

Design *and* Make: Expanding the Boundaries of Generative Design

CIMdata Commentary

Key takeaways:

- *Autodesk University, in its 25th year, showcased a company undergoing significant changes while highlighting their unique strengths.*
- *Long a design company, Autodesk emphasized their strategic commitment to Design and Make, using their generative design tools to support a range of design and manufacturing processes.*
- *Through their Forge initiative, Autodesk is turning their Forge platform into more than just the underpinnings of their product lines, they are creating an integration and collaboration platform to link many disparate offerings beyond their own.*

CIMdata attended Autodesk's 25th Autodesk University (AU) in Las Vegas on 12-16 November 2017. Approximately 10,000 attended, including customers, partners, analysts, media, and, of course, the Autodesk organization in force. As a company, Autodesk is undergoing major changes. In 2016, Autodesk announced their intent to move to all subscription pricing from paid-up perpetual licenses. At the time, Autodesk informed Wall Street about a decrease in revenues in the short term as the company transitions financially. Based on previous experience with companies like Adobe, this financial transition can take about three years and Autodesk is on pace with company and financial analyst projections. With the company going more and more direct, this model change also impacts their channel partners, who must evolve beyond just reselling packaged software. Successful resellers are doing just that. As a final indicator of big changes, the company recently named a new CEO, Andrew Anagnost, a 20-year Autodesk veteran, who gave his first AU keynote this year.

In his remarks, Mr. Anagnost posed the same question that customers ask him: "Will we automate ourselves away, with humans doing less and machines doing more?" He employed some interesting examples. Automated Teller Machines (ATMs) were introduced in 1967, with units deployed quadrupling in the next ten years. According to Mr. Anagnost, during that same period, "total employment in the financial sector went up and there were more bank tellers than ever before." He gave another example of automation benefiting the workforce rather than reducing it. Mr. Anagnost claimed that before CAD software was introduced, there were "about 300,000 drafters in the US," and now over "10 million are using design software." As a result, Mr. Anagnost posited that there are now "more people imagining, designing, and making than ever before." CIMdata agrees that technology often closes some doors, but also opens many windows of opportunity. "Who thought," exclaimed Mr. Anagnost, "that a whole industry would be built on emojis?" While Mr. Anagnost's was a different message, his remarks were very consistent with Autodesk's long-term message, with one small extension: Autodesk is fundamentally a design company, but going forward they will place increased emphasis on the connection between design *and* make.

Several customers joined Mr. Anagnost during his keynote, but one customer stood out because of this design and make connection. Mr. Hilbrand Katsma, COO of Van Wijnen Noord B.V., told the story of his company's innovation journey. Van Wijnen is one of the leading mid-sized design and construction companies in The Netherlands. Their innovation journey started in 2011 when they decided to try to do something about their high costs and high waste. At last year's CIMdata PLM Market & Industry Forum, CIMdata highlighted the

data on construction waste, and focused on how manufacturing technologies and approaches could benefit construction. Van Wijnen looked beyond construction, talking to manufacturers, software developers, and other companies that had one characteristic in common: they all made high-quality products using standard materials in large volumes, and they were all able to standardize their processes. This is in stark contrast to typical construction where everything is custom, using different teams, different standards, different supply chains, and working in the open air, not inside a manufacturing facility. Their goal was to reduce cost by 15%, accomplish some projects as much as 50% faster, all with fewer than three defects per build. They moved from 2D to 3D Building Information Modeling (BIM) and trained their construction team to use tablets to collaborate with office-bound designers, eliminating paper. According to Mr. Katsma, they often struggled and failed, yet persisted. Just two years after launch they reached their goals on their first project, which they credited to platform thinking and using a modular concept for housing. Their latest version homes can be disassembled and reconfigured as owners' needs change. With Autodesk's technology, Van Wijnen can bring the customer into the process to determine materials and finishes, and show them the costs of their design decisions. After configuration, customers can virtually walk through their virtual home and neighborhood. After all decisions are finalized, Van Wijnen can auto-generate the documents needed for building permits with one touch.

Van Wijnen's most recent work highlighted one way that Autodesk is evolving their generative design abilities into architecture and beyond, having been previously more focused on topology optimization and additive manufacturing. With Van Wijnen, Autodesk evolved their generative technology to optimize the design of a neighborhood, setting goals for numbers of residents, green space, and other parameters, and letting the system propose options. Later in the session, Autodesk spoke about their work to extend generative design tools so they can automatically design for as many manufacturing techniques as they can. Other software providers are also using systems to explore design alternatives spaces using more traditional subtractive manufacturing techniques, such as combining aPriori's cost management techniques with design exploration software from ESTECO. Autodesk's move in this direction has the potential to bring these capabilities to many more users, fully consistent with their democratization mantra. Will these solutions displace workers, or unleash hidden potential, as Mr. Anagnost suggested in his opening comments? Time will tell.

During AU, CIMdata had the opportunity to speak in person with Mr. Jeff Kowalski, Autodesk CTO, about the advances Autodesk has made in additive manufacturing and generative design. "3D printing to us represented an area where if you could just get to the form, you could press the button on the 3D printer and it would just come out. We know that's not true, but it was a useful fiction, and enabled us to focus on the design end up front, and that gave birth to generative design. So, you can witness that stuff just around the corner," he said during a conversation about the industrialization of additive manufacturing.

At Autodesk University last year, the company spoke about their Forge platform as the underpinnings for all three Autodesk businesses: manufacturing; architecture, engineering, and construction (AEC); and media and entertainment. To expand their market reach, Autodesk created a \$100 million Forge Fund to encourage others to also develop on the platform. In fact, the first day of this year's Autodesk University agenda included a Forge developers conference. Mr. Dale Lutz, VP of Product Development of Safe Software, stated that he has over 20 years' experience working with Autodesk to leverage existing data created using tools from Autodesk and others. Someone suggested to him that Safe Software look at the Forge API to understand its potential to help. Mr. Lutz gave the task to an intern, who successfully integrated Forge with their product in just two weeks. Unknowingly, Mr. Lutz

hit on one of the Forge team's main recommendations at the Developers conference: have someone work with the APIs that is not bogged down with old ways of thinking about integration and data migration. Luckily for Mr. Lulz and his firm, at the same time a major land developer wanted help to put all their data into Autodesk BIM 360 from 200 different systems, spanning 8 countries that had been in operation for seven years. Over the course of the project, Mr. Lulz and his client were able to retire 150 separate systems that were managing their BIM data. Today they have one system, inside of BIM 360, to access all of their data in the cloud.

Mr. Lulz claimed that working with the Forge API saved development time. Safe Software had never shipped a product developed in two weeks before. Forge supports OAuth 2.0, an industry standard for authentication, that helped them authenticate on a cloud platform. Unfortunately, this was after the company spent three years doing their own authentication. This was one reason their intern could complete his task in two weeks—they were finally using the same OAuth as everyone else. Mr. Lulz also praised the Forge team for their frequent updates and support. When their partner in Sweden began deploying their beta software during the migration, the resulting data volumes were much greater than previously seen and caused some issues. They had to collaborate with the Forge team to find out where the issues were, and Mr. Lulz was amazed at the speed at which updates could be provided once they determined root causes. Lastly, he said the Forge documentation was top notch.

Forge is a great example of a product innovation platform, a topic that CIMdata has discussed at length over the last several years. Autodesk uses it to integrate its many products, but with the Forge initiative they are encouraging partners to develop their applications on top of Forge. Mr. Brian Roepke, Senior Director of Forge Product Management, spoke about "Build on Forge" in the same vein as the Force.com platform from Salesforce.com. To speed development, Autodesk is working on a Forge Integrated Development Experience for their development partners to help them more quickly develop and publish apps. A great part of the success of Salesforce.com comes from being a platform on which numerous other enterprise applications are delivered. If Autodesk can build a robust app community, Forge could be next. They have a lot of experience from their Autodesk Developer Network programs, so it would be a mistake to ignore this possibility.

In conclusion, AU was once again a vibrant showcase for the company and their customers. Their evolution to all subscription seems to be ahead of plan, with company revenues on the upswing year-over-year. The new Autodesk CEO, Andrew Anagnost, is a company veteran with some big shoes to fill, and he appeared comfortable in the role. His remarks in the plenary and analyst sessions were consistent with Autodesk messaging over the last 18 to 24 months, with some key enhancements. Increasing the focus on design AND make is a good move for Autodesk, positioning them as ready, willing, and able to help their customers adopt new technologies and processes that Autodesk is working to democratize. The expansion of generative design beyond additive manufacturing is also positive. Being able to generate optimal product designs using a wide range of manufacturing processes is a big step forward, one that will also help in technology adoption. Finally, their work on the Forge platform and initiative is important to fleshing out their product innovation platform, encouraging a wide range of partners to build on top of Forge but, just as important, also to connect Forge to other enterprise systems and tools. In CIMdata's experience many companies do not lack for tools, but often maintain too many that are incompatible or sit in islands separate from other business systems. It is a good play for Autodesk to act as that integrating platform. Autodesk has seen success with BIM 360 playing this role in AEC applications, and it is just as important in other industries. What we saw at AU is just the beginning of Autodesk's renewed

vision and expansions of their generative design technology and CIMdata looks forward to seeing how customers leverage these new capabilities.

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