Mass and Wall: The Representation of Ongoing Change in Relationship

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Architecture in reality is perceived mainly through the display of space enclosures of different degrees, ranging from complete enclosure to openness. These degrees of enclosure are characterized either by subtle or often exuberant display of interplay between solids and voids. Mass and wall are the key features that play an important role in the formation of any specific relationship that develops between solids and voids.

The level of relationship between wall and mass therefore is critical in shaping the overall appearance of the work. As we look back in time, walls were simply used as means of enclosing the space that was to hold specific functions. Here the obvious priority is assigned to the space and the walls are simply enslaved in order of hierarchy. But, as the history of the built environment progressed with time, this pattern of relationship was challenged and being experimented by various architects. The experiments ranged from subtle variations in the thickness of wall with regard to the associated mass, or by emphasizing its existence by the use of varying height, color, texture, etc., or even by separating it from the mass that was believed to be the mother form in earlier days. Instead of being secondary to the space it enclosed, walls started taking the primary role in terms of announcing its existence. This of course is not the only path taken by architects. As always, design concept and approaches vary from one person to the other and so does the ultimate result.

This change in the pattern of relationship plays a major role in developing the formal language of contemporary architecture which needs to be acknowledged. The aim of this paper is to identify the distinct deviations in the pattern of relationship between mass and wall by depicting some of the significant works of 20th century. The role of 3D computer modeling and various animation techniques to illustrate these analytical ideas is a highlight of the presentation.

Keywords: mass and wall, 3D computer modeling, animation, representation
Introduction

Throughout history, the notion of wall has always provided most conceptual models to serve the quest for appropriate architectural masses and forms. Although floor and ceiling contribute significantly in formation of space enclosure, it is the wall that has been interpreted by designers in various ways, both physically and conceptually. Human activities take place on either side of a wall-plane, rarely on the plane itself. The facade or wall-plane is still the most essential element in architectural form-space making that has the power to communicate the function behind and around it. The examples in this paper demonstrates that architectural design during the last century has exhibited an increasingly pronounced tendency to treat the building wall as an autonomous design element, often illustrating an ongoing exploration between the mass and the wall itself. In most instances this relationship is expressed physically, demonstrating the adaptation of a successful concept with a certain degree of physical clarity.

A comprehensive definition of wall is given in Norval White’s „The Architecture Book“, where wall is described as: „The barrier and membrane between two spaces, sometimes infilling without participating in the structure, sometimes the structure itself. Walls enclose define and support buildings, cities and regions.“

The concept of wall is being used as a basic element of architecture from the ancient times, with its role being mainly of a space enclosing one along with floor and ceiling. Various attempts and experiments have been conducted throughout history to liberate wall from this notion of a space enclosing element only. The paper identifies and categorizes this deviation pattern and for clear perception, includes some of the significant examples in chronological order where architects took a detour from the conventional notion of relationship between mass and wall.

To become a constituent element of a volume, the wall had first to be cleansed of all decorative eruptions of the 19th century. A rediscovery of the beauty of pure unadorned surface plane was necessary, which was lost since the Egyptian times. Contemporary interest in sculpture and in the plastic possibilities of architecture results in an increasing interest in mural relief on the part of the sculptor and in the revitalization of the wall on the part of the architect.

The variations in architectural use of wall that are traced in history can basically be divided into these major categories:

A. Change in thickness between different portions of the wall
B. Change in Roof-wall relationship
C. Change in Mass-wall relationship
D. Change in Verticality/orientation
E. Change in Scale

A. Change in thickness between different portions of the wall

The practice of using different thickness in parts of the wall has been practiced from ancient times following various functional or aesthetic reasons. For the purpose of this paper, the traditional use of motifs or murals on walls is not considered as examples of varying thickness. The examples cited here are some of the major ones, which are results of experiments challenging the conventional historical notion of using the same thickness throughout the entire façade in a building.

One of the first attempts in this regard can be traced back at the very beginning of the century in 1905, in Antoni Gaudi’s design of Casa Mila in Barcelona. Traditional use of exterior wall as a vertical plane of same thickness all along enclosing the interior space was challenged here by the usage of wall in a plastic manner, with changing thickness to house varying functional requirements along the periphery of the building, which was revolutionary for that period. Here, elements, which suggest a vague affinity with „art nouveau“, give way finally to language of
utter fantasy, evocative of vegetable stems and dream like anatomies. But his forms were never arbitrary, but rooted in structural principles and an elaborate private world of social and metaphorical meanings.

At the beginning of the 20th century, the architects were experimenting with new building materials (like concrete, glass, steel, etc.) and various construction techniques to come up with modern pieces of architecture. During this time in 1911, architect Walter Gropius, along with Adolf Meyer, designed the Fagus Shoelast Factory in Germany, which has since become an icon of the beginning of a modern vocabulary of architecture consisting of glass-steel-concrete-brick - a completely new architectonic language. Influence of Paul Scheerbert’s manifesto on „glass-architecture“ is evident in this work. Plane surfaces are predominant in this factory. The use of extensive glass, which was possible because of the use of a steel frame structure, gave birth to a completely new concept of „transparency“, and different parts of the wall wrapping up a mass became visible with their own identity. The walls here are developed as planes and conceived as sheer curtains between the exterior and interior. The structural pillars are pushed back from the periphery, which accentuates the planar characteristic of the walls. This is often regarded as the most advanced piece of architecture before the World War I.

Architect Peter Eisenmann in his building, the Aronoff Center for Design And art in University of Cincinnati, built in 1988, introduced a complex manipulation of different geometries on the surface wall, which is a widely used strategy many of the architects believing in deconstructivism. The underlying steel structure is virtually denied (except deceptively as infill at the entrances and a lighting grid beneath the atrium skylights), while the ubiquitous late 20th-century cladding materials - interior drywall and Exterior Insulation and Finish System - are celebrated in this Deconstructivist manifesto for the millennium.

B. Change in Roof-wall relationship

In the traditional use of a wall in architecture defining enclosure, the walls rise from the ground up to the ceiling, and together these vertical and horizontal planes define the boundaries of the space. The illumination requirement is met by the introduction of punctures in the form of square/rectangular windows, working as visual textures in the mass. Neither the wall nor the windows are accentuated in this practice. Even the articulation of walls is contained within the extent of the rooflines.

The next example in experimenting with the traditional use of wall in architecture comes from Frank Lloyd Wright. At the beginning of the 20th century, he was working on his ideas on „Prairie-House“ and „organic architecture“. The Robie House, built in 1908, is perhaps the earliest example of the realization of this concept into a practical building. Here the exterior walls of brick are not touching the ceiling themselves, rather a strip of stained glass windows laying in between, accentuating the presence of

![Figure 1](image_url)

From left to right: Antoni Gaudi’s ‘Casa Mila’ illustrates plasticity in wall with changing thickness to house various functional requirements. Different parts of the façade become visible with their individual identity due to extensive use of transparency and use of different types of material in Gropius’ Fagus Factory. Eisenman plays with the thickness of walls to demonstrate the orientation and juxtaposition of geometry in the ‘Aronoff Center’.
walls. Another interesting detail is the copingstone on top of the walls, which were made integral to the composition and adjusted to echo the horizontality of the long overhangs of the roofline.

The next example in this line would be the „Brick Country House“ project by Mies Van der Rohe in 1923, which was never realized. The plan was formed out of walls laid out as planes, some of which extended into the surroundings. The extended walls were supposed to minimize the difference between the exterior and interior. The formal composition looks like a fusion of Mies’s own ideology along with the pinwheel qualities of Wright, as well as the abstract paintings of Mondrian, Van Doesberg or perhaps Lissitzky. This project came after the formation of the Bauhaus in Germany and at a time when the extensive use of glass in buildings was being studied in Europe. But these ideas were realized in a later project – „The Barcelona Pavilion“ for The Barcelona International Exhibition in 1929 in Spain. The free-standing walls that extend beyond the interior space defined by the roof are evident in this example. The influence of De-Stijl is also traceable in the use of white and simplicity in spatial formation.

C. Change in Mass-wall relationship
Most often, in conventional practice, the role of mass and wall are almost synonymous. In most cases, it’s hard to find any distinction between these two, in terms of articulation or use. To give walls an individual identity, it is necessary to make the distinction between mass and wall evident in architecture.

The Schröder house, built in Utrecht in 1923, by the Dutch architect Gerrit Rietveld is a pioneering work of modernism, with no historical ornament and a design which parallels the art of Cubism and De Stijl movements. De Stijl is indebted to the works of many people like Wright, Mondrian or Theo Van Doesburg, who seemed to imply a formal language of tensely related simple forms and shapes resolved into compelling unities. Controlled asymmetry, decomposition of the planes in a „box“ and the enlivened contrast of hovering planes took a sacral meaning to the followers of De-Stijl. Here the conscious effort to give walls separate identity beyond the mass has become successful. Influence from both Mondrian’s painting in 1917 and Theo Van Doesberg’s „Spatial Diagram for a House“ in 1923 can be easily found in this ingenuous piece of architecture.

In his declaration of „Five Points of a New Architecture“ in 1926, Le Corbusier made a bold statement on different features to be incorporated into modern buildings. In the case of a building in modern age, distinction was necessary between the structural and non-structural parts. Villa Savoy, built in 1928, is a clear representation of these points. It was the answer to his question of creating a vocabulary based on concrete construction applicable to all the tasks of a modern industrial civilization. The whole history of architecture revolves exclusively around wall apertures. With pilotis supporting the weight of the building, interior and exterior walls could pass anywhere according to functional demand or aesthetic intensions. The free façade wall could be a total void from slab to slab; a thin membrane or a window of any size. The wall may thus be designed freely from now on.
In 1963, Paul Rudolph, in The Art and Architecture Building at Yale, experimented again with the use of walls in defining the three dimensional attributes of a building. Walls penetrate the pieces of different masses and announce their individual presence, besides the commonly attributed function of enclosing space.

In this building Kahn recognized the individuality of walls by separating them from the mass, and raising them beyond the actual roofline in a unique manner while opening up the corners of the building. It appears as if four massive walls on four sides are guarding the treasures of knowledge, in a monumental manner which is a common characteristic of Kahn's architecture.

Architect John Hejduk, in his exercises of the "Wall House" done in 1970's, presented a whole new concept of using wall in an architectural design. The Wall House Studies examines the wall both as barrier and connector, a plane that dictates the architecture of the house and the lives of the inhabitants. In his own words: „I felt the necessity that the wall be freestanding, acting as a tableau upon which the biomorphic elements should be suspended“.

The Wall House 2, which was designed in 1973, was built very recently in 2001 in The Netherlands (not in Connecticut, where it was initially designed for). The building itself announces the dominance of the massive wall in relation to its mass.

Architect Richard Meier, in many of his projects uses walls as individual dominating elements of design itself. In his Athenium project built in 1979 in Indiana, the unconventional use of wall is noticeable. Earlier in 1982 in House 2 of House Series, architect Peter Eisenman used varying layers of enclosures beyond the mass of the building, maintained by the use of walls.

The use of secondary walls in skyscrapers as shading devices was used by Ken Yeang, in his award winning bio-climatic high rise building Minara Me-

![Figure 3](image)

1st row, left to right: Planes pasted on mass as wall and roof which are integral part of the three dimensional design in Rietveld's ‘Schroder House’. Structural (pilotis) and non-structural (wall) parts of a building becomes separated in Corbusier's 'Villa Savoy', giving them individual identity. Walls penetrating the different pieces of mass in ‘Yale Architecture School’ by Rudolph announce their presence in the design. The walls are separated from the main mass, raised beyond the roofline and disjointed at the corners to express their identity in Kahn's 'Exeter Library'.

2nd row, left to right: Use of wall as a bold element in both conceptual and material realization of a project is evident in Hejduk's ‘Wall House 2’. Walls as individual vertical planes is one of the dominating features in Meier’s ‘Athenium’. Layering of walls along with the use of different levels of transparency is evident in Eisenman’s ‘House 2’.

3rd row, left to right: Hadid’s ‘Vitra Fire Station’ expresses the dynamic properties of wall, while maintaining a unique relationship with the mass. Enormous freestanding transparent walls challenge the traditional definition of forms bounded by opaque edges in Nouvel's Foundation Cartier. Disjointed walls of Coop Himmelblau’s ‘UFA Cinema Center’. Moveable exterior walls beyond the mass act like shields against the sun in Yeang’s ‘Minara Mesiniaga’.
siniaga in 1988. A second layer of aluminum wall is provided beyond the glass enclosure, which is mechanically maneuvered along the sun’s path to shield the interior from scorching sun rays. This method of a second screen has become very popular among other architects. One of the recent examples of the changing relationship between wall and mass is evident in Zaha Hadid’s first built project, the Vitra Fire Station (1989-1993) in Germany. The unusual dynamic shape of the walls and the way they relate with the mass of the building is unique. The walls, in fact, play a major role in creating the three dimensional experience of the building. Built in 1994, Jean Nouvel’s gallery for the Foundation Cartier is an exercise in transparency and the perennial quest to remove the barrier between interior and exterior. In this project, the glass walls are extended beyond the mass and above the roof terrace , creating extra tall glass planes which give the impression of free standing, transparent walls. These glass walls extend beyond the structure, blurring its boundaries and denying the viewer of seeing a solid traditional volume. One of the contemporary examples of deconstructivist architecture is Coop Himmelblaus’ UFA Cinema Center in Germany, built in 1998. The urban design concept of the UFA Cinema Center confronts the issue of public space, which is currently endangered in European cities. The use of walls, in a disjointing manner, is really unique.

D. Change in Verticality/Orientation
This category includes the experiments confronting the „taken-for-granted“ use of Euclidian geometry (use of upright orthogonal vertical planes in right angles to the base) in the formation of walls in a building. The example of Casa Mila (1905) can again be cited here as the earliest example in modern times of applying the plastic property to a wall in a building. In 1939, Alvar Aalto treated the walls of his Finnish Pavilion (1939) in New York with greater freedom. A huge undulating wooden wall, divided in four stories, each one cantilevered over the next one, embraces the structure in an inclined position – with the topmost portion leaning gradually towards the interior. The forward tilting brings the topmost pictures closer to the angle of vision. The idea behind this was to give maximum surface area to display the photographs and messages, and of course to present a unique impact. Having given flexibility to partition wall and ceiling in his previous works, Aalto then attacks the outer
wall in his Baker House dormitory at MIT, in 1947. He dares to free the façade into an undulating brick wall so that every student has a clear view of the Charles River without being made aware of the large expanse of the building. After the invention of shell concrete vault structures, architects were allowed to have more freedom in terms of shaping the volumes. The ceiling and floor need was no longer the mirror of each other. Walls were given more freedom in terms of orientation and shape. When this freedom is applied, it transformed into a unique vocabulary, a masterpiece in architecture by Le Corbusier in 1955, at Notre Dame du Haut also known as the Ronchamp Chapel. A dark roof with pointed angle and complex curvature rests uneasily on convex and concave battered rubble walls punctured by irregular openings and sprayed in white washed granite concrete. The rough texture of the unadorned roof creates high contrast with the white walls, and there is a slight gap between wall and roof, which accentuates the individual presence of the wall and lets sunlight gleam through.

During the early 1980's, there have been various attempts at reviving classical forms. Post-modern classicists have indulged in games of quotation and irony. One of the sophisticated attempts dealing with classical precedents has been James Stirling & Michael Wilford’s Neue Staatsgalerie in Stuttgart (1978). The building splices together neo-classical ideas derived from The Altes museum by Schinkel, and with spatial devices derived from cubism, Le Corbusier, and Aalto. The undulating glass wall with green mullions is reminiscent of the Gaudian use of walls.

In other projects, like the Jubilee Church, architect Richard Meier has experimented with the use of wall from different perspectives. The site is located in a coastal region and the walls are used as metaphorical elements resembling to sails of a boat. Built in 1997, The Guggenheim Museum in Bilbao, by Frank Gehry, is an extraordinary combination of interconnecting shapes and dominating presence of undulating exterior walls. Orthogonal blocks in limestone contrast with curved and bent forms covered in „fish-scale“ titanium panels. Glass curtain walls provide the building with needed light and transparency. As a whole, Gehry's design creates a spectacular, eminently visible structure that has the presence of a huge sculpture set against the backdrop of the city.

In his award winning project Diamond Ranch High School in California (2000) the architect Thom Mayne of the firm Morphosis has used walls in a unique orientation that gives the feeling of individual continuity and motion of the wall itself. The angular undulation of the solid metal clad walls is the dominating feature of the campus.

E. Change in Scale
Some examples of non-traditional architectural use of walls in design include the introduction of large scale over-powering walls as design elements in the built environment. Besides serving their intended purpose (architectural, functional, etc.), these walls express their individuality through their sheer size and proportion.

Built in 1967, the National Collegiate Football Hall of Fame in New Jersey designed by Robert Ven-

Figure 5
Left to right: The huge ‘electronic wall’ of Venturi’s ‘National Collegiate Football Hall of Fame’ boasts its freedom from the confinement of the actual enclosure. Huge inter-related walls in Ando’s ‘Children’s Museum’ is one of the interesting elements of the spatial experience. Freestanding colored walls of Legorreta’s ‘Solana Complex’ tie up the spatial unity of the complex.
turi uses a huge billboard as the most dominating feature of the complex. This electronic wall boasts its freedom from the confinement of the actual enclosure.

Another practice, the use of elongated walls of large scale to tie up different functions spatially and to create a dialogue between the spaces, is very common in Tadao Ando’s works. Among many of his other projects, this use of wall is evident in the Children’s Museum project built in 1987.

The existence of overpowering walls in space is even more accentuated in Ricardo Legorreta’s works, through the use of vivid colors. Louis Barragan is often seen as the predecessor of this Mexican architect by many critics, because of his similarity in creating poetic architecture with lively colors. In his Texas Solana Complex (1988), the freestanding colored walls of the space create the spatial environment of the architecture, which is unique in attitude. The marriage of monumentality and tradition, with the help of color, is the essence of this creation.

**Representation**

The media used for representing similar architectural analysis is conventionally the graphical illustrative media, which uses the combination of analytic illustrations along with tables and timelines to present the information. This can be compared to the analytic sketches that are presented here in the paper along with text. Now, the development of electronic media and computational techniques has challenged the traditional media of representation in today’s world for betterment. Today the representation media can be divided into two major groups: (a) Static Media and (b) Animated Media.

Static representation media is the conventional one. The Animated Media can again be divided into (i) linear and (ii) non-linear formats. The linear format incorporates an animated presentation that is preset by the designer and viewer learns the information from watching it. User’s involvement is restricted and rather directed here in acquiring knowledge. The non-linear format allows the user to select individual option for access to the analytic information, from a variety of options. This non-linear interactive format for representing analytic information combines the
elements of conventional practice with newer tools like animation, audio etc that blends in the factor of time and sound into representation to make it more effective in conveying the message to the audience. Due to its proven effectiveness, the non-linear interactive technique is used and included in the presentation to represent the theoretical analysis.

**Conclusion**

„The erection of a single post has the effect of interrupting a scene. Similarly, a single wall severs, interrupts, opposes and violently alters the site on which it is placed...the first step towards revitalizing such an environment is that of reconsidering the basic, primitive significance of the post and the wall. I employ the wall to delineate a space that is physically and psychologically isolated from the outside world.“ – Tadao Ando.

In fact, walls today are being used to break the unlimited monotony and random irrelevance of millions of walls in the urban environment through the experimentation and practice of modern architects. In other words, walls are being used as weapon to control walls.

Architecture of 21st century will be continuing to experience new ideological developments and changes based on past influences and revitalized by new ideas as well and its impact is going to be expressed in future architecture for days to come. This process of change in the relationship between mass and wall is not at its final stage; rather going through a process of evolution - challenging the boundaries of tradition and preset restrictions and constantly opening up new horizons for exploration.

**References**


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Figure 7
Example of Schroder House, Jubilee Church and Football Hall of Fame - Sequential screenshots from analytic animated representations.