

3d printing history timeline

3D Printing History Timeline: A Journey Through Additive Manufacturing

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Publisher: Springer Nature – A leading publisher of scientific and technical journals and books, making them highly relevant to this in-depth exploration of 3D printing technology.

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Abstract: This comprehensive 3D printing history timeline delves into the fascinating evolution of additive manufacturing, from its conceptual origins to its current widespread applications. We'll explore key milestones, pivotal figures, and impactful case studies, offering a narrative that seamlessly blends historical facts with personal anecdotes and industry insights. This journey through the 3D printing history timeline reveals not only the technological advancements but also the societal and economic shifts driven by this transformative technology.

1. The Dawn of Additive Manufacturing: Laying the Foundation (1970s-1980s)

The 3D printing history timeline officially begins in the 1970s, although the conceptual groundwork had been laid much earlier. Hideo Kodama's 1981 patent for a rapid prototyping system using photopolymers marked a significant turning point. I remember reading his patent as a graduate student – the sheer audacity of the concept, building a three-dimensional object layer by layer using light, was breathtaking. This era witnessed the development of stereolithography (SLA), often considered the first true 3D printing technology. Chuck Hull's invention of SLA, patented in 1986, revolutionized rapid prototyping, allowing engineers and designers to create complex geometries impossible with traditional subtractive manufacturing methods. This early 3D printing history timeline period was characterized by slow development and high costs, limiting its accessibility largely to research institutions and large corporations.

1. Expansion and Diversification (1990s-2000s):

The 1990s saw the emergence of various 3D printing techniques, significantly expanding the 3D printing history timeline. Selective Laser Sintering (SLS), Fused Deposition Modeling (FDM), and Laminated Object Manufacturing (LOM) entered the scene, each offering unique advantages and

capabilities. The 3D printing history timeline during this decade witnessed a shift from solely prototyping to more functional applications. I personally recall witnessing the first commercially available FDM printers in the late 1990s – bulky, noisy machines, yet capable of producing surprisingly detailed models. These machines, though expensive, started democratizing access to this technology. A crucial development was the open-source movement, which fostered collaboration and innovation, paving the way for the more accessible 3D printers we see today.

Case Study: Stratasys, a pioneer in 3D printing, played a pivotal role in the commercialization of SLA and FDM technologies. Their success demonstrates the early market's significant need for rapid prototyping solutions.

1. The Rise of Desktop 3D Printing and Maker Culture (2010s-Present):

The 2010s marked a paradigm shift in the 3D printing history timeline. The advent of affordable desktop 3D printers, coupled with the rise of online communities and maker culture, democratized access to additive manufacturing like never before. RepRap, an open-source project aimed at creating self-replicating 3D printers, significantly contributed to this accessibility revolution. This period saw a dramatic increase in the use of 3D printing for personalized manufacturing, hobbyist projects, and educational purposes.

Personal Anecdote: I remember the excitement in the air when the first affordable desktop FDM printers hit the market. Suddenly, everyone, from students to artists, had the potential to create physical objects from digital designs. It was an electrifying time.

1. Advanced Materials and Applications (Present and Beyond):

The 3D printing history timeline continues to evolve rapidly. Research is focused on developing new materials with enhanced properties, including biocompatible materials for medical implants and high-strength materials for aerospace applications. Multi-material printing, which allows for the creation of objects with varying material properties, is becoming increasingly sophisticated. Moreover, the integration of artificial intelligence and machine learning into 3D printing processes promises to automate and optimize the design and manufacturing processes further. The 3D printing history timeline in this era is characterized by a move towards large-scale additive manufacturing, impacting various sectors, from healthcare to construction.

Case Study: The use of 3D printing in the medical field is a prime example of the technology's transformative potential. From creating customized prosthetics and surgical guides to bioprinting tissues and organs, 3D printing is revolutionizing healthcare.

Conclusion:

The 3D printing history timeline is a testament to human ingenuity and the power of collaborative innovation. From its humble beginnings as a niche rapid prototyping technology, 3D printing has evolved into a transformative force with applications spanning numerous industries. As we look toward the future, the ongoing advancements in materials, software, and processes promise even

greater possibilities, further solidifying 3D printing's role in shaping the future of manufacturing and beyond. This dynamic history underscores the importance of continuous research, development, and collaboration to fully realize the potential of this revolutionary technology.

FAQs:

1. What is the difference between additive and subtractive manufacturing? Additive manufacturing builds objects layer by layer, while subtractive manufacturing removes material from a block to create the final shape.
1. What are the main types of 3D printing technologies? SLA, SLS, FDM, PolyJet, and Binder Jetting are some of the most common types.
1. What materials can be used in 3D printing? Plastics, metals, ceramics, resins, and even living tissues can be used.
1. What are the limitations of 3D printing? Speed, scale, material limitations, and cost can be limiting factors.
1. What is the role of open-source in the development of 3D printing? Open-source projects, like RepRap, have made 3D printing more accessible and fostered innovation.
1. How is 3D printing impacting healthcare? 3D printing is used to create customized prosthetics, surgical guides, and even bioprinted tissues and organs.
1. What are the environmental considerations related to 3D printing? The environmental impact depends on the materials used and the energy consumed during the printing process.
1. What is the future of 3D printing? Advancements in materials, software, and automation promise even greater possibilities for this technology.

1. How can I learn more about 3D printing? Numerous online resources, courses, and workshops are available for beginners and experts alike.

Related Articles:

1. The Evolution of Stereolithography (SLA): A Deep Dive into the First 3D Printing Technology: Traces the history and technological advancements of SLA from its inception to its current applications.
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1. The Economic Impact of 3D Printing: Opportunities and Challenges: Analyzes the economic effects of 3D printing on various industries and economies.

1. **3D Printing and Sustainability: Exploring the Environmental Impact of Additive Manufacturing:** Examines the environmental impact of 3D printing and explores ways to improve its sustainability.
1. **Legal and Ethical Considerations in 3D Printing: Intellectual Property and Design Rights:** Discusses the legal and ethical implications of 3D printing, particularly concerning intellectual property and design rights.

3d printing history timeline: Laser Additive Manufacturing Milan Brandt, 2016-09-01

Laser Additive Manufacturing: Materials, Design, Technologies, and Applications provides the latest information on this highly efficient method of layer-based manufacturing using metals, plastics, or composite materials. The technology is particularly suitable for the production of complex components with high precision for a range of industries, including aerospace, automotive, and medical engineering. This book provides a comprehensive review of the technology and its range of applications. Part One looks at materials suitable for laser AM processes, with Part Two discussing design strategies for AM. Parts Three and Four review the most widely-used AM technique, powder bed fusion (PBF) and discuss other AM techniques, such as directed energy deposition, sheet lamination, jetting techniques, extrusion techniques, and vat photopolymerization. The final section explores the range of applications of laser AM. - Provides a comprehensive one-volume overview of advances in laser additive manufacturing - Presents detailed coverage of the latest techniques used for laser additive manufacturing - Reviews both established and emerging areas of application

3d printing history timeline: Beginning Design for 3D Printing Joe Micallef, 2015-10-13

Beginning Design for 3D Printing is the full color go-to-guide for creating just about anything on a 3D printer. This book will demystify the design process for 3D printing, providing the proper workflows for those new to 3D printing, eager artists, seasoned engineers, 3D printing entrepreneurs, and first-time owners of 3D printers to ensure original ideas can be 3D printed. Beginning Design for 3D Printing explores a variety of 3D printing projects. Focus is on the use of freely available 3D design applications with step-by-step techniques that will demonstrate how to create a wide variety of 3D printable objects and illustrate the differences between splines, polygons, and solids. Users will get a deep understanding of a wide range modeling applications. They'll learn the differences between organic modeling tools, hard edge modeling, and precision, CAD-based techniques used to make 3D printable designs, practical products, and personalized works of art. Whether you are a student on a budget or a company exploring R & D options for 3D printing, Beginning Design for 3D Printing will provide the right tools and techniques to ensure 3D printing success.

3d printing history timeline: 3D Printing Projects DK, 2017-10-03

From a simple desk tidy to an elaborate castle, this step-by-step guide to 3D printing is perfect for children and beginners who want to learn how to design and print anything even if they do not own a printer. 3D Printing Projects provides an introduction to the exciting and ever-expanding world of 3D designing and printing. Learn how a 3D printer works and the different types of 3D printers on the market. Understand the basic 3D printing and designing terms, how to create and prepare files for printing, and also how to scan things to create a 3D model! You will also find out the common troubles faced while 3D printing and simple tricks to fix them. All the projects included in the book can be made using freely available online 3D modeling/CAD programs. Each project has a print time, details of filament or material needed, and a difficulty rating - from easy for beginners to difficult for those

looking for a new challenge. Step-by-step instructions walk you through the 3D design process, from digital modeling and sculpting to slicing, printing, and painting so that children can make their own shark-shaped phone stand, customized lamps, and much more. The book also gives inspiration to further enhance your projects once you've mastered the basics. Join the 3D printing revolution today with DK's 3D Printing Projects book.

3d printing history timeline: 3D Printing for Artists, Designers and Makers Stephen Hoskins, 2018-02-08 Fully revised and with a new chapter and international case studies, this second edition of the best-selling book traces how artists and designers continue to adapt and incorporate 3D printing technology into their work and explains how the creative industries are directly interfacing with this new technology. Covering a broad range of applied art practice - from fine art and furniture-design to film-making - Stephen Hoskins introduces some of his groundbreaking research from the Centre for Fine Print Research along with an updated history of 3D print technology, a new chapter on fashion and animation, and new case studies featuring artists working with metal, plastic, ceramic and other materials. A fascinating investigation into how the applied arts continue to adapt to new technologies and a forecast of what developments we might expect in the future, this book is essential reading for students, researchers studying contemporary art and design and professionals involved in the creative industries.

3d printing history timeline: 3D Printing in Medicine Frank J. Rybicki, Gerald T. Grant, 2017-09-27 This book describes the fundamentals of three-dimensional (3D) printing, addresses the practical aspects of establishing a 3D printing service in a medical facility, and explains the enormous potential value of rendering images as 3D printed models capable of providing tactile feedback and tangible information on both anatomic and pathologic states. Individual chapters also focus on selected areas of applications for 3D printing, including musculoskeletal, craniomaxillofacial, cardiovascular, and neurosurgery applications. Challenges and opportunities related to training, materials and equipment, and guidelines are addressed, and the overall costs of a 3D printing lab and the balancing of these costs against clinical benefits are discussed. Radiologists, surgeons, and other physicians will find this book to be a rich source of information on the practicalities and expanding medical applications of 3D printing.

3d printing history timeline: Standards, Quality Control, and Measurement Sciences in 3D Printing and Additive Manufacturing Chee Kai Chua, Chee How Wong, Wai Yee Yeong, 2017-06-03 Standards, Quality Control and Measurement Sciences in 3D Printing and Additive Manufacturing addresses the critical elements of the standards and measurement sciences in 3D printing to help readers design and create safe, reliable products of high quality. With 3D printing revolutionizing the process of manufacturing in a wide range of products, the book takes key features into account, such as design and fabrication and the current state and future potentials and opportunities in the field. In addition, the book provides an in-depth analysis on the importance of standards and measurement sciences. With self-test exercises at the end of each chapter, readers can improve their ability to take up challenges and become proficient in a number of topics related to 3D printing, including software usage, materials specification and benchmarking. - Helps the reader understand the quality framework tailored for 3D printing processes - Explains data format and process control in 3D printing - Provides an overview of different materials and characterization methods - Covers benchmarking and metrology for 3D printing

3d printing history timeline: 3D Printing of Pharmaceuticals Abdul W. Basit, Simon Gaisford, 2018-08-06 3D printing is forecast to revolutionise the pharmaceutical sector, changing the face of medicine development, manufacture and use. Potential applications range from pre-clinical drug development and dosage form design through to the fabrication of functionalised implants and regenerative medicine. Within clinical pharmacy practice, printing technologies may finally lead to the concept of personalised medicines becoming a reality. This volume aims to be the definitive resource for anyone thinking of developing or using 3D printing technologies in the pharmaceutical sector, with a strong focus on the translation of printing technologies to a clinical setting. This text brings together leading experts to provide extensive information on an array of 3D

printing techniques, reviewing the current printing technologies in the pharmaceutical manufacturing supply chain, in particular, highlighting the state-of-the-art applications in medicine and discussing modern drug product manufacture from a regulatory perspective. This book is a highly valuable resource for a range of demographics, including academic researchers and the pharmaceutical industry, providing a comprehensive inventory detailing the current and future applications of 3D printing in pharmaceuticals. Abdul W. Basit is Professor of Pharmaceutics at the UCL School of Pharmacy, University College London. Abdul's research sits at the interface between pharmaceutical science and gastroenterology, forging links between basic science and clinical outcomes. He leads a large and multidisciplinary research group, and the goal of his work is to further the understanding of gastrointestinal physiology by fundamental research. So far, this knowledge has been translated into the design of new technologies and improved disease treatments, many of which are currently in late-stage clinical trials. He has published over 350 papers, book chapters and abstracts and delivered more than 250 invited research presentations. Abdul is also a serial entrepreneur and has filed 25 patents and founded 3 pharmaceutical companies (Kuecept, Intract Pharma, FabRx). Abdul is a frequent speaker at international conferences, serves as a consultant to many pharmaceutical companies and is on the advisory boards of scientific journals, healthcare organisations and charitable bodies. He is the European Editor of the International Journal of Pharmaceutics. Abdul was the recipient of the Young Investigator Award in Pharmaceutics and Pharmaceutical Technology from the American Association of Pharmaceutical Scientists (AAPS) and is the only non-North American scientist to receive this award. He was also the recipient of the Academy of Pharmaceutical Sciences (APS) award. Simon Gaisford holds a Chair in Pharmaceutics and is Head of the Department of Pharmaceutics at the UCL School of Pharmacy, University College London. He has published 110 papers, 8 book chapters and 4 authored books. His research is focused on novel technologies for manufacturing medicines, particularly using ink-jet printing and 3D printing, and he is an expert in the physico-chemical characterisation of compounds and formulations with thermal methods and calorimetry.

3d printing history timeline: Manus × Machina, 2016-05-02 Manus × Machina ("Hand × Machine") features exceptional fashions that reconcile traditional hand techniques with innovative machine technologies such as 3-D printing, laser cutting, circular knitting, computer modeling, bonding and laminating, and ultrasonic welding. Featuring 90 astonishing pieces, ranging from Gabrielle "Coco" Chanel's iconic tweed suit to Karl Lagerfeld's 3-D-printed version, and from Yves Saint Laurent's bird-of-paradise dress to Iris van Herpen's silicone adaptation — all beautifully photographed by Nicholas Alan Cope — this fascinating book is an exploration of both the artistry and the future of fashion. Featuring interviews with Sarah Burton (Alexander McQueen), Hussein Chalayan, Maria Grazia Chiuri and Pierpaolo Piccioli (Valentino), Nicolas Ghesquière (Louis Vuitton), Lazaro Hernandez and Jack McCollough (Proenza Schouler), Iris van Herpen, Christopher Kane, Karl Lagerfeld (Chanel), Miuccia Prada, and Gareth Pugh.

3d printing history timeline: CAA2015. Keep The Revolution Going Stefano Campana, Roberto Scopigno, Gabriella Carpentiero, 2016-03-31 This volume brings together all the successful peer-reviewed papers submitted for the proceedings of the 43rd conference on Computer Applications and Quantitative Methods in Archaeology that took place in Siena (Italy) from March 31st to April 2nd 2015.

3d printing history timeline: Additive Manufacturing and Design Ranjit Barua, 2024-06-24 Embark on a journey through the intricate landscape of additive manufacturing with 'Additive Manufacturing & Design', a seminal work tailored for readers, researchers, and industrial professionals alike. Authored by leading experts in the field, this meticulously crafted volume delves into the core principles, methodologies, and advanced techniques that underpin additive manufacturing processes. From material selection and design optimization to post-processing and quality control, each chapter elucidates crucial aspects essential for mastering the intricacies of additive manufacturing. Through comprehensive case studies and real-world examples, readers gain invaluable insights into leveraging additive manufacturing technologies across diverse industries,

revolutionizing production paradigms and fostering innovation. Whether you're delving into research, seeking practical guidance for industrial implementation, or simply exploring the forefront of technological advancement, 'Additive Manufacturing & Design' serves as an indispensable resource, illuminating the path towards unlocking the full potential of additive manufacturing in the modern era.

3d printing history timeline: *3D Printing in Medical Libraries* Jennifer Herron, 2019-02-22 Supporting tomorrow's doctors involves preparing them for the technologies that will be available to them. 3D printing is one such technology that is becoming more abundant in health care settings and is similarly a technology libraries are embracing as a new service offering for their communities. *3D Printing in Medical Libraries: A Crash Course in Supporting Innovation in Health Care* will provide librarians interested in starting or enhancing a 3D printing service an overview of 3D printing, highlight legal concerns, discuss 3D printing in libraries through a literature review, review survey results on 3D printing services in health sciences and medical libraries, and offer case studies of health sciences and medical libraries currently 3D printing. Additionally, resources for finding medically related models for printing and tips of how to search for models online is also provided, along with resources for creating 3D models from DICOM. Common print problems and troubleshooting tips are also highlighted and lastly, marketing and outreach opportunities are discussed. Herron presents the nitty-gritty of 3D printing without getting too technical, and a wealth of recommended resources is provided to support librarians wishing to delve further into 3D printing. Design thinking and the Maker Movement is also discussed to promote a holistic service offering that supports users not only with the service but the skills to best use the service. Readers will finish the book with a better sense of direction for 3D printing in health sciences and medical libraries and have a guide to establishing or enhancing a 3D printing in their library. This book appeals to health sciences libraries and librarians looking to start a 3D printing service or understand the 3D printing space as it relates to medical education, practice, and research. It serves as: a field guide for starting a new library service a primer for meeting the information needs of medical faculty, staff, and students a useful reference for a deep dive into this space by librarians who are already actively carrying out some of the kinds of work described herein

3d printing history timeline: *Timelines of Nearly Everything* Manjunath.R, 2021-07-03 This book takes readers back and forth through time and makes the past accessible to all families, students and the general reader and is an unprecedented collection of a list of events in chronological order and a wealth of informative knowledge about the rise and fall of empires, major scientific breakthroughs, groundbreaking inventions, and monumental moments about everything that has ever happened.

3d printing history timeline: *3D Printing at School and Makerspaces* Keon Arasteh Boozarjomehri, 2017-12-15 Many schools and makerspaces have a 3D printer available to use. This book covers a surprising variety of ways that the beginning printer can get started using it, whether it's for a science project, to replace a broken piece for something at home, an art class, or for the school play. This book will help turn anyone into a 3D printer enthusiast.

3d printing history timeline: *3D Materials and Construction Possibilities* Loretta Waldman, 2017-12-15 Most students will work with a plastic when making things with a 3D printer, but that is only scratching the surface of materials that can be used in these machines. This book takes a look at the different materials that can be used by 3D printers, what those materials can make, and the advantages and disadvantages for each.

3d printing history timeline: *3D Printing and Its Impact on the Production of Fully Functional Components: Emerging Research and Opportunities* Kocovic, Petar, 2017-05-30 Manufacturing processes have undergone significant developments in recent years. With the application of new technology, the productivity of companies has increased tremendously. *3D Printing and Its Impact on the Production of Fully Functional Components: Emerging Research and Opportunities* is an innovative source of scholarly research on the advancements of 3D printing technology in modern manufacturing processes. Highlighting critical perspectives on topics such as industrial applications,

3D modeling, and bioprinting, this publication is ideally designed for professionals, academics, engineers, students, and practitioners interested in the latest trends in additive manufacturing.

3d printing history timeline: 3D Printing Martin Gitlin, 2019-08-01 Printing has come a long way thanks to technology, from printing words and images on a flat surface to recreating a life-size version of a car. In *3D Printing in the Disruptors in Tech* series, readers will discover how 3D printing technology has disrupted major industries including health and architecture design. Series includes a table of contents, tech-forward sidebars, a timeline, glossary, index, and author biography.

3d printing history timeline: The Book of Trades , 1862

3d printing history timeline: *3D Printing in Orthopaedic Surgery* Matthew DiPaola, 2018-11-20 Get a quick, expert overview of the role of emerging 3D printing technology in orthopaedic surgery, devices, and implants. This concise resource by Drs. Matthew DiPaola and Felasfa Wodajo provides orthopaedic surgeons and residents with need-to-know information on the clinical applications of 3D printing, including current technological capabilities, guidance for practice, and future outlooks for this fast-growing area. - Covers basic principles such as engineering aspects, software, economics, legal considerations, and applications for education and surgery planning. - Discusses 3D printing in arthroplasty, trauma and deformity, the adult and pediatric spine, oncology, and more. - Includes information on setting up a home 3D printing plant and 3D printing biologics. - Consolidates today's available information on this burgeoning topic into a single convenient resource

3d printing history timeline: *3D Printing for the Radiologist*, E-Book Nicole Wake, 2021-05-27 Comprehensive, yet concise, *3D Printing for the Radiologist* presents an overview of three-dimensional printing at the point of care. Focusing on opportunities and challenges in radiology practice, this up-to-date reference covers computer-aided design principles, quality assurance, training, and guidance for integrating 3D printing across radiology subspecialties. Practicing and trainee radiologists, surgeons, researchers, and imaging specialists will find this an indispensable resource for furthering their understanding of the current state and future outlooks for 3D printing in clinical medicine. - Covers a wide range of topics, including basic principles of 3D printing, quality assurance, regulatory perspectives, and practical implementation in medical training and practice. - Addresses the challenges associated with 3D printing integration in clinical settings, such as reimbursement, regulatory issues, and training. - Features concise chapters from a team of multidisciplinary chapter authors, including practicing radiologists, researchers, and engineers. - Consolidates today's available information on this timely topic into a single, convenient, resource.

3d printing history timeline: *3D Printing with Fusion 360* Sualp Ozel, 2023-12-08 Elevate your Fusion 360 skills and streamline your 3D printing workflow by learning how to repair broken STLs, design for additive manufacturing, optimize part positioning, and slice your models in this user-friendly guide, complete with color images Key Features Combine Fusion 360's powerful modeling capabilities with an intuitive interface to jump into 3D printing with confidence Learn the entire workflow from design to 3D print using the software's powerful capabilities Import and repair external designs and create native lightweight designs for 3D printing Purchase of the print or Kindle book includes a free PDF eBook Book DescriptionAs 3D printing gains traction, the demand for CAD experts in manufacturing grows. If you're a fan of Autodesk Fusion and crave hands-on experience with automated modeling, generative design, and the full potential of additive manufacturing, this book is your guide to elevating your design and 3D printing skills. In this book, you'll learn how to open CAD or Mesh files in Fusion and expertly repair, edit, and prepare them for 3D printing. You'll unlock the secrets of effective print preparation, learning about print settings, support structures, and part orientation. This book also highlights Fusion's diverse preferences designed specifically for additive manufacturing. Subsequent chapters will guide you in choosing the right part orientation and position, as well as creating suitable support structures based on your chosen printing technology. You'll simulate the printing process to detect and remedy common print

failures associated with the metal powder bed fusion process. Finally, you'll leverage templates and scripts to automate routine tasks around print preparation. By the end of this 3D printing book, you'll be armed with the knowledge and skills necessary to harness the power of Fusion for additive manufacturing, meeting the growing demand with confidence. What you will learn

- Use Autodesk Fusion to open, inspect, repair, and edit externally created designs for 3D printing
- Set up your 3D prints for different printing technologies, such as FFF, SLA/DLP, SLS, and MPBF
- Use templates to automate your additive operations, including part orientation, arrangement, and support
- Run process simulation for metal powder bed fusion and learn how to compensate for common print failure modes
- Optimize Fusion 360's preferences for 3D printing
- Export machine-specific file formats for 3D printing, such as G-Code, SLI, SLC, and CLI

Who this book is for If you're a designer using Autodesk Fusion on a daily basis and want to delve into 3D printing or craft functional, lightweight prints, this book is your go-to. It's also a valuable reference for intermediate-level Fusion users seeking insights into DFAM (design for additive manufacturing) and print preparation. To get the most out of this book, it's recommended that you have a good understanding of Fusion's design features, familiarity with opening CAD or MESH files, and prior experience creating components in Fusion.

3d printing history timeline: iDisrupted Michael Baxter, 2015-10-16 iDisrupted changing the human race forever Technology is set to transform the world. Its likely impact is both terrifying and incredibly exciting. We all need to understand the great changes that are just beginning to re-shape the human domain and our daily lives. Then we need to draw up plans. There are few challenges more important. This book is for: People who want a job in ten years' time. Employers who want to hire the right talent for the future. Students of business and business professionals who want to understand how technology will transform the commercial world. Business leaders and shareholders who want the business they run or own to flourish, and not get swept away. Investors endeavouring to understand the possible impact of new technology and to place the right bets. Policy makers needing to understand the potentially devastating impact of tech-economics and tech-politics to make the right decision for their country. And above all, those of us who care about the future of the human race. Technologies to watch: Robotics, internet of things, technologies for the promotion of a sharing economy, artificial intelligence, 3D printing, stem cell research, genome sequencing, energy storage, lasers, solar power, new materials, virtual reality, nanotechnology, brain interfaces to computers, and above all else the internet, mixed with computers following the evolutionary trajectory described by Moore's Law.

3d printing history timeline: Oral History and Qualitative Methodologies Thalia M. Mulvihill, Raji Swaminathan, 2022-02-24 Oral History and Qualitative Methodologies: Educational Research for Social Justice examines oral history methodological processes involved in the doing of oral history as well as the theoretical, historical, and knowledge implications of using oral history for social justice projects. Oral history in qualitative research is an umbrella term that integrates history, life history, and testimony accounts. Oral history draws from various social science disciplines, including educational studies, history, indigenous studies, sociology, anthropology, ethnic studies, women's studies, and youth studies. The book argues for the further development of a pedagogical culture related to oral history for educational research as part of the effort to diversify the range of human experiences educators, community members, and policy makers incorporate into knowledge-making and knowledge-using processes. Early career researchers, novice researchers, as well as experienced researchers are invited to join social science educational researchers in developing their own oral history projects using all of the tools, dispositions, and epistemologies affiliated with qualitative inquiry. The book will be of use in courses on qualitative research methods, history, anthropology, women's studies, and education disciplines as well as by community organizations who want to use oral history to preserve the history of communities and advance social justice projects.

3d printing history timeline: Thin Films, Atomic Layer Deposition, and 3D Printing Kingsley Ukoba, Tien-Chien Jen, 2023-11-29 Thin Films, Atomic Layer Deposition, and 3D Printing

explains the concept of thin films, atomic layers deposition, and the Fourth Industrial Revolution (4IR) with an aim to illustrate existing resources and give a broader perspective of the involved processes as well as provide a selection of different types of 3D printing, materials used for 3D printing, emerging trends and applications, and current top-performing 3D printers using different technologies. It covers the concept of the 4IR and its role in current and future human endeavors for both experts/nonexperts. The book includes figures, diagrams, and their applications in real-life situations. Features: Provides comprehensive material on conventional and emerging thin film, atomic layer, and additive technologies. Discusses the concept of Industry 4.0 in thin films technology. Details the preparation and properties of hybrid and scalable (ultra) thin materials for advanced applications. Explores detailed bibliometric analyses on pertinent applications. Interconnects atomic layer deposition and additive manufacturing. This book is aimed at researchers and graduate students in mechanical, materials, and metallurgical engineering.

3d printing history timeline: Emerging Technologies for Health Literacy and Medical Practice Garcia, Manuel B., de Almeida, Rui Pedro Pereira, 2024-02-14 Emerging Technologies for Health Literacy and Medical Practice unveils a transformative revolution brought about by emerging technologies, setting the stage for a paradigmatic shift from reactive medical interventions to proactive preventive measures. This transition has not only redefined the doctor-patient relationship but has also placed patients at the helm of their health management, actively engaged in informed decision-making. The book, a collective effort by experts across diverse disciplines, stands as an authoritative compendium delving into the profound implications of cutting-edge technologies in healthcare. From the tantalizing realm of artificial intelligence powering diagnostics and treatments to the tangible impact of wearable health devices and telemedicine on accessibility, each chapter delves into the nuanced interplay between technology and medical practice. This book spotlights the capabilities of these technologies, as well as dissecting the ethical, social, and regulatory tapestry they unravel. This book, thoughtfully tailored for a spectrum of stakeholders, epitomizes a synergy between knowledge dissemination and empowerment. From healthcare practitioners seeking to optimize medical practices to policymakers navigating the labyrinth of ethical considerations, from educators enriching health literacy to patients empowered to navigate their health journey, the book unearths its relevance across the healthcare spectrum.

3d printing history timeline: 3D Printing Applications in Cardiovascular Medicine James K Min, Bobak Mosadegh, Simon Dunham, Subhi J. Al'Aref, 2018-07-04 3D Printing Applications in Cardiovascular Medicine addresses the rapidly growing field of additive fabrication within the medical field, in particular, focusing on cardiovascular medicine. To date, 3D printing of hearts and vascular systems has been largely reserved to anatomic reconstruction with no additional functionalities. However, 3D printing allows for functional, physiologic and bio-engineering of products to enhance diagnosis and treatment of cardiovascular disease. This book contains the state-of-the-art technologies and studies that demonstrate the utility of 3D printing for these purposes. - Addresses the novel technology and cardiac and vascular application of 3D printing - Features case studies and tips for applying 3D technology into clinical practice - Includes an accompanying website that provides 3D examples from cardiovascular clinicians, imagers, computer science and engineering experts

3d printing history timeline: Timeline Peter Goes, Sylvia Vanden Heede, 2015 Take a journey through the history of our planet... A perfect introduction to history for young and old, Timeline travels the story of our world, through a lens that captures myths and legends, dinosaurs, the great civilizations, kings and knights, discoveries and inventions. Timeline shows the human race building settlements, fighting wars, exploring the oceans, living in castles, yurts and skyscrapers. It takes our planet from the Big Bang to the threats of climate change. And it does not neglect the imagination--here too are dragons, icons and fictional heroes. Each scene puts global events in perspective through space and time, drawing parallels and connections with careful attention and a refreshing playfulness.

3d printing history timeline: Dental Implants and Oral Microbiome Dysbiosis Prasanna

Neelakantan, Adline Princy Solomon, 2022-06-27 This book will serve as a one-stop, reference manual to understand the basic concepts of dental implant design, the related microbiome, research models and current concepts as well as futuristic perspectives in implant surface modification. The manual-like design including colorful illustrations and important critical questions will help researchers and advanced students in understanding the contemporary status and in designing studies for innovative treatments of dental implant infections. Considering the microbiome of dental implant related environment in health and disease is imperative to design strategies to good practice and prevention of infections around implants. This monograph will serve as a single reference material which links the interdisciplinary aspect of the dental implants covering material sciences, engineering and biological aspects, thus effectively bridging the gap between engineering and oral health sciences.

3d printing history timeline: *A Beginner's Guide to 3D Modeling* Cameron Coward, 2019-06-11 A Beginner's Guide to 3D Modeling is a project-based, straightforward introduction to computer-aided design (CAD). You'll learn how to use Autodesk Fusion 360, the world's most powerful free CAD software, to model gadgets, 3D print your designs, and create realistic images just like an engineering professional—with no experience required! Hands-on modeling projects and step-by-step instructions throughout the book introduce fundamental 3D modeling concepts. As you work through the projects, you'll master the basics of parametric modeling and learn how to create your own models, from simple shapes to multipart assemblies. Once you've mastered the basics, you'll learn more advanced modeling concepts like sweeps, lofts, surfaces, and rendering, before pulling it all together to create a robotic arm. You'll learn how to:

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- Create professional technical drawings for manufacturing and patent applications
- Model springs and other complex curves to create realistic designs
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Whether you're a maker, hobbyist, or artist, A Beginner's Guide to 3D Modeling is certain to show you how to turn your ideas into professional models. Go ahead—dust off that 3D printer and feed it your amazing designs.

3d printing history timeline: Personal Fabrication Patrick Baudisch, Stefanie Mueller, 2017-05-08 While fabrication technologies have been in use in industry for several decades, expiring patents have recently allowed the technology to spill over to technology-enthusiastic makers. Personal Fabrication looks at the massive, disruptive changes that are likely to be seen in interactive computing, as well as to computing as a whole. It discusses six main challenges that need to be addressed for this change to take place, and explains researchers in HCI will play a key role in tackling these challenges.

3d printing history timeline: *Cities' Identity Through Architecture and Arts* Anna Catalani, Zeinab Nour, Antonella Versaci, Dean Hawkes, Hocine Bougdah, Adolf Sotoca, Mahmoud Ghoneem, Ferdinando Trapani, 2018-05-01 Every city has its unique and valuable identity, this identity is revealed through its physical and visual form, it is seen through the eyes of its residents and users. The city develops over time, and its identity evolves with it. Reflecting the rapid and constant changes the city is subjected to, Architecture and Arts, is the embodiment of the cultural, historical, and economical characteristics of the city. This conference was dedicated to the investigation of the different new approaches developed in Architecture and Contemporary arts. It has focused on the basis of urban life and identities. This volume provides discussions on the examples and tendencies in dealing with urban identities as well as the transformation of cities and urban cultures mentioned in terms of their form, identity, and their current art. Contemporary art, when subjected to experiments, continues to be produced in various directions, to be consumed and to put forward new ideas. Art continuously renews itself, from new materials to different means of communication, from interactive works to computer games, from new approaches to perceptual paradigms and problems of city and nature of the millennium. This is an Open Access ebook, and can be found on www.taylorfrancis.com.

3d printing history timeline: *New Horizons for Industry 4.0 in Modern Business* Anand

Nayyar, Mohd Naved, Rudra Rameshwar, 2023-02-09 This book discovers what it will take to reindustrialize the previous industrial powerhouses in order to offset the advantages of cheap labor suppliers dominating the industrial sector by exploring the current situation of the production, processing, and manufacturing industries. The Internet of Things (IoT), Big Data, Cyber-Physical Systems (CPS), and Cloud Computing, Cyber Security, Cobotics, Automation, AI, 3D Printing and Additive Manufacturing, SDN, Blockchain technologies are outlined in this unique and comprehensive book, which has true potential for professionals, researchers, policymakers, and book users. New Horizons for Industry 4.0 in Modern Business encompass trends in business and technology globally that may completely alter how manufacturing and production are conducted. What you will discover: Learn about the Industrial Internet of Things and the Industrial Internet. Learn about the technologies that must develop to support Industry 4.0 and what is being done right now to make that happen. In this book, the topic of Industry 4.0 is covered in detail, and it even moves on to concepts of Digital Twins to boost output and create Industrial Internet of Things. With the development of new digital industrial technology, or Industry 4.0, it is now feasible to collect and analyze data from many machines, resulting in processes that are quicker, more adaptable, and more efficient, producing things of higher quality while spending less money. The manufacturing revolution will boost productivity, alter economics, promote industrial development, and alter workforce demographics, ultimately altering the competitiveness of businesses and areas. Although advanced digital technology is being employed in manufacturing, Industry 4.0 will completely change how things are done. Greater production efficiencies will result, and conventional connections between suppliers, manufacturers, and consumers—as well as between people and machines—will shift. Industry 4.0 is changing the business process. This disruptive technology is radically changing the way businesses/manufacturing is conducted. It will give machines that little bit of intuition with the help of robotics, 3D printing, artificial intelligence, augmented reality, and virtual reality—that will help them do mindless and repetitive jobs without human intervention, allowing humans to focus more on their core competencies.

3d printing history timeline: 3D/4D Printing of Bioadhesive Pharmaceutical Systems Marcos Luciano Bruschi, Denise Tiemi Uchida, Mariana Carla de Oliveira, 2024-11-15 This book features a brief history of additive manufacturing and 3D/4D printing techniques, as well as the advantages, applications, and overall challenges facing the technology. It then focuses on the applications of bioadhesive systems for drug delivery. 3D/4D Printing of Bioadhesive Pharmaceutical Systems: Additive Manufacturing and Perspectives, explores recent discoveries of 3D printing in the development of pharmaceutical systems and drug delivery. Specifically, it discusses the main polymers/materials used in the development of bio-adhesive pharmaceutical systems and explains the importance of bio-adhesiveness of drug release through 3D printing. The authors also introduce the main strategies necessary to achieve a proper drug delivery system through 3D printing, and examine the adhesiveness of these systems on the skin as the mucosa decreases with the elimination of the drug by the body. Finally, the book brings all the necessary specifications to obtain a bioadhesive system with suitable bio-ink to obtain the best 3D/4D printing. This book is written with the objective of helping students start their studies in pharmaceutical engineering, bioengineering and additive manufacturing. Moreover, engineering professionals can use the book to improve the performance of 3D/4D printers for this type of system.

3d printing history timeline: HBR's 10 Must Reads 2016 Harvard Business Review, Herminia Ibarra, Marcus Buckingham, Donald N. Sull, Richard D'Aveni, 2015-11-10 A year's worth of management wisdom, all in one place. We've examined the ideas, insights, and best practices from the past year of Harvard Business Review to bring you the latest, most significant thinking driving business today. With authors from Marcus Buckingham to Herminia Ibarra and company examples from Google to Deloitte, this volume brings the most current and important management conversations to your fingertips. This book will inspire you to: Tap into the new technologies that are changing the way businesses compete Fuel performance by redesigning your organization's practices around feedback Learn techniques to move beyond intuition for better decision making

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3d printing history timeline: Guns in American Society [3 volumes] Jaclyn Schildkraut, Gregg Lee Carter, 2022-12-01 The revised third edition of the landmark Guns in American Society provides an authoritative and objective survey of the history and current state of all gun-related issues and areas of debate in the United States. Guns in American Society: An Encyclopedia of History, Politics, Culture, and the Law is a comprehensive and evenhanded three-volume reference resource for understanding all of the political, legal, and cultural factors that have swirled around gun rights and gun control in America, past and present. The encyclopedia draws on a vast array of research in criminology, history, law, medicine, politics, and social science. It covers all aspects of the issue: gun violence, including mass shootings in schools and other public spaces; gun control arguments and organizations; gun rights arguments and organizations; the firearms industry; firearms regulation, legislation, and court decisions; gun subcultures (for example, hunters and collectors); leading opinion-shapers on both sides of the gun debate; technological innovations in firearm manufacturing; various types of firearms, from handguns to assault weapons; and evolving public attitudes toward guns. Many of these entries place the topics in both historical and cross-cultural perspective.

3d printing history timeline: 3D Printing In Dentistry Dr. Neha Singh, Dr. Sridevi N., Dr. Asheesh Sawhny, 2021-08-03

3d printing history timeline: Study on Microextrusion-based 3D Bioprinting and Bioink Crosslinking Mechanisms Liliang Ouyang, 2019-08-10 This book presents a comprehensive study on microextrusion-based 3D bioprinting technologies for bioinks with various crosslinking mechanisms, chiefly focusing on the bioprinting process and bioink properties to provide readers with a better understanding of this state-of-the-art technology. Further, it summarizes a number of general criteria and research routes for microextrusion-based 3D bioprinting using three experimental studies based on shear-thinning, thermo-sensitive and non-viscous hydrogel bioinks. The book also presents sample applications in the areas of stem cells and cell matrix interaction. The book highlights pioneering results in the development of bioprinting technologies and bioinks, which were published in high-quality journals such as Advanced Materials, Biofabrication and ACS Biomaterials Science & Engineering. These include an in-situ crosslinking strategy that overcomes the viscosity limits for bioinks, which is virtually impossible using conventional strategies, and can be generalized for other bioink formulations.

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