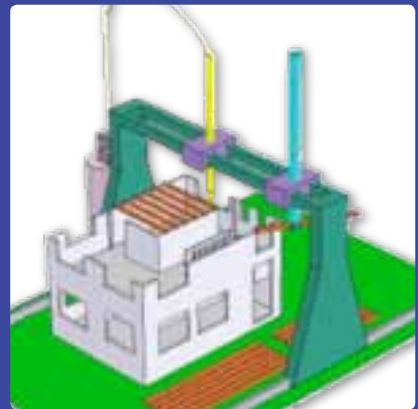


The Future of California's Workforce



about the ...

INSTITUTE FOR THE FUTURE

The Institute for the Future is an independent, nonprofit strategic research group with more than 40 years of forecasting experience. The core of our work is identifying emerging trends and discontinuities that will transform global society and the global marketplace. We provide our members with insights into business strategy, design process, innovation, and social dilemmas. Our research spans a broad territory of deeply transformative trends, from health and health care to technology, the workplace, and human identity. The Institute for the Future is located in Palo Alto, California.

CENTERS OF EXCELLENCE

The Centers of Excellence (COE), in partnership with business and industry, deliver regional workforce research customized for community college decision making and resource development. This information has proven valuable to colleges in beginning, revising, or updating economic development and Career Technical Education (CTE) programs, strengthening grant applications, assisting in the accreditation process, and in supporting strategic planning efforts.

The Centers of Excellence Initiative is funded in part by the Chancellor's Office, California Community Colleges, Economic and Workforce Development Program. The Centers aspire to be the premier source of regional economic and workforce information and insight for California's community colleges.



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Demographic shifts, a deluge of data, smart machines, and new forms and tools of production are just some of the drivers that will reshape many aspects of work in California in the next twenty years. Not only will the content of work change, but many new occupations will arise that are not even in existence today, even basic notions of how work is defined and performed will also be transformed. This report analyzes key drivers that will reshape the STEM disciplines and landscape of work in California through 2032. It explores the impacts of these drivers on important domains of the economy—agriculture, health, security, media, manufacturing, retail, and infrastructure—in that period. To better illustrate the tangible impacts of these changes and what they will mean in terms of real job requirements, we developed prototypes of future jobs, describing the content of each job, its skill requirements, and its education requirements. Think of these prototypes as something one might find advertised when looking for a job in 2032.

Over its forty-year history, the Institute for the Future (ITF) has been a leader in advancing foresight methodologies to help people make better decisions and shape a better future for their organizations. We have used a variety of methodologies, including the Delphi technique (a method for aggregating expert opinions), future-oriented ethnographic methods, and, recently, gaming platforms to crowdsource foresight, and we have worked with a variety of organizations—from Fortune 500 companies to governments and foundations—to develop forward-looking visions and strategies for success.

ITF uses foresight as a starting point for a process we call Foresight to Insight to Action, which enables people to take future visions and convert them into meaningful insights and actions they can take in the near term that will lead to longer-term success. In writing this report, we drew on ITF's foundational forecasts in education, technology, demographics, work, and health, as well as our annual Ten-Year Forecast. For more than thirty years, our Ten-Year

Forecast Program has provided a distinctive outlook on the changing global environment, anticipating discontinuities and potential dilemmas that demand new ways of thinking about complex problems. Also, as part of our research process, we drew insights from several independent education, business, and organization experts through interviews and workshops.

The report begins by outlining key drivers that will be reshaping jobs in the next twenty years. Next, we offer a graphic map of the drivers and the important trends within each of seven industries—from agriculture to security. We then present forecasts of how convergences of drivers are likely to impact these industries. Following each forecast, we present a signal—something that already exists today, whether a new product, practice, market strategy, or technology—that points to a larger transformation. Then we illustrate, with a prototype of a future job description, what that transformation will mean in terms of concrete jobs.

Drivers are important starting points for creating forecasts—plausible, internally consistent visions of the future. Drivers of change are the deep underlying forces that will be shaping the future. When we think about the future of jobs in California, the following seven drivers stand out.

1 Health Divide

A deluge of health information and an explosion of personalized health tracking devices and platforms will further polarize the health care system.

Over the next twenty years, we will see a growing gap between sophisticated, health-literate, empowered individuals and those who are struggling just to meet basic health needs. The “super-better” population will have access to rapidly growing supplies of personal health and behavioral data, constructing rich ecologies of resources toward achieving well-being. On the other end of the spectrum will be the “sick herd,” those who, for various reasons (education, time, motivation, and lack of resources), struggle with poor health outcomes. The result will be an uneven, fragmented health system that will seek to accommodate a variety of new technologies and super-empowered patients armed with large amounts of personal health data. At the same time, health practitioners will be stretched to provide care to the growing ranks of people with chronic health conditions who either cannot afford quality care or lack the necessary skills to be proactive health consumers. The variety of services and tools for providing care will need to expand and diversify greatly to accommodate this fragmentation, creating a wider array of job categories and demands for a wider array of skills.

2 De-institutionalization

Connective technologies are catalyzing new forms of social production, enabling people to work and create value in new ways.

For the past thirty years, we have been building a global connective technology infrastructure, which publisher Tim O’Reilly calls the “architecture of participation.” With the new social platforms in this infrastructure, individuals can do things—by themselves or in groups—that previously required large-scale organizations or formal institutions. Individuals can now easily and efficiently find peers to trade with, learn with, create with, and even solve large-scale challenges with in new ways. These connective technologies are changing economic systems by ushering in new forms of production—variously called social, commons-based, or peer-to-peer production—including micro-contributions from large networks of people using social tools and technologies to create value. New models of value creation will emerge that enable people to take advantage of alternative currencies, streamlined transaction processes, and robust channels for finding and interacting with each other. Coordinating and navigating these fluid networks will be a vital skill and competency.

3 Energy

The energy system of the 21st century will run on renewables and distributed production techniques.

Over the next twenty years, the systems we have built on cheap and abundant fossil fuels will be in the midst of a radical phase shift to a new energy model. This shift will be driven by both realities of climate change and new technologies and techniques for obtaining and managing energy resources. Electricity, for example, will be combined with networking technologies into regional and national smart grids, and will more fully integrate local and distributed energy production systems. At a broader level, technologies for alternative fuel production, next-generation renewables, commercially viable fuel cells, and even early fusion energy generation are all likely to have an impact on the energy sector and everyday energy use. The process of simultaneously redesigning and rewiring national energy infrastructures promises to make this a sector of intense growth in the years ahead.

4 Volatility and Uncertainty

Disruption will be the default field of operation for institutions, with foresight and resiliency being core to survival.

Climate change, rapid technological advances, economic disruptions, social unrest, and super-empowered individuals will lead to greater levels of volatility and unpredictability. Accelerating and intensified change will force organizations and individuals to embrace, or at least accept, uncertainty as inevitable, and to develop strategies for resiliency. These strategies will be built around the ability to quickly reconfigure plans and resources under changing conditions. Successful organizations and social systems will need to develop foresight capacities—to constantly scan the environment for signals of change, make sense of such signals, and rapidly respond to changing circumstances. Volatility and uncertainty will require people and institutions to continually reorient their viewpoints and response strategies. Missions will need to be clear, but plans must be flexible.

5 Smart Machines

New partnerships between humans and intelligent machines will redistribute and redefine labor.

Smart machines—devices and systems with embedded intelligence, contextual awareness, and sensitive feedback mechanisms—are entering more domains of our lives, whether in the form of robots or digital entities. They are assisting in classrooms, design labs, corporate offices, and retail environments. They will increasingly be used in performing surgery, assisting nurses with patient care, building durable goods on factory floors, and tending agricultural crops. Machines almost never simply replace humans in existing tasks; more often, they change the nature of human work. Although smart machines will take over many routine and rule-based tasks, they will also augment and extend human capabilities, in the process enabling us to do things we could never do before, such as exploring the ocean floor or manufacturing at nanoscales. The new partnership between humans and smart machines will foreground fundamental questions about what humans are uniquely good at, and how we use these skills in an era of new types of machine-human partnerships.

6 New Manufacturing

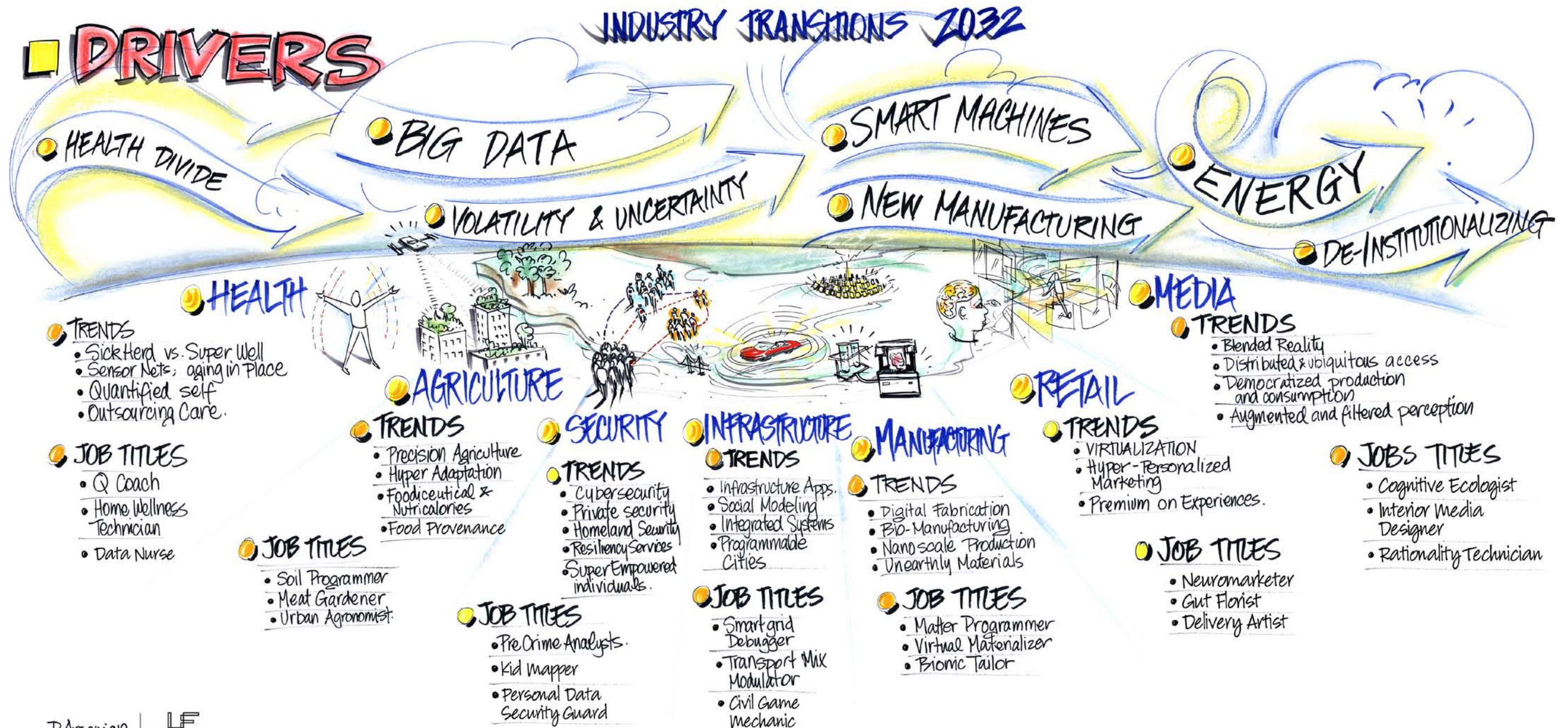
Basic assumptions and practices of producing goods will be challenged by 3D printers, programmable matter, and advanced materials.

Emerging manufacturing technologies are poised to fundamentally change the way things are made. Whereas traditional assembly lines favored uniformity and centralization, new techniques and systems built around rapid prototyping technologies, particularly around advanced 3D printing, will favor customized, localized, and distributed production. The traditional lines between “consumer” and “producer” will be blurred, and in many cases erased, by this process. In parallel, materials science will give this diversified group of producers greater access to nanoscale, biological, and smart components that will imbue familiar manufactured objects with advanced properties and functionalities. As a result, we will see the design of new industrial ecologies around production, and a rethinking of traditional manufacturing practices, roles, and categories.

7 Big Data

More data will be produced in the next decade than has been produced in all of human history.

In the coming decades, a proliferation of sensors, networked computing platforms, and cloud storage will be translating our world into a flood of data streams. Almost every object and interaction will be captured as data. These streams, flowing with very high-resolution information, will need to be analyzed, visualized, and utilized to draw out valuable insights and to inform decision-making. The sheer complexity and amount of information will demand new skills and practices in computational thinking. Being able to work with data will become a necessity for most professions, including design, urban planning and services, and health care. At the same time, big data proliferation will drive demands for data security, authentication, and integration tools.





AGRICULTURE : from mechanized farming to intelligent cultivation

AGRICULTURE

TRENDS

- Precision Agriculture
- Hyper Adaptation
- Foodicentical & Nutricatories
- Food Provenance

For most of human history, farmers have worked directly with the soil and their crops. However, with the development of modern precision agriculture, robotics, and bioscience, cultivation of crops will be defined by a complex interplay between natural processes, smart technological systems, and a new class of tech-savvy farmers. We will see quickly evolving industrial and local agricultural practices, and a shifting relationship between individuals and their cultivated goods. Agriculture has always been a frontier of mechanization, and the next step in this process will be the transition of traditional farm equipment toward semiautonomous robotic equipment. Already, prototype robotic systems have been developed for picking fruit. However, not all robotic agricultural applications aim to replace humans; researchers are currently working on robotic “exoskeletons” to augment the strength and endurance of humans performing agricultural tasks.

The implementation of agricultural robotics will rely on a parallel rollout of cheap sensor and data processing technologies. Over time, complex sensor grids will be put in place to ensure that automated systems, and the people overseeing them, are constantly updated with real-time information about soil chemistry, temperature, and moisture levels. Human farmers will not only program and maintain the robot and sensor systems to produce the best yield with the least environmental harm but also use data analytics to make sense of their crops and the commodities market as a whole. To a large extent, future agriculture—from seed to market—will be an information processing industry.

This agricultural reorientation will happen against the backdrop of global climate change, requiring crops and farming practices to adapt rapidly to changing weather patterns, microclimates, and water availability. Energy use and efficiency will also become a more central consideration, as energy producers and farms will often be sharing or competing for the same land and water resources. In many cases, food and energy production will happen in parallel within agricultural centers.

Biotechnology, new health practices, and intellectual property law will also play pivotal roles in reshaping what we grow and consume. For example, microalgae cultivation is emerging as a potential solution to some problems of human nutrition, and lab-grown meats are being developed to replace many livestock products. Indeed, the biotech sector is entering a period of democratized innovation similar to the developments in computing a few decades ago: imagine the agricultural industry moving at speeds similar to Internet startups.

Finally, from a health perspective, population-level data collection will lead toward “evidence-based nutrition” and in many cases blur the line between food and medicine. It is likely that specially tailored diets and massive amounts of metadata accompanying crops will facilitate a more intimate and transparent relationship between individuals and the cultivated products they consume.



Autonomous Tractor
A robotic prototype of an autonomous tractor from John Deere shows that removing the constraints of onboard human operators can lead to revolutionary designs of current systems.

Source: [deere.com](https://www.deere.com)



future job title: **LABORATORY MEAT TECHNICIAN**

The process of growing *in vitro* meat involves applying a protein to animal muscle cells that helps them replicate into large portions of meat. Once the initial cells have been obtained, additional animals are not needed—much like the production of yogurt cultures. Meat growing will require knowledge of cell and tissue culturing techniques, including an extreme emphasis on sterile procedures and maintenance protocols.

Monitoring the growth and stability of meat cultures will be important for maintaining quality and minimizing health risks. Visual analysis and genetic marker tracking using handheld, microfluidic arrays will be necessary to cut down on bacterial infections and antibiotic-resistant threats to established cultures. Strict attention will be given to form, taste, and texture, including products forming around 3D-printed synthetic bone and tissue scaffolds. Assemblages of different meat culture cells will be machine-plotted around “tissue blueprints” to seed texture variation in the final product. Foodiceutical additives, such as omega-3 fatty acids, will be grown to enhance value and add taste.

COURSE TITLES:

Sterile Construction IV 3 credits (design lab)

Stem Cell Hormonal Therapy II 3 credits (chemorganic practicum)

Nutritional and Amino Acid Marketing 3 credits (demo course)

Visual Analysis 3 credits (distributed learning)

Bone Matrix Printing 3 credits (design lab)

The Architecture of Taste 1 credit (portfolio course)

Mobile Microfluidics 3 credits (info-dev-lab)



Molta
Foodceuticals

Laboratory Meat Technician in Hayward/Castro Valley

APPLY NOW

Molta Foodceuticals, Inc. (MFIC) is a regional leader in the lab-grown meat, foodceuticals, and protein aesthetics market providing innovative, safe, and effective solutions for families, restaurants, and food stores. As the first PETA approved meat laboratory in California, Molta offers sustainably produced protein-based pro-ethical products to address a range of dietary needs for people and their pets. Since 2017, approximately one million families have switched to Molta products for their daily protein needs. Molta is looking for dedicated, contentious individuals who thrive in a creative, challenging, and professional environment - where respect for the energy of new ideas diversity and teamwork can be found at every hub of the organization. To apply for this position, please send your video resume and fMRI scan to: videoresumetimeline.molta@gmail.com

Principle Responsibilities and Duties:

Note: The following are meant to be representative but not necessarily all inclusive of the duties and responsibilities for this position title.

- Survey and analyze meat garden cultures
- Assist in the preparation of histology, sectioning, staining, and scanning of samples
- Participate actively in the optimization and development of sterile techniques and culture
- Help to develop tissue processes and data analyses
- Test novel gardening device technologies including working with developers to refine existing tools
- Support clinical team, external application protocols, and neuroaesthetics team
- Help to design, implement, and evaluate tissue scaffolds and new protein products

Experience + Education + Training Traits:

Project-based lab experience with badges for tissue structuring, ethnoprotein studies, 3D scaffolding, immersive haptics, robo-culturing, and microvisual analysis, including:

- Tissue processing
- Working knowledge of special stains, imaging, and immunohistochemistry
- Use of microscopes, imaging, and crowdsourcing software
- Additional knowledge in tissue optics is helpful and advanced imaging processing apps
- Strong written, social, and immersive communication skills required
- Ability to apply concepts such as growth curves and tactical modeling using interactive algebraic and calculus tools.
- Ideal candidate will have a collaborative task-acquisition ethic coupled with strong interpersonal and inter-robotic skills, self-motivation and/or growth mindset to succeed in problem solving, knowledge of protein anatomy, and direct hands-on experience with medical device interface design.

Analytical and Reading Skills

Ability to read, analyze, interpret, and assist in the creation and refinement of protein service design within the organization while defining problems, collecting data, establishing concurrence, and drawing interpretable conclusions to report on findings for stakeholders.

Physical Requirements

While performing the duties of this job the employee may be required to perform lifting tasks of up to 16 kg. Duties of this job may involve standing and/or walking and/or flexing and/or haptics for extended periods of time. Duties also involve daily tactile interface involvement.



HEALTH: from occasional check-ups to continuous care

HEALTH

TRENDS

- Sick Herd vs. Super Well
- Sensor Nets; aging in Place
- Quantified self
- Outsourcing Care.

The health, health care, and wellness industries will continue their rapid expansion, increasing their relative share of the GDP in the coming two decades. Among the factors contributing to this growth is the aging populations in industrialized nations. In the United States, there will be twice as many people aged 65 or older in 2030 as there were in 2000, growing from 12.9% of the population to 19%.¹ Older Californians will require more health services and will be looking for new medical technologies, pharmaceuticals, and lifestyle products to help them lead more active and engaged lives.

The aging population will affect the workforce in other ways besides demanding more direct medical products and services. With expectations for greater longevity, many people will work longer into their lives and may have several careers before retirement. Lifelong learning, adult education, and retraining opportunities will be necessary as career paths take longer and windier roads.

Another factor contributing to health industry growth is the overall “medicalization” of more and more aspects of our lives. With discoveries in neuroscience and greater access to genetic information, more conditions and experiences are being viewed through the lens of scientific medicine. From behavioral drugs for young kids to the fight against the debilitations of aging, Americans are interfacing with the health care industry earlier and more often throughout their lives. Whereas previously most people would visit their doctor for a checkup once or twice a year except in the event of an acute illness, now many people are tracking and attending to their health continuously. People are increasingly monitoring not only their

vital statistics, such as blood pressure and weight, but also their day-to-day behaviors, including what they eat, how much they exercise, and how much they sleep. Through social networking health sites, such as Patients Like Me or Cure Together, they are even able to run clinical trials and ad hoc experiments for treatments of both common and uncommon ailments.

Currently the drive toward radical self-tracking, as embodied by the Quantified Self movement, is being led by passionate, tech-empowered devotees. Within a few years, however, passive monitoring technologies embedded in our devices or worn on our bodies will make this quantification more mainstream. The data these tracking technologies will generate will expand the health care industry and may fundamentally transform how health care and clinical practice are done. Having these rich and detailed data stories linked to individuals within an overall health information ecology means that diagnosis, treatment, and compliance will be much more data-driven, forever altering the patient-doctor relationship.

Technologies and services that manage and make sense of personal health data will flourish, but those without the means to generate and process their medical data will be at a disadvantage. An underlying “health divide” between those who live in a rich information ecology and those who are data-poor could continue to widen, leading to very different health services and overall health outcomes for these two populations. Although both populations will need to be served, the skills and technical proficiencies that serve them could be very different.



Wearable Health Monitor

Jawbone, a company associated with Bluetooth headsets, has created a wearable bracelet, UP, that gathers data with the option to upload health information to a social network of users.

Source: forums.jawbone.com



future job title: DATA-INTENSIVE NURSE (DN)

Health care is driven by data. Doctors use patients’ descriptions of their symptoms and their first-hand observations to determine possible causes. This practice, called differential diagnosis, is systematically used by physicians and other medical professionals. Because diagnostic errors are two to three times greater than other errors in medicine, differential diagnosis is one of the first places where substantial improvements can and will be made through the use of assistive artificial intelligence and big data aggregation and patterning. Health care is one of the primary applications of IBM’s Watson AI system.

Differential diagnosis support systems will need data-savvy nurses to manage the interview process, rate the symptoms for input, choose additional tests to deduce the probabilities of different diagnoses, and make sense of the results. Data-skilled nurses will support the analytic capabilities of AI by cleaning data and databases, fine-tuning the diagnostic strategy for diseases like schizophrenia, and managing the classes of evidence used to make decisions. Health practitioners will shift their attention to information and operations processes to improve patient and provider experiences.

COURSE TITLES:

Population Data Tracking 3 credits (practicum)

DeepQA: Sentiment Analysis 1 credit (distributed learning)

Disease Prediction 3 credits (upper-level immersion practicum)

Health Service Design: Patient Experience 3 credits (clinical design lab)

Quantifying the Self 5 credits (guest lectures and lab)

Bio-Feedback Instrumentation 3 credits (design lab)

Community Health Insights and Visualization 3 credits (project-based internships)

Health Accounting 3 credits (studio)

Fundamentals of Machine Grammar 3 credits (lecture)

Mobile Microfluidics 2 credits (studio)

Sensor Programming and Maintenance 3 credits (technical)

FIND

The Wayland Clinic

of Santa Monica

Curator of Research Analytics

Job ID: 3393

Location: Santa Monica, CA

Category: Data-intensive Nursing

Procedures and Accountabilities:

- Conduct constant surveillance of the Type-4 diabetes research landscape using OpenScape with the goal of porting resource collections, providing analysis, commentary, and recommendations for strategies regarding Type-4 knowledge network organizations.
- Objectives will include: identifying research and clinical knowledge resources, critical evidence thresholds, and DeepQA best practices for AlssistedDiagnosis (AID) with specific attention to the requirements of Type-4 diabetes patients.
- The curator will conduct poignant, concise, issue-specific patient symptom mapping for clinical patients. The analyst will also develop a framework for AID services to meet the stated goals.
- Developing and maintaining the knowledge networking database, i.e. social spreadsheet files that integrate critical operating data, health histories, foodiceutical and enviro-locational t-scores, treatment pathways, and AID A-matrices.
- Manage junior curators, collections assistants, and knowledge base data advocates..
- Perform patient interviews, monitoring and q-coaching, fMRI pain analysis, and community projections as needed.

Qualifications:

- Mid-level data-side nurse practitioner with knowledge experience with for 7-12 emerging chronic diseases, 2+ years of experience with patient-side and/or data-side interview firms.
- Fully developed and self contained AlssistedDiagnosis process mapping within areas of expertise.
- Existing network of knowledge market contacts/relationships for acquiring background information and disease market intelligence.
- Sensor programming in Q+ or later.
- Leadership qualities and/or experience.
- A highly productive individual who is also willing to contribute to team orientated goals.
- Bachelor of Information degree required, QA or CHA preferred.



SECURITY: from detective work to predictive policing



We are entering a world in which every object, interaction, and move is converted into data. With social media platforms such as Facebook and Twitter creating digital trails of people’s lives, and with video cameras and sensing devices continuously capturing movements of people and things in our communities, we are increasingly creating digital mirrors of our lives as a reflection of and a complement to our physical reality. We consequently now have much higher-resolution views of our communities, enabling us to pinpoint with an unprecedented level of precision which locations are unsafe, unhealthy, or congested. With this new level of awareness often comes new levels of insecurity. And because so many of our most important assets—personal, community, and government—are digital, there are new security concerns that we now have to deal with.

In this environment, cyber security and risk will increasingly become top areas of concern for individuals and organizations, both in the private sector, where identity theft continues to plague online and offline commerce, and in the public sector, especially in national defense. In 2009, the U.S. military launched the Cyber Command, responsible for “planning, coordinating, integrating, synchronizing, and directing activities to operate and defend the Department of Defense information networks,”² and several incidents already point to emerging and increasingly hostile cyber wars between rival nations. The United States has accused China and Russia of infiltrating sensitive military and infrastructure networks.³ The recent Stuxnet attack, which crippled internal Iranian networks for several weeks, has been linked to the United States and Israel by many analysts.⁴ With the electri-

cal grid moving to a networked model, and with more of our lives depending on a functioning digital network, cyber security will be the main theater of operations for the security industry.

Over the next twenty years, the security industry will continue its steady growth in traditional areas, including surveillance, prisons, private security, and police and military applications, driven by counterterrorism and homeland security concerns. At the same time, other security applications will mature, such as cryptography and biometric monitoring. Most provocatively, precrime tools such as predictive analytics and semantic profiling will emerge.

The notion of “precrime” conjures up images of science fiction, especially the film *Minority Report*. Predictive policing, however, is quickly becoming a legitimate strategy for police forces in the United States and around the world, with California leading the way. The cities of Santa Cruz and Los Angeles have already implemented early forms of predictive policing, and many more cities are looking into the technique.⁵ Predictive policing works by using historical crime data and software algorithms to “predict” when and where a crime will occur. Officers (or remote surveillance cameras) are then sent to the area to prevent or apprehend perpetrators at the scene. This practice will require a new set of skills for law enforcement. Programmers will need to create more robust and effective software to streamline automated crime forecasts, dispatchers will need to be able to make sense of the forecasts and distribute resources in an efficient manner, and crime data will need to be generated and processed in new ways.



Predictive Law Enforcement
Los Angeles, with one of the largest police forces in the world, is working with researchers at UCLA and Santa Clara University to explore using predictive tools to anticipate and prevent crimes.

Source: LA Times



future job title: **PRECRIME ANALYST**

Behavior, location, and biometric data are being used to anticipate crime before it happens. Sensor arrays and covert surveillance collect and record local activities and generate forecast crime maps. Behavioral profiling techniques that combine video surveillance, digital expressions, social network relationships, audio recordings, cardiovascular signals, pheromones, electrodermal activity, and respiratory measurements are used to predict behavior. Past crime data is being mapped to locations and times to measure the relative risk of future crimes, and resources are being preferentially directed at those risky areas. Considerable planning is necessary for managing data standards and provenance to ensure fair reporting of probabilities, and since precrime analysts will be responsible for anticipating how many and what types of crimes to target for analysis, timely preparation for future eventualities will also be required.

COURSE TITLES:

- Metropolitan Time-Series Analysis** 3 credits (core)
- Crime Mapping** 1 credit (core)
- Social Bots and Semantic Analysis** 3 credits (theory)
- Intuition Networks** 3 credits (practicum)
- Biometric Search and Retrieval** 1 credit (internship, security clearance required)
- Synthetic Surveillance** 3 credits (special topics)
- Prevalence Mapping** 5 credits (core)
- Precrime Ethics** 3 credits (elective)
- Data Forensics** 3 credits (core)
- Digital Trails** 1 credit (practicum)

FIND

Transperian

PRECRIME ANALYST

Transperian, LLC is a local leader in credit and information management. For more than 40 years, we have gathered, analyzed and delivered the critical information for credit determination and crime detection. The result? Our customers can better anticipate risky business, customer, and community relationships. Our dedicated associates provide biometric, precrime, and credit analytics to approximately 45 million individual customers on five continents and approximately 500 million consumers and businesses worldwide.

The Precrime Analyst position is a key contributor to the vision of Transperian becoming recognized as a Personal Intelligence provider. The individual in this position will proactively work within Transperian to drive business and revenue opportunities from precrime analytic products. In addition to specific data and geographic responsibilities, the individual in this position will be expected to manage effectively across virtual teams, draw upon device resources within and across Transperian and regional civic infrastructures in order to facilitate the development and execution of investigative projects and initiatives. Individuals in this San Diego, CA, position will be expected to work effectively within and across a matrixed precrime organization.

The Precrime Analyst is expected to be familiar with investigative data mining in the visualization, organization, sorting, clustering, segmenting and prediction of criminal behavior space using data attributes such as age, previous arrests, modus operandi, household income, countries visited, housing type, DNA marker, length of residency, utility usage, IP address, number of children, place of birth, spouse characteristics, average usage of ATM card, number of credit cards, etc.

Qualifications:

- Associate of Information Degree required in Information Analytics.
- 3+ years experience in applying analytically based models and solutions within the Banking/Financial/Biometric Services, Credit Card and/or Commercial Lending industry is required.
- Candidates must have an understanding of how precrime pattern recognition can be leveraged to improve credit lifecycle decisions, personal intelligence monitoring, strategies and related processes.
- 2+ years experience in developing behavioral response/targeting searches or similar empirically based social bots utilizing device neural networks.
- Excellent tactical and virtual communication collaboration skills required to interact with external and internal customers at all levels.
- Ability to demonstrate mastery of legal risk avoidance in biometric data mining.
- Experience creating dynamic precrime path-likelihood identification, custom analytic, model and project design and/or solution-set proposals to address Personal Intelligence issues.



MEDIA: from passive consumption to interactive participation



MEDIA TRENDS

- Blended Reality
- Distributed & ubiquitous access
- Democratized production and consumption
- Augmented and filtered perception

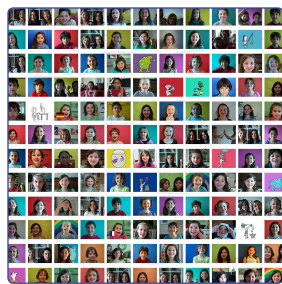
The media industry encompasses a wide variety of forms, including text, music, television, film, and other content. Perhaps more than any other industry, media production and business have been disrupted by the Internet, becoming more decentralized, democratized, and personalized.

In the last twenty years, newspapers, book publishing, and other print media have seen their decades-old (or even centuries-old) business models overturned by the Internet and peer-to-peer communication, especially from news aggregators, Craigslist, blogs, and Wikipedia. In the wake of these revolutions, everyday people have become much more involved in creating, filtering, and disseminating text-based content on the Web and much less reliant on (and less likely to pay for) mainstream media productions.

The same revolutions have affected music, and more recently video, on the Web. The rise of personal and commercial video on the Web has been remarkable. Cisco now estimates that by 2015, 90% of all consumer Internet traffic will be video.⁶ With video cameras standard on mobile phones, and with the ease of exchanging videos through sites like Facebook and YouTube, we, as a society, are moving from being “people of the book” toward becoming “people of the screen.”⁷ This shift will require new video literacies in almost all types of jobs, as video joins text as a default mode of communication in the workplace. To communicate effectively in this environment, laypeople will need to know how to produce, edit, and transfer information via video, including recording and real-time video communication.

Not only will video pervade our content streams, but we will also begin to use augmented reality filters to overlay information and content directly onto our physical environment. This metalayer of information, friend feeds and recommendations, and even advertising will be seen through augmented reality (AR) filters housed in our mobile devices first, then through our glasses and contact lenses,⁸ and then, more provocatively, directly into the visual cortex of our brains.⁹

AR will also increasingly be used to embed games into our environment and workplaces. The movement toward the so-called gamification of life and work will lead to new ways of collaborating and accomplishing workplace activities. Noting that gamers are often highly engaged, focused, and vigilant when playing games, gamification advocates argue that if more work and life activities can resemble the missions and mechanisms of games, people will be more productive and happier in their work.¹⁰ Already, a cottage industry is growing that brings gaming principles to the workplace. The kind of feedback mechanisms and goal orientation of games will increasingly be expected by employees and will change how work is done in the coming decades.



Developing Media Literacies Among Young Children

The Smories website invites children to communicate with one another by recording themselves reading stories.

Source: smories.com



future job title: **COGNITIVE ECOLOGIST**

Whereas cognitive psychologists study how embodied sensations and internal mental processes (including stress, mood, exercise, and even posture) combine to influence thought and behavior, cognitive ecologists look at the entire system of brain, body, and world to create designer thinking environments. For example, high ceilings have been found to elicit feelings of openness and freedom for people in those spaces, often leading to more creative and original thinking. Neurofeedback from users will also increasingly determine how media will be curated, and a design strategy is needed to improve mind-media interactions. As the mind extends itself into the world and offloads more and more cognitive functions to machines and networks, attention to the design of these extensions will be essential for more productive and satisfying thinking.

COURSE TITLES:

Comprehensive Cognitive Design 3 credits (social design lab)

Choice Architecture 3-5 credits (social design lab + portfolio)

Emotional and Narrative Geography 3 credits (info-dev-design)

Memory Buffering 1 credit (internship)

Metaphor 101 3 credits (cultural analytics)


Deep Pattern Recognition 3 credits (data lab)

Social Cinematics 3 credits (studio)

Media Landscaping and Social Cognition 3 credits (lab)

Habituation 3 credits (clinical)

Data Sensualization 3 credits (practicum)

 Careers

Job details

Job Number: 4252-A
Location: US – Los Angeles, California
Job Level: Junior Staff
Field: Cognitive Ecology

Description
ACUV Rail of North America, Inc., consists of four divisions including Group Research and Advanced Engineering, TechCenter, eDrive & Powertrain, and ACUV Rail Advanced Design. All four divisions are focused on delivering a positive impact on ACUV Rail products through the advancement of safe, convenient, and sustainable rail vehicles. Working together, ACUV Rail remains a successful symbol of transportation research and development in North America.

Here at ACUV Rail, we are looking for talented, energetic, and committed individuals to join our diverse team. Our employees are the key to our success, and we support each individual in fulfilling his or her potential. We proudly continue the pioneering work initiated by our founders 125 years ago.

ACUV Rail Research & Development North America, Inc. is looking for a highly creative and passionate Cognitive Ecologist for their Advanced Mobile Workspace Design Lab. This is a Full Time position at the ACUV headquarters in Los Angeles, CA.

The essential duties and responsibilities include:

- Curate data and workspace designs in cockpits and passenger seats, with attention to engaging visualizations and animations for Dashboard Clusters.
- Contribute to a variety of cognitive design challenges, including: human ecology interface zones, haptic animations, immersive visualizations and icons.
- Develop and maintain attention-style guides and icon-language libraries.
- Evaluate competitive designs, cross-cultural impedance, and services to identify emerging best practices in cognitive ergonomics.

The ideal candidate would need the following skills and abilities:

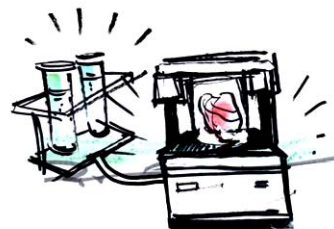
- An inspired advocate for information-environment interactions who understands comprehensive cognitive design principles.
- Strong experience in workspace immersive design, icon semantics, choice architecture, and attention narration. Prototyping and 4D visualization skills are a plus.
- Well-organized, with strong analytical skills, attention to detail and excellent follow-through.
- Works well within a tightly networked team under synchronized schedules.
- Chinese language skills are a plus.

Education and Experience:

- Requires a degree in either Cognitive Ecology or Media Landscape Design.
- Minimum 2 years of experience in information and environmental index creation, attention narration, icon production, and metaphor style guide development.
- Experience working in integrated regional transport industry is a plus



MANUFACTURING: from linear supply chains to lightweight production networks



- MANUFACTURING**
- TRENDS**
- Digital Fabrication
 - Bio-Manufacturing
 - Nanoscale Production
 - Unearthly Materials

Over the last two centuries, mechanization, automation, and industrialization have radically accelerated the production of physical goods. Now, a new generation of manufacturing technologies and models is poised to fundamentally reshape many of our basic assumptions about production itself. The manufacturing industry, and by extension the nature of many economies, will be transformed in the process.

Among the most important transformations overtaking modern manufacturing is the rise of digital production techniques, particularly the maturation of 3D printing technology—a digitally guided, additive approach to manufacturing that assembles products layer by layer, allowing variations to be built into individual units. Although remarkable uses of 3D printing have already been developed, from machine replacement parts to viable human organs, this technology is still in its infancy. It will reach its full potential in the coming decades as it is combined with emerging biotechnology and nanotechnology applications. The rise of more customizable materials will allow manufacturers to more precisely tailor the material properties of a product to fit its function.

From a supply chain standpoint, manufacturing is likely to become a much more diverse sector, with new opportunities to add value at many points in a product’s life-cycle. This transition combines some of the strengths of industrial production with the benefits of the traditional artisanal processes that were originally displaced by it. This shift extends to the replacement of obsolete goods, where “cradle to cradle” design approaches (planning for the full lifecycle and reuse of scarce materials) are likely to become basic to manufacturing practices.

Parallel to the emergence of new materials and new approaches to assembly is the rise of embedded computation, which promises to bring elements of computer manufacturing to even the most humble of manufacturing sectors. As the “Internet of things” takes shape around the availability of cheap sensors and chips, a new generation of programmable objects will come to market. These objects will interact with users in new ways, and in many cases will begin to exhibit a unique personality as a means to encourage engagement and even rapport.



Robotic Warehouses

Kiva Systems is one of several new organizations focused on completely automating many parts of manufacturing supply chains.

Source: kivasystems.com



future job title: **MATTER PROGRAMMER**

As tools for computational programming intersect with design, material science, and synthetic biology, they are increasingly allowing manipulation of the physical properties of matter. Nanotechnology is enabling exploration of new compositions and more precise configurations of atoms and molecules, leading to new, “unearthly” material properties. As custom material assembly becomes more commonplace, the templates and the proprietary processes that drive them will open substantial new business opportunities. In this environment, new working practices will arise around material development processes, and unprecedented intellectual property challenges and ethical conflicts will begin to reshape existing markets for these skills.

COURSE TITLES:

- Physical Programming** 3 credits (data lab)
- Nanoscale Simulation** 3 credits (lab)
- Bioprinting** 3 credits (studio)
- Microconducting Materials** 5 credits (lab)
- Amorphous Alloy Production** 3 credits (studio)
- Programmable Building Materials** 3 credits (lab)
- Energy Transformation Efficiency** 1 credit (practicum)
- 4D Hybrid Layering** 3 credits (lab)
- Measurement and Industry Standards** 3 credits (practicum)



POSITION: Matter Programmer

LOCATION: Pleasanton, CA

Apply Now

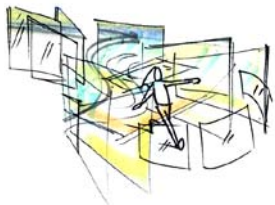
JOB DESCRIPTION: Valence, Inc., a nanofabrication machine shop, located in Pleasanton, CA, has an immediate opening for a Senior MATTER PROGRAMMER! We manufacture alloy metal, polymer, and biologic components for the medical, aerospace, energy, and semiconductor industries.

EXCELLENT wage (DOE) and benefit package for the right qualified individual. Must have a minimum of 7+ years experience, be proficient in at least three of the following languages: English, Spanish, Chinese, Farsi, and Hindi, and have good communication skills, both written and verbal.

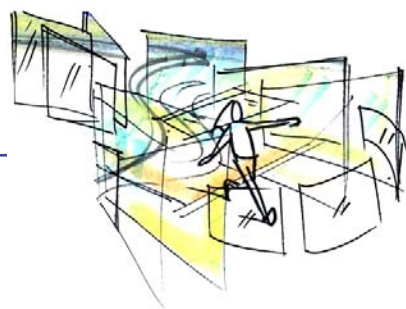
JOB SUMMARY: Senior Matter Programmer will analyze and interpret technical data (design renderings, specifications, parameter space, etc.) and create matter programs, tools and other necessary processes to produce a custom quality product in an open shop environment. Additionally, the Programmer supports the production floor with process improvements. Reading and understanding parametric models is crucial for this position.

ESSENTIAL DUTIES AND RESPONSIBILITIES include the following:

- Codes and implements assembly programs using phase model files to create matter tool paths and programs for molecular lathes, mills or assemblers that are required to manufacture parts.
- Ensures efficient, safe, and effective nanofabrication methods are used.
- Troubleshoots existing matter programs, sequences and procedures. Diagnose and corrects any set-up problems.
- Conducts complete tooling design reviews to simplify tooling methods. Assists in the design of jigs, molecular routers, tissue scaffolds, tools, fixtures and special equipment for matter applications.
- Assists in the training of operators on new matter fabrication equipment and software.
- Produces preliminary simulation documentation, and corresponding CAD files suitable for setup of all necessary workholding systems, fixtures and tooling.
- Communicates effectively with the nanofabrication engineers, tissue plant personnel and individuals outside the company.



RETAIL:
from mass consumption to personalized experiences



- RETAIL
- TRENDS
- VIRTUALIZATION
 - Hyper-Personalized Marketing
 - Premium on Experience

The economic volatility that has created consumer uncertainty for the last several years has already influenced long-term retail spending patterns. Moving forward, massive trade deficits and individual debt loads in a number of industrialized nations are likely to continue to reshape retail spending. Consumption will be defined less by the simple purchase of material goods and more by the personalized emotional, experiential, and symbolic effects that goods and services can deliver.

Indeed, advertising has long made it a point to focus on identity and the emotional experience that retail goods evoke. New tools and technologies are now taking this strategy to another level. Neuromarketing, for example, is an approach to advertising that uses fMRI images of people’s brains as they encounter products or advertising, so that marketing strategies can be precisely calibrated to align with deeply rooted desires and urges. Similar neurological findings are being used to design retail spaces.

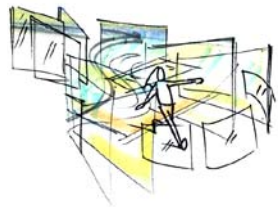
A massive amount of individual data is also being generated automatically by consumers as they go about normal shopping behavior, and far more data will be created as retail transactions continue to move to mobile devices. As a result, analysis of personalized buying patterns and behaviors is moving toward a more individualized understanding of the shopping experience. Future retailers are likely to take advantage of this kind of information to tailor advertisements, and even products, to an individual’s liking. In many cases, mass markets will be segmented down to “markets of one.”

Parallel to this development, an increasing amount of retail will center on the creation, sale, and purchase of virtual goods and services. The emergence of smart phone application markets and online gaming gives some hint of the magnitude of this shift, but it will be greatly accelerated by the ubiquitous deployment of sensors and processors into everyday objects and locations. Already we see tools that allow consumers’ own photos, videos, and favorite themes to be incorporated into retail products at the touch of a button. This transition toward what might be called an “experience economy,” or even a “dream economy,” may be critical to changing consumption patterns if financial, logistical, or environmental pressures force a reconsideration of current approaches.



Neuromarketing
The emerging field of neuromarketing studies consumers’ neurological responses to marketing and products.

Source: greenbookblog.org



future job title: **NEUROMARKETER**

Neural imaging and functional brain mapping are making their way from medical research labs into the fields of public relations, advertising, and design. Functional magnetic resonance imaging (fMRI), for example, can map how a person responds to different kinds of stimuli and how these responses affect decision-making. Researchers using these techniques can begin to differentiate aspects of emotional and executive neurological responses to indicate “comfort” or “anxiety.” Neuromarketers adapt these tools to study the brain’s responses to images, ads, brands, and messages.

COURSE TITLES:

Event Correlation Analysis and Experimental Design 3 credits (statistics)

Market Lab Management 1 credit (internship)

Clinical fMRI 3 credits (lab)

Neural Network Data Mining 3 credits (data lab)

Neuroecology 3 credits (social design lab)

Population Variation of Desire 3 credits (practicum)

Principles of Neuroeconomics 3 credits (data lab)

Cognitive Architecture Modeling and Rendering 3 credits (studio)

FIND

NeuroTab

Neuromarketing Manager

Berkeley, CA, United States

NeuroTab has recently built one of the largest, most state-of-the-art neural imaging and processing facilities in the world at its Berkeley headquarters and is in the process of expanding globally. We are looking for top neuromarketing practitioners to manage our research and marketing programs. Our current research projects include: creativity stimulation in built environments, neurogastronomy, and mood segmentation from music playlists.

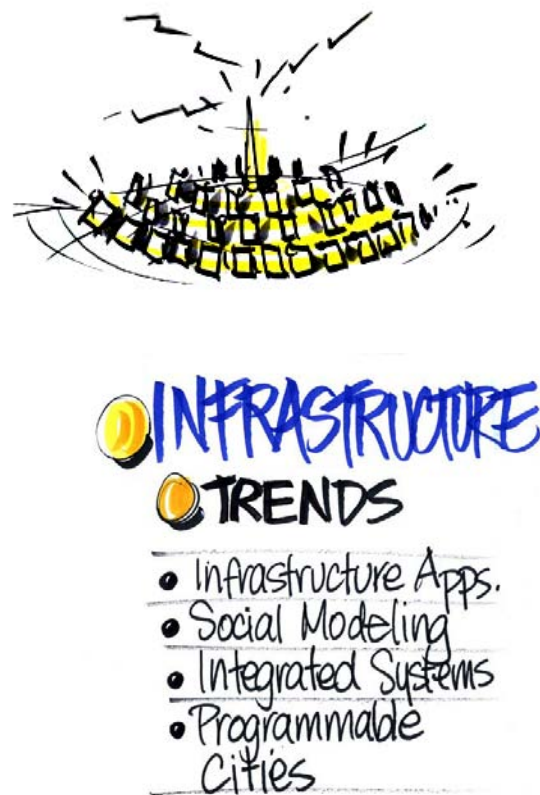
Summary of essential job functions:

- Responsible for running subject evaluations involving galvanic skin response, electroencephalogram, fMRI, visual saccades, and peripheral biometrics.
- Coordinate with lab personnel and interact with sales managers, designers, video directors, chefs, music coordinators, and architects as part of your regular duties.
- Maintain quality standards for protocol design, experiment design, subject recruiting, management of the data acquisition process, and review of analysis results.
- Develop actionable insights from neurophysiological studies, and present results of neuromarketing samples to clients.

Minimum requirements:

- Deep experience in neuromarketing, electrophysiology, experience design, and mobile device ecosystems.
- Expertise in human EEG/ERP and portable fMRI recording methods, data analysis, and marketing background required.
- Must have relevant experience in mood mapping, emotion markets, and rational choice segmentation, including culinary, music, film, and/or architectural, advertising agency, advertising analytics, demographic research, product/service development or marketing consulting.
- Experience with market research firms, strategy consulting firms or client/account management with large advertising agencies is a big plus.
- Must be able to prepare and present outstanding written, video, and verbal reports in the areas of market research, advertising analytics, and program research.

INFRASTRUCTURE:
from basic needs to engine of innovation

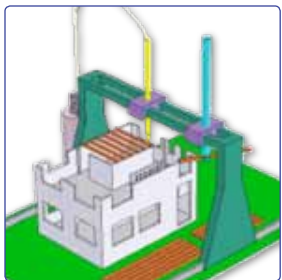


Over the next twenty years, refurbishing the physical infrastructure—roads, energy, even digital networks—will become a major driver of economic innovation. In Europe and North America, much of the utility infrastructure and built environment is now many decades old, often dating back to post–World War II investment in highways and municipal services. These systems will need to be upgraded for the 21st century. Other nations, with different paths to development, have already begun to show the way, often “leapfrogging” Western nations in the installation of modern infrastructure that incorporates digital, mobile, and new materials technologies.

China, for example, has invested heavily in renewable energy technologies and has become a world leader in wind, solar, and biofuel energy production. In many cases, renewable power technologies will decentralize energy generation and will require technicians to develop new economic models that take into account the engineering innovations that allow for distributed, localized power.

Renewables are not the only upgrade of energy infrastructure on the way. Smart grid technologies, integrating networked computers into the physical energy infrastructure, are currently being developed and deployed and will bring greater efficiency to many energy systems. These technologies will demand an energy workforce prepared to think computationally and even to address sophisticated cyber security concerns.

This wave of upgrades will encompass built infrastructure as well. At first glance, it would seem that most roads and buildings are essentially the same as those built a generation ago; however, over the coming decades embedded computation will have a transformational impact on road and building construction. Cheap sensor and digital processing technologies, for example, will soon unlock massive streams of data about cities and their residents. These sensors will often be integrated with crowdsourcing and governance systems to allow real-time responsiveness to needs and issues.



Automated Building Technologies

Contour Crafting is one of several emerging technologies that seek to bring the advantages of automated industrial processes to the construction of infrastructure and built environments.

Source: contourcrafting.org



future job title: SMART GRID GAME MECHANIC

“Smart grid” refers to the convergence of computational technologies and the traditional energy grid. It includes feed-back, monitoring, and flow control tools, with the aim of making the power grid more resilient, efficient, and cost-effective. Electricity providers want to know the real-time status of the power system in granular detail so that they can react to changes in supply disruptions or demand fluctuations, enable distributed storage and power generation (especially renewable energy sources), and control electrical loads in response to operational conditions or financial incentives (for example, through time of use or real-time pricing).

Consumers want smart grid data so that they can better manage their consumption, with more information about their habits and access to cheaper and sustainable energy sources. The applications layer, including visualization and gaming tools, will be a large part of the overall smart grid economy. Game masters and game mechanics will be needed to create responsive feedback to shifts in consumer demand and power supply. Using game-design principles, game mechanics will use real-time information and visualization to design incentives and rewards for quick learning and behavioral change by feeding system-level information back to customers and power grid managers so they can effectively integrate the technological and social aspects of electricity demand.

COURSE TITLES:

- Visual Programming for Interactive Energy 1 credit (core)
- Systems Simulation and Modeling 3 credits (lab)
- Regional Transportation Networks variable credit (internship)
- Principles of Smart Building Detection and Response 5 credits (theory)
- Solar Circuits and Smart Materials 3 credits (research)
- Fuel Sourcing and Distribution 3 credits (lab)
- Systems and Measures Integration 3 credits (research)
- Introduction to Rules and Game Mechanics for Smart Grid 3 credits (theory)
- User-centric Energy Design 3 credits (design lab)

CASIO

Interactive

FIND

◀ ▶

NetworkPathway Engineering offers project-based coursework to help students understand the changing industry demand in smart grid, power engineering and integrated demand side management. CAISO Interactive is implementing the latest phase of smart grid gaming for demand management. Our Control Room in Folsom is a block from BART. We're a small, close-knit team led by very experienced game designers and systems simulators, and our job is to implement and test different mechanics for managing energy demand. Anyone on this project will have a significant impact on crafting the smart grid experience. We offer interns and employees benefit sharing and project equity - we're a team and we will succeed together.

CAISO Interactive is looking for a full time Game Designer that wishes to continue their coursework with the NetworkPathway program. This person will fill a key role in building relevant and engaging gameplay for residential energy consumption and demand management.

Requirements:

- 2 or more years of experience in the NetworkPathway program as a game designer working on consumption mechanics, including the use of sound for positive reinforcement.
- Expert-level Status Badge in computer science recommended, with required badges in systems thinking, game mechanics, and service design.
- Demonstrated ability to gamify complex consumer/household interactions.
- Experience in crafting intuitive and exciting engagements for a broad audience.
- Excellent sensemaking and social intelligence skills, cognitive load management, and the ability to learn adaptively.
- Experience with consumption and demand game development.
- Ability to incorporate real-time feedback.
- Positive and collaborative attitude with cross-cultural openness and the ability to work well in a group development environment. We all succeed together!

You will . . .

- Have ownership or shared-ownership of specific consumer segments, their behavior profiles, and game mechanics as determined by the Game Master.
- Learn Decision Theatre tools quickly and work within a complex Internet of things development pipeline.
- Collaborate with fellow design team members to develop core game narratives and missions.
- Balance and adjust game-play experiences to ensure relevance for residential customers.
- Be prepared to receive constructive criticism, and respond to it positively.

We are creating an exciting new energy experience and are looking for energetic organizers & leaders to help our effort in a variety of facets. You will be an integral part at the ground floor of a multi-talented team. Equity and benefit sharing are part of the package.

You will be working in our office in Folsom, CA, a block from BART. To contact us for this position, please find our group at NetworkPathways/CAISOInteractive and put "Game Mechanics Designer " in the header.

The system of higher education in California will change more in the next 20 years than it has in the previous 100. Community colleges, themselves an innovative solution to the quickly evolving educational and economic landscape of the 20th century, will again be among the first to ride these new waves of change. To continue serving the needs of California students and citizens the California community college system of 2032 needs to understand the key drivers shaping the future and their impacts on industry sectors, workforce, demands and necessary skills.

In this report, we introduced several key drivers of change that will impact every aspect of how we as a society conduct business, organize groups, and build institutions. Following that, we examined the ways these drivers will impact seven major industries, including provocative future job descriptions to illustrate these transformations. And now, to conclude, we offer five implications for the California community college system. These implications are specific insights drawn from the forecasts that are most relevant for community college leaders and educational innovators thinking about preparing the workforce and citizens of the future. Educational and community leaders can use these insights, and many others suggested in the report, to create action steps to continue to prepare for the future

STEM to STEAM

Science, technology, engineering, and math fields will continue to drive educational priorities for the next generation. But these seemingly straightforward disciplines will continue to recognize the needs and benefits of combining with the humanitarian disciplines of art, design, media, and gaming. For workers in STEM fields to realize their full potential as engines of social innovation and business, they will need to be able to communicate their work in a compelling ways. This goes beyond mere illustration. Visualizing meaning and connecting data will be equally important as producing and analyzing data with rigor and repeatability. Already, many STEM-based programs are partnering with art schools and incorporating art and design into core curricula.¹² Clear and persuasive communication in multiple media will increase general scientific literacy and understanding, which will ensure continued funding and more career opportunities.

Distributed and Elongated Education

With Internet-based education coming of age, and mobile computation in the hands of billions, education is moving out of the classroom and onto screens and even embedded in the built environment. Anywhere, anytime learning will mean that informal and ad hoc education will come to more fully complement formal education and credentialing systems.

In addition to distributed education, life-long learning and adult education will continue to expand. Given increases in longevity, a more volatile economy, and accelerating technological change, the idea that education is reserved for youth will soon become indefensible, and in many cases, counter-productive. Lightweight, continuous professional development and skill acquisition will be necessary to serve older, multi-career individuals.

Designer Thinking Environments

Personalized education in the 21st century will mean more than flexible schedules and adjustable content delivery systems. It will also include measurements and insights from the brain sciences. Understanding learning as the way neurons fire together will unlock the power of brain-based education models. These improvements will be seen in the design of the physical spaces for learning, including the use of specific colors, lights, smells, and customized furniture. Cognitive design for learning, attention, and engagement will also include special algorithms that use direct neurofeedback (brain signals) to help curate a user's informational environment in real-time. Educational institutions will increasingly need to re-design educational spaces and incorporate new tools and discoveries from neuroscience and brain research to aid in cognitive load management, making learning more personal and more effective.

Virtual Large-Scale Collaboration

Much work in the future will be done by ad hoc, virtual teams that are joined together based on algorithms that optimize reputation, skills, and group dynamics. Educating for collaboration will be essential for those training these future workers. The ability to work on short-term, fragmented pieces of larger projects, as well as the ability to manage a large project built on micro-contributions will define many segments of the knowledge economy. Increasing social and emotional intelligence, networking communication platforms, and automating trust and reputation indicators within these ad hoc groups will reduce the transaction costs that would otherwise make larger, more stable organizational forms more efficient.

Computational Thinking

Computation resources and capabilities will not only be carried in our pockets, but will be embedded in the physical environment and in all the devices and objects we interact with. The so-called “internet of things” will mean 50 billion objects online by 2020.¹³ This computational world will require programmers to design and manage these systems, but it will also mean that everyday people will need to become literate in computational thinking. The logic and language of digital data, even if humanized and made user-friendly through semantic interfaces, will pervade our lives. Even non-technical fields and endeavors will need to utilize and harmonize with computational systems in order to function effectively. When everything is programmable, almost everyone will need to be a programmer. Educating people to be computationally literate—to be able to represent complex interactions as data and interact with data in meaningful ways—will be an essential part of the educational curriculum.

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Augmented Reality (AR) | The overlay of information and images (meta-data) onto objects in a person's visual field. AR can be done through hand-held devices, or through wearables such as eye-glasses or contact lenses.

Crowdsourcing | A form of distributed problem solving (or production) that uses the combined intelligence, diversity, and experience of many individual contributions to accomplish a task.

Digital Natives | Individuals (including the vast majority of students entering college today) who have been raised in the Internet age, and who expect to have immediate access to digital information and a virtual network of peers.

Foresight | The systematic practice of understanding change in order to make better decisions in the present.

Gamification | The incorporation of game mechanics and engagement strategies into non-game work or tasks.

Information Ecology | A holistic metaphor that emphasizes the inter-relationships between information, media, and users.

Infrastructure | The basic informational, physical, and social structures and facilities needed for the operation of a society, enterprise, or endeavor.

Modeling | A means of decision support involving a simplified mathematical or analytic description of a system or process in order to understand its behavior, identify uncertainties, create predictions, or interpret trade-offs.

Platform | A technology that supports and facilitates the development or distribution of future products or processes. The internet is a platform for global information sharing and knowledge exchange.

Resilience | The capacity of a system to absorb disturbance and reorganize so as to still retain core functions and identity.

Signals | Early indicators that point toward the emergence of larger trends, breakthroughs, and practices that will define the future. Signals could be new technological inventions, a research discovery, social practice, or even an individual behavior.

Smart | Often used in conjunction with cities, networks, phones, devices, machines, and buildings to describe capabilities of anticipation, sensory awareness, connectivity, and adaptation to new situations and environments through the use of sensors, artificial intelligence, feedback, decision support, and contextual awareness.