may want to consider. The \$450 Pimax Artisan is finally available, and we're waiting for the 8K resolution Pimax Vision 8K X to exit pre-order and more news on the enterprise-focused, but incredibly interesting, Pico VR Glasses. The XRSpace Mova is also supposed to debut this year. And if you're eagerly anticipating the PlayStation 5, note that the PSVR will work on the console, as Road to VR reported.

Headsets:

- Valve Index - there are more premium and powerful headsets available; however, the Quest strikes the best balance between price and performance. It's also easier to setup than some other headsets, which is great for people new to VR. The Quest is a standalone headset, so you don't have to connect it to a powerful PC or smartphone. Plus, you don't have to set up base stations around your room, like some other, more premium headsets require. Ultimately, this HMD is a quick and easy path into quality VR. In fact, when we tried on it, we found it to be as immersive as a pricier PC-connected, room-scale VR system, like the Oculus Rift S.



- Oculus Rift S - Oculus Insight translates your movements into VR no matter which way you're facing and provides room-scale tracking without external sensors. Look around, duck for cover and turn the tide of the battle from anywhere in your playspace. With Oculus Touch controllers, you can transport your hands and gestures right into the game. Your slashes, throws and grabs appear in VR with intuitive, realistic precision.



3) Standalone VR headsets

A standalone VR is a monolithic headset, with a built-in screen processor and battery, as well as several viewfinders on its body that provide stable spatial orientation and position recognition relative to the world coordinates of additional peripheral devices. It usually works in tandem with one or two controllers, each of which has 6 degrees of freedom. Some great examples are the Oculus Quest and Vive Focus platforms. Standalone virtual reality headsets (a.k.a. untethered, wireless, standalone VR) don't require a PC or a smartphone to deliver a VR experience.

The self-contained headsets (made popular by releases such as the Oculus Go) include built-in processors, GPU, sensors, battery, memory, displays, and more

These headsets work by having all the computer parts within the headset, including gyroscopes and sensors. This enables the headset to function without a PC, though with less power and functionality. Standalone VR headsets are normally less powerful than their PC counterparts.

Headsets:

- Oculus Quest - There are more premium and powerful headsets available; however, the Quest strikes the best balance between price and performance. It's also easier to setup than some other headsets, which is great for people new to VR. The Quest is a standalone headset, so you don't have to connect it to a powerful PC or smartphone. Plus, you don't have to set up base stations around your room, like some other, more premium headsets require. Ultimately, this HMD is a quick and easy path into quality VR. In fact, when we tried on it, we found it to be as immersive as a pricier PC-connected, room-scale VR system, like the Oculus Rift S.



- Oculus Go - A quick, easy and affordable way to get into VR, the Oculus Go is the best VR headset for maintaining your budget. Like the Oculus Quest, the Go doesn't need to connect to a PC or smartphone to work. Bonus: it's great for glasses-wearers too. On the other hand, the Go is the only headset here that has only 3-degrees of freedom (3-DoF) instead of 6-DoF. That means you're not meant to walk around with it. In other words, don't expect the same quality or level of immersion as you'd get from a PC-connected headset, like the Go's more capable sibling the Rift S.



Vive Focus - the VIVE Focus will take you far in the virtual world. Featuring innovative world-scale tracking with a 110° field of view, users will enjoy a freeing, intuitive experience with nothing to hold them back. When it comes other standalone devices, there are trade-offs, especially when it comes to visuals. Not with the VIVE Focus. From first sight, you'll be treated to high-resolution 2880 x 1600 graphics on par with tethered, professional-grade VR systems like the VIVE Pro. When we say VIVE Focus is ready out of the box, we mean it. No tethered PC required. No external base stations or sensors needed. Just instant wireless VR with high-resolution 3K AMOLED screens and Qualcomm® Snapdragon™ 835 processing.



4) VR Headsets for Web

The WebXR Device API for creating immersive 3D, virtual reality experiences in your browser and provides access to input (pose information from headset and controllers) and output (hardware display) capabilities with Virtual Reality (VR) and Augmented Reality (AR) devices. It allows you develop and host VR and AR experiences on the web.

Headsets:

- Daydream - Lenovo Mirage Solo with Daydream is the world's first standalone VR headset with Daydream. Combine an ultra-crisp QHD display, wide FOV and World Sense body tracking with all the VR apps from Google's Daydream, and you'll be blurring the line between virtual and reality. Works with Chrome and Firefox Reality on Daydream-ready Android devices.



- Samsung Gear VR - With Samsung Gear, you're able to hang out in Oculus Rooms and talk to others, watch 360° videos on social media, and even game together thanks to over 600 game titles. Works with Oculus Browser and Samsung Internet.



- **Oculus Quest** - all-in-one VR: No PC. No wires. No limits. Oculus Quest is an all-in-one system built for virtual reality. Now you can explore almost anywhere with just a VR headset and controllers Oculus Touch Controllers: Arm yourself with the award-winning Oculus Touch controllers. Your slashes, throws and grabs appear in VR with intuitive, realistic precision. Easy set up: The world is your arcade. Set up is easy whether you're at home or someplace new. Oculus Quest works with your environment, so you can play standing or sit in spaces big or small. Guardian Helps Keep You Safe: Explore the universe without tripping over the coffee table. The Oculus Guardian system is designed to help you avoid nearby works with Firefox and Supermedium on Windows.



- **HTC VIVE** - use VIVE seated, standing or in a space up to 15 feet x 15 feet. SteamVR Tracking provides the best experience possible. FULLY IMMERSIVE – Realistic movement and actions from precise, 360-degree controller and headset tracking with realistic graphics, directional audio and HD haptic feedback in the virtual world. The Chaperone system warns you when you reach the boundaries of your play area and the headset's front-facing camera gives you a glimpse of the real-world when you need it.



- **Windows Mixed Reality** - having just the right mix of features and a fairly reasonable asking price, HP's VR1000-127il is arguably one of the most affordable Windows Mixed Reality headsets. Like a majority of the other WMR headsets out there, the VR1000-127il has two 2.89-inch displays, with a per eye resolution of 1440 x 1440 pixels and a 95-degree field of view. It features two front-facing cameras for inside-out motion tracking, complete with six degrees of freedom (DOF). WebVR v1.1 is supported by Microsoft Edge on Windows. Firefox and Supermedium are also supported with SteamVR.



PC requirements needed to support VR

Today, there are a wide variety of VR systems available to the average consumer. Virtual reality offers an immersive experience for hardcore VR users, but PC might require updates in order to support the VR system. VR compatibility will depend on the specifications of CPU, GPU, RAM, hard drive, and other core components. Take your VR experiences to a whole new level with the powerful new GeForce® RTX GPUs. With GeForce RTX, you can count on the lowest latency and highest performance with leading VR headsets—all driven by NVIDIA VRWorks technology. Now the new GeForce RTX SUPER™ Series has even more cores and higher clocks, bringing you performance that's up to 25% faster than the original RTX 20 Series.

GeForce RTX VR features

Creating a truly immersive VR experience demands precise simulation of your environment, including graphics, audio, and behavior. GeForce RTX technology takes advantage of real-time ray tracing, AI, and advanced VR shading technologies to take VR simulations to a level of realism far beyond what's possible with traditional rendering.



Enhanced VR works graphics

Variable Rate Shading (VRS): This new technique increases rendering performance and quality by applying full GPU shading horsepower to areas of the VR scene that need it most, and less GPU horsepower to areas that don't.



Single Pass Multi-view

Developers almost doubled the geometric complexity of VR applications, increasing the richness and detail of their virtual worlds. Single Pass Multi-view improves on this technique by simultaneously projecting up to four views to accelerate next-generation VR headsets with an ultra-wide field of view.



Concurrent processing

Simultaneous floating point and integer processing enables Turing GPUs to more efficiently process the compute heavy workloads of modern games.



RT cores

Dedicated ray tracing hardware enables fast real-time ray tracing with physically accurate shadows, reflections, refractions, and global illumination.



The ultimate graphics platform

GeForce RTX is the ultimate graphics platform for VR—opening a new world of immersive experience with blazing-fast performance, plug-and-play compatibility, and industry-leading NVIDIA VRWorks technology.



Tensor cores

Artificial intelligence is driving the greatest technology advancement in history, and Turing is bringing it to computer graphics. Experience AI-processing horsepower that accelerates performance with NVIDIA DLSS 2.0.



Tensor cores

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Accelerated ray-traced audio

NVIDIA VRWorks Audio is solution that creates a complete acoustic image of the virtual environment in real-time, delivering physically realistic audio that conveys the size, shape, and material properties of the virtual environment. It's accelerated on GeForce RTX's new hardware-based real-time ray tracing technology, resulting in substantially increased performance and quality.



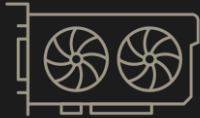
Next-gen shading

Variable Rate Shading focuses processing power on areas of rich detail, boosting overall performance without affecting perceived image quality. Mesh Shaders advanced geometry processing supports an order of magnitude more objects per-scene, allowing the creation of rich complex worlds.

System requirements

NVIDIA's GeForce GTX VR Ready program designates virtual reality ready PCs, Notebooks and Graphics

Cards from leading add-in-card and system builder partners that are configured to deliver an optimal VR experience.



GPU

GeForce GTX 1060 or greater

+



PC

With 3x USB 3.0

+



HMD

Head Mounted Display HTC Vive, Oculus Rift, Widows Mixed Reality

DESKTOP REQUIREMENTS:

- GPU: NVIDIA GeForce GTX 1060 or greater
- HTC Vive Pro GPU: NVIDIA GeForce GTX 1070 or greater
- CPU: Intel Core i5- 4590 | AMD Ryzen 5 1500X or greater
- Memory/RAM: 8GB+ RAM
- Video Output: 1x HDMI 1.4
- Ports: 3x USB 3.0

HTC Vive and Oculus Rift

- OS: Windows 7 SP1 (64bit) or higher
- Driver: Oculus – 361.91 and newer
HTC – 361.75 and newer

Windows Mixed Reality

- OS: Windows 10 Fall Creators Update
- Driver: 387 and newer



GPU

GeForce GTX 1060 or greater

+



HMD

Head Mounted Display

LAPTOP REQUIREMENTS:

- GPU: GeForce GTX 1060 and above*
- HTC Vive Pro GPU: NVIDIA GeForce GTX 1070 or greater
- CPU: Intel Core i5-7300HQ or greater
- Memory/RAM: 8GB+ RAM
- Video Output: 1x HDMI 1.4
- Ports: 3x USB 3.0

HTC Vive and Oculus Rift

- OS: Windows 7 SP1 (64bit) or higher
- Driver: Oculus – 361.91 and newer
- HTC – 361.75 and newer

Windows Mixed Reality

- OS: Windows 10 Fall Creators Update
- Driver: 387 and newer

Who came up with AR (Augmented Reality)?

Morton Heilig is considered a 'father of AR' for all of his research in 50's and 60's when he patented the Sensorama Stimulator in 1962. which he called 'experience theatre'.

How does mobile AR work?

Mobile AR works by utilizing an AR framework that handles the placement of virtual content in the real world and a rendering engine that provides the virtual content. The two are inseparable, and AR as technology means absolutely nothing without meaningful content. Mobile AR usually uses visual triggers to start a certain content in relation to that visual: think of a movie poster triggering the trailer of that particular movie. With the introduction of ARKit for iOS devices and ARCore for supported Android devices, visual tracking mixed with sensor data is also a very important and new way of locking AR content to the real world.

A user captures the image of a real-world object, and then the underlying platform (like smartphone application) detects a marker (ex. image or a code), which triggers it to add a virtual object on top of the real-world image and displays on your camera screen.

- The camera produces footage of real-life objects. This provides a foundation for the scene wherein augmented objects are placed.
- The registration process, which depends on the type of AR application, figures out how to put an AR object in the picture.
- The combined image is transmitted to the device where a user can see it.

What is the different between VR and AR?

Unlike virtual reality, which creates a totally artificial environment, augmented reality uses the existing environment and overlays new information on top of it. Virtual reality means computer-generated environments for you to interact with, and being immersed in. Augmented reality, adds to the reality you would ordinarily see rather than replace it

What type of professionals are needed to us create an AR app?

That is entirely dependent on what kind of virtual content will be shown to the viewer and what the functionality of the app will be.

AR technology itself means nothing without meaningful and high quality content just as Photoshop itself isn't valuable unless we use it to create a digital painting or touch up a photo. This AR content can be 3D, but it can also be an intuitive user interface, a useful, spatially placed in-context information, and so on.

Our AR team:

- The UX designer - AR requires a new approach to how users interact and consume content.
- The content team - creates high-quality content
- The engineering team - they program the content to do what it needs to do and appear where it needs to appear.

What do you need to know about AR?

One industry that can particularly profit from reality technologies is the construction industry. Computer-aided design software (CAD-software) has been used to plan new projects for years, and with the rise of Building Information Modeling all over the world, the uses for reality technologies are numerous. When it comes to the technology that is most promising to use for construction projects, there is no patent remedy. Depending on the size and orientation of business, different reality technologies might fit needs best. Everyone needs a solid understanding of the differences between Virtual, Augmented, and Mixed Reality to know which of these three should go for. And as a picture is worth a thousand words, we made a diagram explaining what is MR and what is the MR differences between VR and AR to outline the core principles

AR technologies

Augmented Reality lets you use technology to create experiences that enhance the world around you. We utilize several technologies to create our AR experiences that are integrated into an array of Augment Reality platforms.

Marker-Based AR



Markerless AR



Web-Based AR



Marked-based AR

Marker-based augmented reality experiences require a static image also referred to as a trigger photo that a person can scan using their mobile device via an augmented reality app. The mobile scan will trigger the additional content (video, animation, 3D or other) prepared in advance to appear on top of the marker.

Marker recognition can be local or cloud-based, it means that marker databases can be stored on the device and recognition also happens on the device. The databases can also be stored on a cloud and recognition happens on a server, the phone is only sending point clouds to the server.

Device-based recognition can happen immediately, but if cloud recognition is used, then it will take a while longer for the content to be downloaded from the server. Usually, it takes a couple of seconds before the user can see any augmented reality experience.

A brief overlook of what you'll need to create your augmented reality experience:

- a static trigger image (aka AR marker)
- digital content such as video or 3D object to feature on top of the chosen picture
- a software for combining the two pieces of content
- a mobile device with a compatible application to scan the marker and retrieve the AR content.

Pros

- If the marker image is prepared correctly, marker-based AR content provides quality experiences and tracking is very stable, the AR content doesn't shake
- Easy to use, detailed instructions are not required for people who use it for the first time

Cons

- When the mobile camera is moved away from the marker, AR experience disappears and the trigger photo has to be scanned again. It is possible to use extended tracking, but in most cases, extended tracking makes things worse.
- Scanning will not work if markers reflect light in certain situations (can be challenging with large format OD banners in ever-changing weather conditions)
- Marker has to have strong borders/contrast between black and white colors to make tracking more stable. Smooth color transition will make recognition impossible.

Markerless AR

Markerless AR does not require image recognition to trigger augmented experiences. Instead, the AR content gets displayed through positional information collected from the device's camera, GPS, digital compass, and accelerometer. The inputs from these data points allow the system to understand the 3D environment through a process known as Simultaneous Localization and Mapping (SLAM). With SLAM, the AR content is overlaid onto the real-world environment, which is viewable from any angle or position.

Markerless AR uses a combination of camera systems, dedicated sensors, and complex math to accurately detect and map the real-world environment — such as the locations of walls and points of intersection.

There are two distinct variations of Markerless AR - projection-based and location-based.

- **Project-based augmented reality** involves projecting immersive light forms onto flat surfaces and then sensing the human interaction with that projected light. This is done by detecting the difference between a known projection and the altered projection resulting from the interaction.

A 3D hologram projected through laser light is also one of the examples of projection-based AR. With a map of the area, an AR-enabled application makes it possible to place virtual objects into a real context and have them stay in place without the need for an QR code or image.

Apps that offer such features usually will ask the user to find a flat surface such as a table or floor for placing the AR elements as the objects will not always make sense floating in the air. For computer vision to detect the flat surface, it has to be textured. You will find it challenging or even impossible to use on a white background or on other single color surfaces. Typically this means virtual objects will appear to “float” in mid-air. But it is also possible to automatically place a 3D augmented reality object onto a flat surface to increase realism, for instance placing a lamp onto a table.

- **Location-based augmented reality** fixes the AR content to a specific place. Once the real-world environment gets mapped and the visual positions defined, the AR content gets superimposed when the user's device data matches the mapped location.

Pros

- Once the content is placed in a room, it is more flexible than marker-based alternatives.

Cons

- The augmented reality content may not make sense in a certain context.
- For a better experience, it is required that the surface has a texture for computer vision to recognize it.

Web-based AR

WebAR is the best technology that serves as the best solution to the needs of users.

One of the most benefited section of the market is Advertisement. It can help to add a new dimension by adding AR for a more interactive and personalized experience. Web Augmented Reality can have that can make signups very easily from users. It has very fewer possibilities for lapses when compared to wearable technologies. AR.js is one of the very important tools

that will work amazingly in a web browser so that there is no need to download the app.

There is also no need to buy a particular device to enjoy WebAR. It will work perfectly on Android, iPhone, Windows, and any other platforms. QR codes can be considered as an important tool that is used with Web Augmented Reality. One can easily scan it from the phone and redirects you to a web page that will take you to the content. QR code is a barcode that is easily readable by smartphones and it is two-dimensional.

There is a vast growth in technologies and also the goals are increasing. And the prime goal is to make adoption of Augmented Reality very simple with the help of web browser audiences. Web AR Allows Accessing Web-Based AR Through a Web Browser.

Web-based Augmented Reality through Web browsers without any need for apps through Web AR. It is a modern advance technology in Augmented Reality.

Augmented reality will be a valuable addition to a lot of existing web pages.

For example, it can help people learn on education sites, and allow potential buyers to visualize objects in their home while shopping. Web AR is taking the internet by storm. Brands, organizations and marketers are all starting to look at Web-Based Augmented Reality technology and identify use-cases within their business.

It is used to display text to the user and to open a URL or even to compose text messages. QR scanner is in-built in the latest iOS and Android devices.

One can also opt for the QR code scanner app for it. The user has to follow the following steps:

- QR code scanning
- One has to open the URL derived from the QR code.
- Scan the same QR code and you can see animations and 3D models.

Web AR provides a fantastic experience to the users and eliminates the need to opt for specialized apps. Users can simply log Web Augmented Reality to access the same functionality without downloading the app.

Famous brands like Samsung, Microsoft, and Apple are adopting various Web Augmented Reality standards. One of the most anticipated products of 2020 is Chrome AR. Instead of opting for specialized apps, one can directly login to AR websites that have the same type of functionality. An unsupported and unofficial version of Web Augmented Reality code is made available on GitHub that will encourage adoption.

During the current climate, we have seen a dramatic increase in the amount of brands looking to deploy Web AR marketing experiences.

Web AR offers a solution to engage with consumers, who in many cases are restricted to their own homes, providing the opportunity to still deliver an immersive brand experience.

These experiences can be activated through direct linking from channels like social media, email and website, meaning that the entire AR campaign is delivered digitally. Something to keep in mind when thinking about marketing to consumers stuck at home!

Pros

- Just like 3D models, animations, videos, and the only thing needed is a good internet connection. As it runs on browsers it does not request any specifications of smartphone or tablet. Not to mention that it does not take up much memory of the device.
- When it comes to cost efficiency it definitely has its advantage to AR because this technology means fast deployment time that leads to fewer costs.

Cons

- The most significant limitation of WebAR development comes from the limitations of your web browser as the quality depends on the memory of the web page that displays the AR image.
- Web browsers have limited access to certain features of a mobile device. While applications have access to a device's all capabilities.
- So far the lower level of interaction seems to be the greatest challenge for WebAR. App-based AR is capable of a higher level of interactivity.
- Real-world scaling is problematic in WebAR development if we compare it to App-based AR but all these disadvantages can be compensated with a good and creative idea of webAR usage.
- It means that if you want a WebAR to be successful it must be simpler, easy to handle and interesting or entertaining.

AR supports the different device models

The device needs to have a powerful enough CPU that integrates with the hardware design to ensure good performance and effective real-time calculations. We are constantly working with manufacturers to make sure their hardware and designs meet these requirements. At the same time, we are working internally to make sure that our using SDK integrates well with every model and we provide good experiences for users.

Operating systems



Operating systems

An Operating system (OS) is a software that acts as an interface between the end-user and computer hardware. Every computer must have at least one OS to run other programs. An application like Chrome, MS Word, Games, etc needs some environment in which it will run and perform its task.

Augmented reality uses your device to blend digital content into the real world. Unlike virtual reality (VR), you won't need any headsets, goggles, or other extra equipment. Instead, all you need is your device's camera and an AR app.

To use Google Play Services for AR, you need an Android device with:

- A Google Account
- ARCore-certification
- At least 1 GB of free space
- At least one AR app installed
- An unmetered mobile network

1) Android

Android is a mobile operating system based on a modified version of the Linux kernel and other open source software, designed primarily for touchscreen mobile devices such as smartphones and tablets.

It is free and open source software; its source code is known as Android Open Source Project (AOSP).

However, most Android devices ship with additional proprietary software pre-installed, most notably Google Mobile Services (GMS) which includes core apps such as Google Chrome, the digital distribution platform Google Play and associated Google Play Services development platform. About 70 percent of Android smartphones run Google's ecosystem.

2) IOS

iOS (formerly iPhone OS) is a mobile operating system created and developed by Apple Inc. exclusively for its hardware. It is the operating system that powers many of the company's mobile devices. It is the world's second-most widely installed mobile operating system, after Android. It is the basis for three other operating systems made by Apple: iPadOS, tvOS, and watchOS.

Augmented reality SDK

Let us discuss some of the numerous AR SDKs that exist at the moment and that we used to develop apps. Could be created for smartphones, tablets or even smart-glasses.

Best AR SDK



1) Apple ARKit

ARKit Augmented Reality development for iOS, one of the biggest mobile platforms of today. ARKit is an SDK for software developers to create augmented reality apps and games for iPhones and iPads.

ARKit runs on the Apple A9, A10, and A11 processors. ARKit uses Visual Inertial Odometry (VIO) to accurately track the world around it. VIO fuses camera sensor data with Core Motion data. ARKit can detect horizontal planes like tables and floors, and can track and place objects on smaller feature points as well. You can take advantage of the optimizations for ARKit in Metal, SceneKit, and third-party tools like Unity and Unreal Engine.

AR apps that one builds with ARKit require iOS 11 or 12. Apple's SDK utilizes iPhone/iPad hardware, motion sensors, camera to enable Augmented Reality applications. So, basically, iPhone 6/6 Plus/7/7 Plus/8/8 Plus/X and iPad Pro models support th, and this means literally millions of mobile devices.

ARKit supports 2-dimensional image detection (trigger AR with posters, signs, images), and even 2D image tracking, meaning the ability to embed objects into AR experiences.

SDK allows developing apps that would recognize spaces and 3D objects, as well as place virtual objects on surfaces. One great example is Ikea Place app, where one can place virtual furniture items in his/her own real space.

Supported platforms: iOS, Metal, SceneKit, and third-party tools like Unity and Unreal Engine.

ARKit Offers:

- Fast, stable motion tracking
- Plane estimation with basic boundaries
- Ambient lighting estimation
- Scale Estimations.
- SLAM tracking and sensor fusion

2) Google ARCore

ARCore is a foundational layer which provides similar capabilities like ARKit, but it works across the Android ecosystem. ARkit provides the ability to build motion tracking, environmental understanding, and light estimation into AR applications. With these capabilities entirely new AR experiences or enhance existing apps with AR features.

The first phones that are ARCore-compatible are the Pixel and Samsung's S8, running 7.0 Nougat, but Google is working with companies including Huawei, LG, ASUS, and others to eventually bring the preview version of ARCore to roughly 100 million devices.

In essence, ARCore is based around 2 elements – real-time position tracking and integration of virtual and real objects. It lets you place objects, texts, etc. withing physical surroundings, and other people then can discover it with Android or iOS phones.

To name a few examples of its capabilities, we may enlist Just A Line app, ARuler app, Ikea Place.

Supported platforms: Android Studio, Unity, Unreal Engine, Web, Android 7.0 and higher, iOS 11 or higher.

Features:

- Environmental understanding: Allows virtual objects to be placed in a way that physically connects with the real world.
- Motion Tracking: Allows users to walk around and interact with virtual content that is rendered in the 3D world.
- Light Estimation: Create realistic looking objects by having its own light change dynamically according to the environment lighting.

3) PTC Vuforia

Vuforia is one of the most popular platforms to help you work with augmented reality development which recognizes the 2D planar image as well as different types of visual objects (a box, cylinder, plane), text and environment recognition, VuMark (a combination of picture and QR-code). Using the Vuforia Object Scanner, you can scan and create object targets (Small, toy size objects). The recognition process can be implemented using the database (local or cloud storage).

Supported platforms: Android, iOS, UWP and Unity Editor and Smart Glasses.

Features:

- Mixed Reality and Eyewear Support including Microsoft HoloLens.
- Recognize and track a broader set of objects, Image.
- Vuforia Ground Plane will be included in Unity as part of a new free deployment option.
- Natural Interactions with Virtual Buttons
- Vuforia Object Scanner
- Model Targets: CAD based detection to detect real-world objects like a car, bike, machine etc.
- Recognition of the different types of visual objects (a box, cylinder, plane),
- Text and environments recognition,
- VuMark (a combination of picture and QR-code).
- It let scan and create object targets. The recognition process can be implemented using the database (local or cloud storage).

4) Wikitude

Wikitude's cross-platform Augmented Reality SDK combines 3D Markerless Tracking technology (SLAM), Object Recognition and Tracking, Image Recognition and Tracking, as well as Geo-location AR for apps. Wikitude SDK is a commercial solution but is also available as a trial version with some limitations like Wikitude logo in cam view etc. Wikitude SDK is currently available for Android and iOS and Glassware platform.

Wikitude also provides Wikitude Studio which eases the development procedure, where no programming skills are required and the app can be created by simply dragging object on the studio screen.

Supported platforms: Android, iOS, Unity Editor, Smart Glasses (Epson Moverio, Vuzix M100, ODG R-7).

Supported development frameworks: Native API, JavaScript API, Unity3D, Xamarin, Titanium, Cordova.

Features:

- Image recognition & tracking
- Object Recognition
- Scene recognition
- Instant Tracking
- 3D tracking technology (SLAM-based)
- Cloud recognition
- 3D markerless tracking
- ARKit and ARCore support
- Instant targets (save and share instant augmentations)
- Windows support

5) Maxst

MAXST AR SDK is an augmented reality engine that integrates a variety of features including Image Tracker, Instant Tracker, Visual SLAM, Object Tracker and QR/Barcode Scanner into an all-in-one package. Maxst offers two different tools for image and object recognition. The generation of a database is online via Tracking Manager. To scan 3D objects there is Map Manager is use applications for Android and IOS (MAXST AR Trainer). The free version differs from paid only by a watermark. The official website has full and easy to understand documentation.

Maxst AR focuses specifically on Natural Feature Tracking, and provides a fairly wide range of deployment platforms, including the Moverio smart glasses.

Supported platforms: Android, iOS, Unity Editor, and SmartGlasses, Windows, Mac OS, Unity.

Multi-platform supported: Android, iOS, Mac OS, Windows

Smart glasses supported: Epson Moverio BT-200, 300 and ODG R-7

Features:

- Fast and robust recognition/tracking performance
- Easy to implement various visual effects
- Instant tracker
- Visual SLAM
- Object tracker
- Image tracker
- Cloud recognition
- Marker tracker
- QR code tracker

6) EasyAR

EasyAR is offering its next-generation SDK, which offers a number of cutting-edge features, such as SLAM, 3D tracking, and screen recording. However, 3D Tracking, SLAM, Screen Recording functionalities are available only in the paid SDK pro version, not in the free version SDK Basic.

Even the free EasyAR augmented reality SDK, however, boasts an impressive set of functions, such as cloud recognition and unlimited recognition queries.

Supported platforms: Android, iOS, Unity Editor and UWP, Windows, Mac

Features:

- 3D Object Recognition
- Environment perception
- Cloud Recognition
- Smart Glass Solution
- App Cloud Packaging
- Tracking of planar images

7) ARToolkit

The ARToolkit-5 is an open source tracking library for augmented reality. The source code for this project is hosted on Github and the compiled SDKs for all other platforms (Mac OS X, PC, Linux, Android, iOS), along with the ARToolkit plug-in for Unity3D.

ARToolkit-6 provides support for three general categories of tracker:

- **Natural Feature Tracking (NFT):** NFT is a sort of gold standard for feature tracking – it supports freeform 2d images which may not have a clearly defined and consistent outside edge. Examples include anything from a drink coaster to a roadside billboard.
- **Traditional template square marker:** These markers are generally a fairly simple icon with a mandatory solid black border around the periphery. **2D Barcode Markers:** These markers are predefined (in the SDK itself) and are typically highly optimized for rapid detection and solid tracking in variable lighting conditions.

Supported platforms: Android, iOS, Unity Editor, Windows, Mac OS and Smart Glasses.

Features:

- Robust Tracking, including Natural Feature Tracking
- Tracking of simple black squares
- Tracking of planar images
- Strong Camera Calibration Support
- Single-camera or stereo-camera camera position/orientation tracking.
- Simultaneous Tracking and Stereo Camera Support
- Simple to use unity plugin: without prior registering targets
- Full Unity3D and OpenSceneGraph Support
- Optical head-mounted display support

8) Kudan

Probably the unique thing about the Kudan SDK, and the one feature that gives it an edge over every other Augmented Reality SDK that I'm aware of is that it has very robust single-camera SLAM. Kudan supports Visual Simultaneous Localisation and Mapping (SLAM) tracking technology available for AR/VR, Robotic and Artificial Intelligence applications. Kudan supports marker or markerless tracking and location requirements also.

Supported platforms: Android, iOS, Unity Editor and Smart Glasses.

Features:

- Simultaneous Localisation and Mapping (SLAM) tracking technology
- 2D/3D Recognition in same application
- flexible to work across mobile, HMD and advanced IoT, AI, Robotics applications.
- Available with markerless and marker operation

9) WebXR

ARToolkit-6 provides support for three general categories of tracker:

- Natural Feature Tracking (NFT)
- Traditional template square marker
- 2D Barcode Markers

Supported platforms: Android, iOS, Unity Editor, Windows, Mac OS and Smart Glasses.

Features:

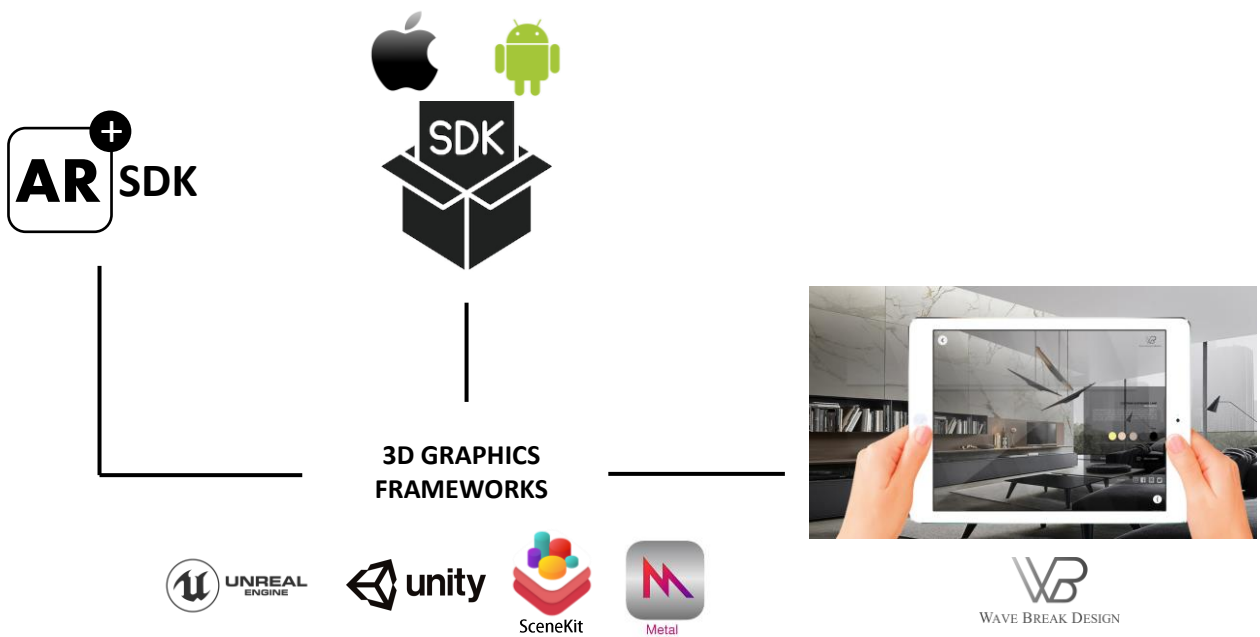
- Robust Tracking, including Natural Feature Tracking
- Tracking of simple black squares
- Tracking of planar images
- Strong Camera Calibration Support
- Single-camera or stereo-camera camera position/orientation tracking.
- Simultaneous Tracking and Stereo Camera Support
- Simple to use unity plugin: without prior registering targets
- Full Unity3D and OpenSceneGraph Support
- Optical head-mounted display support

The role of AR SDK in app development

First, you need to define your objectives by answering the following three fundamental questions: Where to display, What and How.

- **Where:** The where might involve areas like 2-D image matching and tracking, 3-D object matching and tracking, SLAM tracking, and location tracking (using GPS) and sensor-based tracking using accelerometer, compass, gyroscope. Sometimes the where is nothing more than some predefined point locations, often referred to as Points of Interest (POIs).
- **What:** On the other hand, the what might leverage 3-D model rendering, animations and gesture detection. In general, the what can be any piece of digital information (e.g. text, image, video) that the user might also have the ability to interact with (e.g. rotate or move it).
- **How:** How is the very important, because it involves actual AR implementation and AR SDK performs this task on behalf of us (AR developers).

AR SDK: The *core software* powering an Augmented Reality experience is known as an *AR SDK* or *AR Engine*. It solves the difficult task of fusing the real world with the digital content. The AR Engines' capabilities define the potential features of the AR application.



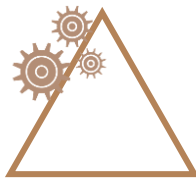
AR Software terminology

The following definitions are flexible and continuously evolving based on our development landscape.

- **Platform:** The operating system something gets specifically built for. e.g., Writing code for an iOS app means that an Android app cannot share the same code.
- **Engine:** Software that can convert, power and render different types of data into content. e.g., Creating a sphere in Unity and adding the ability to bounce.



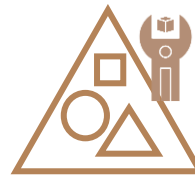
PLATFORM



ENGINE



FRAMEWORK



SDK

- **Framework:** A collection of predefined code that enables quicker development. e.g., Rather than writing code for lights from scratch, SceneKit for iOS offers built-in lights.
- **SDK (Software Development Kit):** A collection of third-party tools and frameworks that supports or adds new functionality to an app. e.g., Adding voice support using Twilio

AR types of engines

Engines can come in several forms. A gaming engine like Unity has its own interface for real-time 3D authoring, but it can also be embedded inside an application. A rendering engine like V-Ray comes as a plug-in for other 3D applications. Software can also have multiple engines depending on the users' needs. The following are examples of common engines:

- **Graphics Engine:** This is the primary technology that draws the images on all screens. e.g., Makes a sphere shape.
- **Rendering Engine:** Still a graphics engine, but specialized for transforming 3D models into stylized or photorealistic images and video. e.g., Makes the sphere look hyper-realistic.
- **Physics Engine:** Simulates how objects would react under the real-world constraints such as gravity and physics. e.g., Makes the sphere bounce.
- **Gaming Engine:** A software environment that contains things like physics engines as well as support for particles, audio, logic, and AI. e.g., Makes the sphere change colors when moved up or down.

Common SDK's and frameworks

These tools make it so that we don't have to code an application from scratch each time. Frameworks also offer crucial features that may require specialized knowledge to code.

There are tons of AR SDK's and frameworks out in the market at the moment (and the list is only growing!). It is important to note that the platform directly impacts the technology that gets used. Some kits can accommodate several platforms, whereas others are made for a single platform and/or device only.

Examples:

- Vuforia: Works on iOS, Android, and UWP (Universal Windows Platform)
- iOS AR Kit: Developed by Apple, iOS only.
- AR Core: Formerly part of 'Tango' Developed by Google, Android only.
- WebXR: Still in development by Mozilla, browser-based.

THE BASICS OF MR

Mixed Reality is a blend of physical and digital worlds, unlocking the links between human, computer, and environment interaction. This new reality is based on advancements in computer vision, graphical processing power, display technology, and input systems. However, the term Mixed Reality was introduced in a 1994 paper by Paul Milgram and Fumio Kishino, "A Taxonomy of Mixed Reality Visual Displays." Their paper explored the concept of the virtuality continuum and the categorization of taxonomy applied to displays. Since then, the application of Mixed Reality has gone beyond displays to include:

- Environmental input
- Spatial sound
- Locations and positioning in both real and virtual spaces

Environmental input and perception

Over the past several decades, exploration into the relationship between human and computer input has

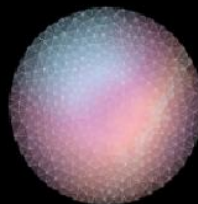
continued, leading to the discipline known as human computer interaction or HCI. Human input happens through different means, including keyboards, mice, touch, ink, voice, and even Kinect skeletal tracking.

Advancements in sensors and processing are giving rise to a new area of computer input from environments. The interaction between computers and environments is effectively environmental understanding or perception, which is why the API names in Windows that reveal environmental information are called the perception APIs. Environmental input captures things like a person's position in the world (head tracking), surfaces and boundaries (spatial mapping and scene understanding), ambient lighting, environmental sound, object recognition, and location.

In Figure 1-1 below you could see Mixed Reality is the result of blending the physical world with the digital world.

PHYSICAL WORLD

DIGITAL WORLD



MIXED REALITY SPECTRUM

Figure 1-1

The combination of all three - computer processing, human input, and environmental input - sets the stage for creating true Mixed Reality experiences. Movement through the physical world can translate to movement in the digital world. Boundaries in the physical world can influence application experiences, such as game play, in the digital world. Without environmental input, experiences can't blend between physical and digital realities.

Augmented vs. virtual reality

Most mobile phones on the market today have little to no environmental understanding capabilities. The experiences they offer can't mix physical and digital realities. The experiences that overlay graphics on video streams of the physical world are augmented reality. The experiences that occlude your view to present a digital experience are virtual reality.

The experiences enabled between augmented and virtual reality form Mixed Reality:

- Starting with the physical world, placing a digital object, such as a hologram, as if it was there.

- Starting with the physical world, a digital representation of another person--an avatar--shows the location where they were standing when leaving notes. In other words, experiences that represent asynchronous collaboration at different points in time.
- Starting with a digital world, physical boundaries from the physical world, such as walls and furniture, appear digitally within the experience to help users avoid physical objects.

Most augmented reality and virtual reality offerings available today represent a small part of this spectrum and are considered subsets of the larger Mixed Reality spectrum. Windows 10 is built with the entire spectrum in mind, and allows blending digital representations of people, places, and things with the real world.

In Figure 1-2 below you could see the Mixed Reality spectrum

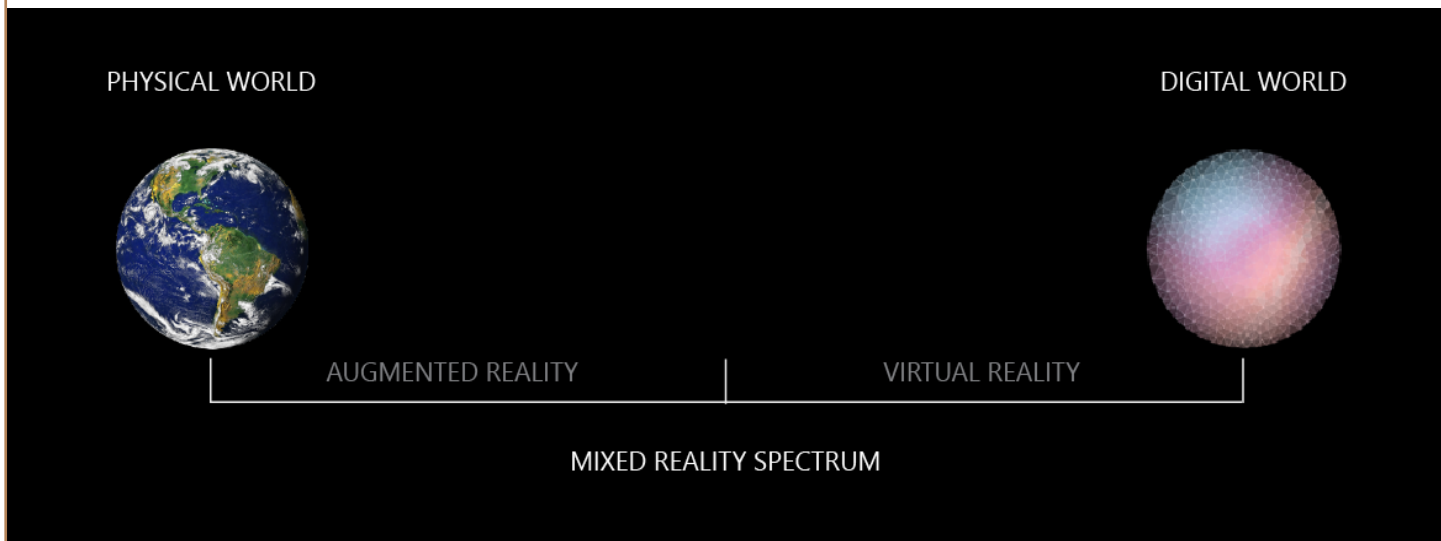


Figure 1-2

Why mixed reality?

Mixed reality and spatial computing bring the model out of the screen and provide users the ability to engage and interact with data more intuitively. Moreover, unleashing the 3D model democratizes the data to a diverse group of stakeholders, offering a more natural way to experience and understand the work to be done.

How are customers using mixed reality today?

Our customers using apps to visualize 3D design earlier and more effectively than ever before, rapidly iterate on design ideas in 3D, collaborate with others (both collocated and remote) while immersed in the design, overlay designs on the real world for things such as clash detection and renovation visualization, and use models in the real world as an “instruction guide” for actual production. This is significantly improving data communication and interpretation to reduce rework, increase productivity, and improve overall job quality. In the Civil and Utilities spaces, customers can use a tool to locate buried utilities or visualize their design before undertaking their daily work. Imagine stepping out on a construction site wearing a Mixed Reality (MR) headset and instantly being informed what’s behind schedule, what’s been

installed in the wrong place or where there might be an issue or clash. This is automatic construction verification in real time using object recognition, machine learning and computer vision.

This is Mixed Reality in the true sense, where digital models are displayed in the context of the real world – so the wearer of the HoloLens can see where things will be constructed or, more importantly for identifying costly mistakes early on, where they should have been constructed.

From design office to site

Mixed reality could be used as a cloud-based construction management solution that acts as a collaboration hub for AEC projects. It can read in files from many different sources – Autodesk Revit, Tekla Structures, SketchUp and more – then be used to coordinate models and manage projects through change orders, to-do lists and RFIs.

The workflow with the HoloLens currently starts in the office where a QA issue might be identified, and someone sent out on-site to investigate. On-site, that person puts on the HoloLens, sees a ‘to do’ list inside the MR environment and then inspects the issue.



At the moment, this is a very manual process. The worker first has to align the real and virtual worlds by telling the HoloLens that certain surfaces it has scanned in the real world are structural columns, staircases or elevator shafts in the digital model.

Once everything is aligned, on subsequent site visits the mapping sensors built in to the HoloLens do an excellent job of automatically recognising it is in the same location. However, as construction sites are continually changing with new elements added on a daily basis, alignment often needs to be done over again.

The idea is the HoloLens is taught to ‘recognize’ objects in the real world — that a beam is a beam, a column a column, etc. — then automatically work out its location based on its knowledge of the design and align itself accordingly.

The automatic alignment would be an impressive leap forward, but the next step would be to use machine learning and AI to automatically identify issues in real-time, a process.

R&D technology that would be able to tell the worker if something is being installed in the wrong spot, something wasn’t installed and should have been, or if there’s going to be a clash. This is automatic, real time construction verification, enabled through object recognition, where the technology not only knows that a column is a column, or a pipe is a pipe but the exact specification of that element. This will not only add a lot of value to construction, but also to asset and facility management.

Location

The HoloLens, in its current incarnation, has relatively limited storage and memory so it’s not really practical to upload entire construction projects to the device.

At the moment getting workers to the precise location of a potential issue still requires knowledge of the site. In the future, it’s not beyond the realms of possibility that a worker could be guided to the next task by a virtual arrow on the surface of the ground. It could even plot the fastest route between issues.

Of course, site safety is of paramount importance, so a beep from the HoloLens could be used to alert

workers when, for example, they get close to the edge of a deck or an elevator shaft, as it knows at all times where it is on site. It could also identify potential dangers through object recognition.

What you see is what you build

Applying MR, machine learning and AI on an ever-changing site is a major challenge.

On the factory floor, instead of working off drawings, the workers use the HoloLens to see exactly where to place complex rebar within the cage. There’s about 50 steps that need to be completed in sequence and, as the worker finishes each one, he or she can move to the next using a simple voice command. Everything that has been completed is greyed out until the whole cage is filled.

MR and machine learning could also bring QA to this process. Rather than having one team build the cage and someone else check it, the system could automatically perform quality control in real-time, not only checking that the bar has been placed in the correct position but warning the worker if an incorrect bar is about to be used.

HoloLens is already being proven out on real life projects, but the most exciting developments look set to come in the future through the application of object recognition, machine learning and computer vision which will allow construction firms to use computers to track progress and identify issues on site, rather than relying solely on humans.

This isn’t just about using technology to drive efficiency, shorten project schedules and bring down costs. With the global workforce becoming less skilled and the complexity of projects increasing, mixed reality could eventually transform construction itself in a ‘what you see is what you build’ future where construction workers are shown precisely where to place elements without having to refer to documentation.

While the HoloLens has been made ‘construction ready’ one has to remember it’s still very early days for the technology. In its current incarnation, the HoloLens is nearly three years old and has well documented limitations in terms of field of view and processing power, but HoloLens 2 is rumoured to be waiting in the wings to be unveiled later this year or next.

What do you need to know about MR?

Mixed Reality is a big place, a nexus where real and virtual worlds collide with a bang. The possibilities are endless, and it starts with us.

There are several development paths we can take through our documentation. The first step is finding the technology that's right for you. Take a look through each one and understand what we using, the available platforms and tools.

MR technologies:

1) UNITY



Full-featured mixed reality app with Unity.

If you want to get started with HoloLens or Windows Mixed Reality immersive headsets, we prefer to use the Unity.

Unity is one of the leading real-time development platforms on the market, boasting an ecosystem with a dedicated learning platform, asset store, full documentation, and a thriving community. Unity's underlying runtime code is written in C++, but all development scripting is done in C#. Whether we are looking to build games, movies and animation cinematics, or even render architectural or engineering concepts in a virtual world, Unity has the infrastructure to support us.

We have several hardware and emulator options when building Mixed Reality apps with Unity. Our developer documentation focuses on HoloLens devices.

Mixed Reality devices:

- HoloLens (1st Gen)
- HoloLens 2

Immersive VR headsets

- HP Reverb and Reverb G2
- Samsung Odyssey and Odyssey+
- HP Windows Mixed Reality headset
- Lenovo Explorer
- Acer AH101

- Dell Visor
- Asus HC102
- Acer OJO 500

The Mixed Reality Toolkit for Unity is an open source cross-platform development kit built to accelerate development of applications targeting Microsoft HoloLens, Windows Mixed Reality immersive (VR) headsets and OpenVR platform.

MRTK for Unity is an open-source, cross-platform development kit for mixed reality applications. MRTK provides a cross-platform input system, foundational components, and common building blocks for spatial interactions. MRTK version 2 is intended to accelerate the development of applications targeting Microsoft HoloLens, Windows Mixed Reality immersive (VR) headsets and OpenVR platform. The project is aimed at reducing barriers to entry, creating mixed reality applications, and contributing back to the community as we all grow.

Modular

We have built it in a modular way, so there's no need to take every bit of the toolkit into your project. There are actually a few benefits to this. It keeps your project size smaller, and makes it easier to manage. Additionally, because it's built with scriptable objects and is interface-driven, it's also possible for you to replace the components that are included with your own, to support other services, systems, and platforms.

Cross-platform

Speaking of other platforms, it has cross-platform support. And while this doesn't mean every single platform is supported out of the box, we have made sure none of the toolkit code will break when you switch your build target to other platforms. The robustness and extensibility with the modular design sets you up on a good path to be able to support multiple platforms, such as ARCore, ARKit, and OpenVR.

Performant

Working with mobile platforms, we constructed it with performance in mind. This is super important, and we wanted to ensure that the tools are not going to work against you.

2) UNREAL ENGINE



Unreal Engine 4 is a powerful, open source creation engine with full support for mixed reality in both C++ and Blueprints. As of Unreal Engine 4.25, HoloLens support is full-featured and production-ready.

Available hardware platforms

We have several hardware, emulator, and streaming options when building Mixed Reality apps with Unreal Engine. While our developer documentation focuses on HoloLens devices, we can package your Unreal projects as x64 desktop apps and run them on immersive headsets just fine.

MR devices

- HoloLens (1st Gen)
- HoloLens 2

Immersive VR headsets

- HP Reverb and Reverb G2
- Samsung Odyssey and Odyssey+
- HP Windows Mixed Reality headset
- Lenovo Explorer
- Acer AH101
- Dell Visor
- Asus HC102
- Acer OJO 500

Available tools and SDKs

The Mixed Reality Toolkit for Unreal (MRTK-Unreal) is a set of components, in the form of plugins, samples and documentation, designed to accelerate development of mixed reality applications using the Unreal Engine.

3) WebXR



The WebXR Device API is an open specification that allows you to experience Mixed Reality apps in your browser on any platform.

4) NATIVE (OpenXR)



OpenXR is an open royalty-free API standard from Khronos that provides engines native access to a wide range of devices from vendors across the mixed reality spectrum. We can develop using OpenXR on a HoloLens 2 or Windows Mixed Reality immersive headset on the desktop. If we don't have access to a headset, emulators for HoloLens 2 and Windows Mixed Reality headsets are available.

Available hardware platforms

We have several hardware, emulator, and streaming options when building Mixed Reality apps with OpenXR development.

MR devices

- HoloLens 2

Immersive VR headsets

- HP Reverb and Reverb G2
- Samsung Odyssey and Odyssey+

HP Windows Mixed Reality headset

- Lenovo Explorer
- Acer AH101
- Dell Visor
- Asus HC102
- Acer OJO 500

Available tools and SDKs:

- OpenXR Developer Tools
- OpenXR Spec
- OpenXR Loader

MR headsets



There are two main types of devices that deliver Windows Mixed Reality experiences:

- 1) Holographic devices are characterized by the device's ability to place digital content in the real world as if it were there.
- 2) Immersive devices are characterized by the device's ability to create a sense of "presence"--hiding the physical world, and replacing it with a digital experience.

Whether a device is connected to or tethered to a separate PC (via USB cable or Wi-Fi) or self-contained (untethered) doesn't reflect whether a device is holographic or immersive.

Features that improve mobility lead to better experiences and both holographic and immersive devices could be tethered or untethered.

Technological advancement is what has enabled Mixed Reality experiences. There are no devices today that can run experiences across the entire spectrum. Windows 10 provides a common Mixed Reality platform for both device manufacturers and developers. Devices today can support a specific range within the Mixed Reality spectrum, with new devices expanding that range. In the future, holographic devices will become more immersive, and immersive devices will become more holographic.

Characteristic	Holographic devices	Immersive devices
Example device	Microsoft HoloLens 	Samsung HMD Odyssey+ 
Display	See-through display. Allows user to see the physical environment while wearing the headset.	Opaque display. Blocks out the physical environment while wearing the headset.
Movement	Full six-degrees-of-freedom movement, both rotation and translation.	Full six-degrees-of-freedom movement, both rotation and translation.

It's best to think about what type of experience an application you wants to create. The experiences will typically target a specific point or part on the spectrum. We should consider the capabilities of the devices they want to target. Experiences that rely on the physical world will run best on HoloLens.

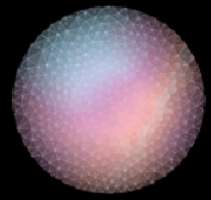
- **Towards the left (near physical reality).** Users remain present in their physical environment and are never made to believe they have left that environment

- **In the middle (fully Mixed Reality).** These experiences blend the real world and the digital world. Viewers who have seen the movie Jumanji can reconcile how the physical structure of the house where the story took place was blended with a jungle environment.
- **Towards the right (near digital reality).** Users experience a digital environment and are unaware of what occurs in the physical environment around them.

In Figure 1-3 below you could see where devices exist on the Mixed Reality spectrum

PHYSICAL WORLD

DIGITAL WORLD



AUGMENTED REALITY

VIRTUAL REALITY

MIXED REALITY SPECTRUM

Figure 1-3

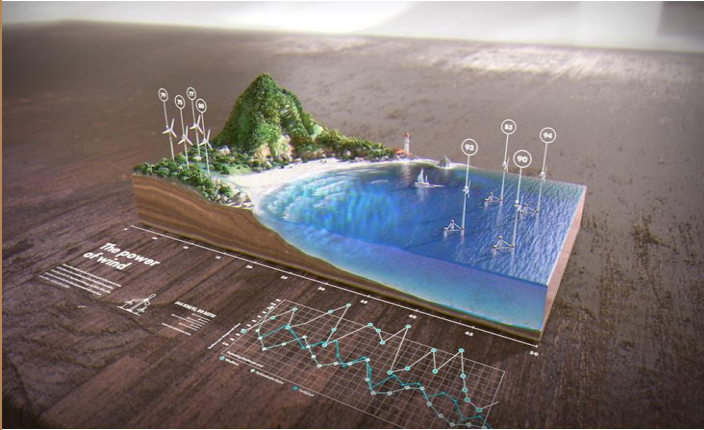
HoloLens 2 hardware

Microsoft HoloLens 2 is an untethered holographic computer. It refines the holographic computing journey started by HoloLens (1st gen) to provide a more comfortable and immersive experience paired with more options for collaborating in mixed reality.



What are the capabilities of HoloLens?

Immersive, ergonomic, instinctual and untethered HoloLens 2 offers the most comfortable and immersive mixed reality experience available, with industry-leading solutions that deliver value in minutes—all enhanced by the reliability, security, and scalability of cloud and AI services from Microsoft.

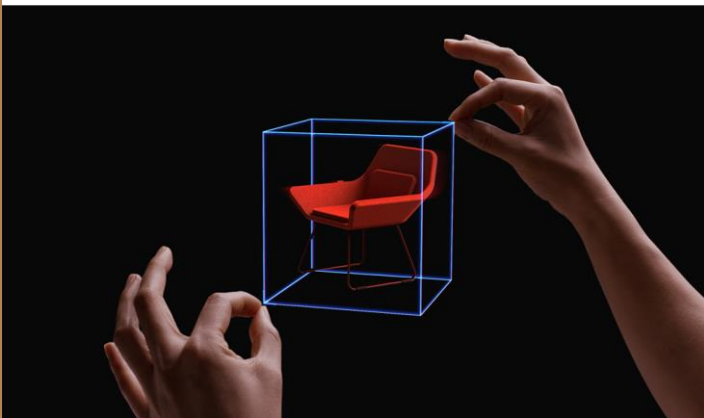


- Ergonomic

Wear HoloLens 2 longer and more comfortably with a dial-in fit system designed for extended use. And keep your glasses on—the headset slides right over them. When it's time to switch tasks, flip the visor up to step out of mixed reality.

- Immersive

See more holograms at once through the greatly increased field of view. Read text and see intricate details on 3D images more easily and comfortably with industry-leading resolution.



- Instinctual

Touch, grasp, and move holograms in ways that feel natural—they respond a lot like real objects. Log in to HoloLens 2 instantly and securely using just your eyes with Windows Hello. And voice commands work even in noisy industrial environments through smart microphones and natural language speech processing.

- Untethered

Move freely, with no wires or external packs to get in your way. The HoloLens 2 headset is a self-contained computer with Wi-Fi connectivity, which means that everything you need goes with you while you work.



What are the core concepts of an experience?

1) Keep the user comfortable - (Comfort)

To ensure maximum comfort on head-mounted displays, it's important for designers and developers to create and present content in a way that mimics how these cues operate in the natural world.

2) How the user sees the world - (Holographic frame)

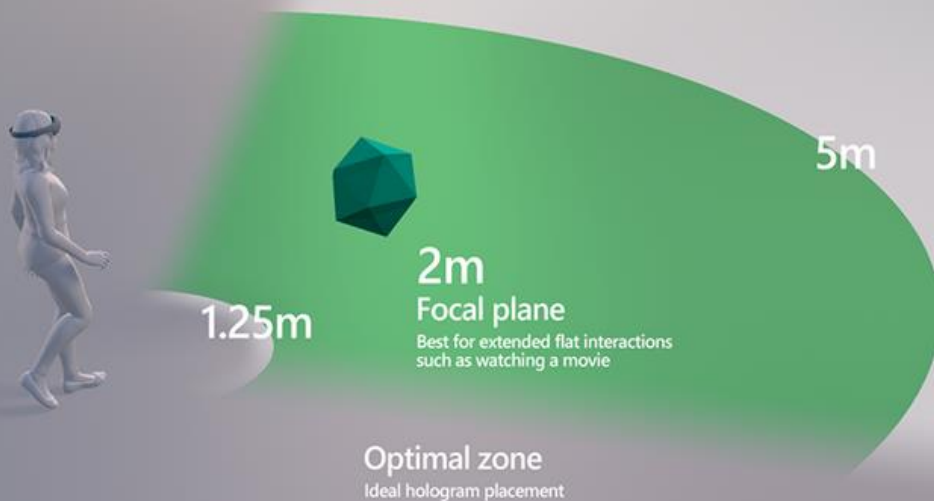
Users see the world of mixed reality through a rectangular viewport, powered by their headset. On the HoloLens, this rectangular area is called the holographic frame and allows users to see digital content overlaid onto the real world around them.

3) Making holographic objects feel real - (Spatial mapping)

Spatial mapping makes it possible to place objects on real surfaces. This helps anchor objects in the user's world and takes advantage of real world depth cues.

4) Suggesting the scale of an object - (Scale)

A key to displaying content that looks realistic in holographic form is to mimic the visual statistics of the real world as closely as possible. This means incorporating as many of the visual cues as we can that help us (in the real world) understand where objects are, how big they are, and what they're made of.



THE BASICS OF HOLOGRAM

1) Hologram table

It remains, however, an outstanding engine for geospatial imaging, presenting laser-scanned or hand-designed 3D maps of entire cities that can be zoomed in on to the smallest details and manipulated.

And now, the UD engine underpins Euclidean's remarkable multi-user hologram tables, which can give up to four users at a time the experience of looking at a hologram that they can walk around and interact with, without the need for bulky augmented reality (AR) headgear.

This is an important point. Euclidean's table only requires users to use a small pair of motion-trackable sunglasses, very similar to a pair of 3D glasses, making them much more relevant in a social meeting or gaming situation than the large helmets and screens you currently need for AR.

Here's the working prototype

When you're wearing these glasses, the table is able to track the position of each of your eyes, and build a custom image for each eye.

When it comes to gigantic point-scanned city maps or CAD renders, this software is extraordinarily fast, yet gentle on processing demands. That makes these hologram tables exceptionally effective as boardroom presentation tools. Euclidean currently has one small 1.5 x 1.5-m prototype table up and running, and that prototype's proven compelling to Australian investor types who have seen it in the flesh. The company has raised enough capital to go into production, with a target of shipping product by February 2018. The tables shouldn't be that expensive, either. Dell tells us he should be able to sell a 1.5 x 1.5-meter (4.9 x 4.9-ft) table for around AU\$60,000 (US\$47,000). Larger versions are also in the pipeline, including potentially something big enough for four people to stand on. That should be pretty spectacular.

It's worth noting that any part of the image that appears to project beyond the edges of the table won't be doing that in real life; the image will fade out as it reaches the edges of the display.



You won't see any hologram that doesn't have the table directly behind it, which makes this video (and the mock-up images used throughout this article) a little misleading – but they provide a general idea of what it looks like

Share Understanding

Showing plans in 3D in an interactive medium is invaluable in the review process, both with collaborators and decision-makers. Interrogate 3D CAD data or other models and explore every angle. Multiple people can work together and walk through full-sized CAD or polygon-based models or explore designs in 3D without wearing bulky VR headsets.

Design Planning

CAD assets and other 3D models can be combined with laser scans and photogrammetry data; any-size point cloud models can be instantly loaded alongside your assets. This is invaluable for obtaining complete context of the area surrounding a project or comparing as-built constructions against computer designs.

Smart Cities

Hologram business tables project holograms of cities up to 70cm high, and the level of detail available is limited only by the data you provide. You can include live feeds of planes, cars, transit or other real-time information to annotate your visualizations. Adding multiple objects and preparing full presentations is a breeze & Holograms are the most futuristic way to plan and display large-scale designs.

2) A hologram room

A Hologram Room is a large room/box made of a metal frame and fabric. Inside the rooms are projectors and tracing equipment that project objects inside that appear to be floating in the air. The Hologram Room's walls make the space look much bigger on the inside as it appears the walls turn invisible so that it looks like you are in a large open space.

Use case

The Hologram Room is used to show large-scale plans or CAD models at life size. You can have a hologram of a car or building, or a design of an aircraft. Users can travel around the environment with the use of a control wand.

Size of device

The front of the Hologram Room is 5m (16.4ft) wide, and it extends back 4.5m (13.1ft). It is 2.9m (9.5ft) tall.

Special requirements

The Hologram is a fully enclosed room so it does not require darkness outside. It is portable, but this requires about a day and four people to rebuild (for ceiling height please see above).

Projection

Hologram projections fill most of the room. The projection area is a trapezium that is 2m by 5m. Within this space, objects float freely in the air.

Number of users

When holograms are inside the room only one person can see them accurately at a time. To other users the holograms will appear to bend. However, when the projections are based on the wall then the room will take up to eight users simultaneously.

Design Planning

CAD assets and other 3D models can be combined with laser scans and photogrammetry data; any-size point cloud models can be instantly loaded alongside your assets.



This is invaluable for obtaining complete context of the area surrounding a project or comparing as-built constructions against computer designs.

It's worth noting that any part of the image that appears to project beyond the edges of the table won't be doing that in real life; the image will fade out as it reaches the edges of the display. You won't see any hologram that doesn't have the table directly behind it, which makes this video (and the mock-up images used throughout this article) a little misleading – but they provide a general idea of what it looks like

Share Understanding

Stakeholders in the approval and review process don't share the context that the engineers and architects have. Showing plans in 3D in an interactive medium is invaluable in the review process, both with collaborators and decision-makers. Interrogate 3D CAD data or other models and explore every angle. Multiple people can work together and walk through full-sized CAD or polygon-based models or explore designs in 3D without wearing bulky VR headsets.

Comparison to other devices

The Hologram Room is one of the more impressive devices because it can produce the largest holograms. It is most valuable for showing life-sized recreations or playing games. For city planning or developments, a Hologram Table may be preferable.

THE BASICS OF INTERACTIVE APPLICATIONS

A revolutionary sales and presentation tool. For office and on-line meetings and retailing commercial real estate and residential properties, which unites all major decision-makers from city planners to developers, from asset managers to leasing agents.

Where to use?

The application works both on touch screens and on websites.

This makes it possible to take full advantage of its huge possibilities.

The application has, among others the possibility of viewing the entire project in 3D with the surrounding area, apartment search engine integrated with CRM, each apartment, accommodation in 3D, views from the window of each apartment, 2D plans, changing the time of day, printing and comparing apartments and many more!

PropTech

The term PropTech describes any technology for the real estate ecosystem. This can span software (property portals like Rightmove and Zoopla are considered PropTech applications!), hardware (for example, sensors), materials (for example, there was a recent news item on how special bricks are being developed to act as batteries for solar panels) or manufacturing (3D printing, offsite manufacturing); here - MIPIM Prop Tech – Europe's leading PropTech fair.

Even more features and a much simpler interface to make your buyer's acquaintance with the potential property as pleasurable as possible. Add a multi-touch screen, interactive table or large format video wall (the bigger, the better) to your sales office and let your clients get absorbed and emotionally attached to their to-be lodging. With a hint of imagination possibilities of such applications can be limitless: besides the touchscreen version perfect for P2P sales in the office, portable mobile/tablet real estate software is also in stock to ensure that your residential complex is always in your pocket for all the business meetings and trips.

Integrate WebGL interface on your company's website, or go even further and put the project on a giant video wall display

VR

With VR, potential purchasers and tenants can virtually inspect their prospective housing from any corner of the world at any time. This means that the property is available for a visit 24/7, which allows agents and clients to save time and money while boosting efficiency and involvement. Using a top-notch HTC Vive Pro helmet in two clicks you can navigate the area and adjust it to your liking: change finishes and pieces of decor on the go – having put so much effort into creating your own dream suite you won't resist buying an actual one. Furthermore, at our booth, you can also take a look at our 3D renders and animation samples - eye-deceiving candy that will make you believe that you are seeing a photo of a stunning peeking into a window of one's bedroom.

Real estate CRM integration

Real estate CRM integration misses out on the opportunity to catch up with your clientele data moment of indecisiveness – integrated real estate CRM system will aid in building and later on improving your customer's relationships.

When a potential customer signs up on the website, they are assigned a unique ID that saves their preferences and favourites while they are browsing through the apartments on a nine-screen touch wall or on an iPad. The CRM integration with our interactive visualization platform gives extra information about a warm lead that they can use to follow up over the phone or by email if the sale isn't immediately closed. If it is finalized, the system removes the property from the application. This also removes the risk of duplicate bookings and duplicate deposits, which can potentially damage the relationship with the client and, even worse, make them pull out of purchase entirely.

Functionality

The interactive 3D application boasts of incredible versatility, extensibility and performance for agents and brokers, developers and construction companies for increased flexibility and profitability on local and global real estate markets.

It's crucial for large-scale residential property development projects to secure forward sales. In an industry that is as competitive and with such high stakes as property, developers need to exhibit their upcoming projects in a way that excites prospective buyers years before the works are even finished.

Once you've seen a photoreal 3D exterior visualization project running smoothly on a high-end interactive touch table, multi-touch display, giant video wall, in your mobile gadget or on your company's website, a whole new world of marketing opportunities is unwrapping right underneath your fingers.

Under the hood of the application hides the photoreal interactive architectural 3D scene rendered by an industry-leading gaming engine with proven performance and flexibility. Software is visually powered by a sleek and customizable interface: each slider and overall look of the program can be finetuned to your demands.

The real estate marketing platform lies an architectural 3D model. Introduce the project elegance no matter the scale- small-scale constructions to massive 100.000 sq m residential quarter grand development. Even in the greatest projects, each ranging structural detail is meticulously worked on realistic textures, light play on various surfaces to create a wholesome atmosphere.

The tailor-made interface is based on your company's brand book or references, to create own style and have all the presentation materials in line. The software's looks and functionality depend wants and features multiple extra perks like 360 panoramas, virtual reality tours, animation videos and interface assembled to suit narrow needs. We can create custom-animated maps for multiple devices to show accurately travel times across the city and the world.

The user experience creating designed to be as friction-free as possible – the interactions and gestures are exactly the same as they would be on any touch screen device to zoom, pan and rotate around to get every possible view of the model.

From there, the user can narrow the results with a minimal number of taps, sorting by number of bedrooms, location, floor level and even the direction of the view.

They can also quickly swap to any other building in the development while keeping the same filters with a single tap.

Call all the layouts and necessary info to the screen, move them around and compare without haste.

For those who take a more artistic appeal to choosing, we can offer a more exciting intuitive navigation between tower blocks just by moving your fingers on the touchscreen in 3D environment, rotating and pinch-to- zooming in and out.

With the time-of-day slider explore which lodging has the sun waking you up early in the morning and which has the most romantic sunsets. As soon as you're all set with the exact location of your accommodation, cut through the floors to match and decide on your ideal haven.

We can provide visitors with a visually accurate representation of the development as well as detailed information about the individual apartments and surroundings.

We can create the amount of content required for the project including separate large apartment complexes which we can to reproduce to the tiniest detail, and we also can recreate the entire environment development and the surrounding shops and landscape.

Also, we can create the custom Content Management System (CMS) we create to manage all the project data. It is invaluable for the sales process because it enables real-time data management, user verification, favourite properties synchronization and up-to-date property availability support.

A custom CMS is a proprietary solution that's created exclusively for one company or use case. With a custom CMS, your business (or the service firm that built it) has control over the platform's functionality, interface and updates.

4.3. HOW MUCH DOES XR TECHNOLOGIES DEVELOPMENT COST?

We can't give you accurate app cost estimation, because we need to know the specifications of your project, software or an app you have in mind, but almost every project starts from USD\$3.500.

XR technologies development cost depends on many factors, including the type of app you develop, features you want to implement.

The basic information we need to know:

- **Type of application** - VR; AR; MR; Hologram; Interactive platform
- **System Type** - Mobile; Standalone; PC; Web, Hologram table or room
- **Platforms** – Windows; OSX; Android
- **VR Headsets** - Daydream; Samsung Gear VR; Valve Index; Oculus Rift S; Oculus Quest; Oculus Go; Vive Focus; HTC Vive; Others
- **Scene** - Simple; Interactive; Complex Experience
- **Development** - 3D Models; Floor Plan; UI/UX design; Coding the experience; Others.
- **Model quality** - Low poly; Mid poly; High poly
- **Features** - Real-Time 3D; Custom Interactions and UI; Analytics Integration; CRM; Analytics; Marketing automation; Multi-user Setups; VR control; Project description; 3D configurations commands; 360 virtual tour; Others.

XR technologies strategy

If you are planning a one of XR technologies strategy to promote your brand, your initial investment into the development of the XR content depends on how you want that content to reach your potential customers.

As we mentioned already, XR technologies requires special hardware, and that is your starting point in planning the content.

For simpler applications, such as virtual tours, it may be enough to develop a mobile app viewable through a simple device, such as Google Cardboard, Daydream or similar.

If, however, you are thinking of a complex, interactive, multi-user application, you will need a more sophisticated set of hardware (VR headset and gloves, sensors, PC-based softwares, touch screen wall or table)

Pre-requirements for XR technologies development

Every development process should start with detailed project documentation – this is the guarantee that the application will exactly meet the needs of the customers. It should include all the important information about the project.

Start with functional specifications – the main idea of the application development, its key features. If you can include some photos, screenshots or hand sketches to illustrate the characteristics of the app – do it!

With precise documentation, we will be able to offer the best solution according to the needs of the customer. Don't forget the user story, specify which problems your potential user has and how your application is going to solve them. Describe the journey through the application development, where does the user start, which actions does he take, how much time does he spend with your application and in which way will your project make his experience better.

It is very important to make content for successful development. Knowing the user and his problems we will be able to find the best technical solution to make the application usage smooth and seamless. The project documentation must be a clear guide for us about the ideas and expectations of the customer.

Sometimes some better solutions can be found – we will then adjust the documentation after the discussion with the customer. In the case when the customer decides to order such a service it takes 3 to 10 days and is paid according to our rates.

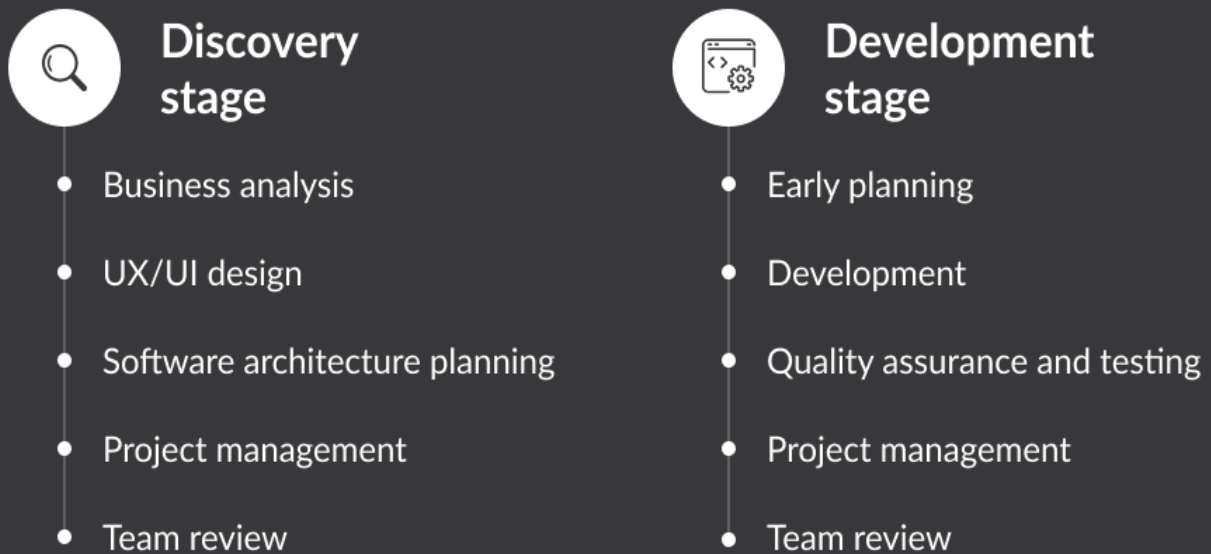
Software presentation

We have three options for you to consider. They depend on your overall needs and aspirations. The more people who require access at the same time the higher the associated running costs can be. So what are they? Estimated costs only, reference only.

- Local Server, a fit for purpose dedicated PC that runs the application 24/7 service out of your office. Pay as you go sever, accessing a service provider like Amazon Web Services (AWS) when required and billed by the minute. Estimate: \$2.68 USD per minute

- Remote server 24/7 service, limitless servers running multiple instances of your presentation. It can be expensive depending on the size of your audience. Estimate: \$2011.92 USD per month. 4-5 instances/users at any one time.
- Presentation by appointment, you might want to consider a more targeted approach. This will allow you to optimize your server time and preserve bandwidth.

At Wave Break Design, the whole development process is divided into the discovery and development stages. The image below describes them in more detail:



Let's take a closer look at each service that influences the formation of XR technologies development costs.

Business Analysis

During this stage, a business analyst identifies business needs and determines the best solution for them. By combining data from various resources, our business analysts offer the best ways to implement the required functionality.

Business analysis helps to create augmented reality apps that are competitive and bring value for end-users. With regard to XR technologies development, the business analysis might take up to 60-80 hours. This part of the discovery stage also influences augmented reality app development cost because a business analyst needs to conduct comprehensive research and give exhaustive recommendations.

XR technology program Design

The work of a UX/UI designer depends on the conducted business analysis. Based on the data received from a business analyst, designers create UX and UI that meet the needs of end-users, visualize all features and make the interface user-friendly.

For example due to the specifics of AR app development, designers' tasks are not limited to UX/UI design strictly. AR apps rely on visual data and effects. Depending on the type of app you want to make, you may need to create animated images or 3D graphic models. The design may become the most time-consuming part of the app development process and thus skyrocket the final augmented reality app development cost. This is because creating AR content is one of the most challenging and difficult tasks in the entire process. Be aware that the design stage may take up to one-fourth of the whole amount of time spent on the development of an AR application.

Software Architecture Planning

This is also an integral part of the discovery stage that influences the final XR technologies development cost. The cost here depends mostly on the type of app you want to develop and what features you intend to include. The time needed to build architecture for an XR technology application may take between 25 to 40 hours. The more complex the app is, the more time this phase takes up.

Project Management and Team Review

The main task of a project manager is to correlate the efforts of all of the other team members. A project manager takes on the whole planning process, sets priorities, controls task accomplishments, etc. Project management accompanies the entire app development process, just like the process of a team review. During the latter, the team reviews the progress of development and identifies which portions of the work need to be improved. These two steps have a direct influence on the final augmented reality app development cost.

Early Planning

Early planning is a very helpful preparatory activity before the development (coding) itself. It usually lasts 1-2 weeks and its main goals are to create the API contract, prioritize tech tasks, and choose the most suitable development tools and practices for the project.

Development

This is one of the main factors that influences XR technologies development cost. Below you will find our very approximate estimates on the time needed to create augmented reality apps with a basic set of features.

Basic features	Implementation time (in hours)
Development with ARKit (basic features and basic manipulation of objects like move, scale, and rotate)	150-170
Basic admin panel	20-30
Back-end (server-side data storage)	40-60
Log-in (email verification, password restoration, social media log-in, etc.)	40-50
User profile	10-20
User engagement feature (such as social sharing, reviews, comments)	10-20
Push notifications for updates, special deals, discounts, etc.	10-20
Menu	10-20

If the budget is limited

What must an XR technologies application (regardless of its complexity) have?

Intuitive interface. Not every user understands how to use the application if the interface of the service is poorly designed.

Stable work. The application should be programmed quite well to ensure that your customers get only positive emotions in the process of using the service.

Quality 3d models. High-quality 3D models of your product will increase the chances that a potential buyer chooses your product.

Constant updates. An application should be constantly updated as new products and technologies are being developed.

All this affects the cost of the XR technologies applications development. The more complex the design and interface, the more money you'll have to spend on it. But it's the case when saving isn't a wise decision.

Wave Break Design expertise

Our team develops unique custom XR technologies and experiences. We cover the full development cycle: from concept to project implementation.

We offer:

- A turnkey solution, from scratch and without templates;
- Research of the market and competitors;
- Forming an application structure;
- Coding without errors;
- Full testing process;
- Integration of the application into your business processes;
- Reconstruction of existing XR applications;
- Help in placing applications in AppStore, Google Play or Samsung Galaxy Store.
- Advice on all issues of XR technologies

4.4. OUR XR DEVELOPMENT PROCESS

Application Design Document



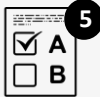
Upon approval, a living document is created that plans out the environment, art, sound, interaction, story, UI, controls, accessibility and analytics.

Graphics Design



Focusing only on the visual aspects our team will work on the 3D Models, lighting, optimization, materials, and replacement of block-out visuals.

Testing



Initial testing of the prototype during the Graphics Design phase. Testing will occur multiple times over the project to test for UX, bug fixing and verification.

Prototype



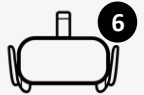
Upon acceptance of the A.D.D we create a block-out prototype of the product focusing on interaction and functionality.

Development



This is the concentration of the project. All the latter half of the living document is implemented with the graphic design.

Deployment



The final product is tested and delivered. Setting up device management. Installation of application to hardware and training.

5. BRANDING & DESIGN

In this article, we will describe our different work processes and answer the most frequently asked questions related to it.

5.1. WHAT IS BRAND?

What's a brand?

Before I dive into the importance of branding and how to build a brand, let's go back to basics: What is a brand?

A brand is a feature or set of features that distinguish one organization from another. A brand is typically comprised of a name, tagline, logo or symbol, design, brand voice, and more. It also refers to the overall experience a customer undergoes when interacting with a business — as a shopper, customer, social media follower, or mere passerby.

What is branding?

Branding is the process of researching, developing, and applying a distinctive feature or set of features to your organization so that consumers can begin to associate your brand with your products or services.

Branding is an iterative process and requires getting in touch with the heart of your customers and your business. It's important for a variety of reasons — I dive into these next.

Branding can be the deciding factor for consumers when they make a purchase decision. In a 2020 global Nielsen survey, almost 60% of shoppers said they actively buy from brands they know, and 21% said they bought a product because they liked the brand.

Branding gives your business an identity beyond its product or service. It gives consumers something to relate to and connect with.

Branding makes your business memorable. It's the face of your company and helps consumers distinguish your business across every medium (which I discuss later).

Branding supports your marketing and advertising efforts. It helps your promotion pack that extra punch with added recognition and impact.

Branding brings your employees pride. When you brand your company, you're not only giving your business identity, you're also creating a reputable, highly-regarded workplace. Strong branding brings in strong employees.

Branding, by definition, is a marketing practice in which a company creates a name, symbol or design that is easily identifiable as belonging to the company. This helps to identify a product and distinguish it from other products and services. Branding is important because not only is it what makes a memorable impression on consumers but it allows your customers and clients to know what to expect from your company. It is a way of distinguishing yourself from the competitors and clarifying what it is you offer that makes you the better choice. Your brand is built to be a true representation of who you are as a business, and how you wish to be perceived.

Branding is one of the most important aspects of any business, large or small, retail or B2B.

An effective brand strategy gives you a major edge in increasingly competitive markets. But what exactly does "branding" mean? How does it affect a small business like yours?

Simply put, your brand is your promise to your customer.

It tells them what they can expect from your products and services, and it differentiates your offering from your competitors'. Your brand is derived from who you are, who you want to be and who people perceive you to be.

The foundation of your brand is your logo. Your website, packaging and promotional materials--all of which should integrate your logo--communicate your brand.

5.2. WHAT IS BRAND DESIGN?

Brand Design can be defined as one of the crucial marketing practices of creating the name, logo, design, and the symbolic elements related to the brand to create a distinctive identity in comparison to the other brands in the market and also providing impetus to the product differentiation.

It is one of the first and foremost practices of the branding process and holds quite an important value as a part of the overall branding strategy of the company as it gives a major edge in the competitive market. The Brand Design has to be exclusive in nature and all the below mentioned design components need to have the expression of unison and oneness:

- Logo
- Tagline
- E-mail Signature
- Uniform for the staff
- Business Card
- Website
- Social media pages
- Marketing collaterals such as brochures and leaflets
- Hoardings and Billboards
- Packaging
- And design templates amongst others

Attributes of Brand Design

It needs to start from the scratch involving all the key members of the management and marketing department formulating a think-tank team who are involved in every minute detailing and happening of the same.

Working as one of the substantial brand strategies, it is vital to integrate its framework and characteristics in every facet of the business along with the marketing and promotional material.

There is a lot of brainstorming and research involved on the part of our design team, branding or marketing department, and the key members of management involved as the finalized creative's and designs become the face and expression of the firm.

The overall Brand Design needs to be well aligned and complement the brand values, objectives, ethos, and fundamentals of the company and should communicate the same carving a distinctive corporate identity of the firm.

If the managers or key members of the company feel that the current Brand Design and strategy is not suiting as per the market dynamics and environment, we can undergo a rebranding exercise by changing and developing the design completely or undertaking the corrective measures suiting the present scenario.

The selection of color palette, typography, message, story, and the design strategy, on the whole, should complement the personality of the business and its offerings. For instance, if the product offerings by the firm are niche and are targeted to Sec A and A+, then the design strategy has to be in accordance to the target market to have an emotional connect with the audience and attain the objective of success and recognition.

Brand Design is just not confined to a catchy logo with the tagline and well designed stationary items, but it also comprises of every expression of the brand with the way the management and the employees handle the customers and deal with the external parties and stakeholders meeting and exceeding their expectations towards the brand.

As mentioned earlier, Brand Design works as one of the central aspects of the overall branding strategy as having a correct and rational approach towards the same results in many benefits for the company.

Importance of Brand Design

1) Competitive Advantage

Having a unique and aesthetically designed brand followed by the attractive strategies definitely makes the company command a distinctive position in the market amidst the tough competition. The edge of a catchy logo, tagline, play of color schemes, and more gives the brand a competitive advantage.

2) Lasting Impression

When the Brand Design and the related strategies are well planned and are presented in an aesthetic manner to the market, there is an instant registration of the brand in the minds of the consumers creating a lasting impression that results in the very good recall factor. Hence, it is always necessary to take care of every minute detail during the entire process of branding.

3) Generates Referrals

It is the thumb rule of the marketing that, 'The customer is best brand ambassador' and it is always essential to keep him at the focal point whilst designing the brand and planning process as once the customer is happy and satisfied he or she will definitely refer the brand to the friends and family resulting in more potential and quality leads for the business.

4) Talks about the Business DNA

As mentioned earlier, the Brand Design has to be in tandem with the goals, ethics, values, and objectives of the company and the design elements and language should reflect the same. And once this aim is achieved, the personality, nature, and the DNA of the business are communicated in a very professional manner to the consumers.

5) Emotional Connect

It connects with the consumers on the emotional level creating an instant space in their minds and hearts with the positive perspective towards the brand and its offerings.

6) Intangible Asset

Companies can reach the highest pinnacle of success and can also shut down any moment plus the profits and losses are the part and parcel of the business, but it is the brand that is stable and constant in nature as an intangible asset of the organization. It offers long-term benefits to the management and business.

7) Brand Recognition

A good Brand Design gets registered in minds of the consumers from the very first visual creating a lasting impact. The brand gets recognized with the color scheme, fonts, logo design, creative's, and other expressions.

8) Sets Expectations

Once the consumers are well aware of the brand and its offerings having a positive outlook in their minds, the expectation is set from the brand and they look forward to the next set of offerings thereby creating a stable and fruitful relationship with the company. Brand Design is the first step to getting the brand introduced to the market and holds a key status in the entire framework of branding and marketing.

5.3. OUR BRAND IDENTITY PROCESS

Complete Brand Strategy



Brand strategy is a detailed plan that outlines exactly what we're trying to achieve and how we're going to achieve it. It is comprised of your:

- Brand Heart (purpose, vision, mission, values)
- Brand Messaging (brand voice, personality, tagline, value prop, brand messaging pillars)
- Brand Identity (logo, color, typography, etc.)

Your brand identity is really a tool to help you communicate your brand visually, thus supporting your brand strategy. As such, before you dive into your brand identity, it's important to have a fully fleshed out strategy.

To Know Personas

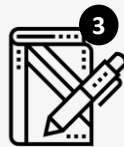


Your brand identity is the “face” that interacts with the entire world.

Whatever we create should accurately communicate who you are. However, one common misconception is that a brand identity is exclusively informed by what your brand wants to present. This isn't entirely true. It's also informed by what your brand's customers want to engage with, or are accustomed to interacting with. If your identity doesn't resonate with them, it won't be effective.

This doesn't necessarily mean your brand's customers will choose your logo color; it means that you will make more effective design choices once you understand their needs, wants, and values.

To Dig Into Current Brand Identity



When you begin a branding project, we want to approach each phase from a philosophical and highly critical standpoint—inspect, poke, and prod until we get to the core of your brand.

Whether we are building your brand identity entirely from scratch or updating a stale identity, we need a full assessment of:

- The current state of your brand's identity
- How that brand identity might be crafted or tweaked to align with your goals going forward

The goal is to understand how your brand is perceived, both internally and externally. Getting an honest and accurate reflection is the only way to understand how and where you're succeeding or how you need to course correct.

To Identify Competition



Building a brand identity is all about differentiation: making brand visible, relevant, and unique. However, without understanding of your competitive landscape, it's easy to blend in. Thus, it's crucial to understand not just who your competition is but how your brand compares, in perception and presentation.

To Write Creative Brief



Once we are completed the previous steps, we have the information we need to start design. However, we shouldn't jump right in. We start with a creative brief that details the pertinent info you need to keep your team on the same page—and ensure we create a visual identity that aligns to your brand.

To Design Individual Elements



Here comes the fun (and challenging) part. We want to design each element in the order dictated here, as each element influences the other.

- Logo

A brand identity is an intricate design system. Each element influences the other, but it starts with your logo.

- Colors

Once we have a solid logo, we can explore the color palette. Color is a great tool to differentiate your brand from competitors.

- Typography

Every visual element in your identity should contribute to a cohesive visual language, and thus each should complement the other.

- Design System

Because brand identity is all about introducing yourself to people effectively, it's important to make it an enjoyable experience.

- Photography

Photography plays a huge role in your brand identity, from your product images to your advertising.

- Illustration

When it comes to illustration, we need a cohesive and uniform language. We think of how illustration will be used in conjunction with other visual elements

- Iconography

Good iconography is influenced not just by the creative visual language but by the applications for the work. It depends on what your product or service is, as well as the industry and medium.

- Data Visualization

Data should be designed for clarity and comprehension, in addition to aesthetic appeal.

- Additional Elements

The brand identity elements, such as: Interactive elements; Motion graphics; Video; Web design.

Brainstorm Visuals



By this time, we have a ton of information to help inform ideation, between your competitive analysis, brand audit, personas, and brief. At this stage, we want to take that text-based information and translate it into visual concepts.

Luckily, the information we have is often steeped in emotional language about your brand's personality, goals, and values. Now the challenge is to figure out how to communicate and enhance those sentiments through visuals.

To Build Brand Style Guide



The only thing more heartbreaking than a poorly designed brand identity is a beautifully designed identity that is never used or used incorrectly. A brand style guide is the savior here—if it's crafted the right way.



6. PROCESSES AND ANSWERS

In this article, we will describe our different work processes and answer the most frequently asked questions related to it.

COOPERATION WITH A CUSTOMER

To start a project, we need to sign a contract with a client. Our cooperation with a customer consists of several stages.

Our cooperation with a customer consists of the following stages:

- We receive a request from a potential client;
- We have a preliminary conversation with a prospective client over the phone or by email. During the conversation, we qualify/disqualify the client trying to answer the following two questions:
 - Are we suitable for the client?
 - Is the client suitable for us?
- If the answer to both questions is “yes”, we discuss a client’s vision of a product;
- We agree on the results which we should deliver at the end of a project;
- We do a rough estimation and present it to a client;
- We do a detailed estimation and assign team members to a project;
- We sign a contract with a client;
- A client makes the prepayment;
- We start the development.

PRODUCT VISION

We always try to begin our study of the client’s product even before the contract is signed.

For example, we try to answer the following questions:

- What makes this product different?
- What is its primary benefit?
- What problem does the product resolve?
- Who is now the user of a similar product?
- Who is the target audience for the product?
- What is the main product attraction for the customers?

We engage all team members in the sales process and encourage their contacts with potential clients. This way, the client gets to know the people who are going to work on their product.

It also helps to deal with unexpected spikes of leads we receive, so that our manager can respond to them in a timely manner.

We use an application to manage schedules and staff availability. We are not focused on tracking time. However, we plan our work on a weekly basis.

NDA

A non-disclosure agreement (NDA), also known as a confidentiality agreement (CA), confidential disclosure agreement (CDA), proprietary information agreement (PIA) or secrecy agreement (SA), is a legal contract between at least two parties that outlines confidential material, knowledge, or information that the parties wish to share with one another for certain purposes, but wish to restrict access to.

If the client requests an NDA to be signed, we suggest that we start our negotiations before signing the NDA.

The reason is that we have a lot of clients and some of them do have similar product ideas and visions.

If the client insists on an NDA, we ask them to give us at least some information about the future project, so that we could verify that there is no conflict with any client we are currently working with or have worked with before.

When no such conflict exists, we consider the project beneficial, and the NDA is mutual, we sign the NDA.

If, however, the client's NDA is not mutual, we use our NDA form instead.

ROLES

For each project, we put together a team of business analytics, designers, and developers. Also, we assign a project manager to each project to organize and coordinate the development process.

Each member of our team has a profound knowledge of their major skill and can collaborate across disciplines.

We avoid referring to our team members as "resources" because we regard them as people and maintain such an attitude throughout the whole development process.

Typically, the project development team also includes an architect, program developers, UI designers, and testers.

Any detected bugs or errors are returned to the development team for fixing.

During the entire development process, the project manager closely communicates both with the team and the client to ensure that the initial project plan is kept and that the costs remain within the estimated budget.

The project manager also resolves any misunderstandings and takes care of change that needs to be made during development. If such changes may result in the development delay or budget increase, the project manager discusses the matter with the client to achieve the most optimal solution, by suggesting either a more cost-effective option or a simplified functionality.

For the entire duration of the project development, communication within the team, as well as the proper distribution of responsibility, is of utmost importance. Effective communication is essential for the team to deliver a high-quality product. The team members communicate at scheduled meetings to discuss the development flow, the product vision, the issues arising during the development. They can also communicate directly to resolve urgent situations, such as a need for assistance or task delegation.

PRICING POLICY

Generally, pricing policy refers to how our company sets the prices of its products and services based on costs, value, demand, and competition. We also must take into account current market conditions when developing pricing strategies to ensure that the prices we choose fit market conditions.

Some potential clients contact us with a detailed document containing the requirements for the final product or with a Request for Proposal.

In some cases, this document contains just a basic description of the product and the client's overall vision of it.

In order to define the project cost, we prepare a rough estimate and a detailed estimate in which we put down the project scope broken down into individual features and components, define the schedule and calculate the number of hours needed to complete each feature.

Projects may differ significantly in size, scope, or complexity. In all cases, very often the time and cost estimations are different.

For that reason, we do not apply the fixed-bid model in our work.

BUDGET

Understanding a client's budget is the base upon which we can build ideas that will help us find success, and help you keep the project profitable.

It is vital for us to know the client's budget for the project. It might be not comfortable for the client, but this information will help to save the client's and our time.

Knowing the budget makes it easier to determine the project scope which can be implemented. If the scope exceeds the budget, we always try to offer a more cost-effective solution. By identifying individual features and functional components of the product, we can also improve the product by:

- Focusing on a smaller set of features at each stage;
- Creating a valuable user experience;
- Establishing a comprehensive relationship with users;
- Including marketing tactics to promote the product;
- Implementing interactions allowing users to bring other users to the product.

RATE

Skill level is a term that can be used to define a person's knowledge on a particular subject. Words such as novice, intermediate, proficient or expert can be assigned to our employee's personal and professional attributes to demonstrate the level of experience have with a particular skill.

Depending on the project development stage, different skills and expertise levels may be required in different iterations.

Engaging our team in 'times and material model' may be similar to recruiting the same employees full-time.

However, working with us has the following advantages:

- Our developers have deep expertise in working with projects of various scale and complexity. We interviewed dozens of candidates and hand-picked high-class professionals to work with us.
- Our team is used to working together. We have established specific routines helping us achieve excellent results without unnecessary costs or time-consuming.
- We are always available for any consultations, discussions or demonstrations.
- We can include, exclude or replace a team member quickly if the project needs require so.
- We grant our clients access to the project management system and to the project repository.

CONTRACT

A contract is a legally binding document that recognizes and governs the rights and duties of the parties to the agreement. A contract is legally enforceable because it meets the requirements and approval of the law.

We use Google Drive to store contracts. In order to track the contracts easily, we sort them in different folders – pending, completed, lost.

Our proposal and contract with the client usually consist of the following sections:

- Summary of the project estimations
- Hourly rates for different skills.
- Payment terms
- Amount of prepayment or retainer according to the contract terms
- Invoices are sent upon the completion of each iteration
- Agreement on the transfer of the ownership of the source code, created in the iteration for which the payment has been received, to the client
- An agreement under which the parties may not use materials breaching any other party's copyright
- An agreement stating that the parties sign the contract of their free will and may terminate it upon the completion of any iteration
- Signature page

QA TESTING

Quality Assurance (QA) is defined as an activity to ensure that we are providing the best possible product or service to customers. We have to ensure, that processes are efficient and effective as per the quality standards defined for software products. Quality Assurance is popularly known as QA Testing. It is all about meeting the needs and expectations of customers with respect to functionality, design, reliability, durability, & price of the product.

The quality assurance processes are expected to take about 20% of the total time allocated to the project development.

Quality assurance has a defined cycle called PDCA cycle or Deming cycle. The phases of this cycle are:

- Plan
- Do
- Check
- Act

These above steps are repeated to ensure that processes followed in our are evaluated and improved on a periodic basis.

The above steps in detail:

- Plan - Organization should plan and establish the process related objectives and determine the processes that are required to deliver a high-Quality end product.
- Do - Development and testing of Processes and also "do" changes in the processes
- Check - Monitoring of processes, modify the processes, and check whether it meets the predetermined objectives
- Act - Implement actions that are necessary to achieve improvements in the processes
- An organization must use Quality Assurance to ensure that the product is designed and implemented with correct procedures. This helps reduce problems and errors, in the final product.

CHANGE REQUESTS

A change request is a document containing a call for an adjustment of a system; it is of great importance in the change management process. A change request is declarative, i.e. it states what needs to be accomplished, but leaves out how the change should be carried out.

Please note that our detailed estimate includes only the project components, which have been positively approved for development.

Any features or functions still under discussion are left out of the scope of the detailed estimate and may be included later and have to be approved.

Any features or components added already during the project development and not included in the detailed estimate are very likely to increase the total development time and cost, eventually resulting in a later project delivery date.

For that reason, we place great emphasis on specifying all components of the project at the estimate stage.

ESTIMATES

Estimation is the process of finding an estimate, or approximation, which is a value that is usable for some purpose even if input data may be incomplete, uncertain, or unstable. The value is nonetheless usable because it is derived from the best information available.

To cover all possible scenarios and to provide for eventual inaccuracies, we usually prepare two estimates per project – upside, and downside.

The upside estimate describes the most optimistic project development scenario, while the downside estimate takes into account all issues and difficulties which may hinder the process.

The downside estimate also factors in the incomplete project specification with features or functions added after the project approval.

At the same time, all project estimates are primarily focused on the development effort required to deliver the requested project, and the time consumption is secondary.

For that reason, we also calculate the downside estimation and advise the client to be prepared for this scenario, as well.

Below is example of program (VR/AR) development's tasks we include in the detailed project estimate.

Role	Task	UX design (hours)		UI design (hours)		HTML/CSS coding (hours)		Frontend / Backend programming (hours)		RA / QA (hours)	
		Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic	Optimistic	Pessimistic
As a dispatcher, I want to be able to:	Login to the system using email and password	3	3	4	4	4	4	10	12	2	2
	Reset my password in case I forget it	2	3	2	2	3	3	5	6	2	2
	Update my account settings, email, password, name	3	3	3	4	4	5	10	12	3	4
	Manage dispatchers	10	12	10	12	6	7	18	20	3	4
	Manage vehicles	20	22	26	28	24	26	40	42	12	14
	Manage hotels and hotels' concierges	14	16	20	22	24	26	36	38	12	14
	Manage missions	24	26	32	34	28	30	54	56	16	18
	See notifications about new missions	8	9	8	9	8	9	20	22	5	6
	Manage settings for prices calculation	7	8	14	16	12	14	16	18	14	16
	Bill hotels	12	14	14	16	12	14	30	32	10	12
As a concierge, I want to be able to:	Bill guests	12	14	14	16	12	14	30	32	10	12
	Login to the system using email and password	2	2	4	4	4	4	9	10	2	2
	Reset my password in case I forget it	2	2	2	2	2	2	5	6	2	2
	Update my account settings, email, password, name	2	2	3	4	2	2	10	12	3	4
	Manage a data and a presentation about a hotel	16	18	24	26	24	26	54	56	16	18
	Manage concierges	4	5	10	12	10	12	18	20	5	6
	Manage missions	22	24	30	32	26	28	52	54	14	16
	See notifications about missions responses	7	8	10	11	7	8	20	22	7	8
	Manage hotels' billing data	2	3	5	6	7	8	14	16	5	6
	See dashboard	18	20	28	30	24	26	28	30	7	8

As a guest, I want to be able to:	See a main page of the application with an explanation about the service	10	12	26	28	24	26	12	14	7	8	
	Sign up the system using email and password	2	3	4	4	4	4	7	8	2	2	
	Login to the system using email and password	2	2	3	3	2	2	7	8	2	2	
	Reset my password in case I forget it	1	1	2	2	2	2	5	6	2	2	
	Update my account settings, email, password, name	2	2	4	5	5	6	7	8	2	3	
	Manage billing data	2	3	5	6	7	8	14	16	6	7	
	Manage missions	18	20	26	28	26	28	52	54	10	12	
	See notifications about missions responds	8	9	8	9	8	9	20	22	7	8	
	Have notifications by SMS											
	See welcome screen	9	10	24	26	22	24	24	26	5	6	
As an in car guest, I want to be able to:	See security measures that must be followed in the car	4	5	14	16	5	6	12	14	4	5	
	Check hotel information	16	18	30	32	22	24	24	26	8	10	
	See a route on a Map	10	12	26	28	16	18	32	36	8	10	
	See in car service info	3	4	7	8	5	6	7	8	3	4	
	Read the press	9	10	22	24	16	18	24	26	8	10	
	Listen to music	10	12	22	24	14	16	40	42	8	10	
	Watch video movies	10	12	22	24	14	16	40	42	8	10	
	View excursions	10	12	22	24	14	16	16	18	8	10	
	Rate a service	9	10	16	18	10	12	26	28	8	10	
	Prices calculation											
Database structure												
Multiple domains support												
User's authorization and user's roles logic												
Servers structure for applications												
Deployment and server infrastructure scripts												
Multiple languages support												
Styles, Color, Simple Logo												
Main layout	14	16	24	26	16	18	7	8	3	4		
Total (hours)	339	387	602	661	475	527	1,023	1,110	278	329		
Price per hour	75	75	55	55	50	50	75	75	60	60		
Total price optimistic (\$)	25,425		33,110		23,750		76,725		16,680			
Total price optimistic (\$)										175,690		
Total price pessimistic (\$)		29,025		36,355		26,350		83,250		19,740		
Total price pessimistic (\$)										194,720		
Scope of work												
Explanation												
UX design												
UI/WEB design												
HTML/CSS implementation												
Frontend/Backend programming												
Main Stack of technologies and tools												
Programming languages												
Application frameworks												
JavaScript frameworks												
Automation frameworks												
SQL data storages												
Key value storages												
Web servers												
Web application server												
Hosting												
Development & communication tools												
Development methodologies & practices												

Advantages of our approach to making estimates

Using the detailed estimate, we have demonstrated the general principles of feature-based estimate preparation.

The benefits of such a plan to project estimates are as follows:

- Higher accuracy. Breaking the project down into features and then into smaller tasks makes the calculation of the required time and cost more accurate. Such an approach also ensures a prompt response to any issues discovered during the project development.
- Better transparency. Connecting features to user stories, we create a better understanding of a particular feature purpose and goal.
- More efficient development. When the development flow is built on the basis of separate tasks laid down in the detailed estimate, the development team can save time on the thorough planning of the project design and architecture. The relations between the project components can also be seen from the project estimate.

INVOICES

It includes information about invoice proposals (preliminary invoices), invoice control, on-account invoicing, vendor invoicing, and credit notes. Invoicing is done through an on-account setup, which is also referred to as a billing schedule. Fixed-price projects can be invoiced per project or per project contract.

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Project invoicing is done per iteration.

The invoice amount is calculated by multiplying the number of hours in the iteration by the rate of each project team member participating in that iteration.

The invoices are prepared and sent to the client after each iteration is completed. Our agreements require all invoices to be paid by bank transfer within five working days after each invoice is sent.

In the event of a lengthy or repeated payment delay, we may suspend the development until we receive the payment of the previously issued invoices.

STANDART DOCUMENT CHECKLIST



3D Models – Preferably well layered, organised, accurate and up-to-date. Preferred file formats: .fbx, .dwg, .dxf, .3ds, .obj, Sketchup .skp, Revit .rvt, .iges, .step, .max



Building Drawings – Floor plans, external elevations, internal elevations (bathroom/kitchen/joinery), relevant sections/details/lighting plans/electrical plans etc. Preferred file formats .dwg & .pdf



Site and Landscape Drawings – Plans, sections, planting plans. Preferred file formats – .dwg & .pdf



Camera Angles – Description or diagram of your preferred camera angles.



External Materials Specifications – An external materials/colour schedule. Preferred file formats .pdf, jpeg, .dwg



Internal Finishes and Fittings – An internal materials/colours/fittings/fixtures schedule. Preferred file formats .pdf, .jpeg, .dwg



Styling Guide/Mood Boards – A collection of reference images that give your 3d render studio an idea for the look/feel you have in mind. Preferred file formats .pdf, .jpeg, .doc



Project Branding Docs – A brand identity doc, logos, colour palettes, website design concept, brochure designs. Preferred file formats pdf, .jpeg, .doc



Target Market Info – A summary of your analysis of the target market for your project. Preferred file formats pdf, .doc

T E
H N
E D

All of ours customers are partners in our mission