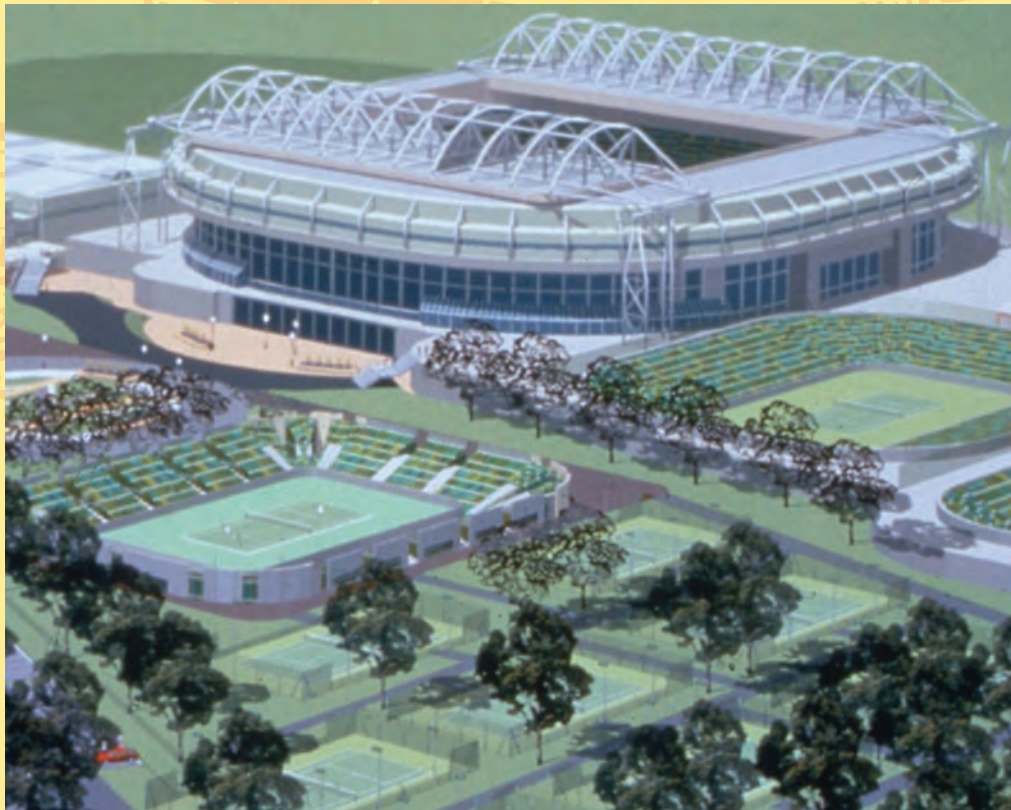


# Back to the Future of BIM

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<Figure 1> IN WHAT YEAR WAS THIS MODEL 3D MODEL MADE? – SEE ANSWER IN THE END OF THE ARTICLE

There are but a few individuals within the field of BIM (Building Information Modeling) who can boast of international acclaim stretching beyond the BIM niche. These individuals are most often recognized for their remarkable efforts in transforming the construction industry, through the invention of ground-breaking technologies. At buildingSMART Korea, we had the great pleasure of talking to one of such individuals; a person whose involvement with the early development of BIM technologies has come to define the tools and workflows that we associate with BIM today (Figure 1).

In 2016, Dr. Jonathan Ingram was awarded the prestigious Prince Philip Gold Medal, an international award, which is on seldom occasions bestowed to individuals from anywhere in the world, who have made exceptional contributions to the field of

engineering.

What is Dr. Ingram's contribution then? you might ask. To answer that question, we will need to dive into the historic archives.

In 1986, on the same year that Windows OS was first released and 3 years after the first release of 2D AutoCAD, Jonathan Ingram was creating a new technology. Unlike most inventors who notoriously shelters their creative minds in basements or garages, Jonathan sought to his attic instead and found that his passion for computational design had nudged him into a hermit-like lifestyle. While at the time, when the industry was still awed by the cutting-edge digital drawing board, 2D

AutoCAD, Jonathan's mind was fixed on another dimension – the 3rd dimension.

The cornerstones for 3D CAD programs had been extensively developed and conceptualized throughout the 1970's and 1980's in applications such as BDS, RUCAPS, GDS, ARK2 and Gable CAD Systems. In fact, the broad theoretical concepts of what we have come to associate with modern BIM practices, were already outlined by the historically recognized “Father of BIM”, Charles (Chuck) Eastman, in the Building Description System (BDS) software from 1974 – almost a decade before the public release of 2D AutoCAD. Despite each of these applications leading ground-breaking contributions to the advancement of computer aided design, neither qualified as an actual building information modeling software.

Before committing to the hermit years in the attic, Jonathan was employed at GMW Computers Ltd, where he worked on the CAD application RUCAPS – a recognized forerunner of BIM applications. RUCAPS was primarily based on the 2½D concepts originally known from the Building Description System (BDS). 2½D refers to the concept of 2D plan, section and elevation views being attached to individual objects to show detailed representations of the object in different perspectives. RUCAPS sought to innovate the 2½D concept by adding additional 3D representations, an idea which Jonathan Ingram proposed while working on developing the application. At the time, limitations in computing power required RUCAPS to be split into +30 individual modules / programs. Working mainly on his own, Jonathan successfully built a bolt-on module for RUCAPS that allowed 3D models to be generated from the 2½D objects, however, these objects were neither parametric, intelligent nor did they contain any metadata (information) – features which later became synonymous with BIM objects.

While being engaged with the RUCAPS development, Dr. Ingram began envisioning the concept of a single federated model, with integrated parametrics, coordinated 2D and 3D views, clash-detection, construction sequencing and rendering. In the end, his obsession with this concept made him quit his job to pursue his own vision. As a young man, just 24 years of age, he got a bank loan that gave him sufficient leverage to purchase a desktop workstation, which he placed right in the middle of his creative sanctuary, the attic. From the depths of two years solitary work sprung “Sonata” in 1986 – just 1 year before the first release of ArchiCAD. Over the two years of dedicated development, Dr. Ingram had successfully achieved

to develop a software containing all his envisioned features. When the program was officially released, it spread shockwaves throughout the industry, with the introduction of what was likely – despite some public debate on this – the world's perhaps first true BIM-capable application. It was this innovation that earned Dr. Ingram the Prince Philip Award as well as the British Computer Society's Innovation Award (Figure 2).

In fact, Sonata turned out to be such a robust application that it continued to be used by major public clients in the UK until 2015, 35 years after its inauguration. Unlike line-based 3D CAD, Sonata introduced early definitions of parametric solid modeling and object-oriented design, where individual object categories would adjust differently depending on their relation and interaction with other object categories. A good example of this is how windows and doors automatically embedded into walls and generated the associated details. Through Sonata's object-oriented design approach, it was possible to rapidly generate construction plans, sections and 3D perspectives and design changes would automatically update on all views. Additionally, the object-oriented design allowed for both quantity take-offs and construction sequencing to be made. Sonata even had an in-built rendering engine – an area of particular interest to Jonathan, who wrote his PhD



<Figure 2>

on that subject. At first glance, the features and workflows of Sonata show striking resemblance to modern building modeling applications such as Autodesk Revit, despite Revit first being released 15 years later in year 2000. According to Jonathan's accounts, he got very close to an acquisition agreement with Autodesk in 1987, which was cancelled in the last second, as the historic financial crash, Black Monday, fell right on the table, just as they were about to sign the deal in the meeting room.

Back in the attic, Sonata endured years of development and evolved into the more complete and user-friendly application Reflex, which Jonathan eventually sold off to the software company PTC in 1996, while also taking on the position as CTO of the company. PTC is today most well-known for the Pro/ENGINEER application, which at the time, had such a significant market dominance in the field of mechanical engineering, that the company was aiming to expand into the construction market to maintain growth. The mid-1990's was a defining age for the development of BIM programs. It was a time where the largest players in the industry led a series of major software acquisitions to safeguard their market dominance. According to Jonathan, this was the reason behind PTC acquiring Reflex for \$30 million. But even with Reflex and Jonathan at hand, PTC was struggling to penetrate the construction sector and quickly gave up on the project (Figure 3).

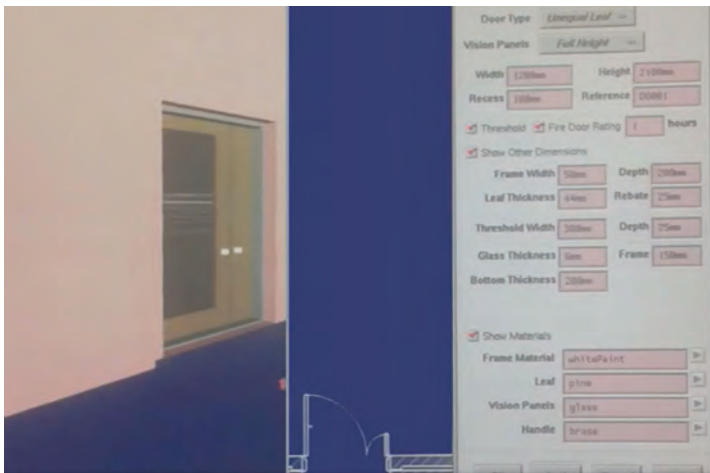
Just two years after the acquisition of Reflex, two PTC employees left the team and founded their own company to begin the development of a building modeling application that they would later go on to sell to Autodesk, they called it Revit. According to Dr. Ingram, they did so with access to a non-

exclusive license of Reflex. He explained that they had initially offered him to take part in this endeavor, but after more than a decade of intense dedication to software development, embarking on yet another of such adventures was simply too overwhelming for Jonathan, who recalled feeling utterly burnt out at the time. The rest is history.

Jonathan explained how Reflex and Revit shared a myriad of features and that it is hard to argue where the Revit team sourced its main inspiration from. That said, the 1990's were indeed a time of fierce competition among large rivaling software companies, each drawing inspiration from one-another, in an attempt to control the new and highly lucrative BIM domain. Where many failed (or were acquired) and some succeeded, Revit excelled among its competitors with the introduction of an ingenious and original feature, which has become defining of the application's success and popularity today – the family editor. The introduction of this feature revolutionized object-oriented design by allowing professionals to easily create, manipulate and schedule parametric objects in a simple and consistent way. Furthermore, the family editor made reusable object libraries easy to generate and share across projects and the consistency in the parametric structure of these objects made it possible to perform various types of analysis based on the object metadata. In other words, the family editor capitalized the “I” (Information) in BIM and made rapid design iterations a possibility.

That all sounds remarkably interesting, but why have I never heard of Sonata, Reflex or RUCAPS, you might ask?

The answer is multi-faceted, but not particularly complicated. As of 2021, the benefits of BIM are still under much debate across the industry. In general, the architects have pushed towards this transition, with clients, contractors, and other consultants slowly, and at times, hesitantly adapting to the new norms. It has taken decades for the industry to reach its current high level of BIM maturity and for many practices, it has undisputedly been a bumpy road to success. Even



<Figure 3> Parametric objects – Reflex



today, levels of BIM maturity vary vastly from company to company and even more between countries.

Wind back to 1980's, where this situation was ever more pronounced with only a small percentile of professionals being familiar with computers. Software expertise was generally a rare and expensive skill to come by in those days. In addition to that, the licensing price of pre-1990 building modelling applications like CATIA, ArchiCAD, and Sonata was steep, and required very expensive desktop workstations to run – a cost which combined was reserved for only the most financially robust customers. AutoCAD, on the other hand, was sufficiently light to run on IBM's first personal computer (PC), which was sold at an affordable price and thus widely accessible to hundreds of thousands of professionals. On the more obvious note, AutoCAD was also more straight-forward for the industry to adapt to than the 3D CAD programs, as it did not impose radical changes to traditional workflows. In other words, AutoCAD was timed perfectly for a ripe market of entry PC users, seeking to take immediate advantage of the new computer technologies. Fast forward +35 years and the same debate between 3D versus 2D still rages on, despite most of the industry having realized the benefits of 3D these days. Around the mid 1990's, when affordable PCs eventually became sufficiently powerful to run 3D building modelling applications, the big software companies had witnessed the market trends and technologies steadily mature over the years and in the meanwhile gained enough momentum to take on the competition with full force, ultimately turning the tides to their favor.

Therefore, it became apparent to us that Sonata was an application simply too ahead of its time. It was launched into a premature market where neither the appropriate skills nor hardware were commonly accessible. Thereto, BIM workflows, guidelines and industry standards were yet to be formulated at an industry level. Once the market had picked up, so had the competition and when Reflex eventually entered the battle, it did so with too little momentum to lead the paradigm shift to BIM. Therefore, it was eventually swallowed up before it ever got a chance to gain a foothold in the industry. That said, both Sonata and Reflex still managed to attract a worldwide user base throughout their lifetime, particularly in China and the United Kingdom.

As is commonly the case with history, the victors receive the greatest attention, which in this case has seemingly left Sonata and Reflex somewhere outside of the historic spotlight.



<Figure 4> ANSWER: 1987 – Using Sonata

Hearing, seeing, and reading about the convincing accounts of Jonathan Ingram's life work, makes it difficult to argue that his legacy and pioneering innovations does not hold a defining role in the history BIM. For those who are interested in learning more about the history of pioneering CAD and BIM development, Jonathan Ingram's newly published book "Understanding BIM" is most certainly a recommendable read.

Therefore, the next time anybody refers to BIM as an "new technology", you can confidently inform them that BIM have indeed existed and matured alongside CAD for more than 35 years. 🌈



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Worked as Head of BIM at an architectural practice in Dublin, Ireland, in which he lead the company transition to BIM, trained +40 employees and supported the development of more than 20 medium-large scale projects.