

INNOVATION, INVENTION AND ARCHITECTURE

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There will be more new inventions occurring in the present design student's lifetime than all the inventions created from first recorded history to the present. Two thirds of all the jobs available in the world by 2020 have not been invented yet. Tom Peters, international business guru, forecasts that 90% of white-collar jobs will be either destroyed or altered beyond recognition in 10-15 years. The student that does not adapt and morph with change will not fare well in the future. By 2015, it is predicted that a person will have to morph every 5 to 10 years to be viable in the global market. The future belongs to people who see possibilities before they become obvious. Ten years ago the term Webmaster was not in the dictionary. Design firms that specialize in designing web sites number in the thousands today. Six years ago there were no Internet travel sites until someone created a hybrid of the growing trend of leisure time and computer ownership and formed Travelocity which spawned other travel sites. The UK alone has 100 travel agencies closing their doors each year. What can be invented today that will put you out of business tomorrow?

Look for disruptive technologies that will create new domains. Nanofactories are predicted to arrive sometime in the next 10-20 years. Nanofactories are capable of producing almost anything atom by atom. With nanotechnology you will be designing and building machines in which every atom and chemical bond is specified precisely. They will become so inexpensive; they will be in every home producing any product from a downloadable file for a fraction of the cost of the manufactured product. Nanofactories have the ability to eliminate jobs ranging from manufacturing to distributing to sales. Nanofactories will also create thousands of jobs that don't exist now. Industrial Designers have the potential to sell their creations over the Internet to be downloaded and built in a nanofactory in your home. Any product or part that is needed can be produced from downloaded files. Industrial designers can research, build and test their designs with a nanofactory in minimum time. They can then market and sell the designs eliminating the middle sales people. A really talented industrial designer could become as much of a household word as a rock star. Nanotechnology is a disruptive technology

Nanofactories that produce food from atoms will take a longer time to develop but it will happen. The Scientific Imperative is if it can be done, it will be done. No one country can block progress in a domain. The nation that does not act like challengers, even if they are the current world leader, will soon be relegated to a follower position. We will be adding three billion people to the earth in the next 40 years by today's predictions. And by today's predictions, there will not be enough water and food to have a sustainable world. What are not taken into account are the new developments in longevity. Flexible housing needs to be investigated and that housing must be barrier free. Two thirds of all the people in the world that have lived past 65 are alive today. As advances in genetics and biotechnology continue, people are going to live longer and the 3 billion projected increases in population could become 6 billion. Are architects prepared to conceive of new housing solutions or will they react after the fact? Will the solutions, by default, be placed in the hands of politicians? The benefits of new biotechnologies will bankrupt the retirement accounts and pension plans of individuals and countries as they are currently established. Twentieth Century solutions will not solve Twenty First Century problems.

2015 is the date predicted that birth defects and diseases could be eliminated in the womb. By 2025, nanosensors can be placed in the body to monitor all body functions and send data directly to your doctor. Microscopic machines will monitor our internal processes, remove cholesterol

plaques from artery walls and destroy cancer cells before they have a chance to form a tumor. MIT is modifying cells into primitive digital computers. They want to create cells that will deliver drugs within a person's body. Emerging biotechnologies will be incorporated into our bodies much as pharmaceuticals are. Caltech medical researchers are working on a nanolab. It squeezes highly automated processes in systems biology onto a one square centimeter silicon chip that has the power to outperform entire laboratories. What will be the function of hospitals and medical facilities in 2025? How many hospitals will be required? How will the new technologies be reflected in healthcare design? In less than twenty years, healthcare facilities will have to reflect the changing technologies. Will architects be the leading researchers who will create the new environments of the future?

Another area for all designers will be virtual reality. By 2030, when we want to experience virtual reality, embedded nanobots would suppress the inputs coming from the real senses and replace them with the signals that would be appropriate for the virtual environment. Embedded nanobots will be able to trigger emotional overlays, sexual pleasure and mental reactions during virtual reality experiences. Virtual vacations thrill seeking, healing environments, and therapeutic physical and mental treatments could be available through virtual reality. It could have a negative impact on travel locations, airlines, hotels and services. What could be invented today that will put a domain out of business tomorrow?

An architect is perfecting a virtual reality podium where the speaker appears in the room and only the organizers know the speaker is not present in the flesh. The speaker can focus on questions from participants in the room and give them the same eye contact as if he/she were present. Boardrooms are being designed so that a virtual meeting can be held with participants from all over the world. The same boardroom is duplicated in every country where there is a participant and each person appears at the conference table conversing in real time with instant translation. What services and industries might that invention put out of business? Remember the movie *Minority Report*? Architect Chad Dyrer has just patented a free space TV/computer screen that hovers in mid-air. Sensors can detect when a user's hand or pointer touches the image, allowing a finger to serve as a mouse. Last year the IBM White computer had the ability to download the United States Library of Congress in 2 seconds. By 2017, your iPod will be able to hold the United States Library of Congress. How will this affect the design of libraries? Will architects help to design new libraries that anticipate and create accelerating change or will they be knowledge workers that are hired to implement someone else's knowledge creations Designers must look at emerging future research and trends and anticipate a world in accelerating change.

*"The twentieth century alone features more turning points in the history of mankind than the previous five centuries put together! When people think of a future period, they intuitively assume that the current rate of progress will continue for future periods. We assume that progress changes at the rate that we have experienced recently. At the 2004 rate of change, the entire 20th Century would take place in 25 years. By 2030, the entire 20th Century would take place in one week. The rate of change itself is accelerating"-Ray Kurzweil from his keynote speech to the World Future Society in Washington DC, July, 2004. Will architects be planning, researching and creating the future or reacting to the future? **Biotechnology, nanotechnology and artificial intelligence have become engines of the global economy. Creativity is the currency of the new millennium and intellectual property is the coin of the realm.***

The university of tomorrow will not resemble the university of today. *"The fixed person for the fixed duties, who in older societies was such a Godsend, in the future will be a public danger!"*

Alfred North Whitehead. The rapid and dynamic demands of problem anticipation, identification and solution will put a premium on continuous learning. Our concept of school will have to change to allow for accelerating change and growth in knowledge and learning. *Baron and Taylor in their book, Scientific Creativity, state that it takes 3-5 years for a person to recover from their University experience before they create any new knowledge.*

Most universities are producing knowledge workers. The knowledge worker will be the equivalent to the assembly line worker of the 20th century. They will be competing globally for any job that does not require proximity. In the 21st Century, a person will be competing with the world for any information that can be reproduced. Technology Review has a yearly list of the best knowledge creators under age 35 that hold new patents, create companies and innovate breakthrough research. The majority of the knowledge creators have combination degrees like computer science and genetics or electrical engineering and biology. No architect has ever made the list. The merging of domains is creating the new fields, hybrids and jobs! Are our universities helping to cross-pollinate and create the future? We should be morphing with other curriculums to create new and exciting futures. Design education is by its very nature a different way of seeing the world. Several business colleges in the US and Canada are asking design colleges to create courses for their students to learn design thinking. They want more than a bottom line analysis of a business problem. As a result, there has been an increase in creative problem solutions coming from the business students. Stanford's College of Engineering requires two courses on creativity to graduate. Einstein called his own work combinatory play. In the future top tier universities will be ranked on how well they facilitate combinatory play between domains. Students should be able to synthesize, creatively combine domains and create knowledge.

To encourage creative thinking in an age of accelerating change, I designed a course for students to be knowledge creators. The students have to sign a nondisclosure statement to get into the class and the required projects include soft innovations, hybrids and inventions. The students create some of the projects as individuals and some in groups. I organize the groups of students by mixing various curriculums, including gender mix, to generate rich dynamic ideas. The class covers creativity, invention and future studies.

Since the act of creation occurs in the flow state, the students are introduced to the concept of flow in the first part of the semester. Many domains use the terms flow, white moment or zone to describe the mental state that results in optimum behavior in creativity. Over the years, I have adopted several methods to help the students discover the physical and psychological environment for flow. Since tension inhibits creativity, I incorporated progressive relaxation exercises developed by Harvard Medical School in the 1920's for patients that need to reduce blood pressure and were allergic to medications. I use guided imagery exercises to visualize designs. We talk about environments that support flow. The act of creation is a self-involvement and is usually not a public performance. Aloneness is usually required for the student not trained in the art of flow which is why many students are more creatively fluid working nights when they have more opportunity for uninterrupted flow. The class works in groups to complete classical divergent and convergent problem solving exercises. I have guest speakers that inform the class about patents, copyright and trademark issues. A venture capitalist informs the class of opportunities and offers them financial support, marketing plans and physical space if their idea is worthy of investment. My university is one of three universities in the United States that has direct links to the United States Patent Office computers in Washington DC. The students have free access to utilize these computers to research any of their ideas. The students must present their ideas in class and the students evaluate each others ideas as to their commercialization

transfer potential. Several students have sold their ideas and some have filled for patents. The purpose of the class is to direct the students to be knowledge creators. To be viable in the future, the students must be producing knowledge instead of reproducing knowledge. The final asks them to investigate emerging technologies and envision a world in 2030 in their groups. Individually they must research how new technologies and future trends will morph their intended domain by 2030. Most students discover that their intended domain may radically morph or even disappear by 2030.

“Do not go where the path may lead, go instead where there is no path and leave a trail.”
Ralph Waldo Emerson