

Formal Oppositions

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Introduction

This research paper is an exploration of objects and architectural projects which have similar qualities, specifically in the case of the intrinsic relationship between the listening device (plastic) and the sounding box (tectonic).

This exploration will begin with Gottfried Semper's extended research on *Style in the Technical and Tectonic Arts* (1861). Specifically the 'Four Categories of Raw Materials' shall be defined and placed in relationship to each other.

The research subsequently takes a side-step to Robert Venturi's *Complexity and Contradiction in Architecture* (1977). Even though this book is an attempt to express in the most compelling and original terms the postmodern rebellion against the purism of modernism; it provides a contextual and historical foundation, as well as disciplinary examples of contradicting elements.

An analysis will follow, in which a comparison will be made by the work by Constantin Brancusi, Oscar Niemeyer, and the important invention of gramophones from the beginning of the 20th century, will further reveal the formal, technical and contextual aspects within this investigation.

The chosen project are selected based on their similar qualities of formal oppositions, but also the works not only belong to the domain of architecture, but also to that of art and product design.

After having unpacked the guiding principles of tectonics, this investigation will hopefully prove to be fruitful for the development and clarification of the graduation project.

Gottfried Semper was trained in Paris as an architect in the late 1820's, after already acquiring a degree in mathematics, at the University of Göttingen. Soon after he would travel through Greece and Italy, in search for archaeological explorations, where he would be introduced to the great debate on *polychromy*. After returning to his homeland, he would soon be named professor at the Dresden Academy of Fine Arts, and simultaneously enjoy a successful career as a practitioner. This lasted until the Dresden Uprising, which ultimately would result in Semper being banished from Germany, and unable to practice successfully as an architect abroad. Over the next decade Semper would publish two of his most important works: *The Four Elements of Architecture* (1851) and *Style in the Technical and Tectonic Arts* (1861).

Semper was inspired by the growing science of anthropology, and therefore his studies didn't mainly revolve just around the creation of built-form, but of all human artefacts. "He believed that architecture developed not from construction, but from the need for enclosed space"¹. Having focused on the development of social separation between the interior and exterior worlds in primitive cultures. This separation he would later define as the *cladding of space* which would be a significant contribution to his theory of *Bekleidung* (dressing). Semper would classify the act of dressing under the craft of *textiles*, which would later develop into an examination of the relationship between the making of crafts and architecture (fig. 1).²

¹ Schwartz, Chad. *Introducing Architectural Tectonics: Exploring the Intersection of Design and Construction*.

² Semper, Gottfried. *Style in the technical and tectonic arts, or, Practical aesthetics*. 247

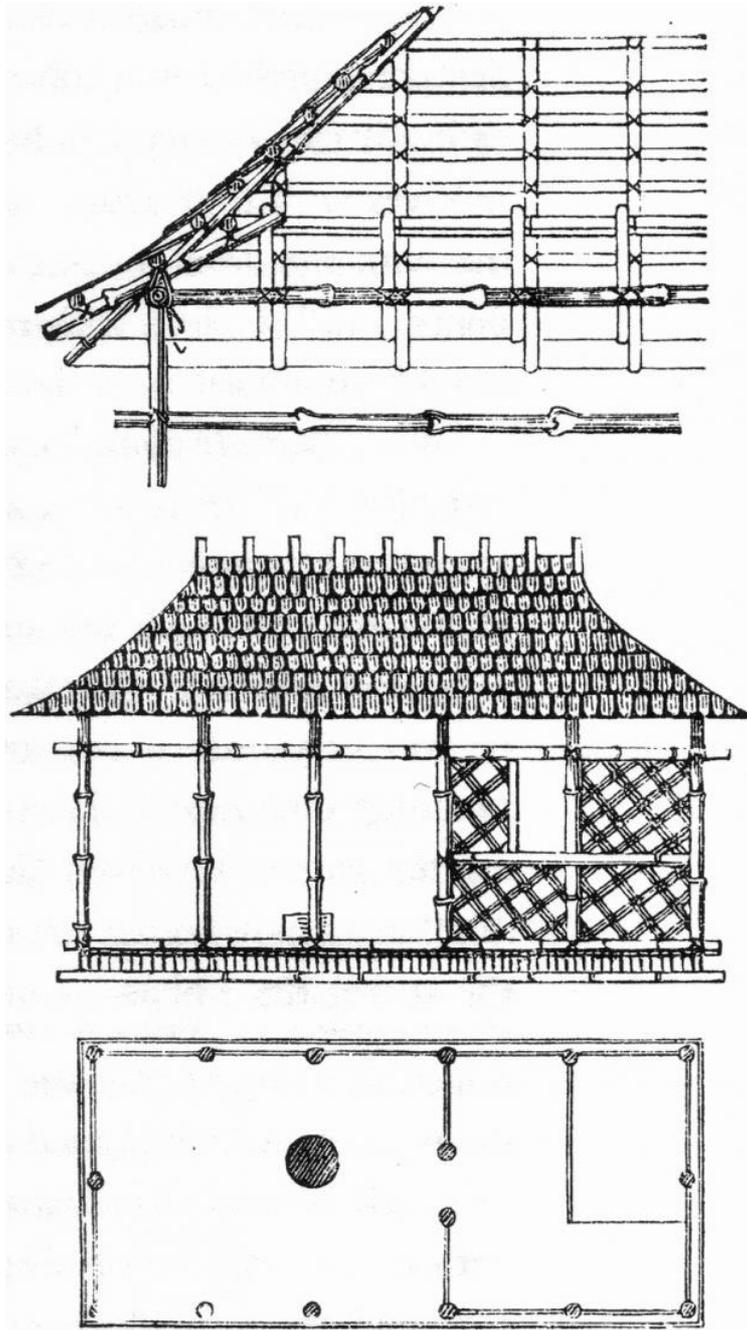


Figure 1 Semper's illustration of the Caribbean Hut

Semper goes on to categorize the 'Four Categories of Raw Material' and the kind of construction that is ingrained in each ones, into four classes of "textiles, ceramics, tectonics, and stereotomy".³ He would go on to pair these four crafts with the 'Four Elements of Architecture'; "the earthwork – the framework – the cladding – and the hearth". Central to these pairings are the innate properties of materials and the effect of those material characteristics on created objects and, at the scale of architecture, on space. The earthwork is tied to masonry, which is hard and durable, the framework is tied to carpentry, which is ductile; the cladding is tied to textiles, which are elastic; and the hearth is tied to ceramics, which have an underlying softness to their creation.⁴ These categories are not to be interpreted as specific entities, but as thematic processes which generate a formal development according to this given system.

Investigation of the Four Categories

Having previously mentioned the four elements, it is important to further explore each element, in order to be able to conduct the analysis of similar given objects and architectural projects. **Ceramics**

Characteristics: Soft, malleable (plastic), capable of being hardened, easily shaped and formed, and retaining a given form when hardened.

The style of ceramics is dependent on the three properties of all plastic pastes: plasticity, homogeneity, and the ability to harden. *Plastic* refers to the process of forming and *pottery* to the practical material purpose that first called it forth. *Ceramics* alludes in the first instance only to the material to be treated – namely, clay.⁵

Semper undertakes the formal/cultural development of these plastic vessels; deconstructing its parts and identifying the various underlying functions. For instance, the spoon, a type of a scooping vessel, carrying a small reservoir, dominates and determines its form.⁶ *Amphorae* is a vessel which initially could only stand with the support of a special base (fig. 2); an *incitega*. The graceful combination in which the *amphorae* and the *incitega* become a whole.⁷ Later, the amphorae-like vessels transform with a fat bottom and base, which enable it to stand without a separate support (fig. 3).

Another characteristic element of amphorae is their *handles*. The reason behind the shape and number of handles for each vessel is hard to identify, yet one thing is a fact, an amphora is never without handles, never fewer than two handles on opposite sides, and they are always ear handles; meaning they are connected vertically to the vessel's neck.⁸

³ Ibid., 109.

⁴ Frampton, Kenneth. *Botticher, Semper and the Tectonic*. 146 - 148

⁵ Semper, Gottfried. *Style in the technical and tectonic arts, or, Practical aesthetics*. 467

⁶ Ibid., 471.

⁷ Ibid., 473.

⁸ Ibid., 474.



Figure 2 Amphorae without a supporting base



Figure 3 A vessel acquiring its own base

Semper identifies the parts of the vase as:

1. Belly
2. Base or support
3. The neck
4. The spout
5. The handle(s)
6. The lid (or sometimes, the stopper)

Having looked at a couple of examples, all the vessels show how they're formed out of a multiplicity of parts, whilst acquiring a unified appearance. Each part may truly be separate, or they may be independent in their ideas, whilst in reality they function as a whole.

"Both the separation of the elements and their *combination* into a unified purpose should be clearly apparent in the work. As much as possible one should emphasize and symbolize the functionally unified appearance through the relation of the parts to one another, the form of the parts, and their decoration."⁹

Tectonics

Characteristics: stick-shaped, elastic, principally of *relative* strength, that is, resistant to forces working vertically along the length.

Tectonics being the first (of the two) construction typologies; refers to lightweight, assembled structure. Characterised by its root *tekton*, which is focused on the practice of carpentry. Timber as a material has a finite length and width and therefore invites artisans to treat construction in a dimensional and scalar sense. In addition, timber is discontinuous and so it begs the skill and knowledge of jointing (fig. 4).¹⁰ Semper further defines the main purposes within tectonics; a specific structural function which is 'technically necessary':

1. The frame
2. The *lattice*,
3. The *supports*
4. The *structure*, an integration of the supports with the frame.

Firstly, in the formal *tectonic* development, Semper introduces the *frame*. This element represents the primary forces which act on the built structure. The frame with the greatest *architectural* significance is *objective*; it expresses its relation to the outside world by formal means.¹¹

The frame itself in tectonics is mostly assembled by timber posts and beams. The beam, is so to speak, the personification of *absolute rigidity* and *elastic* resistance, and the standing post personifies *compression* and *tension*.¹²

With the frame, comes a *lattice* which must be rigid and fixed within. This element defines the limits of the framework and should be full fill a complimenting role. Semper further emphasises the distinction between tectonics and textile frames, which become even more explicit when the former performs other functions in addition to framing.

⁹ Ibid., 524

¹⁰ Schwartz, Chad. *Introducing Architectural Tectonics: Exploring the Intersection of Design and Construction*. 45

¹¹ Semper, Gottfried. *Style in the technical and tectonic arts, or, Practical aesthetics*. 632

¹² Ibid., 629

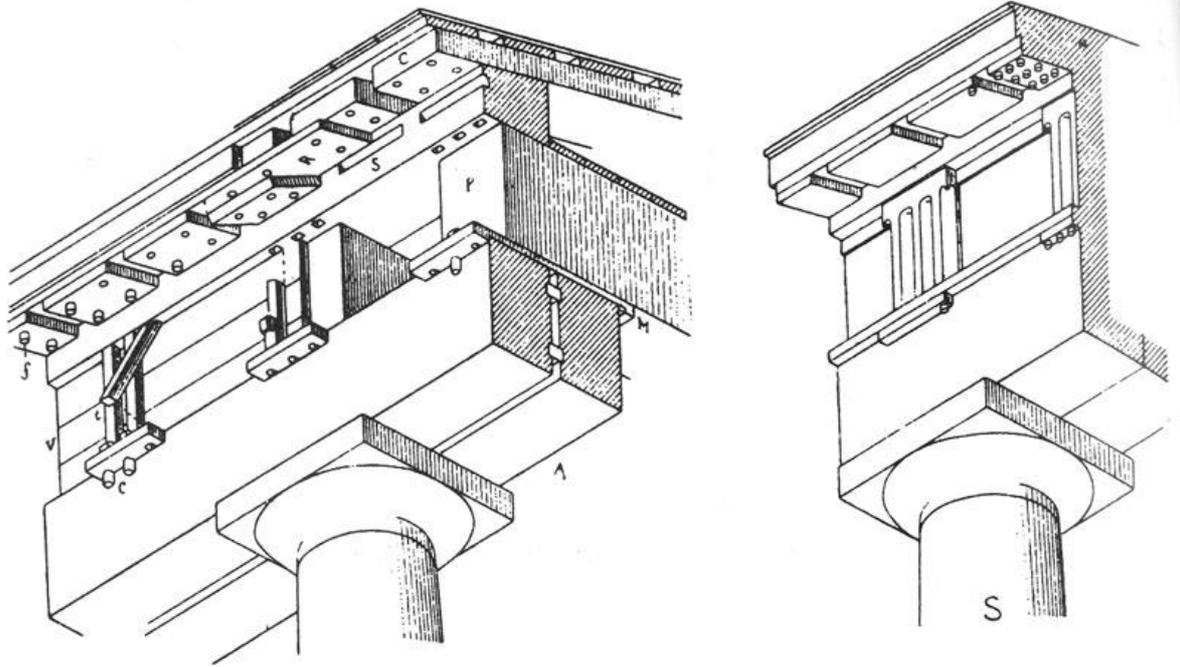


Figure 4 The art of joining

The filling should be structurally separated from the frame. According to Semper, “the frame should seem to the eye to be completely rigid in *itself*, and the filling should be recessed, either *actually, apparently* (by means of colour), or ideally by both means at once.”¹³

The *support* addresses the base of the tectonic structure. Semper refers in his essay to the self-contained tripod form which was often used to carry chalice-like vessels. Similar to the *incitega*, as mentioned previously, the independent tripod form nevertheless combines the latter to produce a more unified appearance.

The *support* is an important tool, since it can be used as an interesting transitional form. The support can convey three activities; receiving, carrying and distributing the load in a way that lends it to a true expression of subordination.¹⁴ In the tripod example, the crossbars (rhabdoi) for instance, hold the three legs in a triangular unit, are an eloquent expression of a system that is light.

The Renaissance took up this ability to determine the contrast between monumental (heavy) and moveable (light) tectonics. Through a series of shades of expression, the *support* is able to express through its transitional form.

Semper states that a tall base is intended more to *accommodate* and *raise* an object, than to actually carry the load of the structure.¹⁵ This way the overall expression makes the structurally less fixed, more independent, and mobile, similar to that of furniture.

On the other hand, having the *support* more grounded ultimately represents a monumental tectonics. One could wonder if tectonical supports are suitable for a monumental representation.

As for *structure*, the art of carpentry is materialised primarily through wood. Its *great compressive strength vis-à-vis* pressure applied perpendicularly to its cross section permits – when trunks are used as vertical supports – height to width ratios that far exceed the stability ratios in absolute terms (namely, the same for all upright bodies) of these two dimensions. To compensate for this lack of stability and to counter the bowing of a support under load, wood requires appropriate connections using rails, struts, corner bands, ties, and so on.¹⁶

The downside to wood is that it is not very *durable*. It requires a protective coating such as a varnish (paint) layer, a dressing, terra-cotta, stucco and so on. The second downside to wood is that it has a fibrous composition, meaning the material does not provide supports when the fibres are incorrectly cut, and thus exposing it to external forces. The third downside is that wood has the ability to shrink, crack and warp as it dries.¹⁷

The fact that wood has all these disadvantages, is what makes this material easily exploitable, and thus able to be made into a virtue of necessity. For instance, the process of gluing laminated sheets of wood together was motivated by structural ends and took beauty into account only as a secondary matter. In any event, the harmony here between the technical and the artistic tasks is once again striking.

¹³ Ibid., 628

¹⁴ Ibid., 643

¹⁵ Ibid., 643

¹⁶ Ibid., 651

¹⁷ Ibid., 654

Thus, “the timber style owes some of its richest motives to the deficiencies of wood rather than to its remarkable properties”.¹⁸

Stereotomy

Characteristics: strong, *densely aggregated*, resistant to crushing and compression, thus of significant *reactive* strength.

Stereotomy being the construction typology, is the practice of cutting stone for construction. Its construction is characterised by piling or stacking mass elements such as stone, brick, or earth.¹⁹ What binds these materials together is their ability to be *divided into many parts* while remaining *unarticulated*.

Given this combination, the forces permit nothing but a structural-mechanical formal expression. Through stereotomic executions, there is a clear departure from tectonic construction, where articulation of the different parts results from a very different kind of activity.²⁰

For the formal character of stereotomic constructions, the surface area (a square or rectangular), as well as the attributes and the size of the units determine this expression.

Semper’s classification between the ‘Four Categories of Raw Materials’ provides a basis for comparison and contradiction. The twofold conditions of mobile (temporary) and monumental (permanent), as well as their spatial and structural functioning, enables alternative readings of formal qualities in any architectural composition.

¹⁸ Ibid., 658

¹⁹ Schwartz, Chad. *Introducing Architectural Tectonics: Exploring the Intersection of Design and Construction*. 45

²⁰ Semper, Gottfried. *Style in the technical and tectonic arts, or, Practical aesthetics*. 728

Contrasts

Due to the contrasting nature of the graduation project, which initially led to this investigation, it seemed crucial to be able to identify the tools which were previously used by architects to be able to define contrasting elements.

In *Complexity and Contradiction in Architecture* (1977) Robert Venturi argues for the beauty of formal oppositions; using case-studies from classical up until modern architecture. He recognises the contradictions which architects applied in order to articulate forms in relation to material and structure.

“Meaning can be enhanced by order; the exception points up the rule. A building with no imperfect part can have no perfect part, because contrast supports meaning”.²¹

Venturi analysed how besides specializing forms in relation to materials and structure, Modern architecture not only separates, it also articulates each element. For instance, when promoting the frame and the curtain wall, it has separated structure from shelter – enclosing walls do not have a structural-support function. On a detail-level, modern architecture continues to separate each element introducing the shadow joint.

In Le Corbusier’s Villa Savoye, the exceptional diagonal of the ramp, is clearly the opposing element in section as well as elevation. This strong juxtaposition to the regular order of columns and the envelope brings a new meaning to the ramp and to the movement throughout the space (fig. 5).

Venturi would compare Le Corbusier to the attitude of Frank Lloyd Wright, specifically in his Fallingwater. Where he insists on a horizontal continuity at the expense of all else. For instance, the exposed stair case ignored all diagonals; there are no strings or railings, but only the horizontal planes of the treads, and the vertical rods from which the stair-element is hung (fig. 6).²²

Diving deeper into the theory of contradictions, Venturi comes across the notion of proportions, as being essential within contrasting, or juxtapositioning. His example of Michelangelo’s Medici Chapel in San Lorenzo, in which Venturi states, “Classical orders make for another kind of contrasting adjacency when the giant order is juxtaposed on the minor order and the proportion is constant regardless of size”.²³

Similar to Jefferson’s various combinations of scales of columns at the University of Virginia create a contradiction notion that every *load* requires its own structure. Yet, the juxtaposition of elements that contrast in scale, even though proportional in shape, present a monumental expression.²⁴ Having this proportional superimpositions, enables the designer to sensitively produce elements of various scales, creating tension, yet maintaining a sense of unity of the total work.

Proceeding onto the notion of tension, it is important to recognise the contrast between the inside and outside, as a major contradiction within architecture. An exterior and interior space provide meaning because of each other. This can be achieved through contrast in materiality, texture, or even colour.

When contrasting the in- and outside space(s), the spatial boundary has the capacity to produce a spatial layer; in between the exterior wall and the lining. Such a layer provides the necessary transition which is needed between the two.

²¹ Venturi, Robert, and Victor Scully. *Complexity and contradiction in architecture*. 1977. 41

²² *Ibid.*, 52

²³ *Ibid.*, 58

²⁴ *Ibid.*, 58



Figure 5 The diagonal ramp in the Villa Savoye

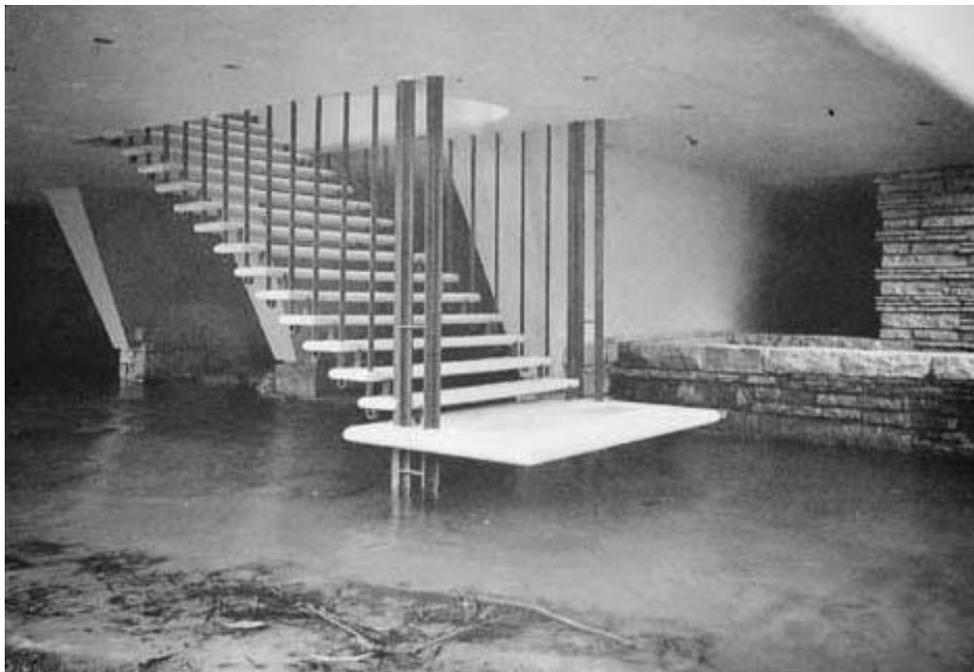


Figure 6 The hanging stair case in the Fallingwater

Details

It is clear that besides recognising the relationship between various 'styles' as defined by Semper, the notion of contradictions, or contrasts, is an essential part of the architectural means of creating an explicit relationship between two or more elements; a relationship which articulates the transition between the two occurrences. This transition can be best deduced to what Semper refers to as the *knot*; the joint between two ropes can be seen as an analogy to an architectural detail. The task of joining materials, such as with the knot, is a practice which is tied to place and culture, as well as the materials involved.

"The details relationship to a building or space can be related to a words' relationship to a sentence. Change on word for another and the sentence takes on a different meaning; change a detail or strategy for detailing in a building and the understanding of place changes as well."²⁵

Details come in all scales and sizes. According to Fascari there two types of joints: *material joints*, and *formal joints*.²⁶ The former refers to the bolt connecting a timber plank to its support; the connection of the column and the post at the capital. The latter refers to the raised plinth that connects the exterior environment to the interior space; and the bridge that connects two sides of the river.

Of specific importance is the intersecting moment between two distinct construction systems. Not to be confused with a typical architectural detail, an *intersection* involves significant points of dialogue; not just between distinct elements and constructional systems, but also ordering principles, narrative paths.²⁷

Frampton also believes that Semper's emphasis on the joint implies that a fundamental *syntactical transition* is expressed as one passes from "the stereotomic base of a buildings to its tectonic frame, and that such transitions are the very essence of architecture" (fig. 7).²⁸

One can take Frampton's quote and replace any of Semper's classifications and respectively express the transition between the two systems. The structural detail not only determines the relationship between the two words at each end, but also define the entire sentence.

²⁵ Schwartz, Chad. *Introducing Architectural Tectonics: Exploring the Intersection of Design and Construction*. 56

²⁶ Fascari, Marco. *The tell-the-tale detail*. 1981. 501

²⁷ Schwartz, Chad. *Introducing Architectural Tectonics: Exploring the Intersection of Design and Construction*. 57

²⁸ Frampton, Kenneth, and John Cava. *Studies in tectonic culture: the poetics of construction in nineteenth and twentieth century architecture*. 1995. 86



Figure 7 Intersection of a contemporary stair and Roman stone wall at Trajan's Market, Rome, Italy

Analysis

The following chapter examines the varied tectonic expressions of 3 projects. This analysis will attempt to define the varied expressions of the relationship between design and construction.

The typical project outline will consist out of a short brief, and then will be followed by a threefold of aspect: "first, the finite nature and formal properties of constructional materials, be those timber, brick, stone, steel, etc. Second, the procedures of jointing, which is the way that elements of construction are put together. Third, the visual statics of form that is the way by which the eye is satisfied about stability, unity and balance and their variations or opposites."²⁹

01 *Mademoiselle Pogany, Constantin Brancusi, 1920*

Brancusi was the twentieth century artist who took the greatest care with the design of the base. He often made it a contrasting element to the piece itself. For him the base belonged to the sculpture.

This sculpture is a portrait of Margit Pogany, a Hungarian artist who sat for Bruncasi between 1910 and 1911 whilst they were in Paris. After Bruncasi's return to Hungary, he carved a marble Miss Pogany from memory, then made a plaster mould of the work, from which he managed to cast four additional versions, including this one, in bronze (fig. 8).³⁰

By representing its subject through highly stylised and simplified geometries, Brancusi's work was a significant departure from conventional portraiture. Large almond-shaped eyes stand out within the oval face, and the curved eyebrows emphasise the eyebrows and the nose with one simple curved sweep.

1. *Formal Properties of Constructional Materials*

Brancusi makes a conscious choice in the materials which are chosen for the construction of this sculpture. One being the *stereotomic* representation of the base through the use of a granite block, and the other, the *plastic* representation of Mademoiselle Pogany's head through the use of bronze in-cast. Having the 'heavy' base as this *stereotomic* earthwork which grounds the bronze element, provides for a natural tectonical representation of construction.

The *ceramic*, or even *metallurgic* component represented through the use of bronze creates a plastic form which has an underlying softness to it. As it's the vocal point of the work, it can be seen as the *hearth*; the dominating visual element.

2. *The Procedure of jointing*

The beauty of this sculpture is the way in which the two elements; the two materials and the two crafts are brought into relation with each other. Noticing the physical contact between the two, one can sense a moment of tension between the two. Brancusi explicitly minimises the point of contact, which emphasizes the contrasting tectonics between the two elements, bringing meaning to not just the 'floating' head, but the base becomes an equal counterpart to the sculptural piece.

At the same time, one cannot help but notice the fragile footing of the bronze head on top of its base, which brings me to the sublime way in which the detail, the single point of contact, manages to create unity between the two. Hidden from the public eye, Brancusi anchors the bronze head to

²⁹ Porphyrios, Demetri. *From Techne to Tectonics*. 2002. 136

³⁰ MoMA. 2018. <https://www.moma.org/collection/works/80744>, visited on 06-06-2019.

the base, which creates a structural transition from top to bottom, and where the sculpture is tectonically a unity.

3. *Visual Statics of Form*

According to Frampton, the work of the Romanian sculptor Constantin Brancusi was surely an inspiration here for the way in which sculpture and base were regarded as integral parts of the same plastic unity.³¹

To the eye, Brancusi truly uses some of the 'tricks' as recognised by Venturi earlier to combine two formally contrasting elements, yet compose a unified composition. When looking at the use of the two materials the eye immediately sees the contradiction in texture, as well as colour.

Yet, through the centric positioning of the head on top of the base, makes the composition structurally balanced. This stable unity is further enhanced through the use similar proportions. The base is not undermined for its sole supporting function; not becoming a backdrop, but is proportionally related to the bronze head in a balanced manner.



Figure 8 Mademoiselle Pogany, by Constantin Bruncasi, 1920

³¹ Frampton, Kenneth, and John Cava. *Studies in tectonic culture: the poetics of construction in nineteenth and twentieth century architecture*. 1995. 321

02 National Congress Brasilia, Oscar Niemeyer, 1960

Oscar Niemeyer has the pleasure of positioning his governmental project, as part of Lucio Costa's monumental abstract bird-shaped urban scheme for the city of Brasilia. The National Congress strongly reflects the influences of Le Corbusier, whilst hinting at the romantic and organic geometries. This is perhaps the most outspoken example of one of Niemeyer's favourite games – that of formal oppositions, here suggesting a new Brazilian aesthetic identity in opposition to the hard straight (male) forms of the European architect (fig. 9).³²

1. Formal Properties of Constructional Materials

When looking at the material composition of the National Congress, one can see a clear distinction between the two centrally aligned *Corbusian* elements; being the horizontal slab, and the two towers, and the two plastic cupolas.

Niemeyer clearly defines the horizontal slab as a light, almost floating, element - which strongly refers to Semper's *tectonics*. The white, concrete framework extending towards the roof expresses the loadbearing aspect, whilst the black reflective glass infill defines the separation between inside and outside, again, in a *light* manner.

The two *ceramic* cupolas, made of reinforced concrete, enable Niemeyer to juxtapose the rigid play of assembled elements with these two plastic shapes. When following Semper's theory of Tectonics, one can argue that the cupolas, have a *stereotomic* character, due to its strong significant *reactive* strength. Yet, Niemeyer attempts to mask this expression by covering the concrete with a layer of stucco; which ultimately gives a smoother texture to the surface and thus, it retains its sculptural *plastic* qualities.

2. The Procedure of jointing

The joint, or as Frampton calls it a 'syntactical transition', can be perceived in the thickened marble cladded roof. When looking at the elevation, Niemeyer almost wants to celebrate the moment in which the horizontal slabs, and the two cupolas meet. Not only does the thick roof edge create a boundary between the two, it also provides a *support* for the cupolas. In this way, the horizontal slab acts similar to Brancusi's base in his previously mentioned sculpture.

In section one can observe how the two cupolas in fact protrude within the horizontal building. Through this structurally honest gesture, the architect unifies the two formal opposites within the interior of the Corbusian slab. This can also be made apparent within the floorplans, where the organic contours fuse within the rigid structure (fig. 10).

3. Visual Statics of Form

The visual statics in this project are strongly perceived through its plastic shape, curving silhouette, and plain surface that contrast boldly with the intricate rectangular pattern of the structure.

This contradictory relationship is further emphasized through a delicate play of tones. The white framework of the horizontal slab relates to the white stucco of the cupolas. However the relationship between the two tectonics is emphasised through the contrast of the black tinted glass and the whiteness of the cupolas. It expresses the sculptural event based on the juxtaposition of objects of contrasting surfaces, colours, and materials.³³

³² Underwood, David Kendrick. Oscar Niemeyer and Brazilian free-form modernism. 1994. 57

³³ *Ibid.*, 95

The sculpture event protrudes further into the interior, in which a contrast in colour expresses both spatial conditions of the cupolas.



Figure 9 National Congress Elevation

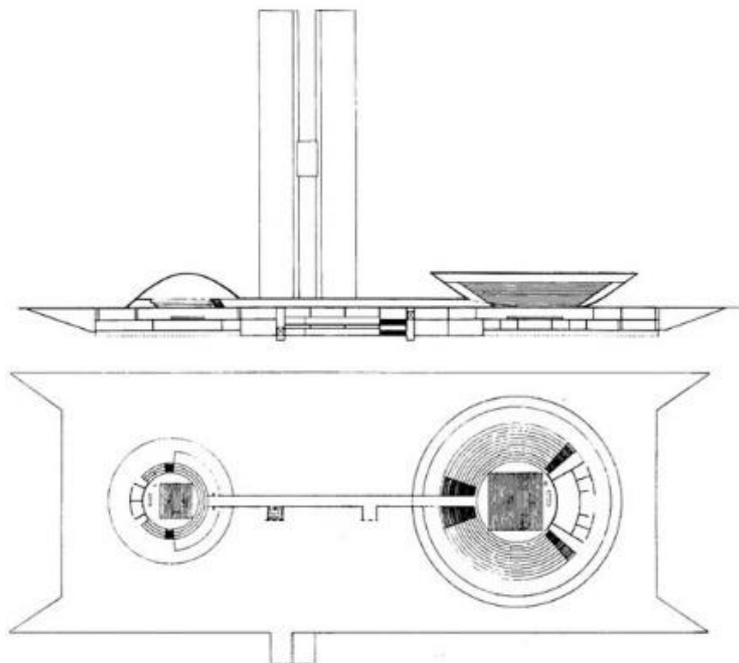


Figure 10 National Congress section and plan

03 Gramophone, -, 1900's

The gramophone originally stems from the *phonograph*, invented in 1877 by Thomas Edison; a device used for the mechanical recording and reproduction of sound. The name *gramophone* was used as a generic name in the UK since the early 1900's.

The gramophone reads from a vinyl record through a small needle which moves along the grooves within the record. The needle is attached to a 'sound-box', which in turn is attached to a sounding horn. As the needle moves through the grooves, moving up and down, it produces vibrations which are transmitted through the sound-box. As this box in turn picks up the vibrations, sound is created and channelled through the horn, which amplifies the sound into the given direction of the opening (fig. 11).

1. Formal Properties of Constructional Materials

The *exhibition box* on which the vinyl record is being laid, and in which there is a hidden mechanism that makes the disc revolve can be classified under Semper's theory as a *tectonic* assembly of components. Assembled from timber, with a base, a framework with an infill, and a 'roof' which caps the entire structure; protecting the mechanism.

The horn had several constructional techniques. One of which is constructed out of brass curved sheets, that are welded together to form a sculptural shape. Another method was to cast the metal into a mould. The latter method provides the advantage of having a great pliability and cohesion of its constituent element. Leading to a certain lightness and delicacy of character, which differs even from plastic effects of clay, porcelain, glass and so on.³⁴

2. The Procedure of jointing

The coupling of the box and the horn are less similar than the two previous examples. Due to the functional nature of the gramophone, it can be either be turned *on* or *off*. In an *off* state, where there is no turning vinyl record, the horn is connected by a *cast-arm* which curves around from the box, gives the effect that the *plastic* shape is floating.

In its *on* state, the gramophone acquires a procedure of joining, which is reduced to the finest point of contact between the needle and the record. The cast arm almost plays a secondary role between the joining between the two, as the *functional* joint is proven to be subtle. The *turntable spindle* protrudes through the box, being the only joint between the record and the needle.

3. Visual Statics of Form

In the gramophone, a similar play of contrasts can be perceived as with the previous two examples. The wood grain texture contrasts with the smooth, reflective materiality of the horn. The latter, depending on the manufacturer, is able to coat the horn in various metal-finishes to strengthen the colour contrast between the two components (fig. 12).

Through the proportions of the box in relation to the horn, which arches over the box, the two contrasting elements are perceived as a harmonious structural ensemble.

³⁴ Semper, Gottfried. *Style in the technical and tectonic arts, or, Practical aesthetics*. 887

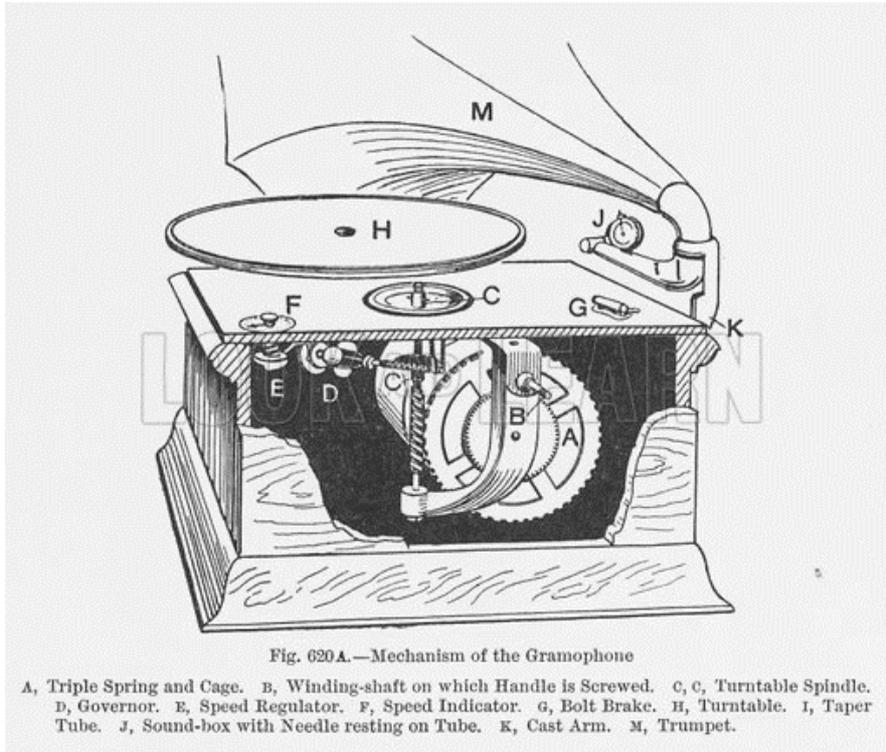


Figure 11 Internal mechanics within the Exhibition Box



Figure 12 A typical early 20th century gramophone

Conclusion

The analysis of the three given projects has proven the authenticity of the tectonic theory. Seeing how each project has an interwoven relationship between space, function, structure, context, symbolism, representation, and construction, identified through Semperian terms, provides an integral way of observing and addressing certain design decisions.

After having initially determined to focus on the relationship between the *tectonic* and the *plastic* (ceramic), one can hardly resist to look further into the classification system provided by Semper. The innate properties of materials and the effect of those material characteristics on created objects, and at the scale of architecture, on space is a conceptual framework that can be embraced for any pairing of building parts with their 'raw materials'.

From the analysis it can be seen how the *plastic* and the *tectonic* within the three projects shared certain moments which justify the relation between two opposing objects, yet simultaneously stress their contradictions, as recognised by Venturi.

The moment at which the two surfaces meet is reduced to a minimum. The contrasting colours, textures and materials strengthen this formal contrast. Yet unity is achieved through the structural logic of the joint, acting as a syntactical transition. Through proportions the two contrasting element become visually a whole.

As a concluding item, I would like to attempt to analyse one of my own interventions, through the eye of *tectonic theory*, to identify consciously the design decisions which have been made, and to see what else can be made stronger.

1. *Formal Properties of Constructional Materials*

When observing the Intervention along the River Arzobispo, the project is made out of three elements: The box, the horn, and the diagonal ramp (fig. 13).

The box is strongly related to Semper's definition of *tectonics*. The bold rectangular timber *framework* is defined by the slightly recessed infill. This *lattice* provides for enclosure of the space where needed, as well as creating openings towards the surroundings. The *tectonic* structure is *supported* by light steel struts, which separate the structure from the ground, making it less fixed, and thus giving it the expression of a more independent, and mobile architecture.

The horn, made out of structural fiberglass juxtaposes the rigid framework of the box. The *plastic* qualities of the material, enable it to be casted in many organic ways whilst maintaining its original 'acoustic' function.

2. *The Procedure of jointing*

The joint between the two components is constructed within the infill provided through the geometry of the framework. The straight surface of the infill meets the organic shape of the horn, celebrating the point of contact between the two formal oppositions.

Similar to Niemeyer's National Congress, one can observe how the horn protrudes the *tectonic* box, and becomes part of the interior space. The organic contours interact with the straight-jacket interior of the box. Structurally the ensemble is less honest, as the horn does not further intersect with the structure of the *tectonic* box.

3. *Visual Statics of Form*

The visual statics in this project are strongly perceived through the plastic trumpet, with its curved silhouette, and the plain surface that contrast boldly with the intricate rectangular pattern of the structure. The horn's secondary structure is executed in a thin, light manner, in order to strengthen the structural tension between the two elements, yet not make the horn fly away.

Proportionally the horn and the box coincides with each other, similar to the gramophone, where the horn sweeps away from the box, yet arches back into harmonious position, where the two elements look unified.

As a point of improvement; the contradictory relationship could be further emphasized through a delicate play of tones and textures. Similar to Niemeyer's play of white tones, to emphasize the framework and the cupolas. Likewise, the contrast of the black, reflective smooth glass, with the opaque white organic cupolas.

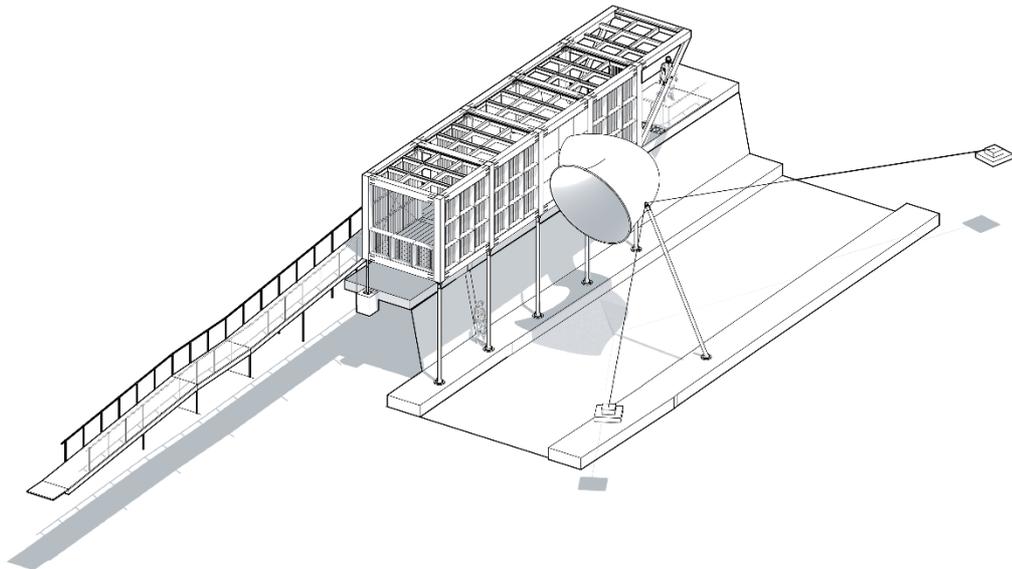


Figure 13 Intervention along the River Arzobispo

Reflection

I believe that prior to this research the *model* of the gramophone served enough purpose, simply through its contrast in shape, as a justification for my design decisions for the box versus the trumpet. Through the investigation of *tectonic theory* and additionally that of *complexity and contradiction* I have been able to understand more clearly the layers which are involved in combining narrative, structural, material and environmental layers which I had already unconsciously used to design, but which I now recognize and identify for what they are and for their meaning.

I firmly believe that *tectonics* does belong to the practice of architecture. This theory provides an opportunity to initiate a dialogue between the constituent elements of architecture – construction and materiality, structure and support, space and function, context, and ornamentation and appearance. As long as buildings continue to have a relationship with the ground, continue to be influenced by gravity and the forces of nature, and continue to need to be assembled, fabricated, or constructed, *tectonics* will play a significant role in the development of the built environment.

I believe that this research provided me with an insightful tool into reading my project and my decisions backwards. Only this time the process of identification was consciously. Now that I have identified it consciously I can add more depth to the design by showing not only how the building works but why it works in the way that I have constructed it, and what it architecturally means if it's this way.