IEREK PRESS
Academic Research Community

http://www.press.ierek.com

ARChive

CrossMark

ISSN (Print: 2537-0154, online: 2537-0162)

International Journal on:

The Academic Research Community Publication

DOI: 10.21625/archive.v2i4.367

Material's Perception Strategy in Terms of Adaptive Re-use Within the Computational, and Parametricism Context

Sarah Mohammad Mansour[1]

[1] *PhD of interior architecture ,Faulty of fine Arts,Décor department, Alexandria University.*

Abstract

Creativity has been assigned to the design or drawing, with materials most often being specified as a result of design rather than being considered a driver of it. (i)

Designers empowered by new technology now consider form as it is defined by identifiable systems. This evidence based, parametric methodology is a response to two decades of digitally-derived projects, often produced simply for their novelty. (ii)

The best work results when the architect has combined respect for the old with a skilled progressive command of the new.

Material culture is portrayed as the physical confirmation and articulation of a culture in its relics and design. In the time that we comprehend the thought of material culture not just as having importance for investigations of the past. Yet in addition getting a projective limit. wW may now be at a critical defining moment.. As computation starts to significantly change our origination of the material, so in architecture this will defy the set up connection between the procedures of design and the physical fabrication of the constructed medium . Obviously, computation was brought into design & architecture the greater part a century back. Furthermore, expanding digitization has since plagued all parts of the field.

As though, it has remained emphatically impacted by the theoretical isolation of the procedures of design and making that has overwhelmed structural plan thinking since the Renaissance, and it is just now that creators are starting to deal with the computational void as never again disconnecting from the physical domain.

Keywords

Adaptive-reuse; parametric design; laser cut; Biodegradable materials; Sustainability; computational; 3d printing.

1. Introduction

1.1. Background and Motivation

This paper is presenting an investigation about the truth about materials, as the using of old traditional materials in the terms of preservation depends on its way of Processing and behavior. Traditional old materials make a conflicted perception about the new and the old parts in the space, **but,** it could be processed with a new processing methods, using digital computation driven tools. **For the final design output**, could coin a mutational adaptive space, on a certain level of insane complexity. We can call it (Insanely – Adaptive). This term will conduct Old

abandoned space and the tradition approaches of adaptive reuse to a new phase and upward its level to be parametrically enhanced. Enhancement will involve both functionality and aesthetics values, a generative unfolding of material behavior in **space and time** from which hitherto unsought design possibilities could originate. Fulfillment new design possibilities and innovation in making, as sometimes the final output could look historical, though the creation process was not a historical one. As NerI Oxman (iv) **Stated *"The future of architecture lies in design that incorporates the systems and materials of nature*."**

So we need to have a new perspective in our dealing with materials in the terms of adaptive re-use within this computational era**.**

2. History Synthesis

2.1. Driving Force for Technical Innovation

Just a couple of remarkable cases of architectural compositional styles consolidated in a solitary building exist generally. New structures tended to rub out old ones, and those structures that survive are the fittest cases of compositional Architectural styles that won when they were assembled. Styles changed gradually finished the course of design history, and dissimilar to today, structures built inside a specific decade—and now and again inside a given century—are comparable in appearance.

Today, style assignments have small importance, current works don't fit into an effectively conspicuous complex example, and contemporary engineering outline dispositions are definitely not static. It is educational to take a gander at extremely old cases of building combination through current eyes. 1-The Duomo at Siracusa in Sicily comprises of a mix of three design elements, (Fig 1) spreading over more than two thousand years. The most seasoned part is Greek Doric, a style dating from around 500 BCE. A Romanesque nave and second story in all probability supplanted the top of the Doric sanctuary amid the Norman time frame (eleventh century), and a rococo exterior and apse were included after an earthquake in 1693. Juxtapositions of these three particular styles are unmistakable from different vantage focuses both inside and outside of the church building.

Regardless of the huge time traverses between the increases of progressive components, the engineering creation isn't divided. Maybe on the grounds that each of the three components are of comparable shading and were built utilizing comparative materials, the diverse times are not instantly seen. Moreover, each of the three bits was attached as a way to a similar end—making the most critical religious working in the city. Since the elaborate veneer is the predominant component, the house of God looks, at first look, similar to a normal Sicilian church developed amid the late Renaissance

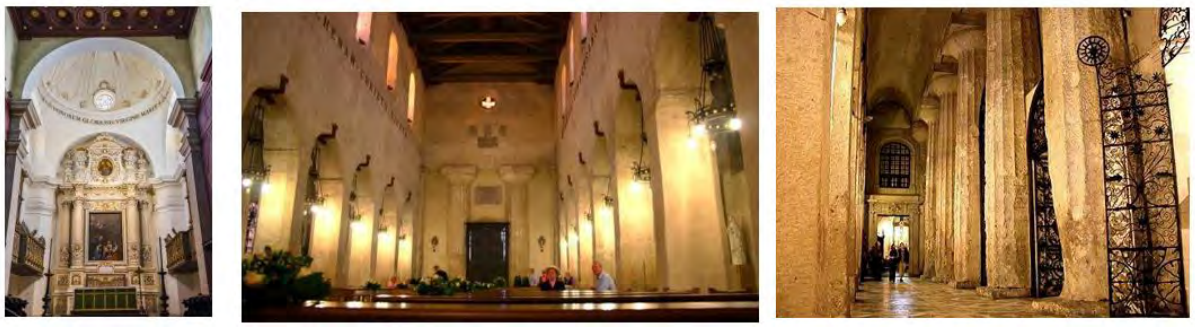

Figure 1. At the Duomo at Syracuse, three unmistakable styles—Greek Doric, Romanesque, and florid—are obvious from different vantages of the house of prayer. The design forbear of the house of prayer feels durable in spite of the dissimilar styles (vi)

Another significance logical inconsistency, on the perception view of the space is:

2- The Mosque at Córdoba, Spain, (Fig 2) inspires an alternate visual reaction. The site was initially a Christian church, worked by the Visigoths around 500 CE, yet was supplanted by a Muslim mosque around 800 CE. The

mosque is rectangular in plan and comprises of arcades included brilliantly hued, twofold horseshoe-formed curves, bolstered by thin segments. Córdoba came back to Christian mastery in the thirteenth century, and around 1525, a Gothic nave was embedded into the focal point of the mosque.

Structurally, the inclusion is limit—the steed shoe curves obviously slam into the Gothic fan vaulting. Shafts of sunlight puncture the dull creation of the mosque in a sensational way, however in the congregation, sunshine enlightenment is splendid and uniform.

The differentiation between the two structural styles couldn't be more articulated, reverberating maybe the contrasts between the religious convictions that won in the sixteenth century.

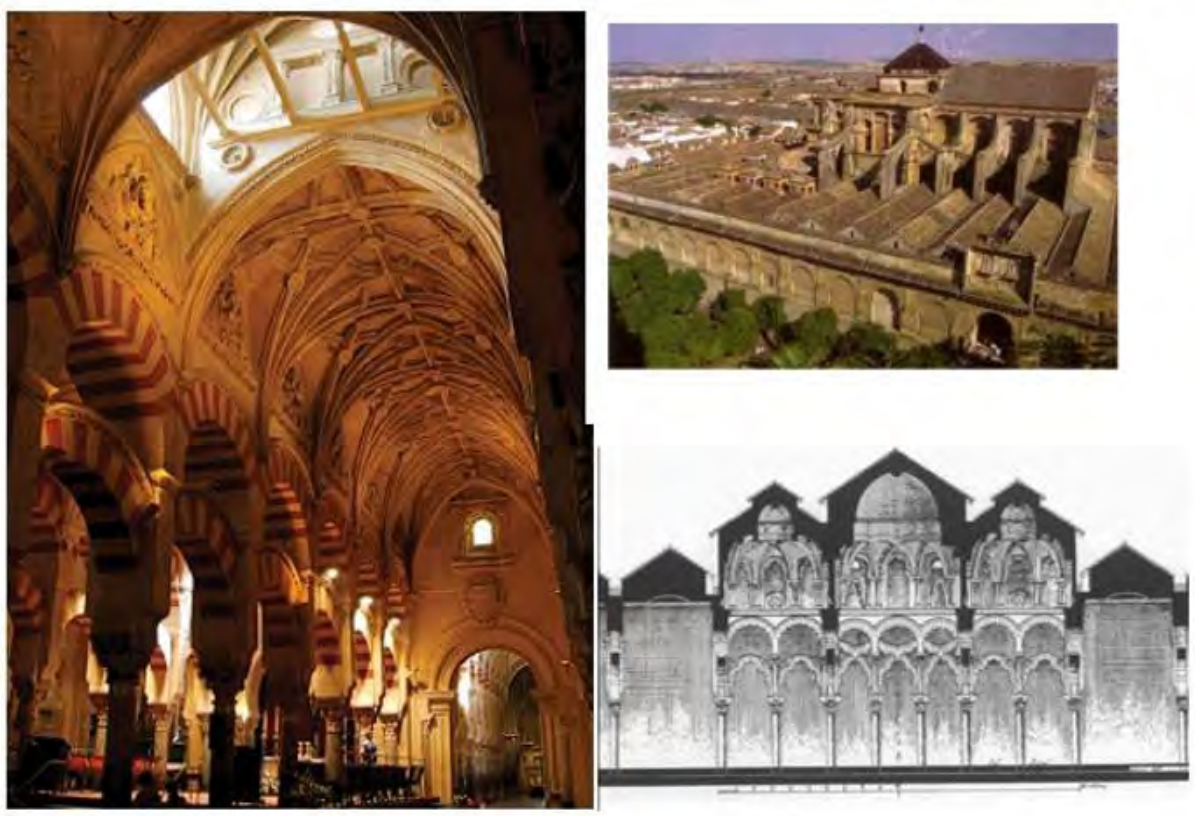

Figure 2. At the Mosque at Cordoba, the two structural styles are unmistakably separated and articulated. The addition of new into old is limit—the Gothic fan vaulting slams into the horseshoe curves.

In both the Duomo at Syracuse and the Mosque at Cordoba , the designer of the more up to date parts of the structures did not browse a variety of conceivable styles: they essentially utilized the style that won at the time . The distinctions amongst new and old curve uncovered through genuinely expressed contrast. Unobtrusive in Syracuse and unforgiving and obvious in Cordoba.

A time stamp must be unmistakably identifiable on both parts (New & Old)

3. Material Synthesis

In the past two examples , we have reached that in the first one (The Duomo at Syracuse) That the subtle difference in choosing the same materials and colors in the preservation phase in the different three eras has led to a vague , indistinct , and unclear ambience .

Users' perception couldn't characterize and recognize each era separately. But if we look at the second case (Mosque at Córdoba (the change consider to be a paradigm shift. The using of the Off-beat colors (compare to the existed) and the new composition of the horse-shoe arches visibly which collide with the Gothic fan vaulting, the experience was totally impressive. The obvious evidences from each style and era make it very apparent to the

occupants without any confusion about the old parts and the new insertions.

But what if we want to talk about the terms of materials in the preservation within the computational, and parametricism context? And what about the mutations of the adaptive reuse in this over-tuned notions? How about Fusing the Physical and the Computational as material synthesis?

Material culture is portrayed as the physical confirmation and articulation of a culture in its relics and design. In the time that we comprehend the thought of material culture not just as having importance for investigations of the past. yet in addition getting a projective limit. we may now be at a critical defining moment.. As computation starts to significantly change our origination of the material, so in architecture this will defy the set up connection between the procedures of design and the physical fabrication of the constructed medium . Obviously, computation was brought into design & architecture the greater part a century back. furthermore, expanding digitization has since plagued all parts of the field .

3.1. Material Strategy in preservation terms:

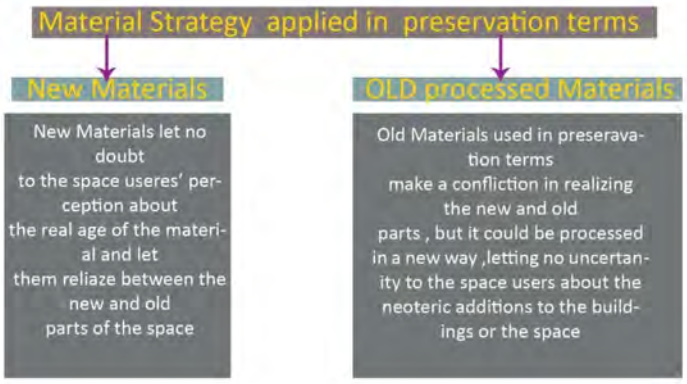

Figure 3. Material strategies in preservation terms. Author work

This strategy is answering the query about the truth about materials,(Fig3)Moreover the new fabrication methods—like additive manufacturing- allow design to be extended to the level of the material structure. Specialists at the ICD utilized multi-material procedures to deliver frameworks that react to ecological boosts with a form transformattion. (Fig 4) The related responsive development does not need any mechanical or electronic parts, or the supply of operational vitality. (vii) **Material as Machine** makes motion Without Motor

(Applicable for traditional materials like wood). While **hygroscopy (viii)** is regularly comprehended as a material lack in innovation, biology has advanced methods for using it as a key element. A few plants utilize hygroscopic activations to create movement: also, conifer cones curve one case of this

Figure 4. 3D-printedenvironmentally responsive material systems, University of Stuttgart 2014.David Correa, Steffen Reichert and Achim Menges/Achim Menges Architect BDA andInstitute for Computational Design (ICD).

We can't disregard existing materials in favor of the new or novel. Fig(5)

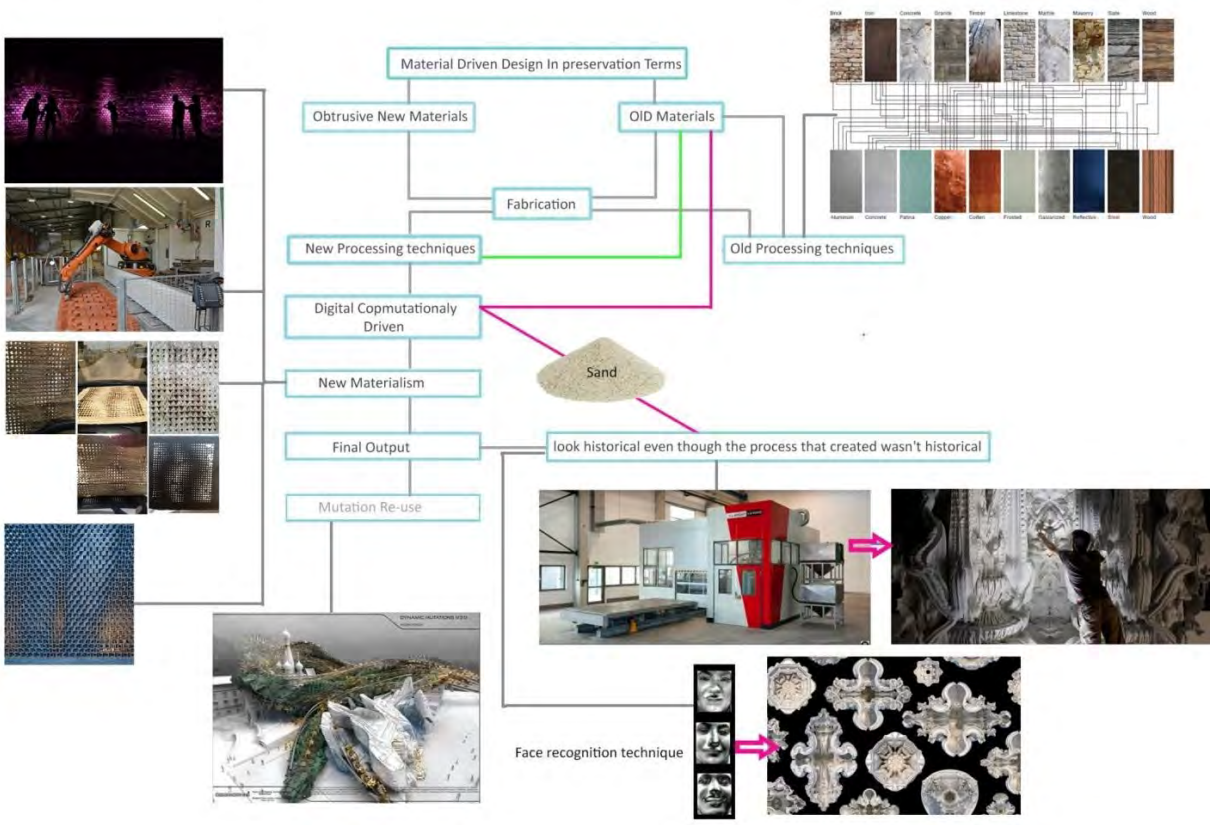

Figure 5. Material strategies processing for old and new materials. Author work.

4. Relevant precedents

In a 1971 lecture to students, stated:**Louis Kahn** xi stated:: *if you are ever stuck for inspiration, ask your materials for advice. "You say to a brick, 'What do you want, brick?' And brick says to you, 'I like an arch.' And you say to brick, 'Look, I want one, too, but arches are expensive and I can use a concrete lintel.' And then you say: 'What do you think of that, brick?' Brick says: 'I like an arch.'"xii*

So we will review some relevant studies about using old traditional materials like bricks and sands had been processed with computational parametric tools, in both design and fabrication phase resulted in final output looked seamlessly brilliant as if we applied this old materials in any old site for preservation term no one could have any doubt that it's brand new part has been inserted eventually to the space.

4.1. Parametric Regionalism

Flexibility is the very center of Parametricism, which nourishes off technological change and flourishes with change. Not constrained to system alone, adjustment in parametric plan can be reached out to react to territorial specifics and varieties. Utilizing computational innovation, the architect applies a coordinated outline philosophy through the investigation of the particular implications of different design parameters, for example, material execution, building tectonics and human conduct. Regionalism isn't just reflected in the nearby setting and atmosphere, yet in addition innate in social perspectives like building materials and craftsmanship.

The talk of regionalism in the computerized age has expansive social and moral criticalness. In the previous years, parametric plan strategy had been connected by designer Philip Yuan xiiito his training and research in China. With concentrating on the arrangement of parameters on the execution of nearby materials like bricks

,concrete, and timber and investigate the new open doors offered by the incorporation between parametric design and local culture.

Consequently, regionalism with regards to the computerized time is progressively worried about the reconciliation and recovery of physical data and virtual information through new innovations. The operation and advance of social frameworks dependably includes rich local traditions and social legacy, and the arrangement of their traditions is firmly identified with the domestic regional condition and social generation. Parametric outline gives another way to deal with design learning and spatial association; it should consolidate provincial data and local behavior from a wide viewpoint. (xiv)

Parametric models have totally broken the limits amongst plan and manufacture, empowering an incorporated life-cycle outline philosophy from conceptualization to operation, amendment and development through the control of geometric data. (xv) The logicality, adaptability, intelligence and constructability of parametric frameworks relate to a completely open arrangement of digital design and fabrication.

Parametric models develop an association between design geometry and performative parameters of local climate, material, structure and behavior. The choice as to which geometrical parameters matter in architectural design turns into the way to the design approach. (xvi)

Digital Design and Fabrication of Conventional Materials(Research and routine with regards to Philip Yuan) (xvii)

Conventional craftsmanship ought not to be seen just as far as its social esteem (Fig 6). The importance of customary materials will be re-imagined as architects give careful consideration to their performative qualities and fabrication logics. Likewise, the extraordinary topographical highlights encapsulated in conventional materials bring rich territorial qualities into architectural design. (xviii) As of late, he has dedicated his building practice to advanced manufacture utilizing nearby materials. Conventional materials have been subjected to morphological investigations to accomplish an inventive standard of performative tectonics.

4.2. Tools of imagination (Michael Hansmeyer Projects – The Grotto).

Between chaos and order, both natural and artificial, neither foreign nor familiar. Digital Grotesque (Fig 7) presents an immersive, human-scale, highly articulated grotto that is entirely fabricated using 3D printing. Fine-grained corns of sand printed at a resolution of 0.13mm allow the creation of a yet unseen architecture. The 16 square meter room is composed uniquely through algorithms (Fig 8). (xxi)

New materials and manufacture techniques have generally prompted radical changes in architectural design. They have for sure been essential drivers in its advancement. Today, additive fabricating is creating emissaries as an insurgency in design. Though in engineering, this development has up to now been used only for small scale forms.

Digital Grotesque takes additive manufacturing innovation to a genuine architectural scale. Digital Grotesque presents a completely immersive, strong, human-scale encased structure with a bewildering level of detail (Fig 9). Its geometry comprises of a huge number of individual facets printed at a resolution of a tenth of a millimeter, constituting a 3.2-meter high, 16 square meter vast room.

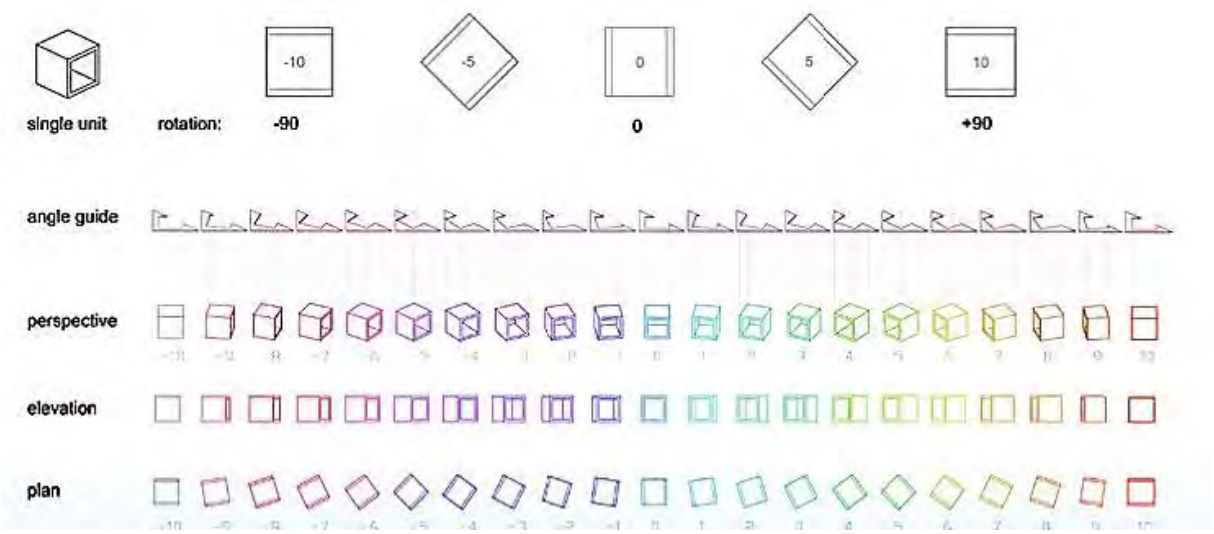

Figure 6. SilkWall. The angles of rotation of the cement blocks were constrained to 21values. Wooden formats were given by the architect to educate the manufacturershow to distribute the pieces to the right position.

Figure 7. Digital Grotesque structure with a perplexing level of detail

The potentials of additive manufacturing in architecture are huge. Architectural details can achieve the limit of human recognition. There is no cost for multifaceted nature : printing this exceptionally grotto costs the same as printing a primitive cube. Nor is there a cost for customization: creating very individual components costs close to printing a standardized series. Ornament and formal expression thus cease to be a luxury. What would we be able to do with this recently discovered opportunity?

4.2.1. Design by Algorithm

The single subdivision process produces shapes that contain data at various scales. The nearer one gets to the shape, the more highlights one finds. Such a progressive separation can likewise be found in exemplary classic architecture design. However dissimilar to customary architectural design forms, here a solitary procedure is utilized both to shape the general frame, and to make the moment surface subtle elements" details". This articulation can be utilized to make lineaments that surpass the limit of human haptic or visual observation that would be altogether un-drawable utilizing conventional means (Fig 14).

4.2.2. Fabrication

The use of 3D printing innovation in architecture has up to now been constrained to prototyping or delivering little scale models. Material expenses are high, machines have constrained to scales, what's more, the larger part of materials are not sufficiently solid to satisfy development necessities.

Sand-printing innovation has as of late developed as an added substance producing strategy (Additive manufacturing) that defeats these confinements (Fig10). This innovation is right now utilized fundamentally to make casting forms in for industrial modern applications. However, it has remarkable highlights that make it reasonable to make architecture compositional parts. In particular, it permits the fabrication extensive scale components. (at present up to 8 cubic meters in estimate). With high resolution and exactness at an aggressive, competitive cost and in brief time frame. The printed sandstone components can be completely self-supporting and can be collected as a strong construction (Fig 11).

Natural sandstone has been utilized as building material since prehistoric times. Church buildings, cathedrals,

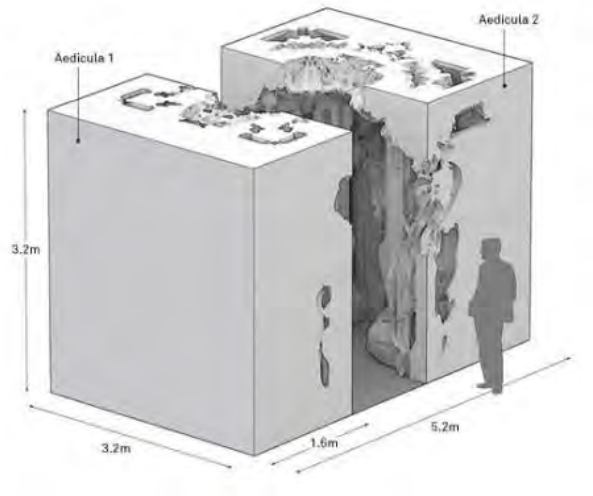

Figure 8. Isometric view to the whole mass.

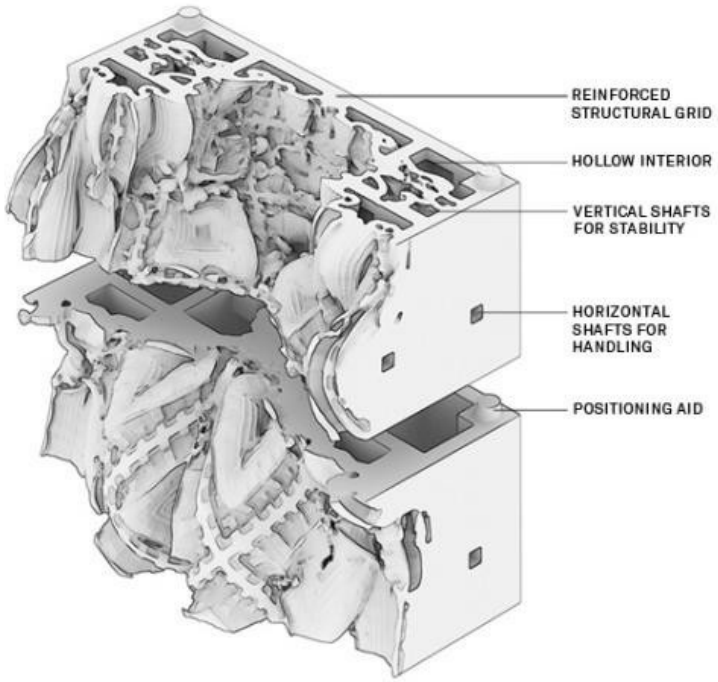

Figure 9. Isometricassembly detail of the mass

Figure 10. thegiant 3D printer

Figure 11. Assemblyin the real life.

Figure 12. Thefinishing coat.

Figure 13. TheExcessive sands while printing process

sanctuaries and other fancy ornamental structures were frequently built with sandstone, as it is a moderately delicate material that is anything but difficult to work while as yet having basic protection and resistance. 3D printed sandstone has fundamentally the same as properties once it is post-prepared. With a specific end goal to additionally solidify the smaller scale “micro-detailing of the grotto” (local parts are thinner than 2mm) and to increase the structural stability, the printed sandstone is infiltrated with resin (Fig 12).

Figure 14. The Intricate Grotesque after finishing and it shows a new phase in additive manufacture and its impact on architecture leading to generate classic forms though the processing phase was computationally done

5. Informed Robotic Materials

Moreover, traditional materials like bricks and clay are now widely used by informed robotic system. Clay are now using in 3D printing with an advancement in printing large scale constructions on site, and undoubtedly with a robotic technology (cable robots and drones) - **robots driven by cables (xxiv)**

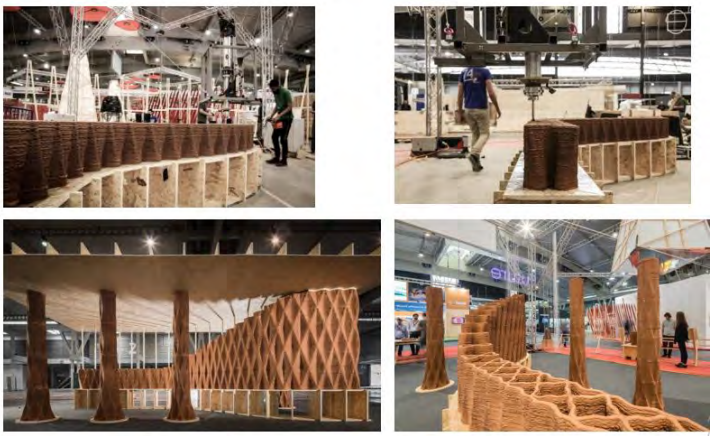

Figure 15. Robotos driven by cables & drones have helped in 3D printing using clay in printing large scale construction

6. Experimental design. ”By Author”:

Suggested sustainable material like palm leaves mat, come in sheets (4*2.5m2) allows transmitting light due to the weaving ability to the material nature.Could be Fixed by to work as screening sustainable system on windows or shading vertical devices (Fig 16).I used Laser cut to perforate suggested design based on a grasshopper definition depends on curve attractor. The shading device could be double layer, creating overlapped design and different alternatives.(Fig 17)

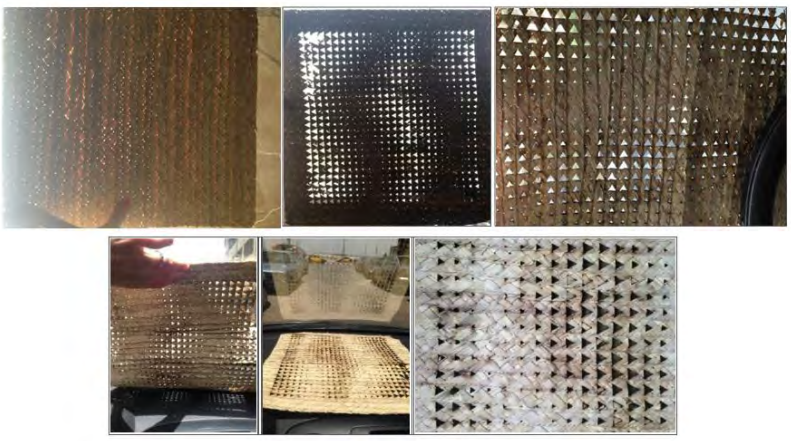

Figure 16. Palm leaves mat before and after laser cut and how it helped to change the users perception to the material.

7. Conclusion

– Materials 'behaviour have been totally altered due it the way of processing and the paradigm shift in computational technology, parametric tools restore the design scene and the final output, reforming endless choices and generate unimaginable ideas.

– Experimentation with the shape of perforation and how each can be used to represent the dynamics of space, as well as what light and shadow effects are created as light source distorts the projection of the shape

– The perforation pattern in the screen system could be based on Daylight simulation according to using simulation software like DIVA for Rhino & Grasshopper and that's for how using it in the applicable part of the study.

Figure 17. double layer, creating overlapped design and different alternatives

8. Recommendations

Sustainability could be enhanced by conducting an investigation and experiment a research for new biodegradable materials depend on a developed 3D printing filament, extracted from palm leaves or palm midribs, referring to a new research from Chalmers University of Technology in Sweden on liquefied wood , which it can be applied and developed to recycle existed palm tree's waste which is easily obtainable in the Arab region. The 3D printing could be used in preservations, and restoration of the old sites, and here it with the supposed new material, we can investigate the adaptability with the building special condition .

That's all will lead to energy and money save by making the best of what we already have mixed with the new innovative technology and cutting edge design tools.

9. References

1. i CASTLE .HELEN, *MATERIAL SYNTHESIS, Fusing the Physical and the Computational.* September/October 2015. Profile No 237.p:5
2. ii Beorkrem .Christopher , *MATERIAL STRATEGIES IN DIGITAL FABRICATION*, 2013 by Routledge.P:8
3. iii MENGES. ACHIM, *MATERIAL SYNTHESIS, Fusing the Physical and the Computational.* September/October 2015. Profile No 237.p:9
4. iv http://www.wired.co.uk/article/mit-mask-maker
5. v Bloszies ,Charles, *Old Buildings, New Designs. Architectural transformation*, 2012, Princeton Architectural Press, 1st edn ,p:41, downloaded from: https://issuu.com/vladimirchuzhinov/docs/oldbuildings.
6. vi Text from Ibid.p:41.Photos;*left;* http://matthewwilliamsellis.photoshelter.com/image/I0000cuOG_riI0eI *Middle:* https://commons.wikimedia.org/wiki/File:2781_-_Siracusa_-_Duomo_-_Navata_centrale_-_Foto_Giovanni_Dall%27Orto_-_22-May-2008.jpg *Right:* http://www.paradoxplace.com/Perspectives/Sicily%20&%20S%20Italy/Montages/Sicily/Siracusa/Siracusa%20Or tigia.htm
7. vii MENGES. ACHIM, *MATERIAL SYNTHESIS, Fusing the Physical and the Computational.* September/October 2015. Profile No 237.p:13.
8. viii **Hygroscopy** is the phenomenon of attracting and holding water molecules from the surrounding, usually at normal or room temperature, environment. This is achieved through either absorption or adsorption with the absorbing or adsorbing substance becoming physically changed somewhat. This could be by an increase in volume, boiling point, viscosity or other physical characteristic and properties of the substance, as water molecules can become suspended between the substance's molecules in the process
9. ix *Ibid p:68*
10. x *Ibid p:68*
11. xi **Louis Isadore Kahn:** From 1957 until his death, he was a professor of architecture at the School of Design at the University of Pennsylvania. Kahn created a style that was monumental and monolithic; his heavy buildings for the most part do not hide their weight, their materials, or the way they are assembled. Louis Kahn's works are considered as monumental beyond modernism. Famous for his meticulously built works, his provocative proposals that remained inbuilt, and his teaching, Kahn was one of the most influential architects of the twentieth century. He was awarded the AIA Gold Medal and the RIBA Gold Medal. At the time of his death he was considered by some as "America's foremost living architect." https://en.wikipedia.org/wiki/Louis_Kahn

12. xii https://www.facebook.com/vanibahl/posts/10154282889178573

13. xiiiYuan,Philip.,**PARAMETRICISM 2.0** . Rethinking Architecture's Agenda for the 21st Century, ARCHITECTURAL DESIGN, March/April 2016, Profile No. 240,P:93.

14. xiv Schumacher, Patrik, *The Autopoiesis of Architecture, Vol I: A New Framework of Architecture*, John Wiley & Sons (Chichester), 2011, pp 5–8.

15. xv Sheil .Bob, and Glynn. Ruairi, *Fabricate: Making Digital Architecture*, Riverside Architectural Press (Toronto), 2012, pp 30–35

16. xvi Hensel .Michael, Sunguroglu. Defne, and Menges. Achim, *'Material Performance', Versatility and Vicissitude: Performance in Morpho-Ecological Design*, March/April (no 2), 2008, pp 34–41

17. xvii Philip Yuan: is Associate Professor at the Architecture and Planning Institute of Tongji University, Shanghai, Director of Archi-Union Architects, and a member of the Shanghai Urban & Planning Consultant Community.

18. xviii Picon .Antoine, *Digital Culture in Architecture*, Birkhäuser (Basel), 2010, pp 30–35.

19. xixYuan,Philip.,**PARAMETRICISM 2.0** . Rethinking Architecture's Agenda for the 21st Century, ARCHITECTURAL DESIGN, March/April 2016, Profile No. 240,P:94.

20. xx **Michael Hansmeyer** is a post-modern architect who utilizes algorithmic architecture techniques, generative art mentalities, and CAD software to generate complex structures. He is currently based in the CAAD group at ETH's architecture department in Zurich. https://en.wikipedia.org/wiki/Michael_Hansmeyer

21. xxi http://www.michael-hansmeyer.com/projects/digital_grotesque_info.html?screenSize=1&color=1

22. xxii Ibid

23. xxiii Ibid

24. xxiv http://www.iaacblog.com/life/iaac-shows-the-potentials-of-3d-printed-buildings-at-barcelona-building - construmat/

25. xxv Ibid