Open-Source Design

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Disruption is defined as a change in the long-accepted business model through the introduction of new methods, often lead by technology. The automotive industry replaced human workers with robots to carry out repetitive tasks in mass production lines. The printed newspaper found users wanting to curate their own content, immediate reporting/delivery, and lower prices. The music recording industry was forever changed as once illegal social networks opened up a new model for searching, purchasing, curating, and ultimately sharing music for profit. The hotel industry is currently being forced to change with the increased use of websites like Airbnb and VRBO where people can economically rent a local apartment or room for a short period of time in almost any city. The taxi industry is being challenged by services like Lyft and Uber which are putting control back into the hands of the consumer. Very few industries are immune, and the common thread throughout is the injection of new technology into industries who were not able to maintain status quo in their new reality.

During the 2016 AIA national convention in Philadelphia, Rem Koolhaas gave an interview in which he cautioned the profession of architecture about an uncertain future. Regarding to the pace of the profession, he stated, "Architecture is a profession that takes an enormous amount of time. The least architectural effort takes at least four or five or six years, and that speed is really too slow for the revolutions that are taking place."[1]

The post-Renaissance profession of architecture has been largely unchanged with regard to accessibility, authorship, and copyright. New technologies have been fully adopted and integrated into the profession, but that technology is also available to a group of novice designers who are engaging the design process without traditional academic training. As well, designs are authored by multiples, and content is shared at large and integrated at will. This begs the question of how the discipline might engage a contemporary context where the pace has accelerated, authorship is difficult to assign, and users are more engaged partners in the design and construction process. This paper will discuss the discipline of architecture as a prime place for disruption and change brought from the outside through a desire to make the design process more engaged, objective, and transparent. This change presents opportunity for architects to lead by example, and engage the public in ways that are inclusive and collaborative.

INTRODUCTION: COPYRIGHT, COPY, AND COPYLEFT

"Productive, collaborative, shared design is happening all around the world, and it is only accelerating. Yet as it becomes increasingly mainstream for software and consumer goods, the open source mentality has been muscled out of architecture by traditional practice and remains in the murky periphery, away from the discipline's spotlight. A reductive categorization is that architecture still operates under the authorship model of copyright, when design, media and culture are moving toward copyleft and Creative Commons. Almost all disciplines are rapidly expanding in scope while architecture progresses tentatively." Carlo Ratti[2]

The act of copying in our culture is generally seen as either a tool for the cheater, the uncreative, or simply as the "sincerest [form] of flattery."[3] The following is a brief overview of the context of the copy in creative disciplines seen from the Renaissance forward, where it has had its most significant hold on the architectural profession.

Act 1: Copyright

Separation of the act of construction from drawing was not deemed necessary by the pre-Renaissance architect as adjacency of the two were most often present in construction. At the same time, other professions such as medicine were establishing themselves in a new, enlightened society by establishing importance through specialization. Architects' desire for professional stature and separation from the working class ushered in an expansion and more strategic use of representational content establishing expertise and authority, and maintaining the control once garnered by being on site. Representations were instrumental in this shift, and the use of techniques such as graphic statics, geometry, and mathematical proportion were strategic in positioning architecture as a scientific endeavor with specialized knowledge.

Post-Renaissance design disciplines of the built environment are predicated on the Albertian model of the architect as form-giver where conception and representation of built form occur initially, followed separately by construction as represented without alteration. Referred to in print media terms as bon à tirer (ready for press), this relationship seeks to assure control of the content by the author. This historical model has altered slightly over time with the addition of contractual models such as design-build, but in essence it

remains largely the same system that has been in place for centuries. Designs and their documents are copyrighted, thus protected through copyright law, with permissions extended to the owner and contractor. This relationship is being challenged in the 21st century as the line between projecting and constructing has become increasingly blurred enabled partly by a democratization of fabrication where the maker and end user are also able to author content.

Act 2: Copy

"Good artists copy; great artists steal." (quote attributed to several people through various permutations)[4]

From the day children enter the formal education system, they are told that to copy is wrong, and are encouraged to produce their own thoughts. The rules of engagement seem to suggest that original ideas are the product of a sharp and innovative mind, and the common class are only able to generate similar copies of those ideas. Over time, this perception discourages students who feel they are not able to generate original ideas championed by those in authority (ie. teachers) and encourages them to find comfort in fields of study where they are able to attain answers more easily, or where one answer (which is provable) is the norm. What this student might not realize is that the championed idea, perceived as original or novel by their contemporaries, is most likely not original but rather has not been seen previously by that group. The truth is that the idea is most often not original and is either a direct copy of something else, or at the least, a phenotype variation of the original genotype. Because the audience is not familiar its previous versions, the idea is seen as original.

Copying in contemporary popular culture is seen as provocative, championed through mass media formats including, but not limited to, art, film, and music. In the art world, historical images are used strategically coexisting with social and political messages in the work of artists including Andy Warhol and Robert Rauschenberg, or even more pointedly, Sturtevant who was explicit and unapologetic about creating exact duplicates of famous pieces often displaying them side by side. The music scene uses the copy, calling it a sample, through short sound clips carefully woven into the fabric of popular music. While there are entirely too many examples to mention, popular artists including the likes of Bob Dylan, The Beastie Boys, and U2 have all used sampling in their music.

In architecture, copyright law protects the likeness of a building design, and subsequent designs that are proven to infringe on that likeness are in violation of copyright. This violation is often difficult to prove. Still, in architecture school the precedent is a tool that allows students to understand the complexity of a design though in depth analysis of designs that have previously faced similar challenges. Students research,

document, and even graft certain portions of a design where they think it might benefit their overall scheme. This is a grey area as many times the design is so close to the original such that it borders the category of copying. Whether this is actionable on the grounds of academic plagiarism hinges on the context and whether the instructor knows the reference from where it has been lifted.

Act 3: Copyleft and Open Content

"It is easier to ship recipes than cakes and biscuits" —John Maynard Keynes[5]

Creative Commons, an online resource for sharing, accessing, and protecting the rights of designers and creators, began in 2001. According to their website, "Creative Commons helps you legally share your knowledge and creativity to build a more equitable, accessible, and innovative world. We unlock the full potential of the internet to drive a new era of development, growth and productivity."[6] The introduction of Creative Commons offered a more formal and accepted method for sharing content which could benefit both creators and users as well as provide more opportunity for content exposure to a wider audience through their online tools for connecting people with content.

Precipitating this more formal system of content sharing was a culture who saw the internet as a place where sharing of digital files was much easier. This perspective focused on the consumers of content and provided little to no protection or consideration for the producers of that content. Applications like Napster, which allowed users to download music free of charge, infringed on copyright law resulting in legal cases brought forth by the artists and producers. While obviously problematic, it did initiate new ways for consumers to access and creators to share music content ushering in new models which have subsequently developed into platforms like Pandora and Spotify. These new approaches offer more exposure opportunities for artists, new economic models through advertising and subscription services, and a way for consumers to have a nearly endless music library.

Open-source design, a term first coined late 20th century in the context of software engineering and computer science, embraces the concept of a sharing community where the development of results outweighed the authorship of artifacts. Recently, the idea of open-source and what it stands for has become even more popular as groups including Google, Facebook, and Tesla have adopted the mindset as a way to encourage the rapid, comprehensive development of their products. Open-source design, at its core, endeavors to fuel collaborative innovation through the principles of "Share the Goal, Share the Work, Share the Result."[7] It has been translated in various scales from furniture (OpenDesk) to architecture addressing social issues such as a global housing

crisis (Wikihouse and, more recently, free, downloadable housing designs by Pritzker Prize laureate Alejandro Aravena.) Many times this content is shared through copyleft venues such as Creative Commons.

Open-access materials often exemplify traits of embedded knowledge where intelligence is intrinsic to their use (ie. organizational frameworks, assembly, etc.) and can be activated without specific training or experience. The designer is able to establish smart design parameters anticipating a range of acceptable options desirable to the user all while not allowing variations that could 'break' or sacrifice the integrity of the system. With embedded knowledge, the guidance of an experienced designer is with the user or novice designer as they work within the immediate context searching for the most appropriate solution.

Opening access to the architectural design process is difficult for many reasons ranging from necessary expertise and training in the discipline to long-standing positions on the proprietary nature of the profession to its products. One of the ways the design process has been communicated and translated is through the use of geometry which has been instrumental in the architectural profession throughout most of its history due to its organizational and communicative potential. According to Robin Evans in The Projective Cast, [8] mathematics does not need, or go through, translation; this is to say it is always at its source and, wherever it shows up, is the same throughout time from its conceptions to its various permutations. While the Renaissance architect used constructed mathematics (geometry) that could be seen and in turn readily manifest into materials by builders, the contemporary architect uses data and complex mathematics (calculus, trigonometry, etc.) to create forms that often cannot be drawn through traditional means of projection. It could be argued that mathematics is an open-source code for describing form and space since it is a prime candidate for building upon, highly accessible to all who seek it, and allows for virtually infinite variations. To remove the stylistic indicators, the open-source system of mathematics brings incredible similarity to the work of architects such as Brunelleschi, Palladio, and Le Corbusier.

The work of Antoni Gaudi demonstrates the use of mathematics, specifically complex descriptive geometry, to create an open-source system that stands the test of time outliving him as author. Surveying the work which led up to what is arguably his most famous project, the Sagrada Familia in Barcelona, there is evidence of him working through a combination of natural forms and mathematical constructs to create a system which is complex, performative, and yet highly accessible to various authors over time. Catenary curves, ruled surfaces, and hybridization of primitive forms with descriptive geometry create a formal logic that has been adapted and scripted by the team of architects completing the work today. Gaudi's

forms, material usages, and proportional logic have stood the test of time seeing a transition from projective drawings, traditional plaster model making, and stereotomy to scripted formal code, 3d printing, and robotic stone cutting without significant change in the architectural language.

WHY OPEN-SOURCE AND FOR WHOM?

During the 2016 AIA national convention in Philadelphia, Rem Koolhaas gave an interview in which he cautioned the profession of architecture about an uncertain future. Regarding to the pace of the profession, he stated, "Architecture is a profession that takes an enormous amount of time. The least architectural effort takes at least four or five or six years, and that speed is really too slow for the revolutions that are taking place."[9] Regarding the referenced revolutions, Koolhaas stated, "In Europe, we're facing an influx of 2 million refugees, mostly from Syria, which poses interesting possibilities. In eastern Germany, there is an area where cities are almost completely abandoned and, partly with the help of architects, there's an experiment of seeing if Syrian refugees who are highly educated, motivated, and committed can re-inhabit those territories. Refugees could reenergize sections of the cities. They offer to architecture an interesting provocation or invitation to do good work and collaborate in interesting ways."[10] He even went as far as saying that architecture's future might not even be architecture itself but possibly organizational systems and the like.

Open source design is not for all projects or all situations. Since it builds from existing knowledge sets and models, it can often decrease design and response time, potentially demonstrating larger degrees of efficacy through adaptability to various situations through mass customization. The wicked problems[11] that are paramount in the global condition are transdisciplinary, and invite architecture to respond more quickly with competent and timely design solutions. To address these problems, the user is not looking for a design that is qualified based on its perceived novelty, but rather on its ability to enact change and empower the users to act within their own systemic context.

Open-source architecture is inherently team-oriented and often transdisciplinary with design teams demonstrating the mantra of sharing the goal, work, and results. Carlo Ratti refers to the open source architect as the "choral architect" suggesting that their role will be to "determine a set of parameters that direct a potential architecture. Architects [will] design the questions, not the response."[12] He expands on this mindset shift stating "Its proponents see it as distinguished by code over mass, relationships over compositions, networks over structures, adaptation over stasis. Its purpose is to transform architecture from a top-down immutable delivery mechanism into a transparent, inclusive and bottom-up ecological system - even if it still includes top-down mechanisms."[13]

Open-source design is predicated on the creation of a geno-type in raw form with specific performance criteria flexible enough to allow for variation. The determination of the parameters that are adjustable also requires disciplinary pro-ficiency to know how those adjustments work when deployed within the larger system. Limits built into that system con-tain knowledge maintaining the relationships, networks, and adaptability relating to the user and/or environment, and based on disciplinary knowledge of construction techniques, materials, and building codes. Contemporary software allows for the design of an instruction set (genotype) which has the opportunity to generate nearly infinite options (phenotypes) based on the depth and sophistication of the data and para-metric definition. The flexibility of the various components within the definition contains necessary limits allowing for interventions at strategic touch points which might engage user input or the influx of continually updated data sets.

USER EMPOWERMENT

The user of architecture in the 21st century desires, and even expects, to be engaged in the design process. The trust in design from the outside has seen its challenges as the pub-lic is no longer able to 'pay no attention to the man behind the curtain.'[14] Many have felt encouraged, even empowered to take on the design of their own space, and engage a self-generated design process. This process all too often engages copying and sampling without knowledge of the source content's intent, compositional logic or cultural and environ-mental catalysts. These novice designers are often able to determine what the user wants or needs, but are ill-equipped with the resources to manifest something as complex as the average architectural edifice. In turn, the results of this design process see users providing a list of demands given to the design team, expected to be translated into formal and mate-rial compositions reflecting their choices thus reducing the agency of the architect.

The success of open-source design in the field of computer science is due to a careful management of base code that is competently shared, developed, and vetted through a team of professionals able to both identify and correct deficien-cies. This is then offered at large to allow for phenotypes that are built on a solid base. Open-source architecture pro-poses a condition in which the development of base systems encourage authorship of various decisions points, and do so with accurate vision of how those decisions affect the over-all systemic logic. Users are empowered to be active in the design process, but are not abandoned without appropriate resources to make informed decisions regarding discipline specific conditions requiring specialized knowledge.

In the book Languages of Art,[15] Nelson Goodman discusses the ways in which artistic works communicate, and in so addresses a comparison between several formats including art, literary works, dance and architecture and a relationship

between autographic and allographic systems of communi-cation. Simply stated, the autographic systems works with direct adjacency to the material in which it is affecting with-out a system of notation; for example a sculptor working directly with the final piece. Comparatively, the allographic system contains notation and allows for the work to happen with distance from the author, and for duplication to exist based in either time or distance. Music and architecture both work within an allographic system where an instructional set, referred to as a 'score' by Goodman, is a prime source of com-munication. The rise of maker cultures and digital fabrication have allowed the architect to come closer to bridging this gap and work directly with material, but the tools which allow this still require the designer to manipulate form and material relations through a digital interface at least one degree of separation from the final artifact. Perhaps the open-source architect, in conjunction with user engagement, can create a hybrid condition where the architect works within an allo-graphic system creating an organizational system or interface suggested by Rem. This in turn could allow the user to directly affect materials, enacting an autographic system with the user as they work within the parameters of the design.

CONCLUSION

The core tenets of open source design are not new in that they build on the arc of precedent and the ability to learn from the past. The use of contemporary software and avail-ability of information accessible through the web has created a condition where the history of architecture is wide open for consideration in contemporary discourse. In an interview with the curators of the 2017 Chicago Biennial titled Make New History, Mark Lee stated "That is exactly why we think history is more important and relevant than ever. Perhaps unlike historicism, where things are subsumed under a grand historical narrative structure, we see history as a horizon, open and accessible, with multiple entry and exit points."[16] The ways in which we understand precedent are much more akin to that of a provocateur which dynamically engages with the contemporary design processes.

The variance in approach from traditional precedent refer-ence to an open model of design exists in the mindset of both the designer and the user. The designer is empowered with a more robust position on precedent oftentimes removed from stylistic indicators, dissecting it to identify the systemic logic of a source code or genotype. The use of contempo-rary software has afforded new opportunities for a higher degree of control in the systemic analysis of organizational structures creating models which can be deployed to develop new design strategies. The development of a genotype serves as base content for creating an interface with the future users of generative phenotypes. Within this interface, the user is empowered to understand where choice exists as well as the connection and effect of that choice within the larger system. The open-source architect must demonstrate confidence in

his/her abilities and role in a larger design problem, one that potentially involves several disciplines each with a significant role to play with specific knowledge to bring to bear. This confidence and disciplinary knowledge has the potential to place architects back at the table as valuable and impactful members of the design team, able to champion the power of design to make a difference. It's time to pull back the curtain and engage users in the design process, in turn removing the perception of the architect as magician that has not served the profession well.

ENDNOTES

1   "Rem Koolhaas: "Architecture Has A Serious Problem Today","" Co.Design Business + Design, Accessed 20 June 2016, http://www.fastcodesign.com/3060135/innovation-by-design/rem-koolhaas-architecture-has-a-serious-problem-today

2   Ratti, Carlo, and Matthew Claudel. *Open Source Architecture*. London: Thames & Hudson, 2015. 94.

3   Colton, C. C., and J. McGowan. Lacon, or, Many things in a few words: addressed to those who think. London: Longman, Hurst, Rees, Orme, and Brown, 1820. #217, p. 114.

4   Garson O'Toole. "Good Artists Copy; Great Artists Steal." *Quote Investigator*, accessed 9 January 2018, https://quoteinvestigator.com/2013/03/06/artists-steal/

5   "MAKE: Interview with WikiHouse's Alastair Parvin and Nick Ierodiaconou / June 13, 2012." *Architecture* 00, accessed 9 January 2018. http://www.architecture00.net/news/2206.

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7   Thomas Goetz, "Open Source Everywhere" *Wired*, 1 November 1 2003, accessed 28 March 2016, http://www.wired.com/2003/11/opensource/.

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9   "Rem Koolhaas: "Architecture Has A Serious Problem Today","" Co.Design Business + Design, Accessed 20 June 2016, http://www.fastcodesign.com/3060135/innovation-by-design/rem-koolhaas-architecture-has-a-serious-problem-today

10   Ibid.

11   With reference to Rittel, Horst, and Melvin Webber; "Dilemmas in a General Theory of Planning," *Policy Sciences*, Vol. 4 (1973) 155–169.

12   Ratti, Carlo, and Matthew Claudel. *Open Source Architecture*. London: Thames & Hudson, 2015. 103.

13   Ratti, 123.

14   Referencing the 1939 film The Wizard of Oz.

15   Goodman, Nelson. *Languages of Art: An Approach to a Theory of Symbols*. Indianapolis (Ind.): Bobbs-Merrill, 1968.

16   Lee, Mark, Sharon Johnston, Sarah Hearne, and Letizia Garzoli. *Make New History* 2017 Chicago Architecture Biennial. Zurich: Lars Müller Publishers, 2017.