AIA Florida

2021 Strategic Council Report

Contents

Acknowledgements

I would first like to acknowledge AIA Florida 2021 President Ignacio Reyes, AIA. Ignacio established “transformation” as the theme for the 2021 year. He had the foresight and experience to see that our profession is changing because of new technologies affecting our industry.

Next, I would like to thank the industry leaders who presented to our council, providing provocative information that helped guide our understanding and finally the recommendations we feel need to be adopted by the board of directors.

I would like to thank AIA Florida Executive Vice President/CEO Becky Magdeleno, CAE, for driving the council forward. She made sure that we stayed on topic and followed through with our research to arrive at a report that will help shape the future of our profession and AIA Florida members.

I would like to acknowledge our recently retired Executive Vice President/CEO Vicki Long, CAE, Hon. AIA, for her input into the thesis that we researched and acting as a sounding board to streamline our focus and build a council that was responsive and thoughtful.

Finally, I would like to thank the council members that did the research and the hard work to create this report. Everyone participated and lent their opinions and experiences to have stimulating conversations. It’s the council members who synthesized the collective thinking into the final findings and recommendations. Their energy was unmatched.

Thank you,

Stephen Panzarino, AIA
2021 AIA Florida Immediate Past President and Strategic Council Facilitator

Executive Summary

This year, the AIA Florida Strategic Council developed two theses based on theme of transformation, the brainchild of 2021 AIA Florida President Ignacio Reyes, AIA.

trans·for·ma·tion

/ ˌtran(t)sfərˈmāSH(ə)n/

: an act, process, or instance of transforming or being transformed

The subject is intriguing because it is forward thinking and will continue to change and challenge the practice of architecture.

Our first thesis centered around the creative process. Will technologies such as artificial intelligence (AI), machine learning and deep learning systems challenge the creative soul of the architect? As artificial intelligence and deep learning continue to advance, it is beginning to change the way the architectural design process is viewed.

> *"AI will make the planning process of architects significantly easier, giving them access to countless amounts of data, creating models, interpreting the building environment, and creating cost estimates. All this information can be easily conveyed to the architect to help shorten design and building time."*

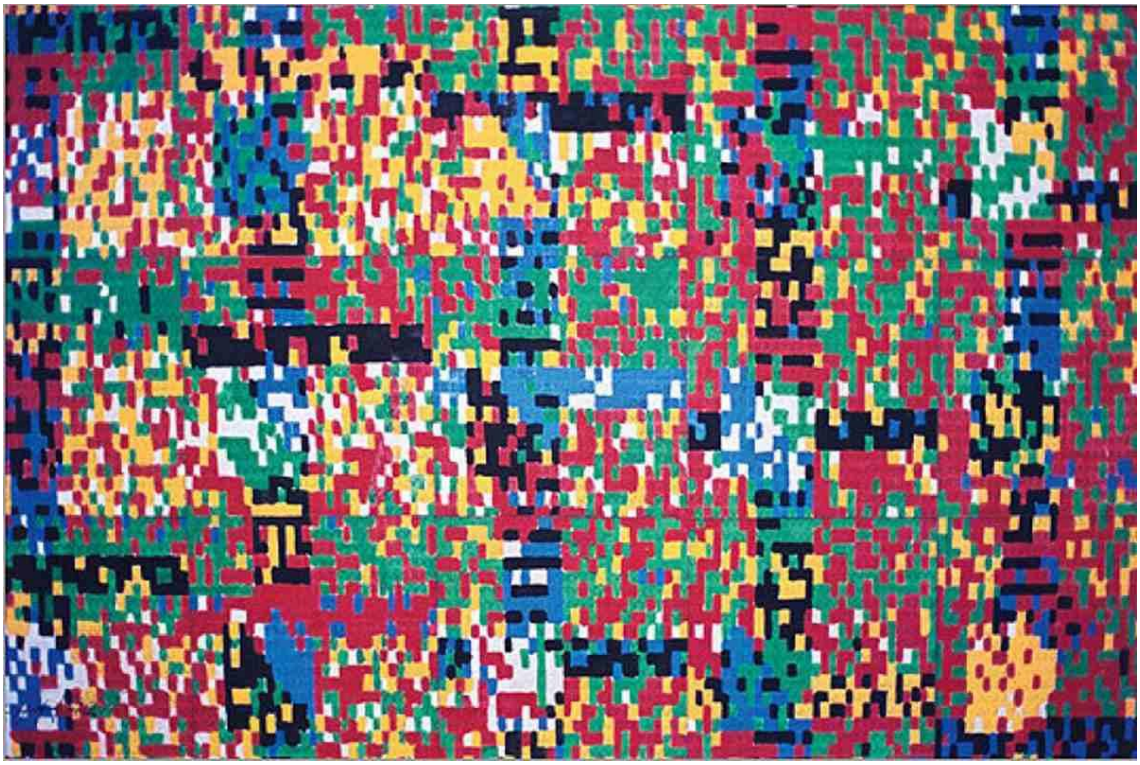
AI will make the decision process faster, more robust, and easier, but will it ultimately change the ability to create inspiring architecture? Vitruvius's three principles of architecture are still fundamental to the creation of great architecture.

Firmitas (firmness, durability) – It should stand up robustly and remain in good condition.

Utilitas (commodity, utility) – It should be useful and function well for the people using it.

Venustas (delight, beauty) – **It should delight people and raise their spirits.**

AI can possibly support and improve the first two principles, but it is the third principle where further study by the strategic council was conducted. The intersection between artificial intelligence and the human mind is still unknown territory. How do we introduce humanity into computer processes? At what point does one stop and the other take over?
"Computers Do Not Make Art, People Do"



https://www.widewalls.ch/magazine/computer-generated-art-10-artworks

Our second thesis centered around the use of mass data or "big data." If architects are to harness data from the built environment, even more significant procedural changes may be coming. How will firms verify the data they produce? How will they exchange data with project partners? Legally, who will be responsible for this data? What services can be sold around this data? How can firms learn from data? Will firms need to employ a data scientist?

Methodology

Each member of the Strategic Council was selected because of specific expertise. Members were also selected based on the parameters identified in the Strategic Council bylaws, architects, academics, and industry representatives.

Through a series of virtual workshops, the council met to discuss the two theses along with a variety of other topics related to technology disruption within our profession. During several of the workshops, outside industry leaders made presentations that gave the council insight to current state and future of the profession. These workshops added other critical aspects that our profession needs to consider if we are to embrace and foster technology as part of the practice.

Summary of Findings

As stated above, the council discussed a host of topics, many of these discussions led to more detailed conversations and research that is found in the report findings.

Some of the key findings centered around the state of our profession and the use of technology throughout the various stages of one's career. Older practitioners may not see the full value technology can have on design or they feel it will ultimately replace the Architect as the lead designer.

Technology will not be able to replace an architect.

Young professionals who have grown up with the comfort of technology in their daily life see great opportunity to use it as part of the design process. This kind of thinking needs to be fostered. Innovation will keep architects relevant and leading the process.

Education is a critical element in fostering innovation. The council recommends creating educational opportunities for various levels and roles within the profession such as principals and firm owners, technology specialists, architects, emerging professionals, etc. Programs would expose professionals to ways to embrace technology during design through construction and how to collaborate with clients, vendors, consultants, and contractors.

As we look over the horizon, numerous challenges will influence change:

- Skilled workforce.
- Supply shortages.
- Population growth.
- (Sub)urbanization.
- Infrastructure.
- Climate change.

Another critical discussion centered around the use of data and how it can improve design outcomes. The issue with data is it is raw, unfiltered and requires organization and filtering. This is the basic building block of the data-information-knowledge-wisdom (DIKW) model useful for understanding how raw data turns into useful information, and then into knowledge and finally wisdom. Data is available everywhere and can be collected under multiple formats. This raises questions around who owns the data, the user's liability and should data be public or private. Data is becoming exponentially larger every day. Architects create data through BIM and other design activities. Is there a business case to support copyright of data?

To address and be prepared for these challenges, we must employ future-proofed design thinking. One key conclusion the council reached was that a one-year study does not begin to touch all the ways technology is going to change our profession. We all agreed that to continue to thrive as a profession we must embrace technology in the development of great design. We must be champions for technology and partner with all stakeholders to encourage and embrace the values technology brings.

Recommendations

The transformation of the practice of architecture is because of computer-based technologies such as artificial intelligence and the management, interpretation and ownership of big data as it applies to design-related creativity. Computer-based tools that are creating disruption in the way most architects go about their daily professional activities. There is so much technology behind AI we can only begin to comprehend. Technology such as Deep Learning algorithms, Neural Networks can be intimidating. Are technology design tools friend or foe?

AIA Florida should work to enable architects to embrace technology and learn how to use it to enhance their practices.

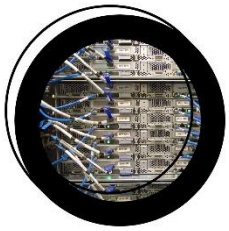
Technology is also transforming education as it relates to exposure to AI tools for students.

AIA Florida should promote hands-on experiences and exposure to technologies for members at all career stages through continuing education.

There is absolutely no doubt that regardless of the development of AI, transformation will take place but there will always be room for the creative mind. Yes, the computer algorithms will arrive at technical solutions faster than any human might be able to do, but we need to use that power to our advantage.

AIA Florida can be the centralized driver and organizer for the distribution of technology and facilitate interdisciplinary collaborations.

Architects have the responsibility to use big data to the health, safety and welfare of the public beyond the design phase. Data produced by architectural designs should be analyzed for opportunities.

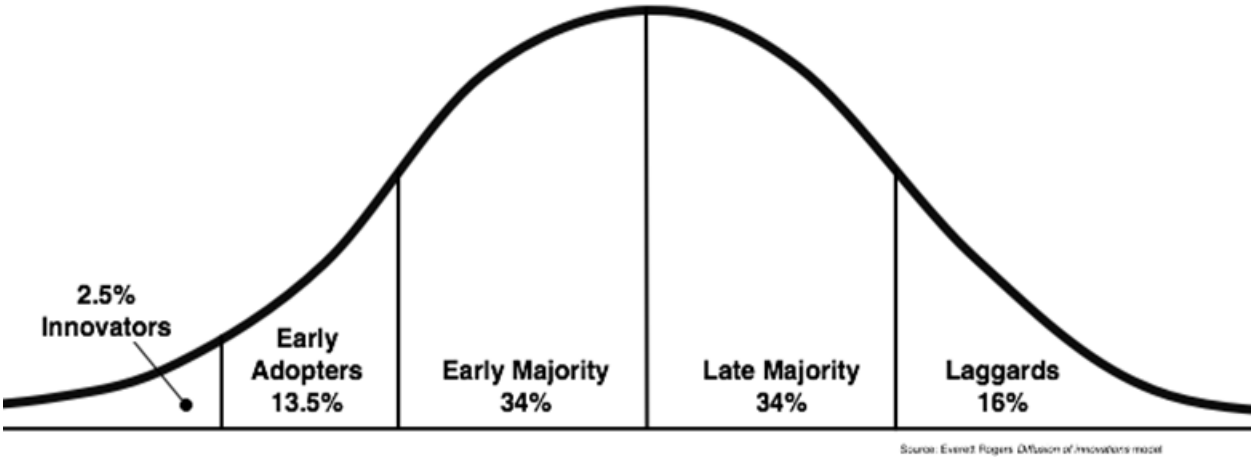


The architectural community should enter a conversation centered on ownership of data and its usage to increase productivity and profits.

The creative talent of an individual is here to stay, and computational design is a tool to be used to our advantage.

State of the Profession

As in any industry the adoption of innnovation and methods of delivering business follow a typical trend as shown in the chart below.



Within the profession there are a small group of architects focused on innovative processes that can enhance design and deliver better projects. Our profession is a risk adverse enterprise, until a process, material or system is tested and shown to be successful under real world conditions, it takes time for the industry to adopt it as the norm. The use of CAD to enhance the production of documents is a good example. The first commercial CAD software was developed in the late 50's-early 60's (innovators) but didn't become mainstream (early majority) until the 1980s. Today CAD is no longer the premier software that it was a few years ago (Laggards). Programs such as REVIT, Sketchup and a host of others through cloud computing are driving improvements in documentation and design presentation.

Architects are working with contractors, computer, and data scientists to advance how we design for the built environment. Building Information Modeling (BIM), parametric modeling, Design for Manufacture and Assembly (DFMA), integrated project delivery are examples of advanced processes that are being implemented by Early Adopters and in some cases Early Majority. With the rapid evolution of available technologies, and the integration of them into the profession, the role of an architect is changing faster than it ever has before.

Although the focus of the Strategic Council was centered around technological advancements, it is important to mention that buildings contribute to the changing environmental issues of today. Architects are finding that to be relevant we need to be active in the conversations of sustainability, climate change and biologic threats.

Also, building design not only needs to address the needs of the users but must recognize and understand how these projects impact a greater social discussion particularly around issues of equity and prosperity.

"To effectively adapt to this future, we, as architects, need to shift our focus to the end-user experience, speed to market, the efficiency of programmed space, and efficiency of construction. In addition to aesthetically beautiful designs, there will be more emphasis on how a building operates and supports the end-users, and their overall experience. The architecture of the building is an extension of the client's business, a tool to enhance the occupants and the members of the community.

"Many architectural achievements throughout history have been driven by the art form and the ego. With the modern shift towards performance and the business necessity of creating a functional building for the client's need, the architect of the future must strike a balance between form and function, art, and science, as well as technology and soul. Only time will tell just how balanced these concepts will be but, at present, they're exhibiting a synergy that makes it a truly fascinating time to be an architect."[1]

-Brian Staton, Assoc. AIA
President and CEO HMC Architects

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1 "What is the future of architecture as a profession?", Building Design + Construction Magazine, July 30, 2019

State of Technology in Architecture Education

Most if not all the Florida schools of architecture have embraced technology within the current curriculum offered. These universities understand the benefits of technology integration and view it as an opportunity. Each school has taken a slightly different approach to technology that fits within their academic offering. These range from robotics labs focused on the process of 3D printing and automation in offsite assembly (DFMA). Others have focused on developing methodologies to integrate data and management of building lifecycle into the design process.

Here is an overview of the teaching opportunities within each school:

University of Florida

- The DCP Fabrication Lab

University of South Florida

- Florida Center for Community Design & Research

Florida A&M University

- Center for Intelligent, Systems, Control, and Robotics (CISCOR)

University of Miami

- UM RADLab
- The Computer Lab
- The Fabrication Lab

Florida Atlantic University

- Fabrication Laboratory

Florida International University

- Robotic inspection, sampling and surveying
- Robotics technology for waste site operations
- Mechatronic design of robotic and automation systems

- Biomedical use of robotics
- Development of modular architectures
- 3D printing, packaging
- High-precision quality fabrication
- Bulk metallic glass manufacturing and characterization

Students are actively engaged in learning how to use emerging technologies as it requires dedication to learn about these technologies and discovering ways of implementing solutions without being a part of the pedagogical approach in the curriculum.

Architectural education should approach technology the same way that it has with any other basis of education in standard curriculum by assessing the value technology can bring and making it a foundational course in our education. The accreditation process for university degrees in architecture must be revisited and include technology courses as a requirement with a stipulation of updating the curriculum continuously based on emerging technologies. Having this system in place will allow a new generation of architects to enter the professional world with comprehensive knowledge of emerging technologies and how to implement them into practice.

These advanced learning centers will shape the next generations of Architects who once they enter professional practice are going to question why these methodologies are not part of professional practice.

Professional Education

Introduction

Today's industry is evolving at a rapid rate and blurring the lines of the physical and digital realms; a change described as the fourth industrial revolution. Industries such as architecture are dealing with unprecedented collisions between the digital and the physical. As a result, we are beginning to feel the pressure of forced adoption from these hybrid technologies. Throughout recent years, data acquisition has been on the rise but the interpretation (data analysis) and application (artificial intelligence) of this data are lost on many slow-to-adopt industries, especially architecture. Now is the time to understand and implement these technologies with our own bias to control the outcome rather than fall victim to digital gentrification from those who can develop these technologies.

This year's theme for the AIA Florida Strategic Council is transformation; we must transform from an industry that reacts to technology to one that is proactive and dictates our use of technology. We must harness the transformative nature of technology, and we must transform AIA Florida from a professional organization that represents a minority involved in the construction industry to one that represents a broader base. Technology can act as the catalyst for all these goals.

Why Does our Industry Need to Transform?

As architects, we are trained to quickly aggregate information from multiple sources to solve complicated design and building issues. We can draw inspiration, form practices and develop procedures from the most unlikely sources to produce creative solutions. Architects' inherent ability to conduct such interdisciplinary thought has always been their strength. These abilities fuel the romanticized version of architecture but fall short in the pragmatic approach to architecture.

The tendency to present technology almost as an outside threat to the profession, rather than an inherent part of it, is new. Architecture has, in the past, often represented technology itself and was equated with technology such as Roman concrete, 19th-century train stations and Bauhaus experiments. As we entered the fourth industrial revolution, our practice has, in large part, reacted to technology instead of being proactive and demanding what we need to increase the quality and quantity of our output.

Technology developed to increase productivity and, as a result, profit. Much of the architecture discipline only adopts technology when they can no longer keep up with the market demands and competition, for example moving from pencil to AutoCAD or from AutoCAD to Revit. A likely reason why we do not actively seek technology and demand innovation is a lack of knowledge to integrate the technology into the process. For our discipline to transform and thrive in the new industrial revolution, there must be a fundamental change to how we view and learn about technology. If we consider the fundamental skills, such as interdisciplinary thought, that are unique to architects and set architecture apart from other professions, we can develop ways in which we learn about

technology, make technology an integral part of our profession and make us leaders in driving the technology which is relevant to our profession.

How Can we Benefit and Thrive from Revolutionary Technology in our Discipline?

Much of the technology we use to practice architecture was developed by technology companies who identified areas that could benefit from technological advancement and tools such as the creation of AutoCAD or Revit. The result is a handful of tools that completely hijack the modality in which we produce our work.

We have come to a point where the software used rather than its design qualities is the identifier of a project. We have been boxed into these modalities by another industry and it has created a loop where the status quo is quantity over quality. With the knowledge of how this technology works, we can start the journey of reclaiming our discipline, from ideas to documentation, instead of allowing another industry to define ours. We can demand the type of technology we need so we can benefit, becoming proactive instead of reactive. One example of the consequences of not joining this discourse is being excluded from it. Autodesk is a multibillion-dollar software company that has fiduciary duties to its shareholders. To assume it is making software to help architects produce their work is dangerous. It creates software and services that will make it a profit, and if that requires it to create software that uses these emerging technologies to reduce the amount of architectural intervention and gain a new customer base of building developers, they must do so. The initial steps of this trend have already begun with Autodesk's recent acquisition of Spacemaker.AI for $240 million. Spacemaker.AI is a tool that uses artificial intelligence to assist in site analysis, acquisition and maximizing developers' living density and quality. The more emerging technologies that are acquired, the less we will be able to participate in the conversation of our needs and dictate our terms of use.

There are benefits of implementing revolutionary technology that are currently available to us, such as:

- Complete tasks faster.
- Increase accuracy.
- Improve communication.
- Ease collaboration.
- Facilitate visualization.
- Automate computation.
- Carry out generative design.

It all comes down to increasing productivity and quality and, thereby, earnings. Using technology to reduce our efforts in repetitive tasks increases our productivity in singular tasks, such as design. These technologies have the potential to reverse the proportions of work and allow most of the time to be spent on design rather than production or management.

What would a building, neighborhood or city look like if we could spend 90% of our time designing solutions instead of 10%?

Why Should we Embrace and not Fear These Changes?

Progress is often halted by fear. In the premise of this conversation, the fear is that technology will replace the architect. Again, knowledge of the technology would ease those fears and reassure architects of their domain knowledge and position.

A common example of this is the notion that AI will replace architects as designers and producers of buildings when, in fact, current AI is nowhere near as capable as the human architect. AI performs well at vertical tasks (given high-quality data) but lacks lateral movement between tasks. A paraphrased example from Rodney Brooks is the following: If you speak to a human in Japanese, and they speak back to you in Japanese, you have an immediate perception of that person. You assume they can understand Japanese, they speak Japanese, and they can read and write Japanese. The same cannot be assumed with an AI neural network that deals with natural language processing (NLP). Although a neural network may be able to read Japanese, the program will not be able to speak, read, or write in Japanese unless it is specifically trained and programmed to do so. This overgeneralization is what leads to fear.[2]

[2] https://www.youtube.com/watch?v=ig1qaqyMIXc

This natural approach we use to understand a human's capabilities instills fear when applied to AI because of the absence of knowledge. With the proper education of this technology, it would be simple to identify our strengths as architects in the future will be in the space between AI's vertical performance and in making connections which we can use to apply creative thinking to solve complex issues. Therefore, if we choose to continue fearing this technology, we will never truly be able to understand its benefits and use it to enhance our practice as we have done in the past with other forms of technology, the solution is to embrace and understand the positive nature of this technology and leverage it to benefit architecture.

How can Education Lead to Proper Adoption and Application of Technology?

It is not sufficient for architects to learn a technology. Only with a proper understanding of context (historical, cultural, psychological, economical) can architects foster a thought process that can assess the appropriate use of technology.

Our views of technology can be altered through education and should not be limited to the next generation of architects but should involve anyone in architecture. An example of this can be a hierarchical approach:

- Principals: Understand the technology to determine where their firms can benefit.
- In-house expert: An employee at the firm with domain knowledge of Architecture and technology to implement and train employees.
- University level: Students should learn about emerging technology in their curriculum from computer scientists and architects and apply it to their work. That knowledge can be transferred from the bottom up to the principals of the firm and can create a loop of knowledge and implementation.

To have a knowledge hierarchy, there needs to be a centralized driver and organizer for the distribution of the technology. The university level provides for students, but firms do not access education regularly. The intersection between firms and students can be the American Institute of Architects. We can be the organization that truly brings our profession into the new industrial revolution.

Why Does the AIA Need to Transform?

Only a small proportion of buildings are designed by architects.[3] Of the architects licensed and living in Florida, about 55% are AIA members. If we want to generate a genuine transformation of the industry, we need to be able to address a greater population of architects and, in turn, affect a greater proportion of the architecture, engineering and construction industry.

AIA Florida can play a more pivotal role in the architectural community by becoming the central hub for continuing education, especially as it relates to technology. This can be done by creating credentials recognized by the AIA that will help career growth by

[3] http://www.harvarddesignmagazine.org/issues/12/seventy-five-percent

developing specializations in technology and other relevant areas such as sustainable design.

AIA Florida should also encourage interdisciplinary collaborations. This can happen in the form of hackathon events (charettes) where we coordinate with other disciplines' professional organizations and host a joint event. In these events, we can aim to solve problems in a short period of time where we develop prototypes of a solution, such as a custom program or a device. The benefit of these events is in the way different disciplines collaborate.

Overall, AIA Florida can change the way continuing education and events are conducted and work towards developing a system that provides incentives for people to learn new technology and skills and capture interdisciplinary collaboration in a natural and scaling manner. This has the potential of creating new sources of revenue for companies and more for employees.

How can we Transform our Industry to Accept This Technology? And how can Technology Transform our industry?

1. **Conduct an industry-wide survey to establish which technological skills are needed across different types of firms and what is the barrier of entry for integrating the required technology.**

2. **Scale education program according to the size of the firm and also address all levels in the architecture path.**

For emerging professionals on the path to licensure:

- Revisit the internship program to be more engaging intellectually on aspects of vision, ethics, morals, encouraging critical thinking more than ticking boxes.
- Better relationship with NCARB so that there is better feedback from practice to education concerning the need and use of technology.
- Create programs with NCARB to repurpose existing programs such as Integrated Path to Architectural Licensure (IPAL) to allow students to enter a firm while completing their internship hours and dedicate a portion of their time to technology education and implementation.
- Work with NCARB to redefine the accreditation requirements of university degrees to require technology to be taught at universities and tested for licensure.

- Create opportunities for trainees to assess the firm they are working with and suggest improvements/changes.
- Provide leadership training to encourage architects to act as leaders in the community. Nurture new talent rather than exploit it.
- Add an examination section that assesses the appropriate use of technology.

For licensed architects:

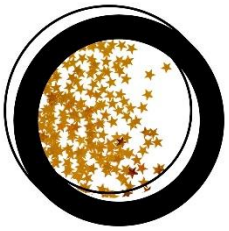
- Broaden architects' knowledge base and vision.
- Improve architects' skillset.
- Create a network so that architects can learn from each other.
- Create incentive structures rather than announcing purely mandatory procedures. Some examples include tax rebates, more funding or better access to certain projects.

3. **Create a membership level that allows for nonarchitects to contribute and create an environment of interdisciplinary collaboration.**

4. **Establish a technology incubator center where interdisciplinary collaboration can occur and lead to technological advances.**

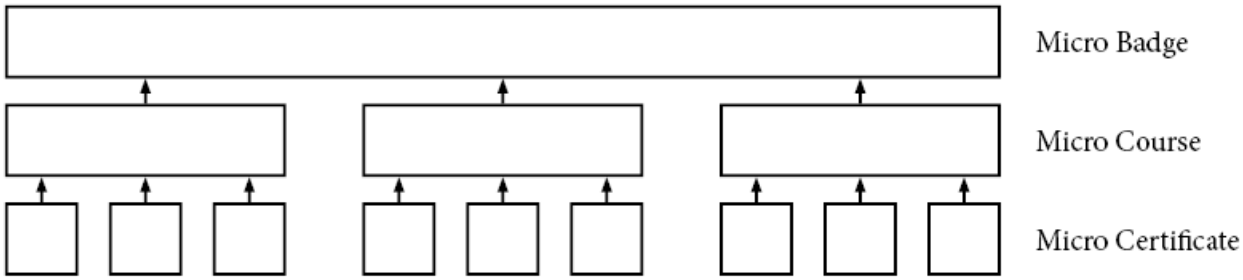
5. **Host events like hackathon or charette that can promote interdisciplinary research and force alternative thought processes to leverage technology to solve problems.**

6. **Establish a level of quality for all events and services.**



7. **Create an incentivization structure for continuing education units so that AIA members are perceived as higher quality service providers.**
    - Member Ranking
    - Reduced membership
    - Micro credentialing

This is an example of a system where AIA members can receive credentials recognized by the AIA that can be used to show career progression and specialization routes. This can become a way of recruiting new talent. You can also automate this process by having members who completed the micro credential courses elevate to instructor level and, as a result, reduce their membership rate or increase their member ranking.



The micro certificate will be 10 – 15 one-hour workshops that explore fundamental knowledge of a course path. After you complete all the micro certificates you are eligible to move to the micro course tier which will require additional time and course requirements. The same applies until you reach the micro badge level. These credentials can be displayed on LinkedIn and résumé to show employers your skills. At the micro badge level, you can certify that a person as an AIA-approved consultant for that particular subject and it will create a network of people who can solve and integrate technological solutions (or any other topic that can be approached through the paradigm). This can also be an additional source of income for the AIA because it can charge for the course attendance.

8. **Create a technology-based member benefits program which could include:**
    - Access to specialist services such as data analysis, subject matter expert consultant, scripting assistance.
    - Resource center, digital library or data repository.
    - Connect to graduates (AIAS) and NCARB interns.
    - Education resources.

Summary

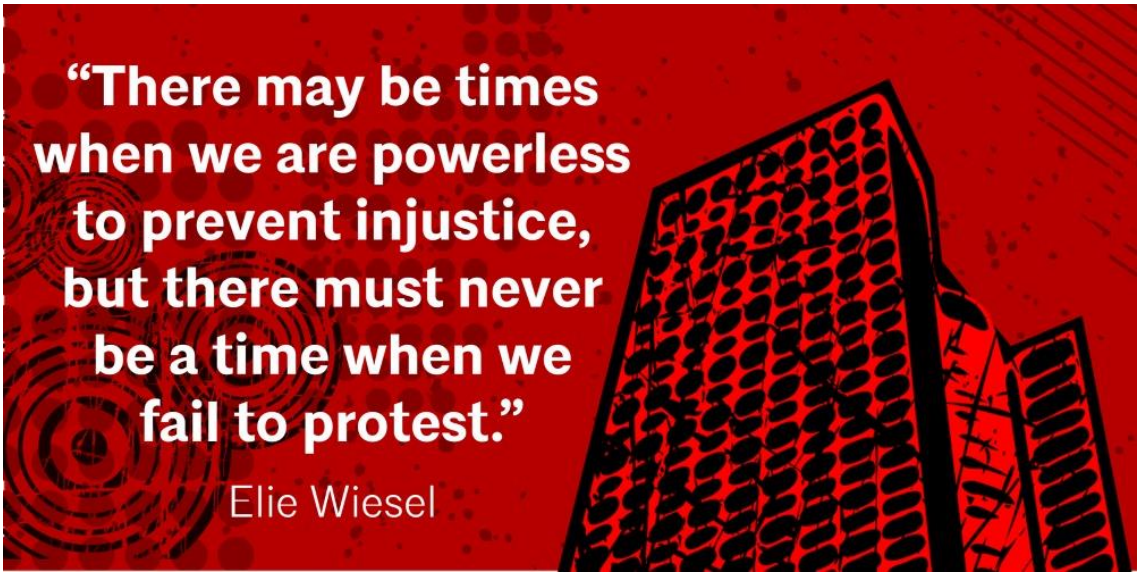
In preparation for architecture's evolving future in the fourth industrial revolution, education is of paramount importance. This pedagogy should not just be for theoretical education learned in classrooms, but pragmatic education that can be taught and applied

in offices. Without this knowledge, we will continue to use the technology that is provided for us that will continuously refine our work into preselected modalities defined by other industries. A lack of education will also promote fear, which will prevent our industry involvement with emerging technologies that will redefine our profession.

With the proper education, we can competently enter this arena and define what our role will be in the future. As architects, we have a unique place in history; we are at the intersection of many disciplines such as art, engineering, history, and science. We find inspiration from the smallest ambiguous topics and abstract them to design spaces that we hope will make a difference to the occupants. Architects need to play a greater part in developing the technology that will help them along this path. Our discipline needs to see this as a moment to progress our profession and embrace the opportunity.

AIA Florida can begin the process to solve the knowledge gap that our profession has regarding emerging technologies by contributing a more pivotal role in the architecture community through the recommendations mentioned above.

Big Data Revolution: A Moral Perspective



Publicly traded companies have a fiduciary responsibility to provide value to the shareholders.

Architects have similar fiduciary responsibilities, but where the publicly traded company operates as an agnostic provider of value, with societal ramifications maybe or maybe not part of the equation guiding their operations, architects are not able to be so detached.

Being tasked with the healthy, safety and welfare of the public, the product of our services directly impacts the members of our communities. An architect’s impact on the community lasts the entire lifecycle of those buildings, which could be 50, 75 or 100 years. Considering the pressing nature of climate change, and the continued impact of the buildings we design on the communities and environment, the architect has a societal responsibility to use the best collective data available to design, to achieve the needs to of the community, but also to lessen or even provide a positive environmental impact.

Inefficiencies in design impact communities for generations to come. Given the lifecycles that buildings operate over, the architect’s societal responsibility to the environment and future generations necessitates that all relevant quantifiable data be leveraged in designs now.

Within our lifetimes, the world will have met the challenge of climate change or have failed. The costs of not doing anything could not have higher ramifications. That places the onus and the responsibility on architects today to design the most efficient, data-driven designs possible. The fact that there is more data than ever, or that this could require different workflows, does not lessen the moral imperative. The health, safety and welfare of the public doesn’t just mean being able to exit a building safely.

Data Ownership and Application

Data is often referred to as the modern-day gold and those who control it can generate a large amount of wealth through increased productivity and insight. The architecture, engineering and construction industry produces an enormous amount of data but ceases to use it past the initial building documentation and construction administration process. Data could be used in an insightful manner to increase performance of the next project, but this process is often anecdotal and transferred through mentorship.

Part of this loss stems from the fact that we do not understand the possible use and potential increased productivity the data that we create can provide because we do not understand the technologies involved with the analysis and output of the data. Companies that are leveraging the power of data in the design domain include Spacemaker. AI (recently acquired by Autodesk for $240 million) and UpCode. Both use the power of data and artificial intelligence to assist designers with site analysis, zoning codes, building codes, and understanding potential variations through a swift iterative process. Using publicly available data, these companies can provide a spell check for design and site analysis.

If we leverage the power of private data that firms produce such as internal building drawings and models that encounter common issues and solutions, we can begin to understand the potential to automate a large portion of the work architects do using the same logic that Spacemaker.AI and UpCode use to create their business solutions. To achieve this, we must refer to subject matter experts such as data scientist to analyze our data and find out where the opportunities lie. Once the initial opportunities have been identified we can consolidate the architectural community's effort to create clean data and enter a conversation of ownership of data and using paradigms that exist in other industries using data to increase productivity and profits.

Opportunities in Deliverables – COBie – Construction–Operations Building Information Exchange

COBie is the widely adopted U.S. specification for the exchange of data to support facility management by owners and operators. COBie is used throughout the world to bring together key project information into one format that can easily and quickly be shared across the whole project team at defined stages of the project.

It is a framework for organizing data developed and collected during the course of a building project for delivery to facilities owners and operators involved in lifecycle management. This information is essential to support the operations, maintenance and management of the facility's assets by the owner or property. The COBie approach is to enter the data as it is created during the design, construction and commissioning phases. Using COBie saves time and money as collecting this information after the project is time and resource consuming.

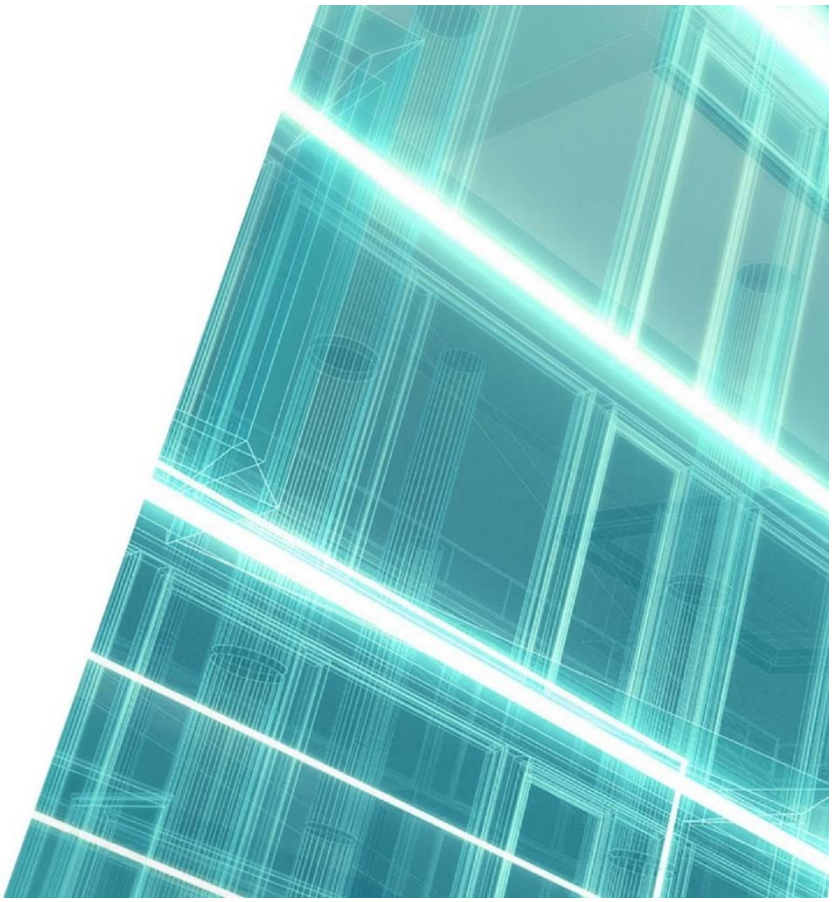
Opportunities in Deliverables – Digital Twins

Your CAD / BIM Business Partner
DDSCAD.COM
DIGITAL DRAFTING SYSTEMS

Demystifying Digital Twin

For Architecture, Engineering, and Construction

AUTODESK.



What is digital twin?

The latest industry buzz is all about digital twin. But what is it exactly? Why should you invest in it? What are the real benefits? And what does it take to actually create one? These are the questions on the minds of many AEC professionals. Let's explore the answers.

First of all, digital twin is certainly not limited to AEC—it has taken root across many industries. But the core definition across all digital twin applications remains the same: a digital reflection of a physical object or system.

For the AEC industry, a digital twin is in the form of the built asset. Take, for example, an office building and its digital twin. At the end of design and construction, there is an exact, digital replica of the entire building, from the roof to the HVAC system and MEP. The actual, physical building is mirrored as a "twin" in a digital, dynamic format.

Unlike a digital model or a simulation, a digital twin isn't static. Just as the final, completed office building changes with use, so does the digital twin. It is responsive and continues to evolve as more data is supplied to it, such as data from artificial intelligence (AI), sensors, or the Internet of Things. That means it can also simulate and predict informed decisions based on real-world conditions of the building.

Digital twin isn't a "one and done" exercise, and there are different levels of use. A digital twin for one project may be more simplistic with editable data, while another may be a fully mature use with enhanced simulations. But the core benefits remain the same.

From the beginning of a project throughout the entire life cycle of an asset, a digital twin continues to live, grow, and provide new insights for better ROI, energy savings, maintenance, and performance. This is the basis of digital twin.

DIGITAL TWIN
'dig-i-tal twin:

A digital twin for AEC is a dynamic, up-to-date replica of a physical asset or set of assets—whether it's a building, a campus, a city, or a railway—that brings together design, construction, and operational data.

FIVE LEVELS OF DIGITAL TWIN

Each level requires a greater degree of maturity and digital transformation but also offers increased value to your business.

DESCRIPTIVE TWIN
A live, editable version of design and construction data

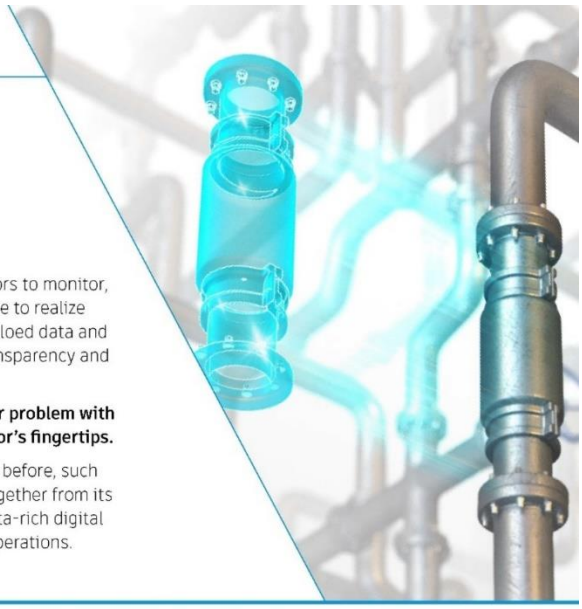
INFORMATIVE TWIN
Additional operational and sensory data

PREDICTIVE TWIN
Leverage operational data for insights

COMPREHENSIVE TWIN
Simulation for future what-if scenarios

AUTONOMOUS TWIN
Ability to learn and act on behalf of users

How digital twin can help today's AEC challenges



Digital twin isn't the latest shiny object. It is solving some major challenges from both the design and owner sides of the equation.

2D plans and specifications remain the industry-standard deliverable for construction documents. However, owners often also ask for BIM (Building Information Modeling) without any means to articulate what they actually need or how they can use it. The typical result? Project teams spend countless, unbillable hours updating models. And, at the end of the day, these models aren't even useful to the owner because data is trapped in files.

This analog, unclassified, and disconnected data is often an insurmountable challenge for owners and operators to monitor, manage, and fine-tune their asset. They are unable to realize the benefits of smart buildings and end up with siloed data and systems, inaccurate information, and a lack of transparency and important insights.

Now, a digital twin can finally solve this handover problem with all the data and insights at the owner and operator's fingertips.

New innovations are making this easier than ever before, such as Autodesk Tandem which brings project data together from its many sources, formats, and phases to create a data-rich digital hub that tracks asset data from design through operations.

GLOBAL GROWTH OF DIGITAL TWIN

89% Up to 89% of all IoT Platforms will contain some form of digital twinning capability by 2025.

–Researchandmarkets.com

31% As a result of COVID-19, 31% of respondents use digital twins to improve employee or customer safety, such as the use of remote asset monitoring to reduce the frequency of in-person monitoring.

–Gartner

48.2 Billion USD The global digital twin market size was valued at USD 3.1 billion in 2020 and is projected to reach USD 48.2 billion by 2026.

–MarketsandMarkets

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Over the past 20 years in the AEC industry the amount of information created and captured has increased significantly. **However, at handover that information is passed on to the owner in an analog form—paper or digital paper.**

A significant opportunity exists for project teams to capitalize on that information by delivering a holistic and usable view of design and construction data as a digital twin of the built asset. **This in turn will enable owner/operators to have a single source of truth for operations that reduces the total cost of ownership, achieves greater operational efficiency, and realizes the value of BIM long after handover.**"

Robert Bray, *Senior Director, Autodesk*

Digital twin life cycle

For a new-build facility, the digital twin life cycle starts at the beginning of the project. Firms collaborate with owners to understand the desired operational outcomes and the data required to deliver those outcomes. As the BIM-based design and construction phases proceed, data is captured and mapped to the model using Tandem. At handover, the digital twin accurately reflects the building's classified object and asset data.

Then the occupants move in, and the digital twin begins its second phase of life: operations.

The digital twin can be connected to other systems to collect operational performance data, and system models can be created to perform simulation. An owner may want to begin to monitor and tune energy consumption and carbon emissions—and, in the future, evolve to support new needs, like facility utilization and contact tracing. To accomplish these goals, the digital twin must evolve over time and requires a constant feed of data.

Digital twin is not limited to new-build facilities and can be created by either leveraging existing data or having the facility scanned and modeled. For existing facilities, the life cycle is fundamentally the same, starting with understanding the desired operational outcomes and the data required to deliver those outcomes.

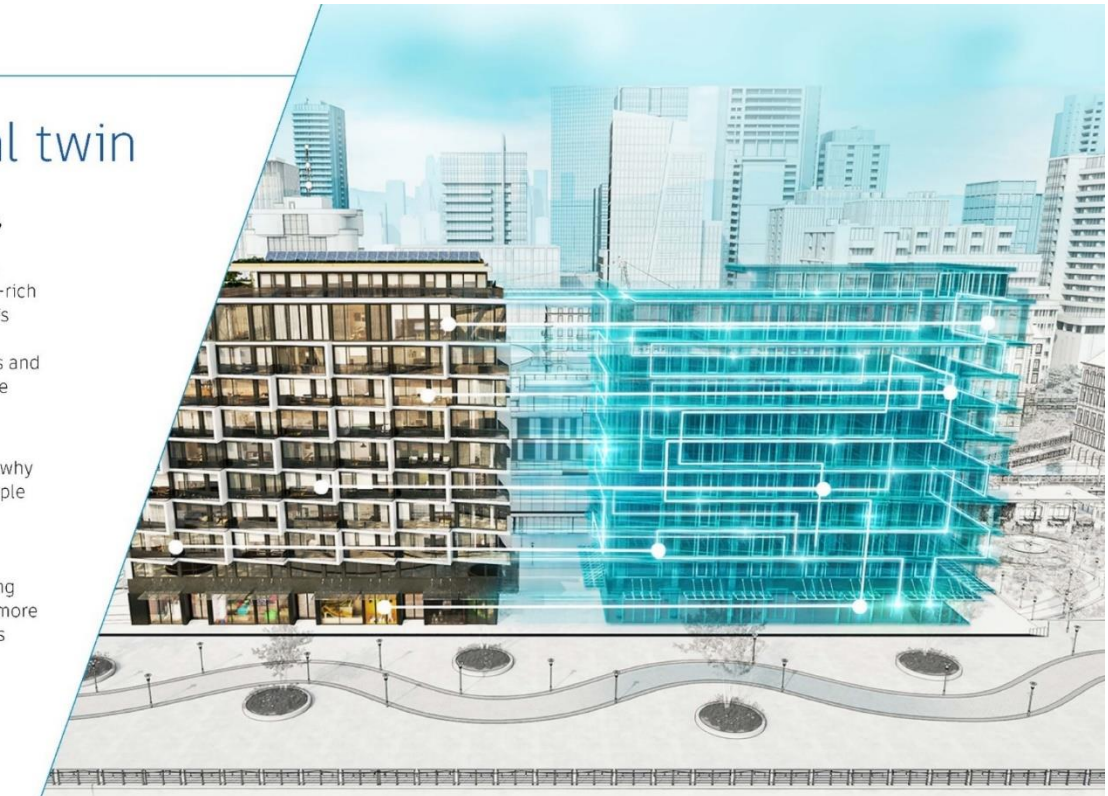
How is Digital Twin related to BIM?

- Although digital twins can be created without BIM, realizing their full promise requires **multidisciplinary models at the core** and an **integration of systems and data** across all project phases.
- Therefore, **BIM is the most efficient path** to the creation of an accurate, high-value digital twin.
- **In the future**, digital twins will become an integral part of the BIM process.

Benefits of digital twin

Building owners want digital data at handover, given the fact that nearly 80 percent of an asset's lifetime value is realized in operations. When owners can begin operations with a data-rich digital twin made up of objects rather than PDFs and spreadsheets, there is an incredible opportunity to accelerate operational readiness and transform an asset's life cycle with maintenance and performance data.

Take the office building example again and its HVAC system. Now, there isn't a mystery about why energy use is spiking. Or perhaps there is a simple signal that air filters need to be changed. Or maybe five years into the operation of the building, the digital twin would alert about a required part replacement for an air conditioning unit and optimum lifetime use. In the end, the more data the digital twin receives, the more benefits owners and operators can reap.



Digital twin benefits

AEC firms

MORE BUSINESS, BETTER VALUE

Winning more work means providing a broader set of services to clients. Adoption of digital twin enables greater competitive differentiation and delivers more value to customers in the form of data.

TIME SAVINGS

Upfront conversations and collaboration with owners help to prioritize the asset's use and performance expectations, as well as determine types of data required to achieve those goals.

COST SAVINGS

With digital twin development in line with design and construction, a cohesive handover of data is possible.

Owners & operators

TIME SAVINGS

From day one, owners and operators can begin efficient operation of assets. Never again worry about misplaced documents or indecipherable maintenance documents.

COST SAVINGS

Informed decision-making extends the value and life cycle of assets.

ENERGY SAVINGS

With performance data and analysis, operators can optimize energy consumption.

Digital twin spotlight:

NEST

Located on the Swiss Federal Laboratories for Materials Science and Technology campus in Zurich, NEST (Next Evolution in Sustainable Building Technologies) is a research platform for testing construction materials and practices. The building itself is completely untraditional, as the outer shell is constantly changing with new experiments and research units.

The entire NEST building was laser-scanned to help create its digital twin. Approximately 3,000 sensors provide data for facilities management, including temperature, air quality, and more. Using Autodesk Tandem, real-time and historical data are combined for greater transparency into the performance of the building and BIM models can be directly loaded into the digital twin.

Getting started with digital twin

Digital twin isn't far off in the future—it's happening now. Learn more about how to join Autodesk's Project Tandem, digital twin community, and upcoming beta program to build the future together.

GET INVOLVED ›

Sources

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Researchandmarkets.com: "Digital Twins Market by Technology, Solution, Application, and Industry Vertical 2020 – 2025" Learn More

2021 Strategic Council

Jaime Birmaher

Jaime Birmaher is President and CEO at Digital Drafting Systems (DDSCAD), an Autodesk Gold Partner located in Miami Lakes, Florida. He has served the AEC Community in the Design Software and Hardware Technologies space for over 35 years. Jaime graduated with a Bachelor of Science in Electrical Engineering and a Master of Science in Engineering Management from Florida Institute of Technology (FIT) in Melbourne, FL. He is very active with AIA Florida and loves helping his customers achieve their goals, while using the software tools and implementation services his organization provides. He loves technology in general, especially as it applies to buildings and construction. He is "all in" with BIM, "Digital Twins", Generative Design, 3D Printing, 3D Scanning, and measured Artificial Intelligence. Some of his hobbies include cars, running, traveling, and drones.

John Dietz, AIA

John is an architect at AECOM in Orlando where he works in a management and coordination capacity serving as the primary contact for the client. He coordinates teams and processes across disciplines. His expertise includes programming and conceptual design through construction administration services.

Selma Göker Wilson, Int'l. Assoc. AIA, RIBA, TMMOB

Selma Göker Wilson trained as an architect in the UK and is licensed in both in the UK and Turkey. With over 30 years' experience working in four countries, she has been involved in projects ranging from private homes to opera houses, with a particular specialization in performance arts buildings. During the past 10 years working in Sarasota, Florida she has been involved in the renovation of the Sarasota High School, the Van Wezel and Sarasota Municipal Auditorium, all of which have received AIA design awards. Göker-Wilson currently works with Schimberg Group where she is involved with the design of several net zero projects for non-profit organizations.

Göker Wilson embraces her role as an architect to generate change and transformation. Her cross-cultural background inevitably results in asking questions and challenging the norm. In this context, she has chaired the Sarasota Design Conference over the last three sessions helping to grow its program.
Göker Wilson believes that practicing architecture is enhanced by academic involvement. To this end, she has over six years teaching experience at university level where she has taught studio design as well as developing a professional practice course and an elective on performance arts buildings. She also has various articles published in journals in Turkey and Japan.

Joshua L Jones, Assoc. AIA

Following graduation from the USF School of Architecture and prior to starting his doctoral studies, Joshua worked at The Beck Group, Alfonso Architects, and Gensler. Over seven years of practice in architecture, his professional experience has been in commercial design build, residential design build, healthcare, aviation, and corporate architecture.

Joshua is now a Ph.D. candidate at the University of Florida and served as president of the University of Florida College of Design Construction and Planning Graduate Student Association for two years while concurrently being an active American Institute of Architects. In parallel to his dissertation research, he designs leadership as a director at Studio Zeren. His goal is to employ his diverse skills, analytical methodologies, and strong work ethic to the benefit of future peers, emerging professionals, the local community, and extended institutions.

Stephen Panzarino, AIA

Stephen is a 1984 graduate from the New Jersey Institute of Technology School of Architecture and moved to Florida with his wife and two daughters in 2003. Stephen has been a member of the AIA Florida Gulf Coast Chapter since 2006 and has volunteered his time by serving on the executive committee during that period.

Stephen has been integrally involved in shaping the direction and vision for the AIA Florida Gulf Coast since he joined, and in 2010 was elected State Director. As a member of the AIA Florida board, he has been an active participant on the Finance, Membership and Advocacy committees as well as a member of the FAPAC Board. He was also a member of the committee to reshape the board and helped define the foundation of the Strategic Council. During his term as vice president, Stephen chaired the Advocacy Committee and the Professional Development Committee. He served as secretary/treasurer for AIA Florida before being elected to serve as president in 2020. He successfully led AIA Florida the all the hurdles that came during 2020. He is currently the immediate past president overseeing the design awards program and facilitating the Strategic Council.

Ignacio Reyes, AIA

Ignacio Reyes, AIA, is a licensed architect with 27 years' experience designing educational, religious, civic, and federal projects. He is currently Vice President, Chief Development Officer for Leo A Daly architects. Based in West Palm Beach, he leads the firm's growth plans in all markets nationally and internationally.

Ignacio has been an active member of professional organizations such as the Design Futures Council, ULI, SCUP, NCARB, and USGBC. He believes strongly in community involvement and has served on many local and state organizations including the many charitable organizations and boards and is an active volunteer with Palm Beach County Schools.

Ignacio previously served as president of AIA Palm Beach and is a recipient of the AIA Palm Beach James H. Anstis, FAIA Gold Medal. He also led AIA Florida's legislative efforts serving as vice president of advocacy for two years shepherding the passage of landmark resilience and climate change legislation and protecting the licensure of architects. Ignacio's tenure as the 2021 AIA Florida president has seen many accomplishments. Among them are the passage of long-sought Good Sam legislation, the

formation of an EDI Advisory Council and the working with colleagues in the design profession in response to the tragedy in Surfside.

Jorge Tubella

Jorge Tubella is a creative technologist who combines his interest in robotics, artificial intelligence, and design to research autonomous construction systems. He has presented his work at international conferences, delivered workshops on robotics, and has collaborated on a National Science Foundation grant for developing robotic curriculum and simulations using virtual reality and augmented reality learning platforms.

Tubella's help was critical in establishing the Robotics and Digital Fabrication lab (RDF) while he was a student and a research assistant at FIU. Since the lab's inauguration, he has mentored students and faculty helping them integrate technology into their projects. He has worked on notable projects such as the 'Water Wand', a water quality monitoring device for king tide inundation, and the integration of various sensors and hardware onto robotic arms.

Jorge has been recognized as a Worlds Ahead graduate at FIU by the president of the university in 2018 and student of the year by the American Institute of Architects in 2017. He has also received an award for his master thesis, a service award by the chair of the architecture department for his leadership roles, and was awarded a Crest CAChE Fellowship.

He holds a Master of Architecture and a Master Architecture from Florida International University.

Jason Vollen, AIA

Jason is an award-winning architect, technology consultant, researcher and educator. As a transdisciplinary strategic thinker, he utilizes scientific and procedural acumen to leverage opportunities at the intersection of business, energy and sustainable technology. Jason manages interdisciplinary teams in solving complex problems, relationships of climate technology, technical integration and technology commercialization.

Glossary

Architecture

Analytics – Data, Descriptive, Predictive, Prescriptive

Data Analytics

The science of examining raw data with the purpose of drawing conclusions about that information.

Descriptive analytics:
Using data aggregation and data mining, these analytics provide insight into the past and answer, “What has happened?” Descriptive analytics are useful because they allow organizations to learn from past behaviors and understand how they might influence future outcomes.

Predictive analytics:
Using statistical models and forecasting techniques to understand the future, these analytics answer, “What could happen?” Predictive analytics provide companies with actionable insights based on data and estimates about the likelihood of a future outcome.

Prescriptive analytics:
Using optimization and simulation algorithms, this relatively new field of analytics goes beyond other types of analytics by recommending one or more possible courses of action. It answers, “What should we do?” Prescriptive analytics essentially predict multiple futures and allow organizations to assess a number of possible outcomes based on their actions.

Artificial Intelligence (AI)

Machine or software technology that mimics human intelligence. Rather than the computer following preset commands, AI can learn, recognize speech, plan, solve problems, and self-correct. Most AI used today is classified as weak or narrow AI, in that it is focused on a single or narrow set of tasks (a virtual assistant, for example). Strong AI, which is theoretical today, would be able to use its intelligence in a broad range of situations and perform well in all of them.

Augmented Reality (A)

An overlay of digital imagery or content on the real world. Examples include the yellow first-down line projected on football fields, the Pokémon Go! game, and pop-up displays on cars that show information like driver speed.
Big Data
Big Data Revolution

Block Chain Technology

Business Intelligence

An umbrella term that includes the applications, infrastructure, tools, and best practices that enable access to and analysis of information to help organizations improve and optimize decisions and performance.

Computational Thinking
A tool particularly useful for the computer age, because it not only teaches critical thinking but also focuses on helping students "develop and employ strategies for understanding and solving problems in ways that leverage the power of technological methodologies

Construction-Operations Building Information Exchange (COBie)

Digital data
The subset of Data (as defined above) that is transmitted by, maintained, or made available in electronic media.

Digital Twin(s)

Education
Empirical
Based on, concerned with, or verifiable based upon experience rather than theory or pure logic.
Ethics
Moral principles that govern a person's behavior or the conducting of an activity.
Humanism

- Fundamental Humanism
  Classical outlook or system of consideration asserting predominance of human interests, values, and/or dignity rather than divine or supernatural matters. Fundamentally, humanism is the discourse on human nature.
- Mechanical Humanism
  Contemporary system

Machine learning (ML)
A subset of AI, ML is the use of algorithms to help machines "learn" new information without having to be programmed. Machine learning guides things like product recommendations a user gets based on past purchases. *(Tech Target, Techopedia)*

Metadata

Data about other data. For example, image file metadata might include the creation date, image resolution, and file size. Some types of metadata, like file size, are created

automatically, while others are created by the user, such as keywords used for website metadata.

Natural language processing (NLP)
A subset of AI, NLP allows machines to understand human language as it is spoken. NLP is used both in systems that understand human commands, like Alexa or Siri, and in systems that read text.

Non-fungible Tokens (NFTs)

Parametric Modeling

S.T.E.A.M
an acronym for Science, Technology, Engineering, Arts, and Mathematics. A novel understanding of the term has emerged that may potentially redefine STEAM as an acronym for another relevant combination of attributes -Self-starter, Thinker, Energizer, Adventurer, and Maker.

Technoism
The shift in relationship between American Architecture and technology that occurred in the 1950's that is characterized by practitioners seeking to bridge the gap between possible reality and real possibility with newly emerging technologies. Notable technoists include R. Buckminster Fuller, Charles Eames, and Richard Rodgers.

Technology
The practical application of knowledge, commonly scientific, in a particular area or volitional purpose. A term whose meaning has been altered from its original interpretation.

Thinking
Forming or Having ideas; supposing; judging; imagining with intent; meditating. In adjective form, Having the faculty of thought; cogitative; capable of a regular train of ideas.

Transformation
an act, process, or instance of transforming or being transformed

Virtual Reality

While augmented reality is meant to enhance a person's surroundings, virtual reality is designed to immerse a person into a completely digital world. Using the technology often involves wearing a device over eyes and sometimes on hands.
Vitruvian Triumvirate
Firmitas (Firmness, Durability) – works that stand up heartily and rare enduring
Utilitas (Commodity, Utility) – works that are useful and function well for the people using it.

Venustas (Delight, Beauty) – workmanship that delights people and raise their spirits.

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