

Reading the Rationality of Mangunwijaya's Architectural Tectonics

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Abstract The development of tectonics as a discourse in the modern era has further exerted the influence of technology on works of architecture, thus allowing for more freedom when it comes to exteriorizing various structure forms. This phenomenon has resulted in diverse perspectives when it comes to understanding the concept of tectonics, most alluding to a physical representation. In essence, tectonics discusses not only physical forms, but also the verity that produces beauty. These current times - where the general public is dumbfounded by the ever-advancing technology - makes for greater appeal in researching Mangunwijaya's works on tectonics, for he was able to showcase both adeptness and simplicity, far away from neither technological advancements nor modern fabrications. His works on tectonics are highly appreciated by many observers. This research concludes that the essence of tectonic beauty lies heavily in its truthful and authentic representation instead of merely technological advancements. This understanding encourages architects and educators to enrich their knowledge when it comes to unveiling truthfulness behind a structure and what that represents as a discourse in tectonics beauty, while at the same time voicing a response to the current discourse on tectonics. Comprehension of Mangunwijaya's works on tectonics was able to be established through organizing a rational reading method in regard to case studies, finding relations between physical elements that construct tectonics with representations of tectonics, as well as regarding context as a significantly influential factor. Through a comprehensively-and-rationally-arranged

matrix, digestible and teachable understanding of Mangunwijaya's tectonics was successfully obtained.

Keywords Tectonics, Technology, Truthful, Authentic, Representation, Reading Method, Rational

1. Introduction

This research discusses Mangunwijaya's works on tectonics. Results obtained from the study of these works are believed to contribute to the discourse on tectonics that is currently in development. In order to understand Mangunwijaya's works on tectonics, an adept reading method constructed through an understanding of ontology and the tectonics representation that it showcases is needed. Efforts put into understanding tectonics through an artistic perspective tends to pose subjective and qualitative qualities to it, yet this type of effort has a better chance of grasping qualities missed by the more rational understanding on tectonics. The current discourse on tectonics shows that research innovations have been made when it comes to reading of the rationality of tactile tectonics.

Tectonic ontology is a crucial aspect in this research, for it poses as the starting point, as well as providing the limitations, scope, and research consistency. Shallow understanding in regard to ontology within the study of tectonics might lead to research inconsistency, and

inconsistency, in turn, would blur the rationality that poses as the perspective of this research. Thus, tectonic ontology would be understood thoroughly based on apparent physical aspects and the rationality they contain.

Rationality in understanding Mangunwijaya's tectonics was chosen as the focus of this research because tectonics possesses a high rational dimension. Choosing rationality as the focus is not synonymous to eliminating non-rational dimensions that exists within tectonics instead, it serves as an effort to search for consistency within the understanding of tectonics that can be rationally accepted and may pose as tectonics reading discourse with a universal dimension. Universal dimension would function as a helpful reading method in establishing comprehension regarding tectonics.

The formulation of the reading of Mangunwijaya's tectonics was carried out by studying four tectonics case studies by Mangunwijaya: Saint Mary Assumpta Catholic Church in Klaten, Bentara Budaya Jakarta, Duabelas Rasul Sendangsono Chapel in Magelang and Kuwera Guest House in Yogyakarta.

By using the case study method [1], proposition, protocol design, analysis and findings in the form of reading method matrix are then arranged. With aforementioned reading method, these four case studies were looked into, and the result is a set of trademark tectonic uniqueness that is characteristic of Mangunwijaya. Furthermore, since the reading method carried out was rational and universal in nature, reading results were also able to determine Mangunwijaya's tectonics position in the context of the ongoing tectonics discourse. Said results are relevant to this research in the context of enriching pre-existing tectonics discourse. The hidden tectonics phenomenon [2], as well as the birth of various perspectives on tectonics would get their share of clarity through results of this research.

2. Materials and Methods

2.1. Tectonics

Tectonics derived from the Greek term *tekton*, which translates to carpenter or builder [3]. In its development, the etymological meaning of *tekton* as a carpenter had to be altered contextually because its understanding became problematic, especially when compared with the term *arche-tekton*. *Arche* translates to the word chief; it was deemed unfit for the term *arche-tekton* to be translated to 'the chief carpenter.' The meaning of the term *tekton* was then shifted; it no longer referred to carpenters alone, and instead referred more to the activity of all sorts of creation process that required strategy and technique in its application [4]. The strategy and application technique have since brought *tekton* to its authentic discourse, which is to create within context. The natural context that is automatically in synergy with tectonics is the universe and

its variegated cultures.

The essence of tectonics is a paradoxical dualism between the physical and the metaphysical, coreform and artform, Ontology and representation [5]. Generally, tectonics is understood as the art of construction, with the understanding that construction itself is the subject that conduces art. Boetticher [3] has clearly stated that the discourse of tectonics would constantly develop along with mankind's understanding of the laws of nature, and the development of tectonics can only be done in the context of structure and construction, nothing else.

2.1.1. Tectonic Ontology

Ontology is known as the science of being. Ontology discusses the natural state of being, becoming and existing. As a reality, ontology can be viewed philosophically through three perspectives: objectively, subjectively, and constructively [6]. In simple terms, tectonic ontology may be understood as the visible physical form of a structure, for a tectonic work is not fictitious in nature. The physical form of said tectonics comprises the materials used and the techniques applied in processing and assembling these materials. In processing and assembling, tectonics is bound by the laws of nature (statics), making the truthfulness of the application of the laws of nature one of the defining aspects of tectonic ontology. A diagrammatic layout is one way to effectively explain how tectonics comprises the logic of force, materials, and techniques (figure 1). The logic of force plays the role of the configurator of load distribution, per the laws of nature. Meanwhile, the Materials aspect is dependent on the performance of the logic of force, and the Techniques aspect is dependent on the performances of both the logic of force and materials. These physical tectonic aspects conjointly represent the truth which automatically results in the abstract beauty of tectonics.

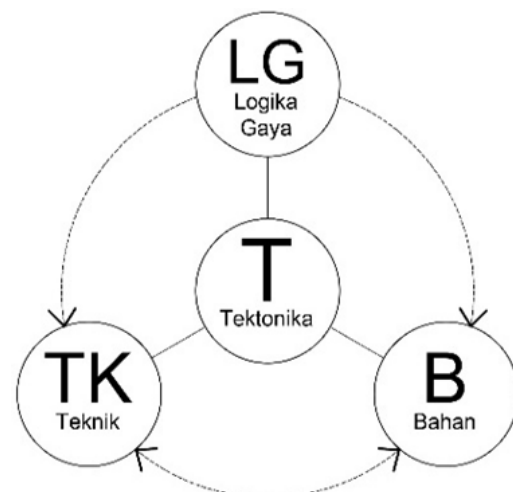


Figure 1. The Three Elements That Construct Tectonic

2.1.2. Tectonic Rationality

Rationality is understood as a rational quality or

condition which possesses the ability to be mutually agreed upon due to its strong reasoning [7]. This strong reasoning is marked by its ability to be discussed logically, and therefore, it is able to be accepted by many. Rationalism is a philosophical belief that puts forward ratio in order to obtain truth, achieved by thought process. Rational truth is classified with the term coherent truth, which translates to a truth that assembles pre-existing truths into an arrangement of new and more complex truth. [8].

Tectonic rationality can be found in the static truth that it possesses, as well as its function as a constructed work. Through its physical manifestation, tectonics thus possesses a subjective value, represented by its apparent physical construction. The verification of non-physical values involves looking into its existing physical form. Here, rationality is required as a tool so that the achieved understanding may be coherent. Therefore, the discourse on rationality of tectonics is in fact a reading method so that tectonics may be comprehensible.

A tectonic ontology that consists of the logic of force, materials, and techniques possesses a high rational aspect-- due to its tangible existence. Through identifying the three aspects mentioned above, tectonic rationality would become readable, while through the discourse on the interrelation between the three aspects, tectonic work is then able to be rationally understood. Rationality is extremely helpful in the reading of tectonic works, for it temporarily separates the reading from the appreciation of tectonic works—which often distorts a reading process.

2.1.3. Tectonic Representation

Tectonics is a matter of ontology and representation [5](Schwarzer, 2016). A representation of tectonic ontology is inherently independent and autonomous. Therefore, said representation may be obtained from the tectonics itself. In correlation to the amount of truth, tectonic representation can be divided into three aspects: static truth, function, and beauty. The main representation of tectonic works concerns static truth—which can be seen through the display of the logic of force within a construction. The benchmark for quality lies in efficiency (appropriateness): essential principal truth, not overdone yet not inadequate. Static truth is represented when the arrangement of the logic of force can distribute the gravitational load under the laws of nature. A correct display of the laws of nature is the display for tectonics. Aside from the correct logic of force configuration, static truth representation can also be seen in the congruence of nature of the materials with their abilities to support a load. When a material used in tectonics plays its role correctly in supporting load distribution, it can be deduced that said material well-represents the laws of nature. The more in congruence the nature of a material with the performance of force that occurs upon it, the more ideal its representation would be.

Function representation can be seen in two different perspectives, which are: space function and usage function. Space function applies when construction modules form a three-dimensional composition. Construction will result in the creation of space in consequence of its construction functionality. Construction may work well alongside space function, as long as its existence, which does not go against the laws of nature. Functionality value rises when space under the control of static truth efficiency is successfully constructed. Indirectly, space functionality within tectonics is determined by the nature of a material and technical accuracy.

Usage function occurs when a construction plays double roles: both as construction work and as a space to hold activities for its users. Usage function can be seen in the elements that form tectonics, processed together with their main function as constructors in terms of materials and techniques. Usage function is closely related to the creativity put in processing the elements that form tectonics.

The representation of beauty in tectonics can be seen in the shapes of visible ornaments that decorate a construction [9][9]. However, it should be noted that those that represent tectonic beauty can only be the ornaments embedded within a construction. As for added shapes and ornaments, they are not considered part of a tectonic beauty. To comprehend tectonic beauty, one would have to revert to the art of construction, which is done by taking into consideration the truthfulness that radiates beauty. Referring to said comprehension, tectonic beauty can be categorized into three types: *abstract beauty, rational beauty, and symbolical beauty* [5].

Abstract beauty is a beauty produced from authentic, natural performance, which is the static truth that is inseparable from tectonics. Rational beauty is a beauty that originates from the true tectonic functions, which are: construction function, space function, and usage function. Meanwhile, symbolical beauty is an expressive beauty that is thoroughly attached to tectonics, serving as a physical expression and representation of tectonics. Symbolical beauty is inherently subjective and is heavily influenced by the observer's experiences, making a rational discourse nonexistent. However, symbolical beauty in tectonics can be identified rationally. Identification is the effort to read into tectonics without appreciating the tectonics itself.

2.1.4. Tectonics Discourse

In the 1840s, Karl Bötticher started his discourse on tectonics. In his work, "The Development of the Forms of Greek Tectonics" (1840) and "the Tectonics of the Greeks" (1844, 1852), Bötticher presented two architectural theories regarding utility and representation. These theories were known as coreform (werkform) and artform (kunstform). With these theories, Boetticher was able to answer the need to separate between construction and art,

as hoped by Schinkel (1781-1841). However, in its development, Boetticher ended up re-combining the core form and art form into a synthesis of beauty perception that involved the observer and values of the past, so those tectonics had to return to the understanding of ontology and representation [5]. The understanding of tectonics as ontology and representation grew along with scientific advancements and attention to context. This resulted in a new perspective in regard to tectonics which emphasized more on representation than ontology. Ever since then, this new perspective has become some sort of new theme for tectonics.

Boetticher [5] believed that a place served as the essential element in tectonics, while Frampton [3] believed that culture was the core element in tectonics, and Semper [10] believed that material was the core element in tectonics. Frascari [9] believed that detail was the core element in tectonics. In the modern era, with up-to-date scientific advancements and technology, Zaha Hadid in Al-Awan [11] believed that dynamic form was the most essential element in tectonics. Digital technology advancement has currently become the dominant tool for constructing tectonic works, serving as a limitless strategy in manipulating form and space in architecture. Tectonics has begun to reconvene with core form-art form. The difference lies in the form being more dominant in comparison to tectonics. The phenomenon which occurs is called hidden tectonics/ disappearing tectonics [2]. The effort to answer the hidden tectonics phenomenon was bridged by Al-Alwan [11] in his journal titled *The Connotation of Tectonics in Architectural Theory*. Al-Alwan made a comparison between classical tectonics with digital tectonics. The difference between the two tectonic groups lies in their essential factors; classical tectonics has the following essential factors: materials, techniques, and cultures as elements that define its tectonics, whilst essential factors of digital tectonics are: tools, articulation, and assembles. Through this comparison, Al-Alwan was able to solve the hidden tectonics phenomenon with the conclusion that classical tectonics still exists, though the essential factors that define it have changed. Al-Alwan also explained that the similarities found in the essence of the two types of tectonics signify that both types represent clear expressions and both were created in an attempt to establish truthfulness in creation [11].

2.2. Mangunwijaya's Ideas

If there was one Indonesian architect with one of the biggest potentials to develop tectonics in his architectural works, it was YB Mangunwijaya. He was a multi-talented theorist and practitioner. Discussions surrounding Mangunwijaya have been done plenty of times, especially after his passing in 1999. Among the fields that he practiced were: architecture, literature, culture, education,

and spirituality. In all of those fields, Mangunwijaya stood out greatly [12] [12]. This research focuses on Mangunwijaya's figure as an architect, although it may indirectly touch on other potentials that may be evident in his architectural works.

Mangunwijaya received a formal architectural education in the West (he attended an architecture university in Germany). He paid a great deal of attention to technical expertise and beauty [13]. He shared his views on architecture in the two books he wrote: the first book was titled *Pasal-pasal Pengantar Fisika Bangunan* (1980) and the second *Wastu Citra* (1991).

In his first book, Mangunwijaya discusses the truthfulness in the works of nature within architecture and divides it into two groups: the first one is natural stipulation (sunlight, rain/humidity, wind, and earthquakes), and the second is natural comfort [14]. Through a correct observation of the works of nature, a great advantage in the form of comfort that is in harmony with nature would be achieved. Thus, however small the work created is, it must be in harmony with its usefulness in regards to the works of nature. Truthfulness in this aspect was crucial to Mangunwijaya. His second book contains in-depth expositions of the two words that pose as the title of the book, which are: **usability (*guna*)** and **imagery (*citra*)**. Usability and imagery are a unity within an architectural work, for it refers to the essence of creation. Usability refers to a civilization level, while imagery refers to a cultural level [15].



Figure 2. Four Case Studies of Mangunwijaya's Works. a. Saint Mary Assumpta Catholic Church, b. Duabelas Rasul Chapel, c. Bentara Budaya and d. Kuwera Guest House.

In a tectonic context, the words usability and imagery possess meanings that are in congruence with Boetticher's beliefs in regard to *core form* and *art form*, for both beliefs classify architectural works into a core form and beauty. One difference that may be raised between the two would be how Mangunwijaya viewed core form based on its "usability" while Boetticher viewed core form based on its "shape and arrangement." Tectonics, as viewed by Mangunwijaya, was not merely limited to matters related to the static durability of a structure. The essence of

tectonics lies in the sharp embodiment of logic in analyzing elements in relation with one another so that a building may be erected correctly in accordance with the laws of nature, ergo earning an ecclesiastical reward (*pahala*) in regard to the structure's beauty [15].

Mangunwijaya's architectural understanding— as reflected in both books— influenced many of his realized works. These works have sparked discourses due to the construction beauty they possess. Mangunwijaya's architectural principles— which respected construction and truthfulness while at the same time serving aesthetical purposes— embodied the true definition of the discourse on tectonics (*the art of construction*). This cements the understanding that Mangunwijaya heavily applied his tectonics principles within his works [16] [16]. Within the context of the hidden tectonics phenomenon, Mangunwijaya's tectonic works are fascinating to research, for, physically, his tectonic works are highly transparent and exposed. His construction ontology is out in the open and far from the concept of hidden tectonics.

2.3. Research Method

This research involves readings in the tectonic works of Mangunwijaya through several qualified case studies. It begins with observing the physical object of the visible and developing logical arguments as the basis of rationality, as stated by Groat [17] [17]. The research method used is the case study research, based on the case study research method as developed by Yin [1]. Opening with tectonics preposition, followed by consistently applying research protocols in case studies, this research will answer questions posed regarding the distinctiveness of Mangunwijaya's tectonics through a rational reading method.

2.3.1. Case Study

This research takes four of Mangunwijaya's works as its case studies, with the following criteria: constructional integrity, originality, construction materials, and construction specification. The first case study is Saint Mary Assumpta Catholic Church in Klaten (figure 2, a). This church was one of the earlier architectural works of Mangunwijaya's. Visually, the façade of this building exposes its unique materials and shape. Transparent innovations in regards to its construction materials— concrete, wood, and steel— are apparent. Tectonics display is prominent in structure and locality [18] [18]. This structure also possesses a high degree of originality. Mangunwijaya's involvement in this project is very dominant.

The second case study is Bentara Budaya Jakarta, Indonesia (figure 2, b). Bentara Budaya Jakarta is an example of an ideal Mangunwijaya work. Tectonic expression and the application of the logic of force are apparent in this structure. Visually, the application of the

logic of force can be seen in its concrete construction. This work showcases a tectonic combination of wooden and concrete materials. The originality shown in this work is pretty high. Mangunwijaya initiated the construction of this work exceptionally.

The third case study is Duabelas Rasul Chapel (figure 2, c), located in the pilgrimage complex of Sendangsono, Magelang, Indonesia. The application of concrete and wooden materials in the structure of this chapel is highly evident, and the structure boasts an impressively unique quality. This work showcases a high degree of originality and had been planned out gradually by Mangunwijaya (1969-1991).

The fourth case is Kuwera Guest House (figure 2, d), Yogyakarta, Indonesia. Mangunwijaya frequently accommodated Kuwera Guest House. This place was where most of his experiments on construction and their details took place. Thus, the structure itself highly bears the influence of Mangunwijaya. Visually, the construction work is visibly unique, with the dominant use of wood materials. Originality of the construction is undoubtedly high, for it showcases what might as well be the epitome of Mangunwijaya's application of technicality [19] [19].

2.3.2. Reading Method of Mangunwijaya's Tectonics

This research emphasizes the importance of tectonic reading, because, without a correct reading, we may slip and fall into a partial comprehension of tectonics and stray from the intrinsic understanding of tectonics. Thus, it is crucial to assemble a potentially effective reading method on tectonic works in architecture.

Departing from the ontology that results in representation, it would be suitable for a tectonic reading to begin from visible physical appearance (ontology). Through this physical appearance, one may identify core elements that would supply its representation. An observation into ontology requires the knowledge of the representation aspect one would want to aim for; without knowing which representation aspect one is aiming for, an ontological reading would be biased and undirected. Therefore, a mutually influential correlation between ontology and the representation aspects within a reading must be established. The reading method of Mangunwijaya's tectonics can be explained through a matrix that weaves together the roles of tectonic ontology with the aspects of tectonic representation.

Tectonic ontology, as previously discussed, is about the logic of force and techniques, while tectonic representation is about static truth, function, and beauty that are visible— therefore, it is able to be observed with the naked eye both on a structural/ construction level— as well as in terms of space and usability, and also visible shapes and ornaments. The reading method of Mangunwijaya's tectonics can be illustrated with a matrix in seven steps. (Figure 3)

In the first step, the representation of static truth is

observed upon the logic of force applied in the construction, the benchmark being the consistency of said truth and its autonomous capability as complete construction (step1).-In the second step, the static truth is observed on the materials, which consists of their suitability properties and the nature of the materials concerning their ability to support the load they carry. The more appropriate the material, the more ideal. (step 2). In the third step, the static truth of the techniques is observed used to connect these materials. The more appropriate a technique is in terms of the logic of force and the materials' nature, the more ideal (step 3).

In the fourth step, attention is paid to construction function, consisting of construction arrangement, choice of materials, and technique choices. The configuration of the three forms space function and usage function. A rational narrative explanation regarding these functions is done based on visible physical observation. The more rational a narrative of construction functionality is, the more ideal it is (step-4).

In the fifth step attention is paid to the beauty radiated by the logic of force, materials, and techniques; the beauty of configuration and form within the logic of force, along with the joints that weave them together. A high level of order and accuracy would result in a high level of idealism. Beauty is also readable (perceptible) within the character and the authenticity of construction material. Meanwhile, when it comes to techniques, beauty is readable through the techniques used in producing the materials, and the techniques used in connecting these materials. The

benchmark for beauty— that is reflected by the application of the logic of force upon the materials and techniques— would fall somewhere along the spectrum between humanism and machinery— depending on the context. So how exactly do these— the logic of force, materials, and techniques— react towards a context? And is the influence of context embedded in construction, or is it added? The more embedded a context is within a construction work, the more ideal it becomes. Meanwhile, the tendency to fall between humanism and machinery is optional. (step 5)

In the sixth step aestheticism contained within a construction is identified. As a consequence of the value of truth contained within a construction – functions retained and contexts that influence it— tectonic beauty are identified into three types: abstract beauty, rational beauty, and symbolical beauty. To identify does not necessarily mean to translate the meaning of these beauty. It instead means sorting through them based on a rational understanding; this was what Boetticher had done while studying Greek structures. The richer the beauty he managed to identify, the more ideal were these rational, abstract, or symbolical beauty (step-6). In the seventh step these identification results are summarized with idealism as its gradable benchmark. A rational judgment does not provide a value— it instead provides a position within the ideal range, so that every tectonic work in the case study would fall under a specific position within the ideal range (step-7).

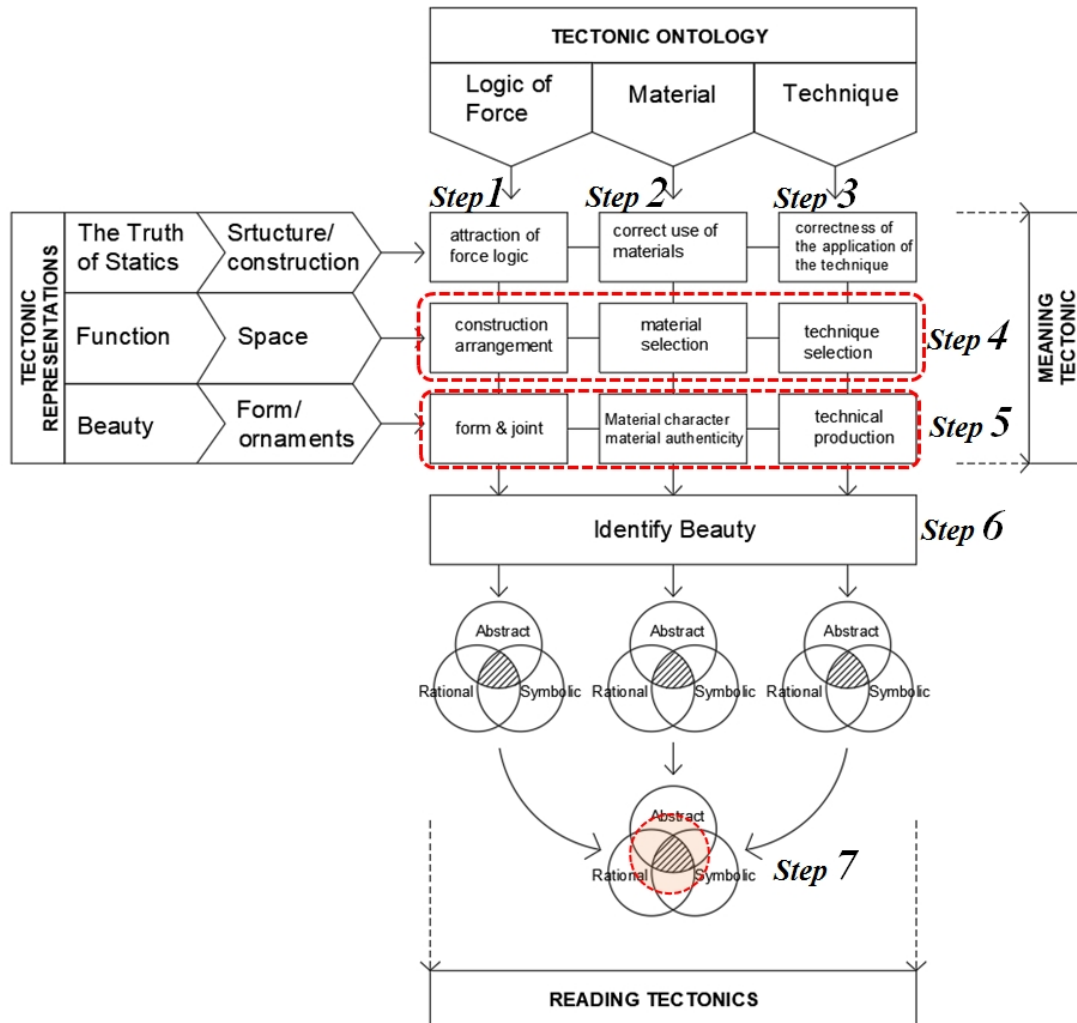


Figure 3. Matrix to the Reading Method of Manguwijaya's Tectonics

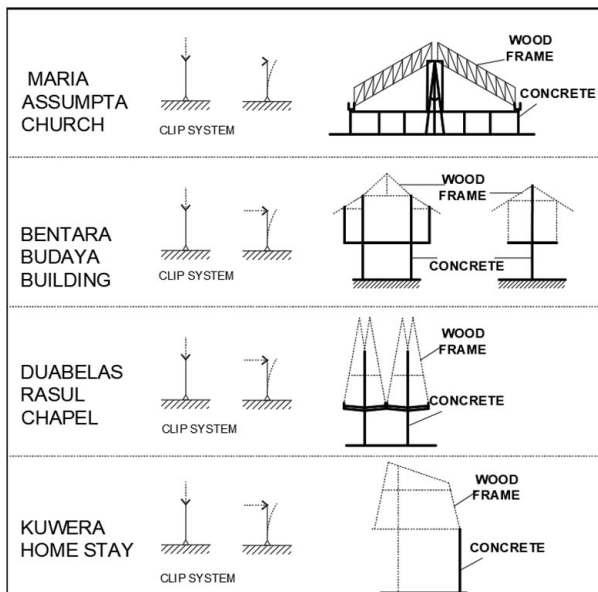


Figure 4. Construction System of Case Studies' Tectonics

3. Results and Discussion

3.1. Construction in Manguwijaya's Tectonics

Results obtained from the reading of static truth representation show that all of the objects of study represent their truth. Aside from containing truth, each application of the logic of force seems to have been developed attractively. These are where the pattern tendencies and principles that Manguwijaya developed show the most. Construction compositions he developed possess synergy between light construction (wood, steel) and heavy construction (concrete). The heavy construction supports the light through a construction autonomy with the same hierarchy to create shape and form (figure 4).

Materials for construction in Manguwijaya's tectonics play a significant role. Autonomy reflected in both light and heavy construction proves that. For example, utilizing wood as a light material with a pull force to evenly spread out the heavyweight concrete— meanwhile, the concrete

itself serves as a weighted pedestal that evenly distributes the load over the structure's foundation.

The techniques applied in Mangunwijaya's tectonics may be simple, but they are efficient and congruous with the logic of force and the materials used. The bolt and notch system in the wood joints is a simple yet functional technique. There appears to be nothing special in terms of Mangunwijaya's techniques, neither visually nor technically. The observation of Mangunwijaya's tectonics leads to the comprehension of truthfulness in construction and transparency in terms of the physical appearance of the construction work that represents this truth.

3.2. The Formation of Space in Mangunwijaya's Tectonics

The formation of readable space in Mangunwijaya's tectonics varies from one case study to another. In the Saint Mary Assumpta Catholic Church in Klaten, the formation of space prioritized creating an adequately vast space for the congregants, namely, the need for a wide-spread room. The effort to create this was done by constructing two main support beams with concrete. These support beams would carry a copiously heavy load, so a composition—made out of three beams that connect at the very top—was added (figure 6 -A). The shape of this three-legged support is particularly unique and draws attention to the construction. Upon these two support beams, there stretches a steel-framed block that poses as the support (ridge) of roof construction. The roof plane is in the shape of a hexagonal saddle, symmetrical and stable (figure 5 -A). Rationally, it is understandable why Mangunwijaya put forward construction durability in the construction of this wide-spread roof. The rest of the floor plan pattern was designed based on its users' needs: asymmetrically-patterned, built around the altar, and constructed with natural materials. Visually, the readable tectonics possesses a symbolical construction beauty.

The formation of space in the Bentara Budaya building was done with a small column span (3.5m x 3m), with a height distance of 3.5m per floor. This sort of column and height module is efficient in accommodating its function as a gallery. Circulation, constructed as wide as the distance between columns (3,5 m)—situated in the middle of the building—is spacious enough for four visitors to converge, while the 2m viewing distance from the gallery walls serves as an ideal distance for object observation (paintings). The construction of reinforced concrete is exposed, from columns to blocks and floor plates. The determination put in the effort to reflect the performance of load within the construction work is characteristic of tectonics of Bentara Budaya building. To showcase the performance of load support, construction is intentionally left exposed—from the reinforced concrete to the construction of its roof truss (figure 5 -B).

A particularly interesting space formation is readable in

the construction of the Duabelas Rasul Chapel in Sendangsono. The space of the building was constructed by combining space modules to form one bigger and unified space. The uniqueness of this construction on display lies in how every space module is supported by only one column, and this column can effectively hold the concrete load along with the light roofing above it. The education provided by this display is that a construction supported by a single column may be stable enough; however, a conjoint arrangement with other modules would provide even greater stability as well as a charming structure display. When it comes to this chapel, its construction consists of spaces, forms, along with details and ornaments (figure 5 – C).

The formation of space in the Kuwera Guest House varies greatly. The reason is that the spaces in the Kuwera Guest House were formed gradually—the same goes for its construction. Asymmetrical space patterns can be found here, designed according to the designated activities for each space. However, construction remains to be the priority in the formation of space. What is interesting about Kuwera Guest House is the construction of its roof, which plays a dual role, which is: (1) as an element to distribute the load of the roof, (2) as well as a wall border between spaces. The space created in the roof space is unique and interesting because it is rare to find in other places. Even though the building consists of overlapping construction due to partial space development, its construction character and the unique role of the main roof are sufficient in earning the Kuwera Homestay its tectonic character (figure 5 – D).

Space function is established through an efficient construction module, a relatively small gap between columns in accordance to the maximal module of simple construction (3-4 m). Duabelas Rasul Chapel, Kuwera Guest House, and the corridor of Bentara Budaya are examples of this. Furthermore, the arrangement of the spaces between columns and the overhang in Bentara Budaya's gallery is very proportionate. The spaces of Mangunwijaya's structures are made out of carefully planned construction arrangements and construction modules. This showcases how Mangunwijaya's tectonics puts forward construction as the element that forms space dimension. Furthermore, Mangunwijaya also proved that space can be created with the limitation set being construction itself, resulting in a space ambiance that would represent the construction's uniqueness. In his experiment on the Kuwera Homestay, Mangunwijaya did a copious amount of patchwork while developing space function. This resulted in a trademark space ambiance uniqueness embedded within the construction.

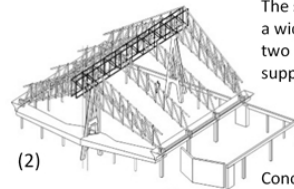
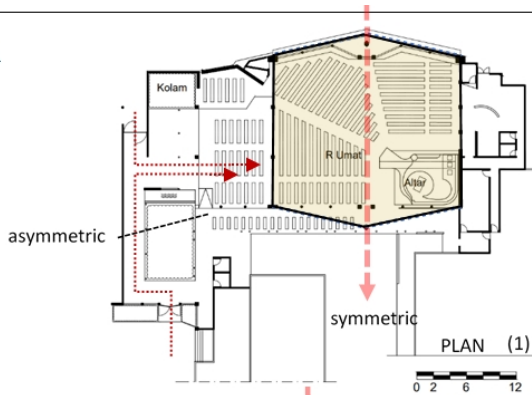
Usage function that has managed to be obtained from Mangunwijaya's tectonics has double functions: as both construction work and as a vessel to support activities, to shade from the sun, to serve as a barrier, and to shape functional details. The construction of the roof that

enables it to function as a wall as well, the construction of windows that also function as walls, and the construction of the mezzanine stairs in Kuwera Guet House, are some of the examples. The same thing also applies to Bentara Budaya's corridor that utilizes column bases as seats, with

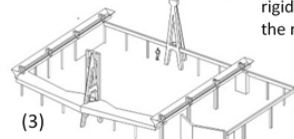
molded concrete blocks also serving as human-scaled ceilings. Mangunwijaya's tectonics does not only possess a space function— it also plays a part in other functions, such as usage function and other rational functions— all posing as part of a construction.

3.3. Forms and Ornaments in Mangunwijaya's Tectonics

MARIA ASSUMPTA CHURCH, KLATEN



The steel construction forms a wide span space, resting on two unique concrete supports

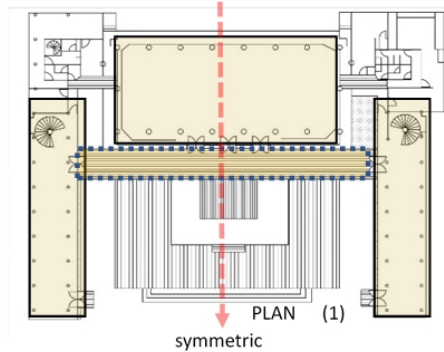


Concrete construction as a rigid material that supports the roof frame.

CONSTRUCTION AND SPACE

A

BENTARA BUDAYA GALLERY, JAKARTA

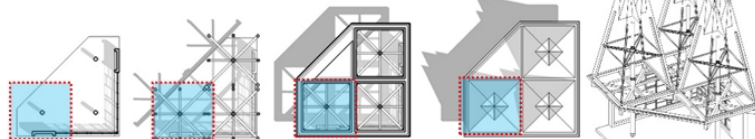


Konstruksi beton sebagai bahan kaku yang menopang rangka atap yang ringan (kayu). Rangka konstruksi diekspose dengan baik, baik bahan beton maupun kayu

CONSTRUCTION AND SPACE (2)

B

DUABELAS RASUL CHAPEL, SENDANGSONO MAGELANG

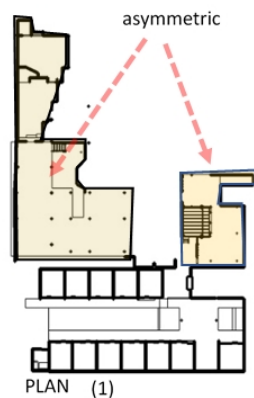


Konstruksi dikembangkan mengikuti modul yang efisien. Bentang ruang diperoleh melalui gabungan tiga modul yang serupa. Bangunan ini efektif ditopang oleh hanya tiga kolom.

CONSTRUCTION AND SPACE (2)

C

KUWERA HOMESTAY, YOGYAKARTA



Construction is developed in stages, following the needs, there are many variations of space formed by construction.

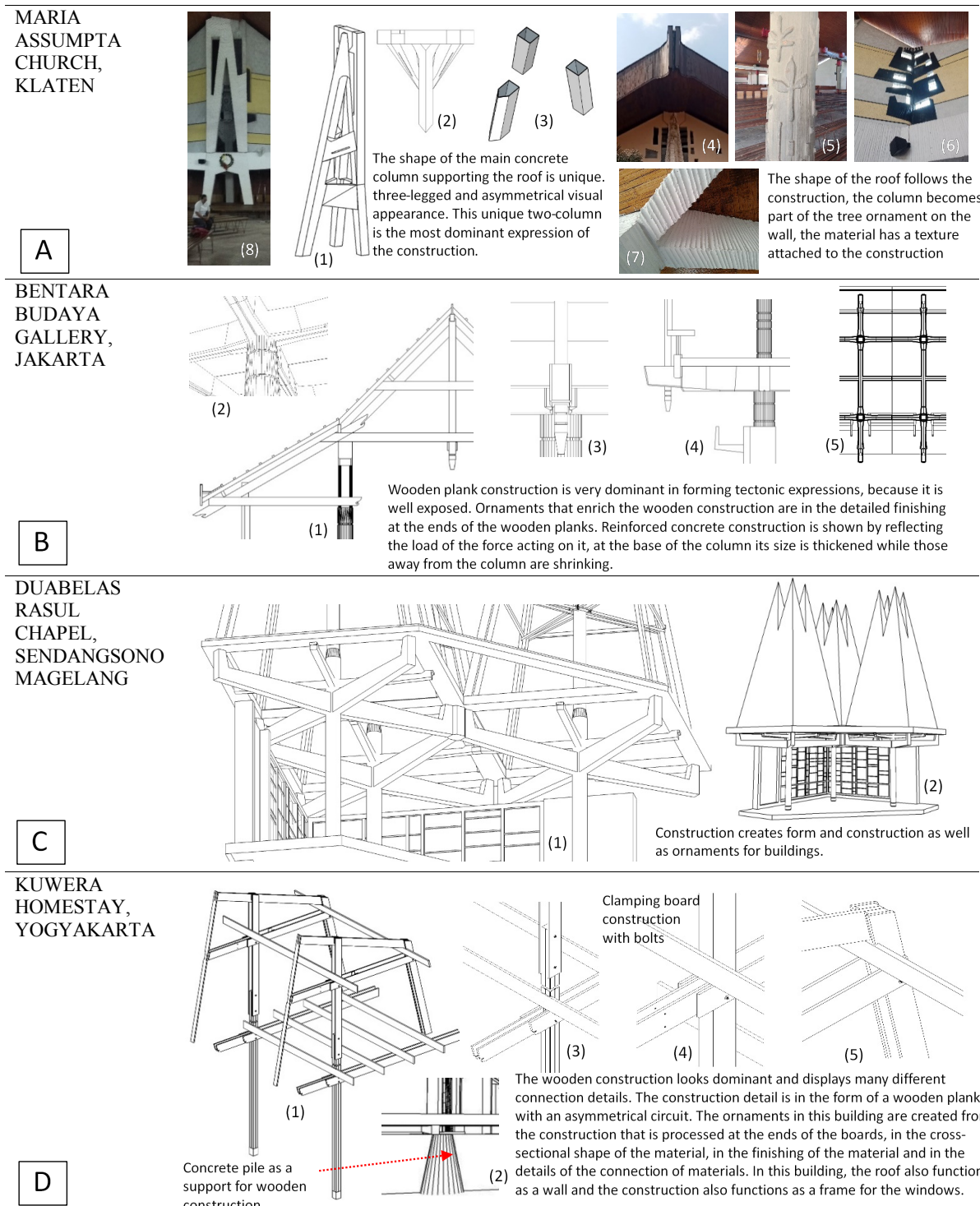
CONSTRUCTION AND SPACE (2)

D

Figure 5. Construction and Space in Mangunwijaya Tectonic Works

Observation of spaces in Mangunwijaya's tectonics results in the knowledge that space is formed due to construction. The observation of forms and ornaments also proves that the two are formed due to construction as well. Ornaments in Mangunwijaya's works serve as visual enrichments embedded in construction. As discovered in the Saint Mary Assumpta Catholic Church, the main support for the roof construction is the triangular-shaped

concrete frame. This particular shape is highly unique because it manages to serve the same function with a different shape compared to common-construction-support beams; as for the ornaments, they can be found on the concrete columns, in the pronounced application of material textures, and the choice of the round cross-sectional shape of the column (figure 6 – A)



The ornaments of Bentara Budaya's tectonics can be seen in the connective elements of its construction. Ornaments upon the wooden materials can be seen in the construction knots and on the edges of the straining beams. While on the concrete materials, ornaments are seen in the intersection between blocks to columns and on the overhangs. The shape of the ornaments on the edges of the beams has become a trademark trait of Mangunwijaya's ornaments. This sort of ornament shape can be repeatedly seen in many of his other works, unlike the ornaments on the intersections between blocks to columns and the overhangs that can only be found in Bentara Budaya. Mangunwijaya managed to visually express how heavy load is supported by the concrete blocks, while at the same time creating ornaments out of these same parts (figure 6 -B).

Ornaments on the Duabelas Rasul Chapel's tectonics are formed by the modular, repetitive, and leveled construction of the overhangs. The construction of this chapel reflects the logic behind load distribution from an overhang to a column. By combining three construction units into one unified form, construction form of the building ends up looking intricate and unique. This intricacy results in the construction functioning as an ornament as well. In addition, impressions on these ornaments are also strengthened by the addition of textures embedded within the construction. This is particularly apparent in the concrete materials, which showcase the characters of the concrete molds used (figure 6 - C).

Ornaments on Kuwera Guest House's tectonics are not too significantly pronounced. What is notably significant is the rich construction variety, which manages to display various construction connectors, especially the details on the straining beams' connectors. It can be seen on details of several connectors that construction was gradually expanded along with the developments of the spaces needed. Even though this comes across as experimental, construction details are still able to be held rationally accountable. The construction of the Kuwera Guest House's tectonics supplies its observers with the education that construction alone can invent particular trademarks in the creation of space, resulting in spaces that are embedded in the construction (figure 6 - D).

All four observed case studies find that the forms found in Mangunwijaya's tectonics are particularly unique to their respective constructions as a whole, while all four observed case studies find that the forms found in Mangunwijaya's tectonics are particularly unique to their respective constructions as a whole, while the ornaments on his tectonics serve as parts of the construction that have been enriched (figure 7). If one were to be associated with Boetticher's theory, Mangunwijaya's tectonics is considered rational in nature, for it is embedded within his construction works instead of serving as a separate addition.

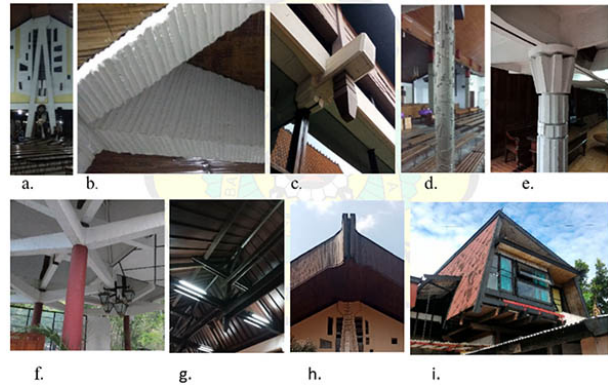


Figure 7. The symbolical beauty embedded within the construction: symbolical column shape (a), texture attached to its material (b), the console that showcases the load (c), the round and textured columns, (d) column heads that reflect the construction function, (e) the showcase of the logic of force, console beams placed on a single column (f), wood truss system (g), roof fascia that follows the shape of the roof (h), asymmetrical building construction (i)

3.4. Identifying Beauty in Mangunwijaya's Tectonics

The reading into the beauty function of Mangunwijaya's tectonics results in the culmination of strong abstract beauty enriched by an abundance of rational beauty, while the symbolical beauty found in Mangunwijaya's works are specific in nature since they originated from rational beauty. The symbolical beauty is not independent, nor is it separate from construction—instead, it is an expression of rational beauty that is inseparable from construction. The initial identification of symbolical beauty can be found in construction arrangements, which is the configuration of load distribution. Said configuration, aside from possessing a highly rational side that provides cognitive enrichment, also possesses a symbolic side that shows through the shape composition of the structure itself. Symmetrical or asymmetrical pattern formation is one of the examples of symbolical beauty. In the tectonics of Kuwera Guest House, the symbolical beauty lies in the asymmetrical composition of the main construction (figure 5-i). Meanwhile, in Bentara Budaya and Duabelas Rasul Chapel, symbolical beauty is found in their symmetrical compositions (figure 5-h). On the roof construction of Saint Mary Assumpta Catholic Church, the symbolical beauty lies in the attractive and symmetrical shape composition; meanwhile, in the main supporting column of the building, the symbolical beauty is found in its asymmetrical composition (figure 5-a).

The symbolical beauty in Mangunwijaya's tectonic works is at display through a combination of materials and techniques that are complementarily inseparable from construction. Even when a material or technique already contributed in the form of rational beauty—in practice, at the same time, they also indirectly provide symbolical beauty for a construction work. What is unique about Mangunwijaya's tectonic constructions is that materials

and techniques have two roles in creating tectonic beauty; this may be the case whenever rational and symbolical beauty are both embedded in a structure.

What further enriches the symbolical beauty of Mangunwijaya's tectonic works are the contexts that influence the forming of the materials and the techniques applied. In this case, context is what triggers the existence of symbolical beauty. Without context, the symbolical beauty on a tectonic work would decline, leaving rational and abstract beauty on sight. The existence of context to influence materials and techniques enriches symbolical beauty. For example, in the case study of Saint Mary Assumpta Catholic Church, the exposed materials (especially concrete) were presented in unique manners (textured), and it was clear that these materials were exposed deliberately. Simply by observing the exposed material, the technique used to construct is immediately apparent (context); it involves a simple application of logic, namely by using bamboo formwork to reinforce concrete molds. The skewed final look— for the dried concrete follows the varying shapes of the bamboo— raises a series of rational conjectures.

3.5. Mangunwijaya's Tectonics Representations

Reading into tectonics through visible physical ontology fruitfully results in the identification of the roles of the elements that construct tectonics, which are: the logic of force, materials, and techniques. By identifying these elements, one can finally explain the tectonic representations that radiate through these forming elements.

3.5.1. As Rational, Symbolical Works

The rational reading of Mangunwijaya's tectonic works concludes that rationality can be identified comprehensively and vastly— not only on construction function, but also on space function, usage function, and beauty function. The rational reading was also able to identify the symbolical beauty embedded in the constructions. These two findings lead to the understanding that Mangunwijaya's tectonic works are inherently rational and symbolical, and, technically— and visibly— display a set of unified, cohesive, tectonic objects. A question that arose following the reading was, in tectonics, how could symbolical values possibly enrich rationality? The answer to that question lies in the context that influences an object; specifically, in the factors that influence the processing of materials and technicality that, aside from being logical, are also embedded in the construction. Mangunwijaya preferred to utilize simple materials-processing and techniques: layering concrete over certain formworks (rounded shapes or certain textures), the particular arrangements of bricks, using timber to construct the frames and joints. Mangunwijaya was partial to the construction of trusses, even going as far

as assembling double-layered trusses (Kuwera Guet House). Finishings of the constructions are enriched without getting their functions degraded— all of these are the things that signify the symbolical beauty of Mangunwijaya's tectonics.

Symbolical beauty embedded in the construction is part of the internal context— characteristic of Mangunwijaya. Beauty composition which occurs after its relations with abstract beauty, rational beauty, and symbolical beauty has seven possibilities: 1). Abstract-dominant, 2). Rational-dominant, 3). Symbolical-dominant, 4). Rational-and-symbolical-dominant, 5). Abstract-and-symbolic-dominant, 6). Abstract-and-rational-dominant, and 7). Abstract-rational-and-symbolic-dominant. Observation results of Mangunwijaya's tectonics on the chosen case studies show that Mangunwijaya's tectonics fall into two possibilities: rational-and-symbolical-dominant (Saint Mary Assumpta Catholic Church, Duabelas Rasul Chapel, and Kuwera Guet House) and: abstract-rational-and-symbolical-dominant (Bentara Budaya), as shown in Figure 8.

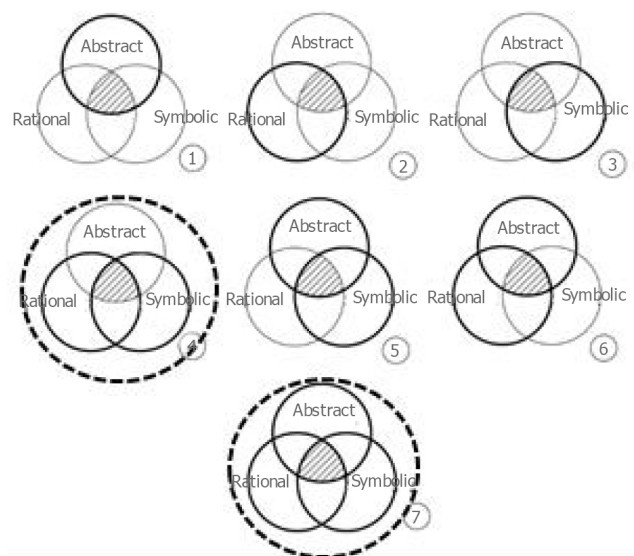


Figure 8. Mangunwijaya's Tectonic Tendencies: rational and symbolical

3.5.2. Craftsmanship and Naturalism

Mangunwijaya's tectonics stands out in two elements: (1) materials and, (2) the techniques used to construct these materials. Both support each other in the creation of a construction. Materials are categorized as either natural or artificial, while techniques are categorized as manual expertise and machine sophistication. Materials serve as dominant physical elements, molded with specific, truthful, and visibly logical forming techniques.

It is physically apparent how workers' expertise (in construction) holds a crucial role in inventing expression within a work. The carefully arranged bamboo formwork

(albeit varying in size) in the concrete construction of Saint Mary Assumpta Catholic church proves that. The organized arrangement of bamboo formwork (albeit varying in size) on the concrete construction of Saint Mary Assumpta Catholic church proves that. Craftsmanship was relied on in terms of pronouncing the expression of these materials. Construction materials became— not only original— symbolical through the simple technical application. Correlation between materials and techniques found in Mangunwijaya’s tectonics can be explained through the following combination: craftsmanship – nature, craftsmanship – artificial, machinery – nature, and machinery – artificial. Mangunwijaya’s tectonics, however, tends to showcase this particular combination: craftsmanship – nature. (Figure 9)

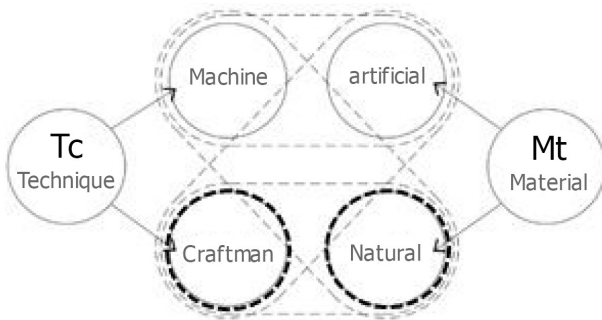


Figure 9. Tendencies of Materials and Techniques Representations

3.5.3. Human Skills and Simple Technology

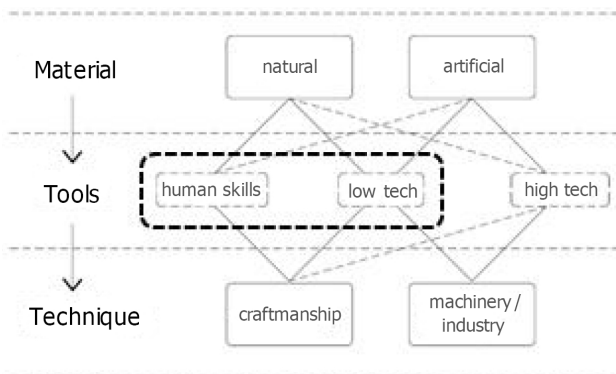


Figure 10. Tools and Technology that Mangunwijaya tended to use

Research results show that the relation between materials and techniques in Mangunwijaya’s tectonics is dynamic in nature because the two elements have resulted in the invention of numerous alternatives in solving construction problems. Mangunwijaya optimally seized this dynamic nature as an opportunity to express his creativity. He opted to use simple methods in assembling and processing the construction materials. Judging from the range of the tools he used, it was concluded that Mangunwijaya tended to rely on human skills and simple technologies to construct the representations of his

tectonic work. Advanced technology was nowhere to be found within his tectonic works. The position of Mangunwijaya’s tectonics in the context of materials – tools - techniques is explained through the diagram below: (Figure 10)

3.5.4. Openness and Readability

Mangunwijaya’s tectonic works possess high values of openness. Almost all of his tectonic works consist of exposed spaces. They were constructed with great expertise and are worthy of appraisal. The construction arrangements, the openness of materials, and techniques processing exude how Mangunwijaya was open to educating architectural truth and construction beauty to observers. Openness is part of tectonic autonomy; without openness, tectonic beauty cannot be appreciated. In several architecture cases, tectonics are hidden in the shape display of a structure (hidden tectonics). In one of his works (Saint Mary Assumpta Catholic Church in Klaten), the steel roof construction is deliberately not in display. The construction is neatly encased by the roof above it and the ceiling below it. This raises the question regarding Mangunwijaya’s consistency in regard to construction openness. In some of his architectural works, the display of shapes is visibly more dominant in comparison to construction— provided that it is within reason, of course.

3.5.5. Transcendence

Transcendence in Mangunwijaya’s tectonic beauty is especially identifiable through the static truth shown in a construction. The static truth contained within a construction arrangement provides a universal, logical comprehension that can be accepted by all (undebatable). Transcendental value in Mangunwijaya’s tectonic beauty is also strengthened by material expression and technicality that corresponds with universal values. The utilization of natural materials such as natural stones and bricks in an exposed manner establishes a universal transcendental value. Meanwhile, a technical application that prioritizes simplicity in method and work strategy may also provide universal beauty, exuded by their humanistic values. Despite the varying degrees, transcendental values in Mangunwijaya’s works are always perceptible. Transcendence becomes most apparent in Mangunwijaya’s work when said work showcases transparent visual openness that is “truthful” through exposures of materials, technicality, and construction arrangement.

3.6. Discussion

This research attempts to conduct a reading of Mangunwijaya’s tectonic works, which is proven to be fruitful. The result is the discovery of a reading method

towards the rationality of Mangunwijaya's tectonic constructions. This research also results in the conviction that said reading method is sufficient for reading Mangunwijaya's tectonic rationality. The reading method specifically developed to read Mangunwijaya's tectonics demands several preliminary comprehensions regarding Mangunwijaya's tectonics, which consist of the comprehension of Mangunwijaya's tectonic ontology as well as the comprehension towards rational contexts that affect the distinctiveness of Mangunwijaya's tectonics.

3.6.1. Mangunwijaya's Tectonic Ontology

The reading of Mangunwijaya's tectonics provides the understanding that the physical ontology of tectonic works has a broader dimension beyond serving as physical objects. This is because tectonic constructions contain values of truth dynamically appreciated through the creativity of the logic of force, materials, and techniques. Philosophically, tectonic ontology adheres to dualism, the belief that an object possesses two core values, the physical and non-physical, much like how humans have body and soul. This research shows that tectonic ontology—in an operational context—comprises tactile elements of construction and beauty values. Tactile elements can be found in materials and assembly techniques in construction, while beauty can be found in physical representation of a structure. A thorough observation of physical representations of tectonics resulted in two beauty categories: (1) truth-based beauty, and (2) symbolical beauty. Truth-based beauty is then divided into two: abstract beauty and rational beauty. A deep comprehension in regard to the essence of tectonics brings this dualism of tectonic ontology to a new ontological existence—a missing piece of the preexisting dualism, to bridge further understanding. Based on symbolical classifications, tectonic ontology is not purely dualistic and instead falls under the third symbolical category: physical-transition and non-physical [20][20]. The physical face is tectonics as a tactile material, while the transition face is the two-faced sides of truth that can be observed both objectively and subjectively, and the non-physical face is the visible symbolical representation.

Tectonics as an applied artwork is special in terms of context because it possesses the main context that influences its creation, which is the value of truth (static truth), along with other non-aesthetic contexts, such as social structure, cultural influence, economical situation, function, purpose, and so on. Tectonics and truth are a unity that constructs beauty. Without truth, a tectonic work cannot be appreciated and is deemed incomplete. Truth is the spirit of tectonics; hence, tectonic reading must be initiated by observing the value of truth before observing other elements that influence tectonics.

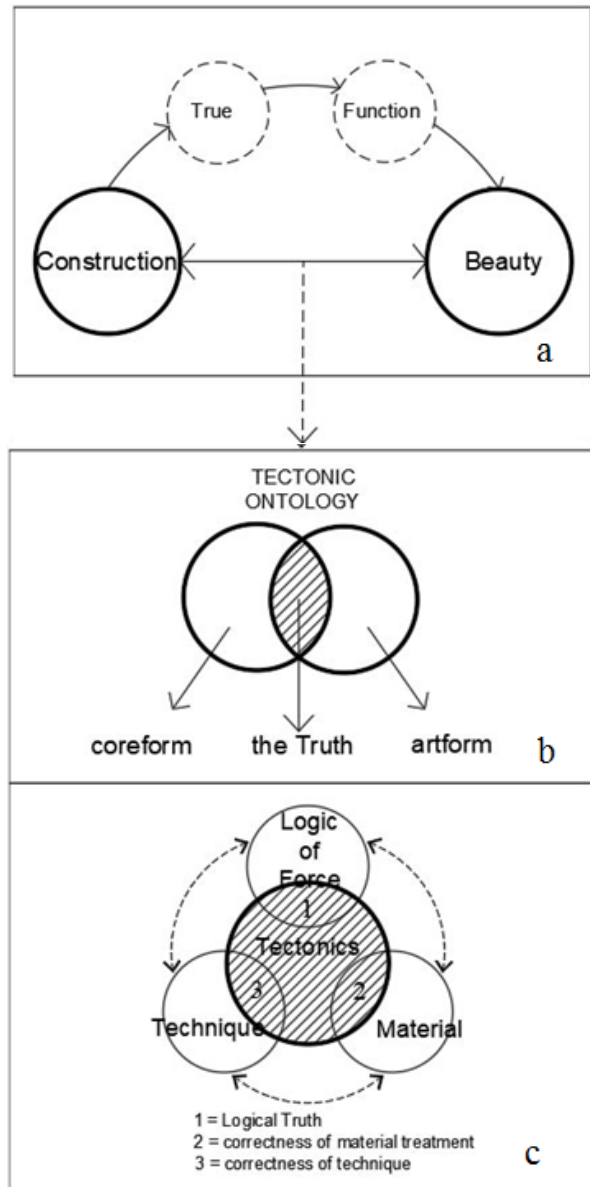


Figure 11. Mangunwijaya's Tectonic Ontology: coreform – the Truth – artform

The visual appearance of tectonic materials and techniques on Mangunwijaya's constructions are highly expressive, and they provide symbolical meaning for construction as a whole; this shows how dominant the roles of materials and techniques play in the creation of beauty. However, said beauty would not radiate when the materials and techniques used do not contain truth (for example, if the application of a material is not suitable to its nature and character or if the application technique is incorrect). This goes to show that the value of truth in tectonics does not only show through the logic of force but also materials and techniques; the relation between the logic of force, materials, and techniques in tectonics is shown in the diagram (figure 11.c). Tectonics serves as the truth of the logic of force, materials, and techniques within the unity of construction. Truth, which is placed

inside the tectonics circle shows the limits of truth within the context of a tectonic work and does not represent the truth in a universal context. The limit shown in the diagram is the threshold of conformity in proper tectonic work. Outside the threshold of truth, the logic of force, materials, and technique may enrich tectonics. Not every element would receive equal enrichment; one may be more dominant than the other.

This research proposes a discourse on the enrichment of tectonics ontology, which is the idea that tectonics ontology is made out of not only core form and art form (a dualism) but core form- the truth – art form (figure. 9-a, b) Both branches contain the truth, therefore binding dualism under the same level in the hierarchy. The act of reading into tectonic works should advisably be paired with reading into both branches, for within them lie beauty choices that can be narrated rationally.

3.6.2. Context in Tectonics

The research conducted discovered that context plays a crucial role in tectonic works. Context enriches tectonics, one of the aspects influenced being its rationality. The context that influences rationality in tectonics is called the rational context. During a tectonic enrichment, rational context explains construction arrangements, materials and techniques applied; the enrichment in the discussion being construction enrichment, which is done so that construction may not only serve its basic construction function, but also other functions such as its space function, usage function, and beauty function. Physically, enrichment caused by the rational context would be embedded in the construction. The rational context built out of a physical reading of tectonics would be gradationally dynamic in nature. A work of tectonics may exist in varying rational contexts, dependent on the physical condition and the amount of rationality it contains. This rational context dynamic is readable within the construction and a rational reading does not expand its scope in terms of the truth within a construction process (which may either be the same or different from the rational context being built). However, the rational context is rationally testable and is capable of being narrated rationally.

3.6.3. Difference between Reading and Appreciation in Tectonics

The research done into Mangunwijaya's tectonics shows that a reading process is dissimilar to the process of appreciating a tectonic work. The act of reading is rational, and identificative, which refers to ontology, while appreciation is an effort to provide meaning, which involves feelings, a comprehensive experience, which refers to representation. In tectonics, the two (ontology dan representation) are a whole unity; the interdependence between the two is as solid as their integrity, making what is visible to be what is implied. Without an extensive

understanding of tectonic ontology, the appreciation towards tectonics would only stretch as far as the observer's experience and would tend to stray away from the essence of tectonics itself. On the other hand, when the tectonic ontology is extensively understood, the appreciation in result would be orderly and exist within the tectonic discourse. The currently-developing tectonic discussion requires a more extensive ontology understanding, amidst the ever-evolving technological representations. Fabrication may be becoming more advanced, yet all the more undignified the technicalities and craftsmanship all the same, having been consumed in a promising result-oriented drive. Mangunwijaya's tectonic works encourage us to rekindle our understanding of humans as subjects, who inherently possess values of beauty, both innately and within their works.

4. Conclusions

Mangunwijaya's architectural works are very distinctive in the context of Indonesian architecture, due to the strong tectonic expressions. Through tectonics, Mangunwijaya entrusted his architectural beauty. Mangunwijaya's tectonic works are highly complex— it would take a scrupulously assembled reading method to properly understand them. They consist of physical tectonic elements and their representations.

Understanding Mangunwijaya's tectonic ontology can be done by studying the physical elements that construct tectonics, and the truth embedded in them. These elements are the logic of force, materials, and techniques. The truth of the logic of force can be observed in the arrangement of a construction, the truth of the materials can be observed in the way the materials are treated, and the truth of techniques can be observed on the truthfulness contained during the technical applications.

Mangunwijaya's tectonic rationality can be understood through the physical elements of tectonics influenced by rational contexts. A rational context is a context that enriches construction and possesses a strong rational narration. A rational context would explain tectonic rationality in carrying construction function, space function, usage function, and beauty function. Tectonic rationality is also marked by the embedded enrichment within a construction.

Tectonics' reading method can be built by analyzing the relationship between the physical elements that construct tectonics with the faces of its representation, which are: static truth, function, and beauty. A thorough, rounded relationship between these faces would enable the elaboration of tectonics in all aspects that it possesses. This reading method results in a gradational reading. The analysis can be used to position the distinctiveness of tectonics.

The reading of tectonics— with ontological and rational

comprehension and an arranged reading method— resulted in the discovery of unique qualities on Mangunwijaya's tectonics, as well as the perception of his works as both rational and symbolical. Mangunwijaya inserted internal contexts to enrich his tectonics through unique materials processing (especially his application of exposed, reinforced concrete), low-tech tools, the selection of natural materials, and techniques that relied heavily on craftsmanship. Mangunwijaya let his tectonic works appear exposed— truthfully and transparently— so that every observer may appreciate the value of truth radiating out of every work, which leads to transcendence. The beauty of Mangunwijaya's tectonics is in its rationality; therefore, Mangunwijaya's tectonic works can be appreciated physically without having to learn the architectural processes nor the history that influenced them.

The choice to process context in an embedded manner in tectonics is a crucial point in tectonics comprehension. This choice keeps the consistency of tectonics as the art of construction. Failure in turning the influence of context into an embedded value within construction would cause the observer to miss the appreciation of rational tectonic beauty and would cut off the chain of tectonic consistency as "the art of construction."

Reading into the rationality of tectonics through visible physical appearance is a dynamic process because the reading results would be gradational and unique— open to interpretation within the corridor of tectonics discourse. Results of the reading into Mangunwijaya's tectonics revert to a statement that Mangunwijaya stood by, which was: *Pulchrum splendor est Veritatis* (beauty is the emanation of truth). This statement is closely related to Mangunwijaya's consistency in truthfulness, and the subsequent beauty (beauty) earned from said truth. Hence, to read Mangunwijaya's tectonics would lead to the acquiescence of the essence of tectonics: the integrity of truth and beauty as they are. Its truthfulness is not faded by distracting elements but is strengthened by what can be created in correspondence to say the truth, for tectonics as a product, to be able to radiate its beauty according to the physical potential it possesses.

Finally, everything that has been discussed in this research reverts to Mangunwijaya's beliefs regarding usability and imagery (*guna dan Citra*). Tectonics is the frame for usage. Usability supports imagery, while imagery enriches usability. They are always in harmony: tectonics and imagery – usability and imagery – *wastu* and imagery.

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(2016-2021) titled: *Membaca Rasionalitas Tektonika Karya Mangunwijaya*. Previously, part of this dissertation article has been published through the proceedings of ARTESH (*Arts for Technology Science and Humanities*), the first international conference held on 30 November - 2 December 2018, held by Bandung Institute of Technology, pages 736-742, with the title *Material and Technique as A Dynamic Potential of Art of Construction in Mangunwijaya's Tectonic Masterpiece. Case Study: Maria Assumpta Church, Klaten Indonesia*.

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