

Visualizing the Future Globally

Tracking Worldwide Demand for 3D Graphics Skills

January 2021



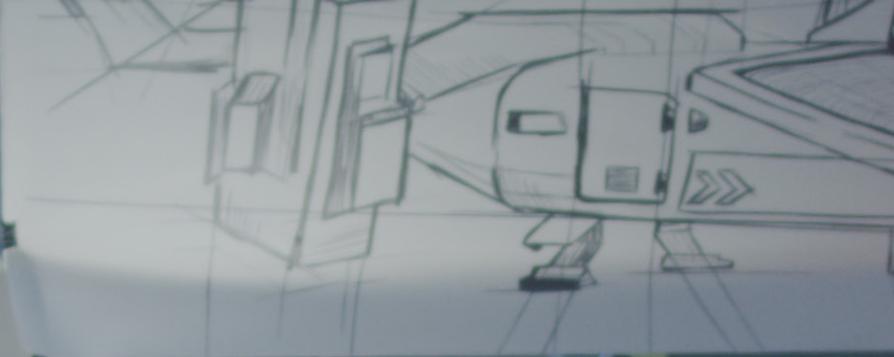


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1.

Executive Summary

The rapid growth in the use of 3D technologies has redefined production and design—and demand for 3D skills is being felt in job markets around the world.

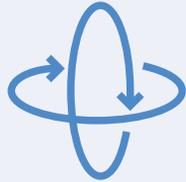
In a 2019 Epic Games and Burning Glass Technologies report¹ on the US job market, we found that competency in 3D graphics is in enormous demand across multiple industries, representing a robust market of more than 315,000 job postings. The use of real-time rendering 3D software is growing exponentially, with demand for these skills increasing 601% faster than the job market overall. In the previous report, we also found that supply of real-time 3D-proficient employees is not keeping up with the heightened demand, causing an employment hole in the market and strong entry-level opportunities for those with real-time 3D skills.



Epic Games and Burning Glass collaborated once again in 2020 to further research the labor demand for 3D graphics skills—this time broadening the scope internationally. Burning Glass analyzed job postings in select English-speaking nations, such as the UK, Canada, Australia, New Zealand, and Singapore, as well as 20 European countries. Using the same list of key 3D graphics and real-time skills as the US report, Burning Glass found similar and, in some cases, even more noteworthy results than in the US report, highlighting that **3D graphics and real-time 3D skills are in high demand across the globe.**

¹ Walsh, Matthew; Markow, William; and Bittle, Scott. “Visualizing the Future, Demand for 3D Graphics and Real-time 3D Across the Economy” (2019) Burning Glass Technologies; www.burning-glass.com/research-project/visualizing_future_3d_skills_workforce/

Key Findings



30X

Demand for real-time skills has multiplied by as much as 30 times in Singapore.

Real-Time 3D Skills

In the European and English-speaking non-US countries Burning Glass analyzed, there were almost 34,000 job openings looking for real-time 3D skills in 2019, and demand for real-time skills in 2019 has multiplied by as much as 30 times in Singapore, and has grown at almost twice the pace of the US demand for graphic 3D skills.



Demand for 3D graphics and real-time skills is growing

Growth in English-Speaking Countries²:

Demand for 3D graphics and real-time 3D skills is outpacing overall job market growth in the non-US English-speaking nations studied. The market for these is growing more than 10% faster than the overall job market and over 50% faster than that of the average information technology skill. Across the world, real-time skills are pulling ahead of 3D graphics skills in terms of growth. In Australia, New Zealand, and Singapore, the market for real-time skills has grown over 450%, 10 times faster than 3D graphics skills demand.

10%

faster than overall job market

50%

faster than average information technology skill

² Growth information not available for EU dataset.



New hybrid 3D modeling jobs:

- ✓ fashion designers
- ✓ civil engineers
- ✓ interior designers
- ✓ city planners

Emerging Career Areas:

Demand for certain 3D graphics and real-time 3D skills is rising in career areas that had not previously registered demand for these skills, like Unreal Engine in media and design or 3D rendering in fashion design. These digital skills are driving growth in these sectors and creating new types of hybrid 3D modeling occupations—fashion designers, civil engineers, interior designers, and city planners are all using 3D graphics and real-time skills in new and exciting ways.



Dominant, steady growth:

Germany
UK

Countries with the Largest 3D Graphics Demand:

Demand for some 3D graphics skills is becoming universal across all geographies studied, while for others it remains geographically fragmented. Countries like the UK and Germany are the dominant force, universally showing the highest demand for 3D graphics and real-time 3D skills in a variety of occupations and industries. They demonstrate a lived-in relationship with 3D skills, with steady growth and larger job posting count, likely reflective of a large number of current workers with 3D skills in those countries.

2.

Introduction

3D graphics tools and software recreate reality on a computer, aiding industries from architecture to filmmaking in creating complex simulations of real life on our screens. These digital assets are used for a variety of projects, including designing products, creating entertainment, and visualizing buildings before they are constructed. Real-time 3D applies real-time rendering to 3D data, enabling the user to experience and explore a virtual world interactively, without the constraints of pre-rendered frames that leave the viewer no choice of what to see. With real-time rendering, frames are calculated and displayed in fractions of a second (sometimes up to as fast as 90 frames per second), meaning that the scene can react virtually instantly to changes in input, such as where the viewer is looking, or if a light switch is turned on or off.

Real-time 3D is changing the ways in which individuals interact with designs and concepts, pushing these technologies to the frontier. Trainee surgeons are practicing critical techniques in virtual reality; customers are configuring the car of their dreams and seeing the result in

every detail, from any angle, in an instant; broadcasters are using augmented reality to bring home the dangers of hurricanes, floods, and wildfires. The labor market and talent-sourcing implications of such a futuristic technology are yet to be explored worldwide—how and where do real-time skill proficiencies add value to the global market? How can the digital workers of the present world prepare for this software evolution? How can the employees in traditional careers prepare for the inevitable changes to their jobs from virtual reality?

A previous Epic / Burning Glass Technologies report examined the increasing demand for 3D graphics and real-time 3D skills in the US job market. With this report, we investigate how 3D graphics and real-time 3D skills have impacted job markets globally. We look at how different countries engage with real-time and 3D graphics skills, which jobs and industries are experiencing new transformations through 3D graphics skills, and in which jobs 3D graphics and real-time 3D skills have become foundational for the modern worker, including boosts in compensation for highly valuable skills.

To begin answering these questions, Burning Glass looked at international job posting data from five English-speaking nations (the United Kingdom, Canada, Australia, New Zealand, and Singapore) and 20 nations of the European Union.³ For comparison with the 2019 US report, we used the same skill definitions to extract job postings calling for 3D graphics and real-time 3D skills. Burning Glass and Epic partnered to analyze these job postings based on occupation, industry, market salary, and more, to determine the value of 3D graphics skills in the job market.

3D Graphics Summary

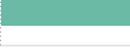
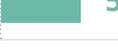
Country	Job Postings Calling for 3D Skills (2019)	Growth Since 2013
UK	117,125	21%
Canada	18,901	29%
Singapore	11,200	12%
Australia	10,046	54%
New Zealand	1,713	104%

Real-time 3D Summary

Country	Job Postings Calling for Real-Time 3D Skills (2019)	Growth Since 2013
UK	9,583	243%
Singapore	4,210	>1,000%
Canada	1,549	290%
Australia	1,287	653%
New Zealand	102	467%

³ The English-speaking and European data sets are comparable across areas such as skills, occupations, and industries, but the English data set includes greater detail, such as salaries, trends, and historical detail. For more details, see the methodology.

EU Summary Data 2019

Country	3D Graphics Job Postings	Real-time 3D Job Postings	Real-time 3D Proportion of the 3D Graphics Market
Germany	120,342	8,965	 7%
France	70,820	2,440	 3%
Spain	54,828	958	 2%
Italy	35,727	945	 3%
Belgium	18,166	340	 2%
Netherlands	18,024	989	 6%
Poland	16,700	1,004	 6%
Austria	10,469	514	 5%
Ireland	8,623	330	 4%
Portugal	7,714	296	 4%
Czech Republic	6,036	195	 3%
Sweden	5,491	523	 10%
Romania	4,092	244	 6%
Slovakia	2,829	73	 3%
Estonia	2,775	5	 <1%
Bulgaria	2,638	189	 7%
Denmark	1,218	122	 10%
Finland	1,124	96	 9%
Hungary	1,083	33	 3%
Luxembourg	969	46	 5%

3.

Where are 3D Skills Essential?

Places and Spaces
Where Nearly All Roles
Demand 3D Skills

There are a number of occupations where 3D skills are becoming foundational to the job. Workers in these roles will advance their careers by learning these skills, and companies in certain sectors will need to embrace these skills to remain competitive. Labor market demand justifies the creation of programs dedicated to 3D graphics and real-time 3D, as job postings increasingly request these proficiencies. Some prestigious universities offer programs dedicated to these skills—showing that such programs are both viable and desirable. Training pipelines that have not already adapted to the new foundational 3D skills in these roles will need to in the future.

The charts below demonstrate how various occupations in different global economies fit in their markets. The vertical axis looks at the proportion of 3D graphics skills demanded in job postings for each occupation, while the horizontal axis shows the size of the occupation in the local labor market, that is, what percent of total online job postings in 2019 were specifically postings for the given occupation.

The View from the Controller: 3D Skills and the Video Game Industry Internationally

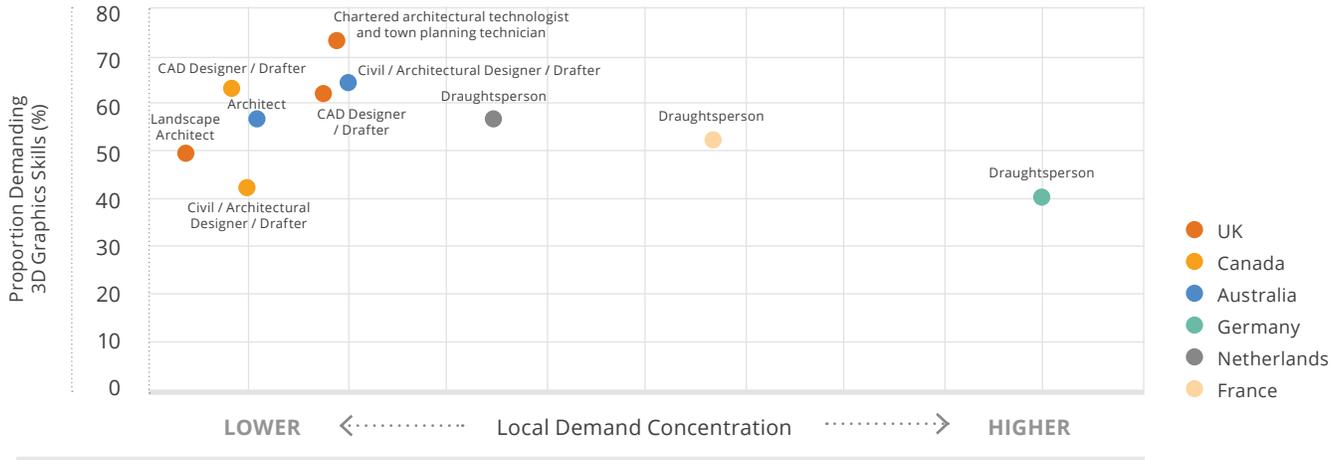
Canadian video game developer job postings distinctly calling for real-time 3D skills have more than doubled in the past 6 years, likely due to a larger focus on optimization and immersive animation. Specific technologies, such as Unreal Engine or Maya, are proliferating in the field—video game employers now seek experienced and creative experts of these softwares. The percentage of job postings for game developers using specified real-time 3D graphics skills has grown 46% since 2013, now representing 29.2% of the video game software development market.

In the **UK**, the percentage of video game developer job postings requesting specified real-time 3D software competencies has grown 160% since 2013, almost tripling in the process. Specific expertise in real-time software requirements now represents 25.4% of the video game developer market. Though the industry itself has grown, the demand for real-time software expertise outpaces this trend, showing that employers are looking to increase both the variety and efficiency of the real-time skills of their workforce.

While video game programming is in healthy demand in the more dominant 3D graphics countries such as **Germany** and **Spain**, there exists a massive market for game programming within Eastern European outsourcing studios in countries such as Bulgaria and Romania, where game programming alone makes up 12.5% and 14.5% of their 3D graphics market, respectively. This is over 10 times larger than the 3D graphics demand in job postings within Spain and Germany.

Finland also boasts a large game programming market, at 7.3% of its overall 3D graphics market. A **2018 Neogames report** estimated that there were 3,200 people employed in the Finnish video game industry in 2018. The report went on to mention that the nation has experienced the highest video game developer turnover in Europe and is now stabilizing into an impressive leader in the sector.

Architecture and Construction



Within architecture and construction, 3D graphics skills are fundamental to the top occupations. Drafting architectural and construction plans is a major part of the occupation. EU countries such as Germany and France have a larger demand for these roles. However, it is in the occupations with less relative demand, such as the CAD designers and architect job postings seen in the UK, Canada, and Australia, where 3D graphics skills are ubiquitous.

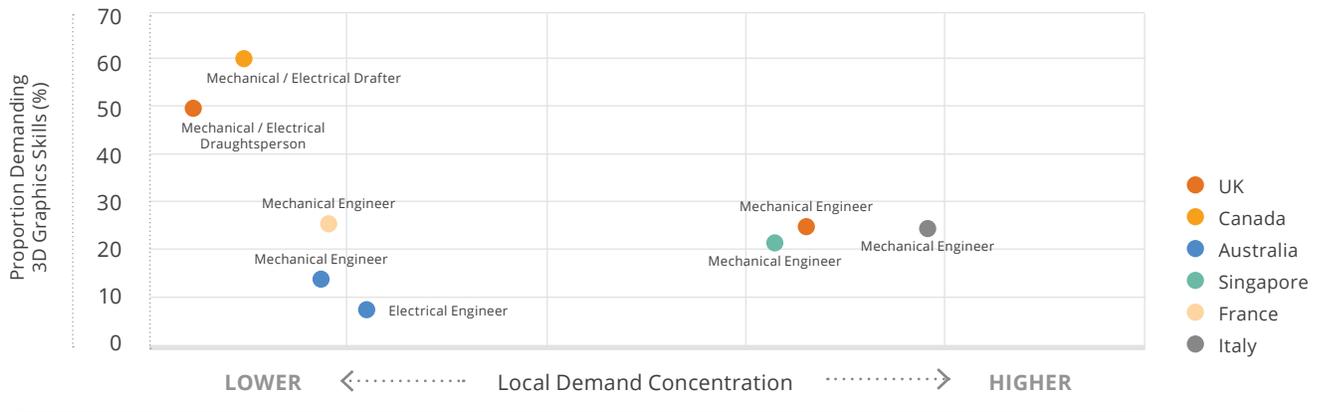
Civil Engineering



Civil engineering jobs are exhibiting a split in their adoption of 3D graphics technology. Universally (across multiple countries), the civil engineer occupation, which is high in demand, does not call for proficiency in 3D graphics as much as its specialized counterparts, such as civil engineering technicians or cartographers. This is representative of a required specialization as the industry moves toward 3D graphics.

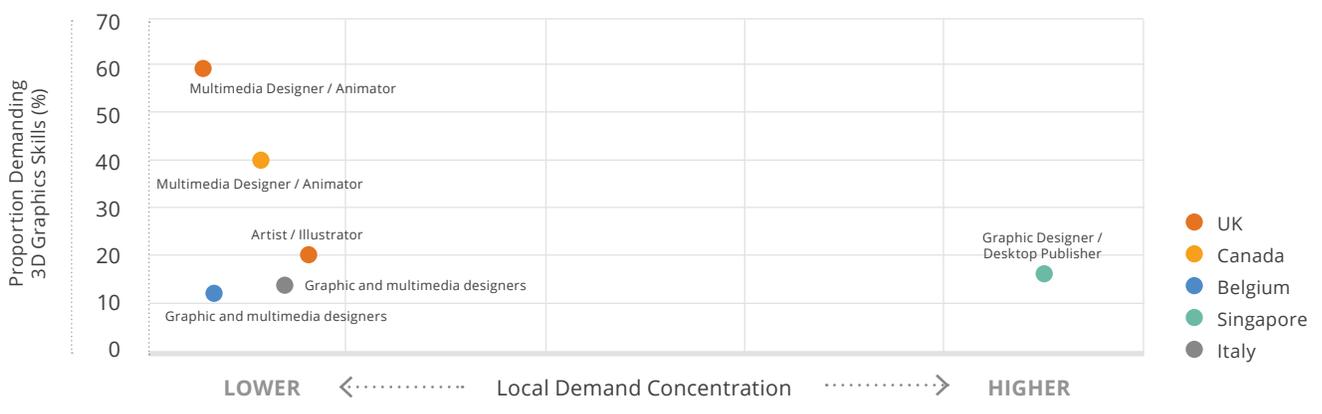
However, this gap is closing. In the UK, 3D graphic requirements in civil engineer job postings have increased by 42% since 2013. If this trend continues, 3D graphics proficiency will become a requirement for those training to enter the field.

Mechanical and Electrical Engineering



In this career area, engineers, especially mechanical engineers, are in high demand. Though the drafting positions are smaller in comparison to the overall economy, there is evidence of 3D graphics demand across the field. Similarly to the draughtsperson job postings in architecture, as the proportion calling for 3D graphics skills increases, the need for qualified candidates will only accelerate.

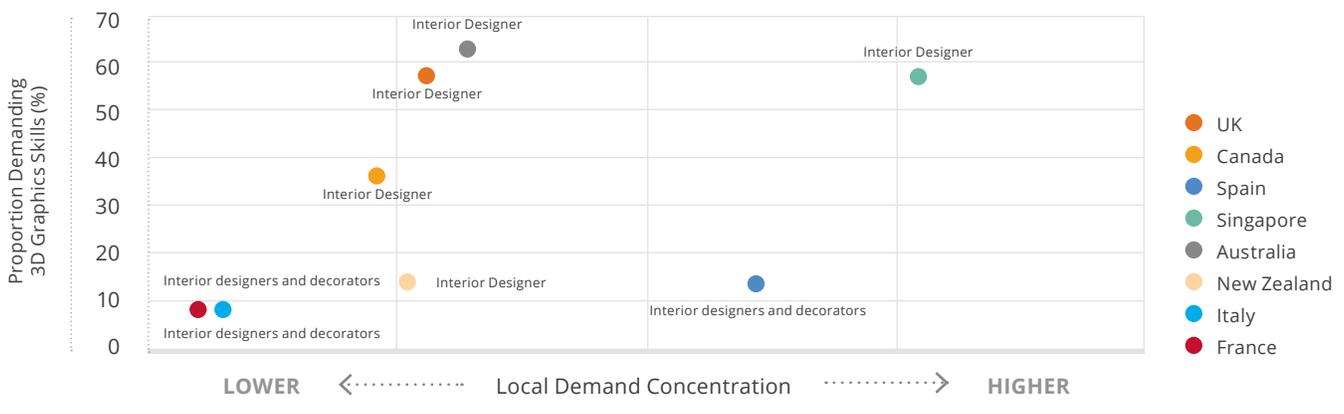
Graphic Design



As people who work with video design and 3D graphic programs daily, it is not a surprise that multimedia designer job openings are showing the highest demand for 3D graphics. However, in some countries like Belgium and Italy, these jobs have a smaller fraction of demand, perhaps demonstrating a delay in the adoption of the software.

Though most of the English-speaking jobs had fewer total postings in 2019 than seen in 2013, they represent a major future area for 3D graphic skills, as those skills grow into a higher proportion of the demand. In the UK, multimedia designers and animators experienced a 182% growth in the proportion of real-time 3D job openings. Singapore, where graphic design jobs represent a larger portion of the job market, experienced a seven-fold increase in real-time 3D job openings in this career area since 2013. Though this is a smaller pool of demand, 3D graphic job postings within it are growing quickly.

Interior Design



Interior design represents an interesting growth area for 3D graphics tools. In Singapore, 3D graphics skills are becoming ubiquitous in the interior design field, which is a growing industry in and of itself. There is a distinct gap between countries where 3D graphics skills are widely demanded for interior designers (UK, Australia, Singapore), and some of the countries where demand is smaller, such as Italy and France, which are historically known for their design work, but may be falling behind due to antiquated styles. These designers may be highly skilled in the artistic aspect of the work, but they will need to train in the rising 3D graphics applications to remain competitive in the market.

4.

Where is Demand for 3D Skills Largest?

Economic Sectors that
are Demanding 3D
Skills Worldwide

This section breaks down the largest sectors and tools in the 3D graphics sector. We look at solid modeling, digital content creation (DCC) software, and real-time skills emerging in architecture, engineering and construction (AEC), and at how Unity and Unreal Engine are shaping the graphic design digital landscape and the skills driving the industry forward.

Leading Technologies: Engineering

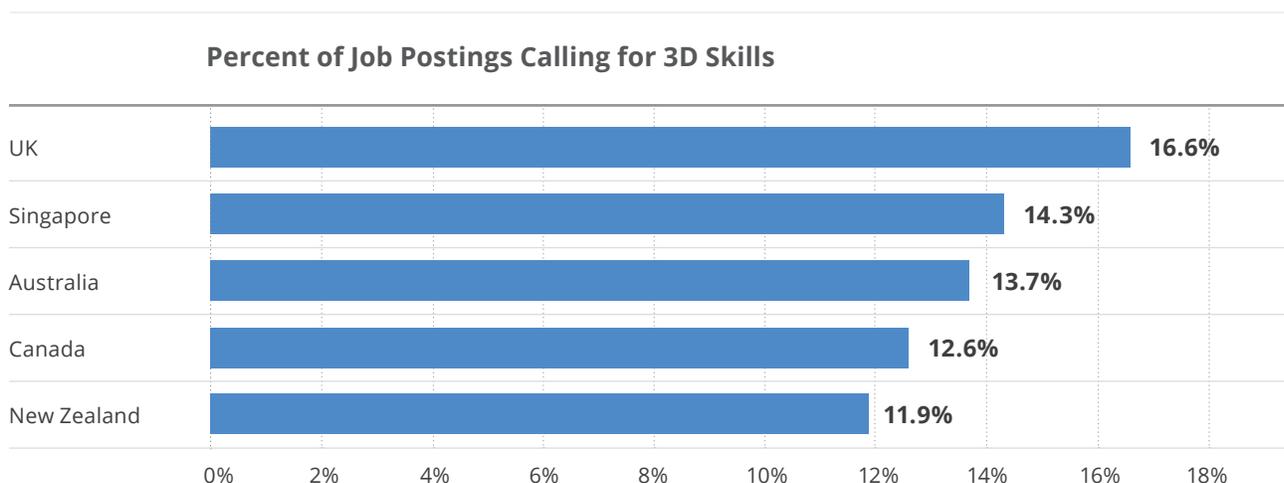
Throughout the past two decades, computer-aided design software has become the standard for 3D modeling for design in many industries around the world. Now, the ability to use solid modeling software is becoming ubiquitous in some sectors, such as engineering, demonstrating a push for computer-aided and software-driven development for engineering and product design. Engineers and drafters use solid modeling to add

complexity to a CAD model, designing the product and materials from the inside out.

A significant percentage of all job postings for engineers request solid modeling and 3D modeling technologies such as AutoCAD or Solidworks. These skills are by far the most prominent 3D graphics skills in engineering, making up almost all fractions of 3D graphics skills in the engineering jobs.

In France and Germany, some engineers are beginning to incorporate real-time software into their 3D modeling. Select engineering job postings in these countries are calling for augmented reality and virtual reality. Though not quite universal in demand yet, these postings are a demonstration of a push toward real-time 3D modeling in an occupation that previously only relied on CAD for digital modeling. Real-time 3D rendering skills, such as virtual and augmented reality, are being requested for engineering jobs in these European nations.

3D Skills in Engineering Job Postings



Solid modeling is by far the most requested 3D graphic design skill category in Europe. In Spain and Germany, solid modeling CAD software is requested in a third of all graphics job postings, and in France this proportion is over two-thirds. Over half of graphics postings in Italy, Belgium, Austria, and Ireland request solid modeling software knowledge. Outside of solid modeling skills, however, demand for 3D graphics skills in these countries is fragmented across many different subcategories.

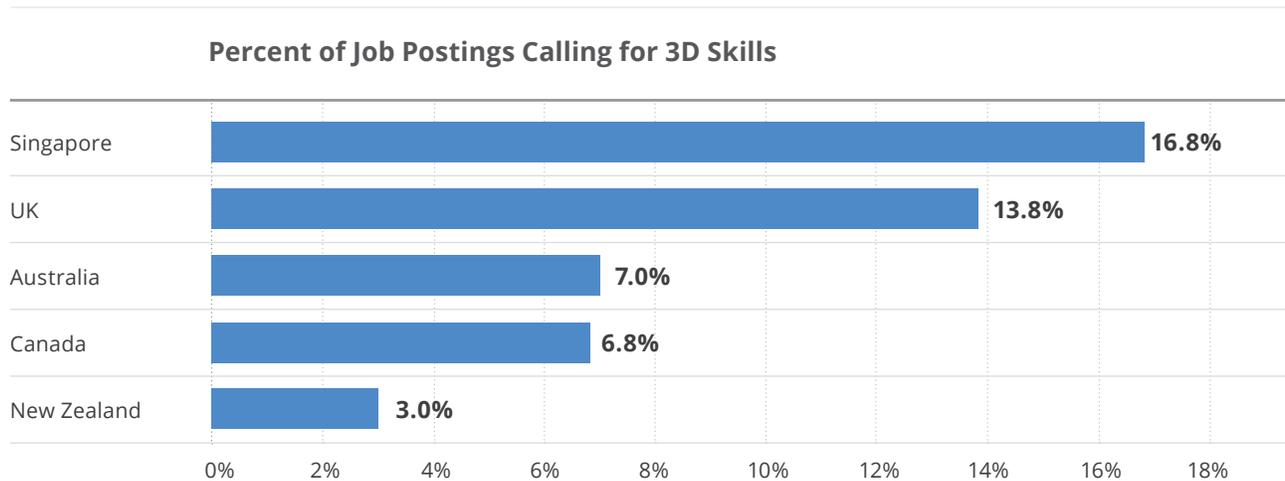
Real-time skills are appearing as a major growth area in many large 3D graphics industries. Real-time skills in engineering have grown almost 400% within the market in the UK, where skills like Naviswork and Solidworks have been exponentially requested.

Ubiquitously Useful: Graphic Design

Singapore follows a similar pattern in this regard. While it still has high rates of 3D tool usage within engineering, it also has high uses of digital content creation (DCC) software in design and media, with 11% of all postings requesting this skill.

Software like Unreal Engine and Unity are accelerating the growth of real-time skills in design and media in Singapore. Many real-time tools, such as X3D, have gone from virtually no demand in 2013 to a jump in market demand in Singapore. Occupations such as industrial designers, graphic designers, and multimedia designers are growing in their demand of real-time 3D skills.

3D Skills in Design and Media Job Postings



In the UK, Unreal Engine is the driver within design and media jobs, more than tripling in demand within the job market since 2013. The same pattern occurs in Canada and Australia. Hiring managers looking for visual artists in France, Italy, Sweden, and Germany are requesting Unreal Engine, an example of real-time 3D skills becoming foundational outside of design and technology-specific occupations.

Artists and illustrators are also increasingly expected to develop proficiency with real-time skills. Job postings for new artists and illustrators in Canada have increased their requests for skills such as Unity and Unreal Engine by over 10 times since 2013. The percentage of artists and illustrator job postings calling for real-time 3D skills has increased by almost 35% in Canada.

3D Ubiquity: Construction and Architecture

There has been an increase in 3D skill growth in the already large sector of construction and architecture worldwide. Australian and UK construction and architecture jobs have more than doubled in demand of 3D skills, with 1,017 Australian job postings and 7,755 UK postings requesting these proficiencies in 2019. In Australia and New



Zealand, this sector has the second-largest fraction of postings requesting 3D graphics. In the EU, draftsman is the most common occupation to request 3D graphics skills, where the job postings for the occupation consistently call for 3D graphics skills in over 50% of job postings. Draftsman is the top 3D occupation in Germany, France, Italy, Austria, the Netherlands, Belgium, Ireland, Czech Republic, Sweden, Slovakia, Luxembourg, and Malta. Draftspeople are also experiencing a shift toward real-time 3D modeling software, as job postings call for virtual and augmented reality skills, such as Twinmotion, a virtual reality 3D architectural visualization tool.

Even in places where the sector is decreasing overall, like Singapore, the percentage of jobs calling for 3D graphics skills, largely solid modeling software, is growing. Although there are fewer of these jobs available, a larger quantity of construction and architecture jobs are calling for 3D graphics skills.

5.

Real-time 3D Use by Country

Heat Map of Top Real-Time Skills in Europe

	UK	Germany	Spain	France	Poland	Ireland	Netherlands	Sweden	Austria	Italy	Finland
Virtual Reality	Green	Light Green	Yellow	Yellow	Light Green	Light Yellow	Light Green	Light Yellow	Light Green	Yellow	Yellow
Augmented Reality	Green	Light Green	Yellow	Yellow	Light Green	Light Yellow	Light Green	Light Yellow	Light Green	Yellow	Yellow
Unity	Light Green	Light Yellow	Green	Light Yellow	Light Green						
Unreal Engine	Green	Light Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Yellow	Light Green	Yellow
Game Programming	Yellow	Light Green	Light Green	Yellow	Light Green	Green	Light Green	Light Green	Light Green	Light Green	Light Green
Dassault Systemes 3DEXperience	Yellow	Yellow	Yellow	Light Green	Yellow	Red	Red	Yellow	Yellow	Yellow	Yellow
Digital Twin	Yellow	Light Yellow	Red	Yellow	Yellow	Yellow	Yellow	Yellow	Light Green	Light Green	Yellow
Mixed Reality	Light Green	Light Yellow	Red	Orange	Light Orange	Yellow	Yellow	Light Orange	Yellow	Yellow	Yellow
HoloLens	Yellow	Light Yellow	Light Orange	Yellow	Light Orange	Yellow	Yellow	Yellow	Yellow	Yellow	Light Green
Siemens Lifecycle	Yellow	Light Yellow	Red	Yellow	Light Orange	Red	Yellow	Yellow	Yellow	Yellow	Yellow

As real-time skills become ubiquitous proficiencies amidst a technological evolution, certain key real-time skills are taking over industry demand and becoming increasingly necessary in certain roles. Augmented reality, virtual reality, Unity, and Unreal Engine are some of the major real-time skills that come up frequently in global analyses.

Extended Reality (XR)

Extended reality (XR), which encompasses augmented reality (AR), mixed reality (MR), and virtual reality (VR), is becoming increasingly popular in software development, architecture, and engineering, especially in Germany and Poland. In Germany, these skills are the most-demanded real-time skills, each with a demand of just under 3,000 postings in 2019. In Poland, AR and VR are the second and third-highest-called-for skills, just behind game development, and are commonly called for in conjunction as tools to create real-time rendered realities.

In the UK, augmented reality is a commonly requested skill, with high recall in tech jobs such as software engineering and web development. In Singapore, AR and VR experienced a peak in demand around 2016-2017, after which demand dropped. However, since 2018, AR doubled in demand in Singapore, largely due to the increase in augmented reality used in education and classrooms, as well as research around its capabilities outside of gaming. With countries around the world, like Canada and Australia, utilizing AR in new ways such as industrial production, higher education, and health care, augmented reality has expanded in utility far past the video game reputation it recently adopted.

Virtual reality has recently been decreasing in popularity within the video game industry. In the UK, where virtual reality is the most requested skill, video game-specific VR peaked in 2017 and has decreased 15% from 2018 to 2019. VR remains relevant, however, by increasing in popularity along with augmented reality in the engineering sector, experiencing an 11.5% growth from 2018. Similar patterns appear in other countries such as Canada and Australia, where VR shows a decrease in video game demand, but a huge (>35%) increase within engineering.

In the US report, AR had the highest expected growth, projected to grow 207% in 10 years. VR is a close second, predicted to grow 189% in the US in the next 10 years. In comparison, AR is predicted to grow 172% and VR is predicted to grow 170% globally in the next 10 years, according to Burning Glass projections.



Unreal Engine and Unity

Unreal Engine and Unity are real-time 3D applications that have been proven to encompass a large share of the 3D graphics sector globally. They are both popular in design and illustration, as well as fundamental in video game design and development. In Spain, Unity was requested in over 2,500 job postings in 2019. Germany has a demand of about 900 job postings for each of these real-time skills. In the EU, these skills are most demanded in graphic and multimedia designer careers.

In the UK, demand for Unreal Engine has quadrupled since 2013. Unreal Engine is the second most demanded real-time skill in Canada, where it has grown 5 times in demand since 2013. Unity is a top skill in Australia and Singapore, where it has grown over 5 times since 2013. Though these skills have lower demand than some of the mainstream 3D skills, their growth indicates that they will only become more relevant in the future of 3D graphics.



These skills both have a high predicted growth in the next 10 years in the US: according to the Burning Glass model, Unity will grow 72% and Unreal Engine will grow 122% in the US. By the same model, Unreal Engine is predicted to grow 138% globally, and Unity is predicted to grow 70% globally in the next 10 years. In 2019, there were 66,481 job postings for real-time skills globally. Burning Glass demand projections for the sector indicate that in five years, there could be as many as 111,000 postings calling for these skills each year.

6.

Where is Demand for 3D Skills Emerging and Maturing?

New Sectors Exhibiting Demand for 3D Skills

Worldwide, 3D graphics skills are expanding beyond the occupations and industries in which demand for these skills was first established. Civil planning and fashion design are examples of industries where 3D modeling skills are becoming highly requested, digitizing these industries, and streamlining the work of their designers and production managers. Globally, 3D skills are becoming increasingly useful for more individuals to master and for more companies to adopt.

Within the Civil Planning Sector

Within planning and analysis jobs, 3D graphics skills are growing in popularity, particularly in civil planning. Job postings looking for solid modeling software have almost doubled in the UK and Australia within this sector, a reflection of the rise of 3D skills for transportation planners, who experienced a 49%-72% growth in 3D skill demand since 2013. UK demand for chartered architectural technologists and town planning technicians with 3D graphics skills has more than doubled in postings since 2013, and the percent of job postings demanding 3D graphics skills has grown over 65%. A comparable job in Germany—the town and traffic planner—

has over 3,500 postings in 2019 calling for 3D graphics and real-time 3D skills. Most civil planning technicians use software such as Solidworks, Autodesk/Revit, Naviswork, and Microstation for their 3D graphics needs, but up and coming tools, such as Twinmotion, represent new developments in the field.

Civil engineers are another example of this growing sector, with 12% of civil engineering job postings in Germany requesting 3D graphics skills. Real-time skills like virtual reality and Naviswork are frequently called upon in these civil engineering occupations. In the UK, civil engineering jobs in 2013 called for 3D graphics skills in 15.9% of postings. In 2019, this number had jumped to 22.6%—a 41.8% growth in demand in six years. Research and development managers, who also work on city planning, had close to 4,000 job postings in France requesting 3D graphics and real-time 3D skills in 2019. Though the planning and analysis sector is not the largest 3D graphics industry, it has experienced significant growth in the last few years. The fraction of job postings calling for 3D graphics in this sector has doubled in the UK since 2013, and the fraction calling for real-time skills has quadrupled. In Australia, the number of 3D graphics job postings in this field

has tripled since 2013. Globally, though this sector is still not comparable in size to the 3D graphics demand in construction and architecture, it is quickly growing and trending toward becoming a major industry within the 3D graphics world.

Fashion Design

Graphics skills in fashion design are on the rise, especially in the 3D graphics share of the job market, underlining a shift in the sector toward more technical skills. Fashion designers are moving from pencil and paper to 3D modeling on their computers. We see postings decreasing in number but increasing in sophistication and digitalization. This possibly reflects an increase in speed in automation in the manufacturing industry, expediting the production pipeline and increasing the capabilities of product simulation.⁴ In many European countries, product and garment designers are increasingly required to possess 3D skills. Although many product and fashion designers still begin the design process by sketching on paper, it has become more common for these designers to transfer their sketches into a DCC software for prototyping and implementation. This type of tool allows

for quick edits and to test different fabrics, materials, and swatches.

In the UK, the number of total fashion designer job postings has dramatically decreased; however, the number of postings calling for graphics skills has ultimately increased, with now over 14% of UK fashion designer postings calling for 3D graphics skills. In Spain, the Netherlands, Germany, and France, almost a third of postings for product designers request 3D skills, specifically computer aided design software. Latvia and Lithuania, although they have a very small design industry, have some of the highest rates of CAD requests in the job market—35% of job postings for product designers in Latvia request CAD skills. We are seeing this as a revitalization of fashion through computer-aided design software, like Sketchup, and technologies that are new within fashion, such as 3D rendering. Some fashion designers are being replaced by software that can do their jobs automatically—but the fashion designers that stay are those who know how to use these tools effectively.

As the fashion to production pipeline becomes more streamlined and digitized, creators in the industry will be required to pick up 3D graphics skills.

⁴ (Scan2CAD, 2017).

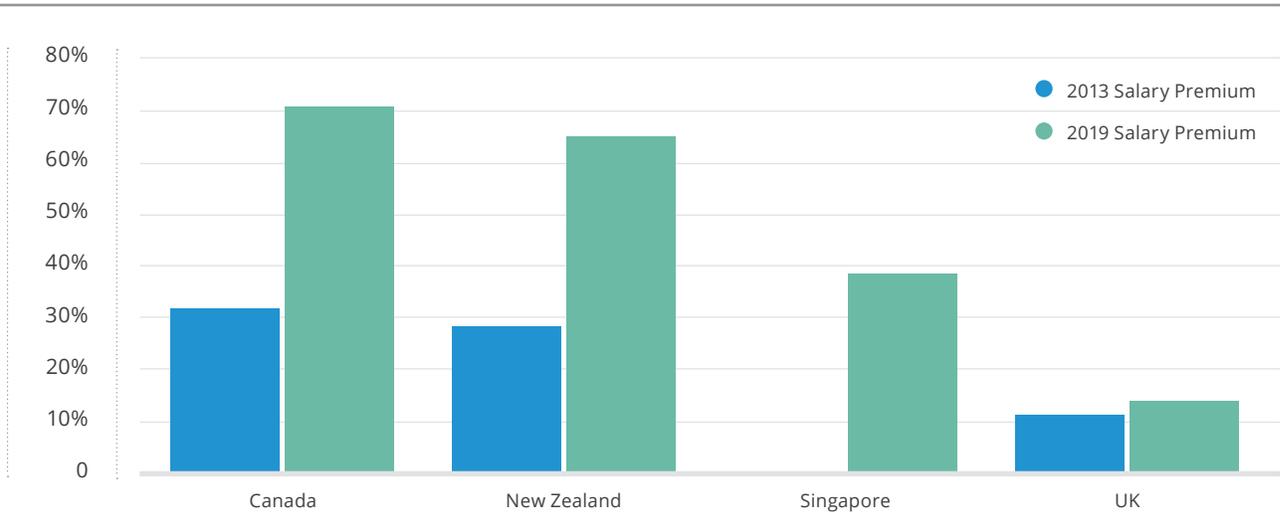
7.

Salary Premiums for Qualified Candidates

Supply for major 3D graphics skills is not keeping up with growing job market demand, causing market salary premiums in the increasing number of jobs that are looking for these skills. As these skills grow in demand, 3D graphics salary premiums are growing higher, motivating job seekers to pick up these 3D proficiencies for higher wages.

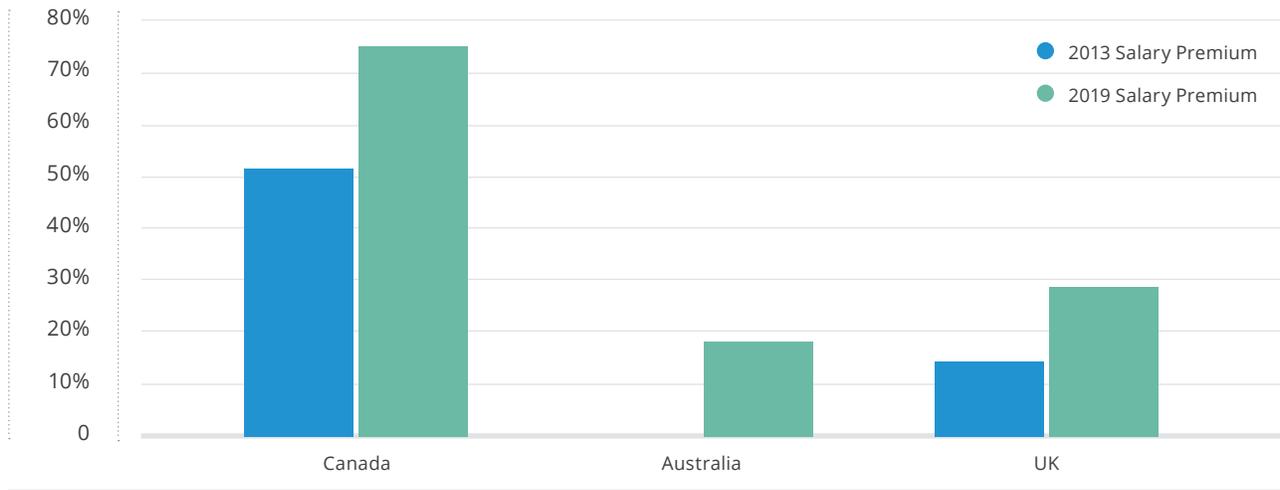
In Canada, the average 3D graphics job opening in 2013 offered a 33% salary premium over the average Canadian market salary. In 2019, this premium doubled to almost 70%. In Singapore, 3D graphics experts are in such high demand that the average salary premium offered for a 3D graphics skill has grown from 0% (average salary is consistent with the country’s average worker) to a 40% average premium.

Average Salary Premium for 3D Graphics Skills



Real-time 3D salary premiums are also increasing, reflecting supply not keeping up with the hiring demand.

Average Salary Premium for Real-time 3D Skills



Across the world, salaries are increasing year by year, but there are also certain skills that are garnering special salary increases. Being most rare, real-time skills have some of the highest average advertised salaries, as well as growth in average salary since 2013. In Australia, Naviswork has quadrupled in demand and almost doubled its average advertised salary. In the UK, Unity, MotionBuilder, and augmented reality have all increased in average advertised salary by around 40% since 2013. In 2019

in the UK, Unreal Engine skill paid 34% above the average market salary and Unity expertise paid a 43% premium, with the average salary for job seekers with these skills landing just under £50,000.

These findings indicate a growing global 3D graphics market, where supply is not yet keeping up with the accelerating demand. As in the US, employers are willing to pay the salary premium to hire a 3D graphics skilled worker.

8.

Conclusion

The use of 3D graphics and real-time skills has grown from a narrow specialization in a handful of industries to the mark of digital change across the world. 3D graphics skills, especially real-time, are the entry key to creative industries such as architecture and fashion design, where traditional artists are being replaced by a team of specialists who are experts in 3D graphics. In fashion design, job postings are decreasing to make way for a digital industry, where the designers who stay are well-versed in 3D modeling. Gaining proficiencies in these skills opens the door to career opportunities and salary premiums for workers.

For educators, industry leaders, and students entering the fields we have identified, gaining 3D graphics and especially real-time 3D skills provide a tremendous opportunity for advancement. As these skills move from a specialty to a core requirement in these fields, training providers need to build these abilities into their curriculum, while employers need to take a more strategic view of how to acquire 3D talent in a competitive market. The implications extend to many corners of the world: there is a widespread net of opportunities and growth areas for those willing to realize them.



9.

Methodology & Appendix

Methodology

To identify and define the 3D graphics and real-time skills for the analyses presented in this report, Burning Glass Technologies and Epic Games used the skills and skill definitions created for the US report. The complete methodology for that process is detailed here:

To analyze demand for 3D graphics skills and real-time 3D in the workforce, Epic and Burning Glass took a two-stage approach, first defining the full universe of 3D graphics skills and then identifying which of those skills leverage real-time techniques. In defining the universe of 3D graphics, Burning Glass and Epic pulled in jobs that use 3D skills from the following categories: computer-assisted design; digital content creation; rendering; virtual reality (VR); augmented reality (AR); game engines; performance capture; design visualization; 3D modeling; film and video; and a collection of general skills. Burning Glass and Epic identified 209 skills related to 3D graphics. (For a list of these skills, see the Appendix.) The second stage was to flag the 3D graphics skills that specifically utilize real-time 3D technologies and techniques. This process was informed by trade publications,

product descriptions, and industry blogs, as well as through consultation with professionals with years of experience in 3D graphics. Epic and Burning Glass flagged 97 skills as relevant to real-time 3D.

To conduct the analyses based off the robust skill definitions, Burning Glass drew from its detailed database of online employer demand, which includes over half a billion current and historical job postings across the US, UK, Canada, Singapore, Australia, and New Zealand. Burning Glass collects postings from over 45,000 online job sites to develop a comprehensive, real-time portrait of labor market demand. Our software extracts top-line information about each job such as title, employer, and industry, and then “reads” each job description to identify actual job titles, skills, and qualifications that employers are seeking. We then eliminate duplicate postings and place each job in a database for further analysis. Our detailed data offers the unique ability to identify and track important labor market trends as they happen, and before they are visible in other data series. Burning Glass has developed a skills taxonomy with nearly 18,000 unique

skills. Many 3D graphics skills are included in this taxonomy. In the case of emerging real-time 3D skills not in the Burning Glass skills taxonomy, skills were located in job postings using keyword searches of the text of the job posting. Burning Glass's unique data assets provide a detailed view into the jobs and skills that employers demand.

Burning Glass additionally leveraged recently acquired European Union job posting datasets to analyze the skill and occupation demand across 20 countries in the EU. Comparable keyword searches were used to identify these skills in order to compare EU analyses to the English-speaking statistics.



Appendix

Graphic 3D and real-time 3D postings internationally, 2019

	3D Graphics Postings	3D Graphics % of Local Market	Real-time 3D Graphics Postings	Real-time 3D Skills % 3D Graphics Market
Germany	120,342	1.3%	8,965	7.5%
UK	117,125	1.6%	9,583	8.2%
France	70,820	1.5%	2,440	3.5%
Spain	54,828	2.6%	958	1.8%
Italy	35,727	2.4%	945	2.7%
Canada	18,901	1.3%	1,549	8.2%
Belgium	18,166	1.3%	340	1.9%
Netherlands	18,024	1.6%	989	5.5%
Poland	16,700	1.5%	1,004	6.0%
Singapore	11,200	2.6%	4,210	37.6%
Austria	10,469	1.6%	514	4.9%
Australia	10,046	0.9%	1,287	12.8%
Lithuania	8,854	8.1%	38	0.4%
Ireland	8,623	2.0%	330	3.8%
Portugal	7,714	1.4%	296	3.8%
Czech Republic	6,036	1.1%	195	3.2%
Sweden	5,491	0.9%	523	9.5%
Latvia	4,292	5.7%	17	0.4%
Romania	4,092	1.0%	244	6.0%
Slovakia	2,829	1.7%	73	2.6%
Estonia	2,775	2.3%	5	0.2%
Bulgaria	2,638	1.2%	189	7.2%
New Zealand	1,713	0.5%	102	6.0%
Denmark	1,218	1.1%	122	10.0%
Finland	1,124	0.6%	96	8.5%
Hungary	1,083	0.8%	33	3.1%
Luxembourg	969	1.7%	46	4.8%
Croatia	953	1.4%	19	2.0%

List of 3D Graphics Skills (Real-time 3D in Bold)

Abvent Artlantis	HoloLens	Real-time 3D
Act-3D Lumion	HTC Vive	Samsung Gear VR
Amazon Lumberyard	IC.IDO	Siemens Lifecycle
ARCore	iClone	Smart World Pro
ARKit	Id Tech	Snap Lens Studio
Augmented Reality	Immersive Displays	SolidTrack
Autodesk MotionBuilder	Insite VR	SpeedTree
Autodesk Navisworks	InstaLOD	StarVR
Autodesk VRED	JanusVR	SteamVR
BabylonJS	Light baking	Stereographic
Bentley/e-on LumenRT	Lightcraft Previzion	Synthetic Environments
Crytek CryEngine	Lightmapping	Three.js
Cubic Motion	Lightworks Slipstream	Twinmotion
Daqri 4D Studio	Luxion Keyshot	Uningine
Dassault Systemes 3DExcite	Magic Leap	Unity3D
Dassault Systemes 3DExperience	Marmoset Toolbag	Unreal Blueprint
Dassault Systemes 3DVia	Microsoft Simplygon	Unreal Engine Datasmith
Digital Mockup	Mixed Reality	Unreal Studio
Digital twin	Mo-sys	Valve Source Engine
Distributed Interactive Simulation	Ncam	Vicon
DX Studio	NVIDIA Optix	Virtual Prototype
Enovia V5 DMU	Oculus Rift	Virtual Reality
Enscape3d	OpenFlight	Virtual Simulation
e-on VUE	OpenSceneGraph	Visual Simulation
Epic Unreal Engine	OpenSpace	VizRT
Flight Simulation	Optitrack	Windows Mixed Reality
Game Engines	Pixyz	X3D
Game Programming	Powerwall	Xsens
gITF	Presagis Creator	Zero Density
Godot	Presagis FlightSim	Zerolight
Google Cardboard	Presagis Panorama	3D Animation
Google Daydream	Presagis Vega Prime	3D Coat
HMD	PTC Vuforia	3D Computer Aided Design
	Quest3d	3D Computer Graphics

3D Conceptual Design	CentiLeo	Nvidia Iray
3D Design	Chaos Group V-Ray	OnShape
3D Modeling	Character Rigging	Optitex EFI
3D Rendering	Civil 3D	Otoy Octane
3D Simulation	Corona Render	Parametric Modeling
3D Texture Painting	Dassault Systemes Catia	Performance Capture
3D Visualization	Dassault Systemes Solidworks	Photogrammetry
3D Web	Derivative Touch Designer	Photorealistic 3D
3Delight	Disguise.one	Physically Based Rendering
Adobe Dimension	Editshare Lightworks	Pilgrimage 3D Coat
Allegorithmic Substance Designer	Environment Capture	Pinksoft Fstorm
Allegorithmic Substance Painter	Esri CityEngine	Pixar RenderMan
Altair SolidThinking	Evermotion Nox	Pixologic ZBrush
Ansys	Foundry Mari	Previsualization
Artomatix	Foundry Modo	ProRender
Artvps Shaderlight	Generative Design	PTC Creo
AutioDesSys formZ	Geopak	Quixel Suite
AutoCAD	Glare Technologies indigo	RandomControl Arion
Autodesk 3ds Max	Global Illumination	Ray Tracing
Autodesk Alias	Graphisoft ArchiCAD	React VR
Autodesk Arnold	HDRI	RedShift3D
Autodesk Fusion 360	IronCAD	Robert McNeel Rhino3D
Autodesk Inventor	Kallos Studios Fuzor	SideFX Houdini
Autodesk Maya	Look Development	Siemens NX
Autodesk Mudbox	Lumiscaphe Lumis 3D	Siemens Solid Edge
Autodesk Recap	LuxRender	SketchUp
Autodesk Revit	Matterport	Solid Iris Technologies Thea
Bentley Microstation	Maxon Cinema 4D	Strata 3D
Blender	mental ray	SU Podium
Blender Cycles	Motion Graphics	Surface Modeling
Blender Eevee	Motiva Colimo	Texture baking
brighter3d	Nemetschek AllPlan	TurboCAD
Building Information Modeling	Nemetschek Vectorworks	UV Mapping
CADKEY	NeverCenter Silo	Ventuz
Cebas finalRender	NewTek Lightwave 3D	Vizor.io
	Next Limit Maxwell	World Building

Acknowledgments

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About Burning Glass

Burning Glass Technologies delivers job market analytics that empower employers, workers, and educators to make data-driven decisions. The company's artificial intelligence technology analyzes hundreds of millions of job postings and real-life career transitions to provide insight into labor market patterns. This real-time strategic intelligence offers crucial insights, such as which jobs are most in demand, the specific skills employers need, and the career directions that offer the highest potential for workers. Find out more at burning-glass.com.

About Epic Games

Founded in 1991, Epic Games is an American company founded by CEO Tim Sweeney. The company is headquartered in Cary, North Carolina, and has more than 40 offices worldwide. Today, Epic is a leading interactive entertainment company and provider of 3D engine technology. Epic operates Fortnite, one of the world's largest games with over 350 million accounts and 2.5 billion friend connections. Epic also develops Unreal Engine, which powers the world's leading games and is also adopted across industries such as film and television, architecture, automotive, manufacturing, and simulation. Through Unreal Engine, Epic Games Store, and Epic Online Services, Epic provides an end-to-end digital ecosystem for developers and creators to build, distribute, and operate games and other content.

About Unreal Engine

Epic Games' Unreal Engine is the world's most open and advanced real-time 3D tool. Creators across games, film, television, architecture, automotive and transportation, advertising, live events, and training and simulation choose Unreal to deliver cutting-edge content, interactive experiences, and immersive virtual worlds. Follow @UnrealEngine and download Unreal for free at unrealengine.com.

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