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Data, Disruption and Design

An Interview with David Morgareidge of Page

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Data, Disruption and Design:
An Interview with David Morgareidge of Page

Innovation disrupts many domains of business but few domains drive innovation. Technology is one major exception that tends to disrupt all the other domains it touches. Architecture and design, like so many other fields, are being transformed by technology. The question for practitioners and AEC leaders is how to best harness emerging technologies to enhance professional practice and the value propositions of their firms.

One practitioner at the leading edge of technology and design is David Morgareidge, the predictive analytics director at Page — a 450-person multidisciplinary design firm with offices in Texas, California, Colorado and Washington D.C.

Morgareidge graduated with honors from the University of California, Berkeley, with a bachelor's degree in Architecture with Honors. He began his architectural career designing buildings, developing a specialty in integrated digital modeling environments that help analyze and optimize building performance. He founded and served as chief executive of a performance consulting firm and later as chief information officer of A/E firm Reynolds, Smith and Hills.

In January 2015, Morgareidge spoke on predictive analytics (PA) at the Design Futures Council Leadership Summit on Design Innovation & Technology in La Jolla, California.

How did you define predictive analytics for the conference delegates at the Design Futures Council summit?

At a high level, I'd say that PA is a comprehensive design methodology in which all project decisions are based on the extensive use of data, statistical and quantitative analysis, explanatory and predictive modeling, and fact-based management. It employees a range of tools that support the processes of simulation, optimization, statistical analysis and forecasting. Predictive analytics done right is not a software "bolt-on" to a traditional project delivery approach. It is, instead, tightly integrated into, and in fact it is the driving force behind, a new, higher performing, data-driven design methodology.

How is your work different than traditional practice?

Let me start by saying that the focus of my career over the past seven years has been on the work and activities performed inside a facility, and today I'll focus on that. Earlier in my career I applied these same methods to the physical facility itself, and perhaps in a subsequent conversation we could touch on how those two perspectives need to converge.

Also, I should mention that 85 percent of the projects in those seven years were healthcare-related, so I'll often use healthcare examples to illustrate a point, but rest assured, there are many parallels to be found in nearly all other market sectors.

OK, to get back to your question!

There are four major elements that differentiate a PA-based practice from a traditional one.

First, PA is the only design methodology that allows you to build a fully virtual, digital, faithful representation of all of the work that occurs within a space — minute by minute, hour by hour, day by day, week by week, month by month, through all of the seasonal and other volume cycles typical of the environment being studied.

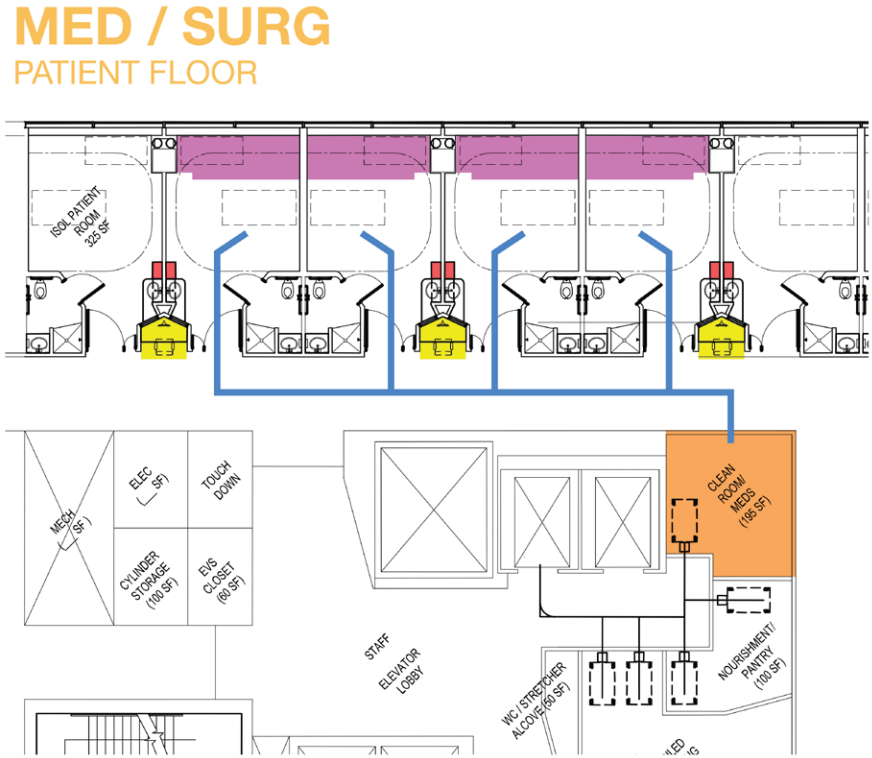
Second, and most importantly, PA is the only design methodology that allows you to evaluate a design using the exact same operational and financial performance metrics as will be used by the owner once the facility is operational. This means that there is absolutely no daylight between how the project team will asses a design scheme and how the owner will assess the built facility. This is a fundamental tenant of Page's deign philosophy because it eliminates the possibility of unmet client expectations post-go-live. At the very start of a project, we'll define the metrics that are important to the client, and then we'll select performance levels for each one, for each planning horizon that is to be addressed by the project. These are then documented in a visual dashboard that becomes true north for the project from that point on.

Third, PA provides an environment in which the interdependent and interactive nature of the relationship between those elements that contribute to first costs (equipment, space, technology) and those that contribute the most to long-term operational costs (staffing) can be quantitatively evaluated, thereby allowing informed and intelligent trade-offs to be made between the two. This is critical when you have a life-cycle perspective (which owners increasingly do have) because in many vertical markets staffing costs are between 70 percent and 80 percent of the life-cycle expense of the facility.

Fourth, and also very important, is that PA allows you to first, define the boundaries of the entire, possible solution space for the project; second, use optimization engines to exhaust that space, examining hundreds or thousands of options; and third, rank order all of the results based on the owner's specified criteria. This is possible only in PA because of the fact that the facility — and the work performed within it — are built digitally, and in great detail. Predictive analytics is the only approach that allows me to be satisfied that I have truly done my job as a designer; I have found, within the each client's unique set of financial, temporal and physical constraints, the optimal solution.

An example: While developing a simulation model for a hospital's patient bed floor, we found that the four primary patient types, which had varying lengths of stay and acuities, were supported by varying subsets of 55 clinical nursing processes with a 4:1 patient-to-nurse staffing ratio. Note that it was the PA team that conducted a large percentage of the end user meetings to obtain this data, which was shared with the architectural team. We then modeled this work to optimize the quantity and locations of equipment supply rooms and to study the impacts of centralized versus decentralized nursing station concepts. During this time I noticed that about 75 percent of the nursing processes included a trip to the Clean Supply/Meds Room.

I wanted to suggest to the client that we consider implementing a Nurse Server, which is a "mini" Clean Supply/Meds Room adjacent to each patient room. It contains about 90 percent of the supplies that would be found in the primary, centralized Clean Supply/Meds Room. I first confirmed with the design team that they felt that sufficient space could be allocated to support this addition to the plan without compromising other objectives.



The client was interested in exploring the idea, so we performed a simulation which that included not only nurses, but also patient care supply technicians, pharmacy technicians, and linen technicians. I wanted to be sure that we looked at not only at the benefit to the nurses, but also at the added work that the Nurse Server would create for the other staff members that would have to support a far more granular distribution of their respective supplies. Our simulation showed that the Nurse Server would reduce the amount of non-value-added nurse walking by 21,900 hours per year, with only a small increase in the number of technician hours, and the client immediately chose to adopt the plan. The value, in terms of patient and staff satisfaction, of the opportunity to convert the 21,900 hours of saved nursing time into direct patient care far overshadowed the added technician cost. The take-away there is that simulation is not about simply cutting costs or making things "efficient." It is about finding optimum client value within an evaluation framework that also includes qualitative elements.

How are predictive analytics and modeling changing the design process?

I don't know that any "new" stages are required on a PA project, but I would say that the type of design work performed during programming, concept design, and schematics take on different characteristics. It is also true that after design is complete, facility transitioning, post-occupancy evaluation and project archiving phases are also changed when PA is engaged. Here are some examples.

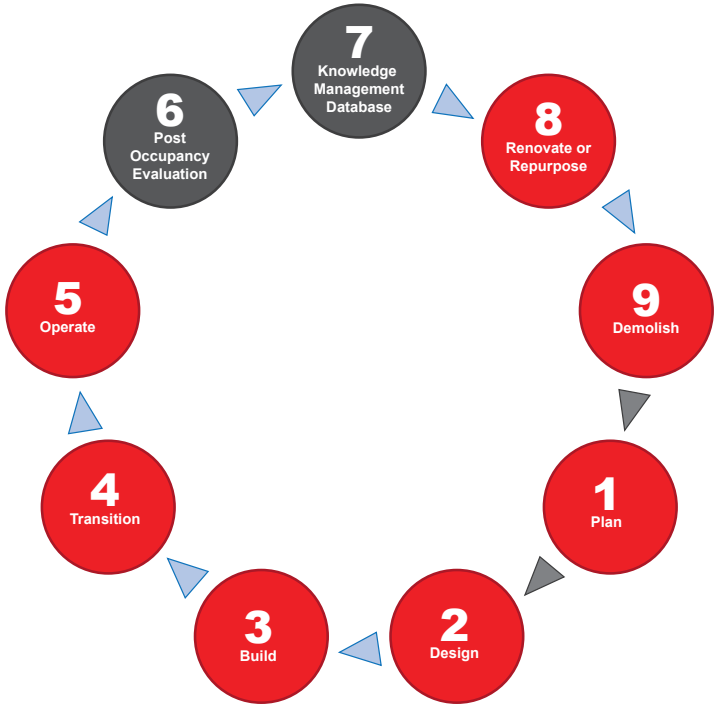
A traditional process has "visioning" sessions that will produce some qualitative notions about what the project should accomplish. In a PA process, in addition to the soft targets, there are specific, quantitative, financial and operational performance metrics identified, with target performance levels set for each of them, for each planning horizon. These are usually established within the context of performance percentile bands of both national and client-specific benchmarks against relevant cohorts.

A traditional process conducts "end user" meetings where there is conversation about how care is provided. In a PA project, however, it is a far more detailed process. A true concept of operations for the current state is developed that includes every step, of every process, of every unique patient's care plan. This process does not talk about how things work. It defines, at the micro level, based on staff profiles, staff schedules, patient arrival patterns, patient types, equipment throughput cycle times, architectural space, materials management policies and procedures, etc., every bit of work performed. In a PA project, this data is not anecdotal, but is instead derived from the electronic health record, manual data tracking techniques, or real time location-based services (RTLS) that track the movement of all patients and staff, second by second throughout the entire space. The role of the IT department and chief medical

information officer's staff is much higher in a PA project than in a traditional process.

Client leaders sometimes assume that their facility's day-to-day operations are, and have historically been, monitored more accurately than they were. Of the 42 projects that I've completed, nearly every one began by the client reviewing our scope of work for current-state data requirements and stating that they could fulfill them. However, good data was available on only one of those projects. Once we review the data and advise the client of its deficiencies, regardless of how the client chooses to fill the void, time and expense will be added to the project. To help prevent this occurrence we now preform a check of the data ourselves, before signing the contract, to be sure that we are not just taking the client's word for what they assume they have. In order to help ensure that a current state data collection effort does not unduly affect project schedule, we will often begin the current state data evaluation on a notice to proceed, or, even as a part of the proposal development process, depending on the relationship to the client and the nature of the proposal procurement process.

A traditional process does not objectively and quantitatively validate its operational constructs



against current operations. In a PA project, the rich process definitions we just discussed are built into a "base case" simulation model that is run in order to do two things. The first is "verification" of the model, which is the process of determining that a model's implementation and its associated data accurately represent the modeler's conceptual description and specifications. That is to say, to make sure that, from a software and programming perspective, the model is operating properly. Second is "validation", which is the process of determining the degree to which a simulation model and its associated data are accurate representations of the real world from the perspective of the intended uses of the model. That is to say, to be sure that the model accurately represents the actual work being studied. Only after these two tasks are complete does the PA team move forward with developing and running future-state scenarios.

Traditional approaches have limited capability to explore alternatives due to cost and schedule constraints imposed by the delivery methodology itself. In a PA project, the virtual, digital model, coupled with optimization engines, allow one to evaluate hundreds or thousands of alternatives, and to then rank order the results based on the client's performance criteria, to find the truly optimal solution in a quantitative, objective, data-driven way. Traditional approaches cannot do that.

Traditional approaches may or may not incorporate lean principals. In a PA project, not only is lean (a softer science) incorporated, but so is Six Sigma, which helps us understand the causes of process variability (which impacts both the profitability and the smoothness of healthcare operations) and helps to eliminate them. When we are working with hard data, we can apply statistics to determine not just whether one solution "seems" or "feels" better than another, but to use levels of confidence and p-values to see if the performance improvement observed is statistically significant and therefore worth implementing.

A traditional process should be performed within the context of two important documents, but that is often not the case. The first document is a current, thorough demand study that accounts for competitive market forces, demographic changes, current and anticipated reimbursement policy changes, and medical technology changes that may shift the venue, cost, duration, and staffing requirements of care that may affect revenue, volumes and facility requirements. The second is a current system-wide facility master plan that is based upon the demand study. Unfortunately, it is often the case that these two documents are not current and/or are not thorough. The traditional process can skate over these shortcomings and proceed, delivering, however, a potentially flawed end product. The PA process, on the other hand, really needs to have this work complete, if it is to properly fulfill its mission. Predictive analytics is a detailed scientific method and as it looks out to the future, the input to the model needs to be equally well founded in fact. This reality forces the client on a PA project to do the hard work that really they should be doing anyway,

if they want to say that they are effectively and efficiently managing their resources.

A traditional transition planning effort usually has to create the material with which to train staff in how to operate the new facility. On a PA project, the simulation model is the detailed "concept of operations" that can serve as the basis for training the new staff, many of whom may not have been employed during the time of the design effort.

A traditional post-occupancy evaluation focuses on the physical facility, and can be linked to design or construction warranty issues. On a PA project, operational and financial performance become added dimensions. The same scope of work as was included in the initial current state performance assessment is repeated, except this time, it is done on the new facility. The quantitative component compares actual clinical and financial performance against the performance as projected by the simulation. The qualitative component seeks to understand the rationale for usage patterns found (especially for those that may vary from what was assumed during design) and for any variances between projected and actual performance.

A traditional project is simply archived to document the work performed. In a PA environment, the project is decomposed and stored in a robust database that is used to track all of the design elements (spatial, process and financial), the projected performance metrics, the actual performance levels achieved as documented in the POE, the national benchmarks, and research relevant to all aspects of the facility type. The interface to this database allows designers to rapidly identify what has worked, what has not, and the reasons why, thereby enabling them on each successive project to move more rapidly and more cost-effectively to a better performing solution.

What disciplines are affected?

If the project begins as a new construction or renovation effort, architecture will of course be affected during the programming, concept design and schematic design phases. However, PA is a comprehensive methodology, and it will therefore also impact the design processes of the medical equipment planners and the low voltage/IT and clinical communication designers. Those on the client's team who are responsible for staffing models, patient scheduling protocols, clinical protocols and clinical performance, process improvement, and those in finance responsible for the project's pro forma and all of the facility's financial metrics, will also have their relationship to the project altered. All of these elements are no longer able to function in a silo. The impact of each one of them, on each of the others, becomes apparent in the simulation and a more collaborative, interactive project process ensues.

It is also important to note that PA can also begin as a process improvement project, where the initial intent is to not have a capital cost component. However, all of the same disciplines are typically included, because to be

thorough and balanced, the process improvement study should examine the impact of these other infrastructure elements. No clinical process occurs in a vacuum without them! The results of doing so can often shift the thinking of the institution. I had one client who was adamant about the fact that all capital funds would go towards their new emergency department (ED), which by their own account was 10 years overdue, and none towards fixing up the old one. That was until they saw the types of changes being recommended for the new ED, and how small capital investments could enable some of the improvements to be implemented in the existing ED, where they would still have to work for another three years before the new ED would be operational. That changed their mind, and several hundred thousand dollars were spent to achieve an improved level of performance in the existing ED.

What results have predictive analytics and modeling enabled you to provide your clients?

The benefits can be evaluated in two ways. First, there is the financial return on the investment made in PA, which in my practice has delivered ROIs that range from 10:1 to 20:1, and that are composed of first cost savings, life cycle operational savings, or a blend of both, which is actually the most common situation. Second, there are the quantitative, first cost or operational cost savings themselves, of which there are many types. I'll give you a few specific examples from projects on which I've worked.

Construction costs were reduced by $623,000 on a 42,000 square foot clinic floor when we found that eight percent of the initially planned floor space was not required and could be shelled. Elevator construction costs were reduced by $3M on a 1.4 million square foot hospital and the construction schedule was shortened by one month.

Construction costs were eliminated for a regional medical center that wanted to add 1,800 surgical cases annually to its existing operating room (OR). Another design firm had examined the situation and concluded that two new ORs were needed at a cost of $3-5M. We found that if we focused on process and scheduling adjustments, no new ORs were needed.

Medical Equipment costs were reduced for a new hospital by over $8M when 20 percent of the ORs were found to not be necessary to handle opening day volumes.

Full-time employee (FTE) costs were reduced by $100,000 per year in an Emergency Department and by 26 percent in a Central Pharmacy.

Annual operating costs, including staff and facilities-related expenses, were reduced by $528,000 for a 33-physician clinic practice.

We prevented over-building for a 22,000 square foot family health clinic when it was determined that instead of the originally planned 36 exam rooms, only 27 were actually needed even under peak patient volume conditions.

We prevented under-building for a non-invasive cardiology clinic when simulation demonstrated that the design with which the client and the architect had been comfortable for one year was, in fact, undersized in the echocardiogram area by 50 percent, and would have resulted in four hours of overtime daily without the addition of more rooms.

Predictive analytics prevented further development of an initial ED design that the architect was promoting. Simulation found that the design would have resulted in queuing of up to 11 ambulances at one time, 10 percent of the year, due to insufficient ambulance bays.

The revenue per exam room was increased by 50 percent in a 33-physician clinic. The amount of non-value-added nurse walking time on the patient bed floors was reduced by 21,900 per year.

The cost per patient encounter was reduced in a prototype patient-centered medical home by 13.1 percent when compared to a traditional family practice clinic.

Clinic visit cycle times were reduced by 30 percent in a Department of Defense active duty clinic and emergency department length of stays were reduced by 40 percent.

Turnaround times for blood tests in an existing central lab were reduced by 40 percent.

How can predictive analytics be applied outside of healthcare?

This is what Page is intensely working on now. For example, we have developed an entirely new approach to office space design that addresses the needs of firms with an increasingly mobile workforce that has a growing need for multiple types and sizes of collaborative workspaces, while the organization is simultaneously trying to drive down facility costs and drive up worker productivity. We'll be presenting this methodology at IFMA's World Workplace in October. Materials management, vertical transportation, food courts, and pedestrian plazas are examples of non-healthcare project types that I've already completed. Job-site optimization is a service that we've begun to offer our construction partners. So far it includes the problem of optimizing the quantity, reach and location of cranes as a function not just of physical reach across the site, but of construction velocity and overall project costs. We are taking the same approach to man-hoists on smaller projects.

Transportation hub analysis, including light rail and airports are also in the works, along with sporting venues. Frankly, there is really just about no limit to where PA can be effectively applied.

Some architects, designers, and planners are concerned that too much focus on data will diminish practice by depriving it of intuition and artistry. Are architects and designers destined to become servants of data, or the other way around?

Good designers, today, are not afraid of data. One of the very best that I know fully embraces and promotes PA and its processes because he

believes (and, quite rightly, I'd add!) that more data makes him more powerful and effective because he can examine more options, more accurately, in less time, and therefore make better decisions quicker for the client and make more profit for his firm. What good designer would not want to do that?

While this concept may still be new to some in "AECOM" (no, I'm not referring to the 100,000 employee firm! I use AECOM to refer collectively to the architecture, engineering, construction, operations and maintenance industries supporting the built environment), PA has been demonstrating its performance enhancing capabilities in other market sectors for some time. In their book *Competing on Analytics: the New Science of Winning*, Harris and Davenport documented their study of nine vertical markets (and no, AECOM was not included in the study, being the laggard that it is; there would have been nothing to report!) in which they found that there was a strong correlation between those firms that were performing at the peak of their industries, and those that had most thoroughly and effectively integrated PA into their operations. The same principal holds true for design firms, and good designers know that.

This chart form the book shows that as you move from dumb data up the ladder to actionable business intelligence, the four things you'll need to reach the top are optimization, modeling (simulation), forecasting, and statistical analysis. And these are precisely the foundation of PA at Page.

What parts of the design process or contributions of an architect cannot be replaced by analytics?

That is a touchy subject. Let me give you a bit of a preamble before I offer an answer. Derek Parker, former CEO of Anshen + Allen, Fellow of the AIA, is an internationally recognized expert in the design of healthcare and research facilities, having designed and planned more than 50 major hospitals and bio-medical facilities in 15 countries. He has received more than 75 awards for his work and published numerous papers and given many presentations on healthcare design worldwide. In 1993 he cofounded the Center for Health Design to help bring evidence-based design to health care. Hopefully you are getting the picture that Derek is not a 20-something techie, but an accomplished, experienced professional, and who is nearing his 81st birthday. He is an architect's architect. So there is a tremendous amount of weight to his recent statement that 80 percent of what an architect does today could be better performed by a computer, and that 20 percent is work that only a human designer will ever be able to accomplish. I recently conducted a Large Firm Roundtable survey and asked human resource directors how they saw this trend affecting their hiring. One of them responded, saying "We can do with eight on BIM, what used to take 20-30 people." So if you take the middle value and call it 25, then she'd have 68 percent of the work performed by the computer, and 32 percent by human designers. That's not too far off from Derek's sense of things.

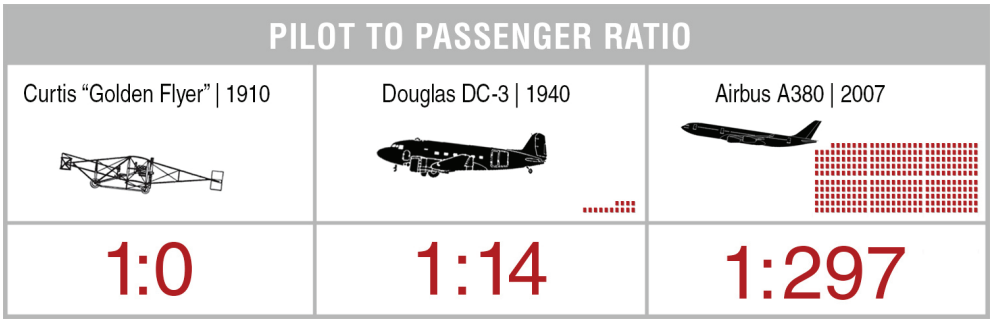
Is 20 percent the right number? That depends on your planning horizon. Near term, today, maybe Derek is right. Long term, I'd say it's less than 20 percent. AECOM technology is still rapidly evolving. Every industry that has felt the full impact of automation has seen countless tasks, job types and FTEs either eliminated or dramatically reduced in number, giving way to intelligent systems. In the airline industry, for example, 105 years ago the ratio of pilots to passengers was 1:0 — there were no passengers! Now that ratio is 1:287, on planes that fly themselves and offer showers, spas and sleeping compartments!

How many pilots do we need to transport "x" number of passengers per year? How many architects do we need to design "x" square feet of buildings per year?

The pilots may have about reached the bottom of their curve (how much bigger than an A380 can you get?), but the architects are just now approaching the steeper part of theirs.

To be sure we have the right context in mind when discussing this trend, I should mention that the PA work that we've been discussing is just a very small sliver of the larger BIM (Building Information Modeling) environment that is driving these changes. BIM has traditionally focused on the physical aspects of a facility, and PA has had more of a work process orientation, but fundamentally, they are both part of the same inexorable data-driven and design-process-automation march towards the AECOM future. As common platforms evolve among the virtual representations that define land, traffic, existing facilities, building products, construction processes and technologies, logistics, codes and regulations, etc., comprehensive design will occur with a speed and accuracy that will displace many employee profiles now earning a good living in AECOM. The next 20 years will be disruptive to both educational institutions and to the AECOM workforce.

For someone like me who has studied and practiced architecture, it is concerning that architects as a whole seem to be less aware of this trend than construction firms and some developers. The latter two are making strides that are intended to supplant some traditionally A/E-provided services, thereby making



themselves more important and comprehensive components of the facility project team, at the architects' expense.

How do data and the more human and intuitive aspects of design find a balance?

I was engaged by the OR steering committee for a new surgical suite and their one big hope for the new OR is that it would be compact, efficient, and reduce the 2.5 miles per day that they had to walk in the existing hospital. We developed some innovative approaches, including a two-level design, and got their walking distance down to .67 miles. But one thing about the design bothered me. The faculty lounge, which is where many surgeons would refresh between cases, was way off to one side of the floor. So I created a model that had the lounge much more central, ran the simulation, and presented the results to the steering committee.

They unanimously rejected the notion immediately. Wait, weren't these the "reduce my travel distance" guys? Yes, they were, but the originally proposed location was the only space in the entire facility on that floor that had natural light next to a sunken garden area. That natural light was more important to them than the reduced travel distance. And that is how the design process should work. Predictive analytics let them make an informed decision using the full spectrum of their value system.

It's the same with aesthetics. Predictive analytics does not stand in opposition to aesthetics. It merely provides input to the quantitative elements of the decision. Aesthetics and hard data should both be balanced contributors to all design decisions. And when aesthetics or other more qualitative factors win out, that is okay, since the choice is being made with full knowledge of the objective, operational effects.

What skills will future practitioners need in design practices that are increasingly evidence-driven?

They will need to know more about the integration of higher order issues, spanning a broader spectrum of disciplines including urban planning, landscape architecture, transportation, buildings, construction, maintenance, operations, finance, risk analysis, and decision science, and less about technical details. They will need to know much more about tools that virtually represent and simulate the built environment in all of its complex interrelationships, across the entire life cycle continuum. In fact, some of those now working in A/E firms will shift to work with the systems developers as subject matter experts, rather than remaining as practitioners.

Most good firms today have at least one percent of their staff in non-traditional roles that are working toward this new paradigm. Some that have the clearest vision of the future have boosted that to over 50 percent! They have embraced the success that PA has had in other industries and are applying those strategies full-bore in AECOM. These firms will succeed because they will deliver a level of quality at

Organizations and individuals who are making unique contributions to developing the technologies, standards, delivery processes and strategies, as well as the legal and financial frameworks that move predictive analytics forward:

UNIVERSITIES AND RESEARCH LABS

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a price and on a schedule that will leave their competition without clients.

Will these changes simply result in architects having to know and do more, or will their role change fundamentally?

I am not even sure that "architect" is the right word for the AECOM project leader of the future. This individual will have to understand so much more, as I pointed out a minute ago, and be able to do so much more, that they will have a very different role. Will that person be on the design side? Or will they be on what we now consider the construction side? Or, maybe on the development side?

There are those in each of the three camps that are attempting to achieve that position of influence with the client. Regardless of which hat they wear, educationally, I suspect that they will be graduates from programs similar to MIT's doctorate in Design and Computation or Georgia Tech's doctorate program with a Concentration in Computation.

How is the rise of predictive analytics and modeling likely to change the traditional business model of an architecture and design practice?

Teams will be much smaller, more agile, with members being the highest performing conceptual thinkers.

For many firms, I think that the opportunity is not the creation of something new and dramatic,

but is instead just to begin to re-train, re-staff and invest heavily in off-the-shelf technologies in order to better meet the new client expectations and design environment realities. Most firms don't have the resources to go beyond that.

For the few firms that have the vision and the capacity, I think that there are opportunities to create new value propositions.

First, firms can develop a custom technology bridge to reach as yet unmet AECOM functional requirements, and several firms have already done this very successfully. Gehry Partners was one of the first when it created Gehry Technologies (now part of Trimble), which is a very powerful force in design automation and project management solutions, with over 100 employees and offices around the world. The Beck Group formed Beck Technologies, which is developing new software with a construction focus. Most recently, the design firm Aditazz tackled the simulation software development model with a remarkable intensity and vision.

Second, firms can figure out how to develop the project knowledge management database that I mentioned earlier. This can be done using commercially available tools, and will be the key to reaching a truly evidence-based design foundation. The investment would be relatively small (a few man-years) and could easily be marketed to other firms.

How will this approach change the relationship between all parties in the design and delivery process — and beyond?

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First, the growth of PA services has tended to accentuate the commoditization problem of traditional architectural services. I've had clients tell me that they are willing to pay higher fees for PA services rendered in early design because that is where the clinical and financial viability of the project are defined and because PA services are still not commonplace. After the heavy concept design or light schematic design is complete, some owners feel that any smaller, local firm, for a smaller fee, can take them from that point to a finished set of construction documents. I have been awarded some work like that where I got the upfront PA work but my firm did not get the follow-on architecture.

Second, PA will tend to place an increased burden of performance on the design team. For now, contracts are not yet holding the design or consulting firm accountable for post-go-live operational results, but that will change. Actual accountability for achieving the targets is shared between the design team, the transitioning team, and the staff of the client, but as it is with long term physical facility accountability in P3 projects regarding performance, methods will be developed to better hold the design team responsible for achieving stated performance objectives.

I think that we can look toward firms like the Plenary Group to see the future. In the P3 (Public Private Partnership) project arena, a contractual agreement between a public entity and private entity (consortium) transfers the responsibility of a facility's engineering, construction, operation

and/or maintenance to the private sector for a defined period of time, with compensation spread over the contract time period, and tied to the achievement of specified performance levels. The collaboration will be intense, and goes well beyond Integrated Project Delivery (IPD) agreements, because it makes the AECOM entities rely on each other for their revenue not just for a few short years to build the facility, but for another 20 or 30 years post-go-live.

Owners are beginning to consider this model because it takes an expensive and complex operation that is not their core business off their balance sheets and off their minds.

The next frontier in this market is to add the clinical operations component, which has not yet been done. Plenary and I, however, have had some preliminary conversations on this subject.

How does the Page approach differ from other firms?

Page has had a consulting group for decades, working across all market sectors. These folks are not the designers developing floor plans, but instead are focused on the use of quantitative methods in early programming and design phases. It is a richly diverse group, with seasoned AIA Fellows, former healthcare consultants, industrial engineers, and recent grads performing energy analysis and parametric modeling. The one tool that was not yet in place was process simulation, so my joining the

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firm was just a natural extension of a strategy that Page had already been developing, and which had taken root in its culture

There are two reasons I chose to build my practice at Page.

First, during my initial meeting with the firm's healthcare leadership their opening remarks were different from those of other firms I'd considered. They said, "We like what you are doing in healthcare, we get that, and we want you to continue and expand it. But your big mission is to take that design approach that you've evolved in healthcare and apply it to all of our other market sectors. That is where we think the new frontier is shifting, and that's where we want to have a leading edge impact." That's what I was seeking. It is true that healthcare is the most process driven, process rich market with the most complex problems to solve, and a huge, universally acknowledged national consensus that costs have to come down and quality has to go up. The perfect storm for PA! But if you look just a little bit harder at the other market sectors, the opportunities are many, and Page hopes to help pioneer meaningful, data-driven design change in those sectors now.

Second, the firm has a very flat, empowering, collaborative culture. It hires good people and gives them space to work. I've never experienced anything like it. The whole firm feels powerful, engaged, nimble and capable.

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