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### **The World and Business Computing in 2051**

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## **THE WORLD IN 2051**

During the early 21<sup>st</sup> century, we will enter the fourth industrial era<sup>1</sup>. A few key discoveries in fields such as Artificial Intelligence (AI), Molecular Engineering, Power Generation etc. [1] will sustain an explosive level of technological development. Coupled with the natural evolutions in technologies, these discoveries in turn, trigger large scale changes in business, politics and society in general (please refer to Table 1 for a hypothetical list of major events).

The new technologies are both complex and require heavy capital investments. Scale economies favor large globalized organizations with the resources to produce and market products on a world-wide basis [2]. Predictably, the technology industries experience rapid growth, while in traditional industries, the situation is reversed. Extensive automation and a new generation of information systems cause large scale consolidations in industries such as automobiles, banking, insurance etc., greatly reducing the number of participants in each sector.

The government also succumbs to the consolidation revolution. Immigration, customs, property management, taxation and many legal disputes are handled online automatically. Properties are tagged with AI chips (“property chips) which amongst other things, also act as “locators” for “transcabs”<sup>2</sup>. Voting on major issues is now carried out electronically. The reduction in number of conflicts has caused downsizing of armies and armaments. These changes have reduced the role of the governments, leaving them free to concentrate on the important issues of technology and human resource development, health care and most importantly, the welfare of its citizens.

Prompted, by concerns such as intellectual property, global telecommunications and broadcasting, space colonization and the release of genetically engineered organisms, which cannot be resolved on a national basis, the UNTO (United Nations Trade Organization), the trade wing of the United Nations is established. In the interests of political neutrality, the decision is made to headquarter the organization in Geneva. To be consistent with their new role, the Swiss promptly outlaw capitalism and make the country a haven for non-profit organizations. Under the aegis of unity in trade and commerce, the UNTO passes a number of resolutions. Resolution #1/10 is concerned with a system of universal identification for all individuals. As its role expands, the UNTO finds it necessary to keep the populace informed of new developments and consequently purchases the rights to global newscasting.

International and trade relations are greatly improved as a result of these moves. The world is connected by uniform power, transportation and communication grids (the “Great Grids”) [3]. The effects on the world economy are dramatic. It is now possible to travel by high-speed train from Beijing to Bogota on a single ticket. Aided by an electronic bureaucracy, customs and immigration are streamlined and goods move freely around the world. GNP growth rates have doubled in many countries. Industries begin to stratify along national borders, based on established competencies [4]. Factory automation is now concentrated in Germany, Japan and Taiwan, while the fashion industry revolves around France and Italy with additional participation from Korea, Taiwan and Romania (Please refer to Table 6 for a hypothetical distribution of industries).

A combination of improvements to conventional agricultural methods such as genetic farming, hydroponics and soil engineering have increased agricultural yields, to the extent that poverty and hunger have been greatly reduced [5]. The world is still sharply divided by technological and intellectual resources. The general level of literacy is higher than it ever was, but unfortunately, even a bachelor’s degree is insufficient to deal with the complexities of 21<sup>st</sup> century technologies. Some countries such as India and Indonesia capitalize on their human resources and traditional strengths. Several countries in Eastern Europe, Africa, Asia and Latin America poor in knowledge resources, are still at a subsistence level and dependent on aid from the more developed countries (whose ranks have now doubled).

Common diseases have been reduced through genetic treatments and gene therapies<sup>3</sup>. Replacement organs are grown in laboratories like vegetables. Robotic surgeons provide fast and efficient treatment for injuries. Alternative medicines are slowly replacing drugs as the preferred form of treatment. These developments cause consolidations in the pharmaceutical and health care industries. Mental illnesses are unfortunately prevalent as their origins are still a mystery. Substance abuse is also widespread owing to the demands of the Technological Society (T-society) and the availability of potent drugs from underground laboratories. Violent crime is greatly reduced with the help of eugenics as well as through IT-enabled law enforcement. AI chips, image recognition technologies, shared databases and dedicated satellites assist Law Enforcement Officials in tracking known felons. Information crimes are on the rise due to the high stakes involved. Theft and sale of personal information, corporate secrets impending regulations are more frequent nowadays.

The biggest threat to society is a counter culture, called the Moron movement<sup>4</sup>, named after its ideal of limitless pessimism. The members wear black clothes, chant anti-social mantras, do not believe that humankind should exceed the boundaries set for it by natural laws and favor a return to the relatively simple life of the twentieth century. The cliché of the teenage son or daughter from a wealthy family falling into the clutches of the leaders of the movement is repeated time and again. Most of the group's activity is introspective (ritualistic sharing of grief), although some of the more radical members have been known to vandalize IT centers (promptly cleaned up by robots), bomb rapid transit stations and steal information. However, the movement is secretly encouraged and funded by local governments, as a harmless outlet for the meek<sup>5</sup> and the disgruntled. Government infiltrators in the group's leadership ensure that no real damage is done by it. The occasional destruction to property is tolerated as a necessary social cost. The movement is popular with politicians<sup>6</sup> and consequently the media, despite the fact that most of its members do not have voting rights.

The confidence of having conquered the pressing problems of poverty, hunger, disease, crime etc., through science will result in a new age of enlightenment. Forests are replanted, historical monuments restored, extinct animal species are brought to life and urban sprawl is replaced by visually appealing, eco-centric buildings<sup>7</sup>. Competitors will routinely share customer information [6], previously opposed governments will agree to divide up industrial sectors based on mutually recognized strengths, universities will engage in commercial ventures and displaced factory workers will voluntarily stay home in return for a percentage of the profits.

Humankind's ambitions remain unsatisfied despite a technology-created, though somewhat-stressful utopia. The need for achievement is as strong as ever; the answer is obligingly enough, in the form of socio-economic factors such as population pressures, the need for building materials, a highly advanced aerospace industry and space tourism. These pressures ultimately drive man (woman) into space with a material motive. Even as environmental and other religious groups protest, bases are established on Moon and Mars; planetary colonization has begun in earnest [7].

**Table1: Some Hypothetical World Events, 2001-2051**

2007	City of Sao Paolo, Brazil experiments with mass governance. First city in the world to allow Jose to vote electronically on city issues <sup>8</sup> .
2010	Phillips announces its Symbolman series chips for Artificial Intelligence applications.
2012	Annabelle Hopper, the great grand daughter of Grace Hopper is awarded Turing prize for her contributions to image descriptions using a branch of mathematics called <i>Discrete Calculus</i> .
2015	CERN physicists capture the Higgs Boson (HB) ushering in a new age of power generation.
2016	Microsoft announces its trillion-image pixel library project to build a database of all objects in the universe. In collaboration with universities and companies around the world, Microsoft undertakes the ambitious project of compiling a comprehensive database of images. When completed, 32 Trillion images would be available instantly for applications in Education, Simulation and Image recognition.
2018	WorldTel Networks awarded contract to build the I3 <sup>9</sup> , hailed as the fastest and most sophisticated version of the Internet.
2020	The first HB electrical power plant for the world, is completed in Siberia in record time. The 100 square mile plant is expected to generate 20 Trillion Kilowatts once it reaches peak capacity.
2022	Mars mission declared a complete success. Carbon Dioxide and Methane gas generators installed on the red planet.
2025	Widespread consolidation in the power and transportation industries.
2026	Boeing's experimental robotic freighter lands safely for the 10,000 <sup>th</sup> time. The International Aviation Federation to introduce new legislation to allow robotic pilots.
2030	UNTO passes resolution# 1/10, on a Universal Identification System.
2035	World population crosses the 10 Billion mark.
2037	Rare Rembrandt sold to British collector for Euro1 billion.
2038	Renault Auto and Utilities announces its <i>monthly</i> operating results.
2039	Global currency unit agreement debated in the UNTO.
2040	Minolta's <i>housemaid</i> series robot experiences record sales.
2045	France passes the Aesthetics Laws - Fashion Police become a reality.
2050	GlaxoSmithKline launches its genetic factory into space amid widespread protests from environmentalists.
2051	India and Japan collaborate on the first ocean-city project - Asteroid belt to be mined <sup>10</sup> . Dubbed the "Dwaraka" project, it is the first time that an entire city is built on the ocean with material from the heavens.

## **THE BUSINESS ENVIRONMENT IN 2051**

The Mega-corporation will be a reality. Scale economies, technological complexity, capital requirements and automation drive out most medium and some small sized businesses. The latter type of businesses will thrive in certain labor intensive areas such as clothing design, geneology, vacation planning, art etc. They operate on essentially the same lines as before, aided by Information Technology (IT). The business landscape in each industry is populated with oligopolies which operate internationally. Trade relations, political stability and intellectual property have improved to such an extent that a single company such as JC Penney can supply clothing to every one from the Russian Premier to the Captain of New Zealand's Rugby team.

The manufacturing and process-oriented industries are the first to be streamlined by robots [8] and factory automation. Initially the robots simply mimic their human counterparts, doing routine tasks like drilling and welding. Succeeding generations have sophisticated capabilities to carry out a wide range of tasks (within a size range), such as the assembly of an engine, from components coming off an assembly line. Flexible manufacturing has been achieved, but the holy grail is now a self-replicating factory<sup>11</sup>. The new employees are very productive and output has tripled almost overnight. Non-production jobs also fall under the axe of automation, as most clerical, administrative and middle-management jobs are replaced by standardized computer programs. Transaction oriented industries such as banking, financial services, and commodity-retail suffer the next wave of consolidations.

Limitless power generation will usher in yet a third wave of consolidations in the manufacturing, power and mass-distribution industries. Utilities now provide grocery, transportation, power and communications facilities<sup>12</sup>. Most cities in the world have efficient mass-transit systems and are well connected by high-speed inter-city trains. Global commerce, spectacular scenery (ocean bridges for example), cheap power, and abundant local transportation have greatly improved the attractiveness of the train as a method of transportation. Both business and leisure travel are on the increase. The consequent reduction in numbers of personal automobiles result in consolidations in the automotive, the auto-parts industry and the insurance industry as well. Some of the insurance companies are absorbed by the utilities and some by banks<sup>13</sup>. It will now be possible to apply for a loan for a plush ten- room condo and request insurance for it at the same time. An expert system at the bank will consult the "property chip" and PID databases to obtain details and will automatically authorize a loan to be issued. Banks will also double as *transaction centers* which carry out transactions on behalf of other companies.

The retail-clothing industry has coalesced into the fashion clothing and the garment industries. High fashion clothing for business and special occasions is retailed through conventional mall outlets, while daily-wear garments are personally tailored and delivered to the customer. Customers need to occasionally go to “e-tailor” kiosks in malls to be scanned for measurements. These specifications are updated to an industry database, accessible to all participants [9]. Retail companies offer choices of all colors, fabrics and styles as well as the option of multi-year contracts. The current rage among women<sup>14</sup> is the “Smart Suit,” a close-fitting,  $\frac{3}{4}$  sleeve suit-style (traditional mens) shirt and  $\frac{3}{4}$  length trousers (in bright or sober colors) that can adjust automatically to full length if needed. Retailers naturally offer special incentives to sign life-time contracts. Since information on the customer’s buying habits (described later) is also available, it is common for prospective customers to receive free clothing samples.

The space freed up as a result of consolidation in various industries is used for cultural, recreational and educational purposes. Museums and libraries are stocked well with holographic records, pedagogic material and interactive games. Some of these are also available at shopping centers as are child-care facilities and art institutes which are mushrooming everywhere. The Aerospace and robotics industries are flourishing and are continuing to absorb the available supply of scientists and engineers. Other growth industries include AI, Biotechnology, Pharmaceuticals, Metals and Materials, Construction, Information Technology and Tourism. The consolidations cause a catastrophic level of job displacement, but the need for mathematicians, engineers, physicists, bio-physicists and pharmacists is acute as ever.

With a majority of their employees gone, companies have done away with physical buildings. The modern equivalent of the office is the *IT center* which is rented out on a per-use basis and billed to the company in question. At such facilities, people from several companies work in a semi-casual, yet professional atmosphere exchanging gossip and the latest in technology. Such centers are well equipped with advanced communications and information processing/display facilities<sup>15</sup>. They will enjoy direct connection to the I3, rendering possible, instantaneous contact with corporate and governmental applications. Although it is possible for people to work from home, the need to address liability, security and performance issues have forced companies to take up contracts with the IT centers. Homes, hospitals, recreational centers, schools and other such establishments are linked through what the media light-heartedly refers to as the “Play Grid.” Secure links from this grid are relatively slow and the majority of the employees prefer the more efficient and more social environment offered by the IT centers. Many of the centers

are refurbished from the headquarters of companies which have disappeared in the consolidations. The larger centers have built-in recreational areas.

**Table 2: Key Business Trends**

Scale economies, technological complexity and capital requirements drive out most medium and small sized businesses.
The Mega-corporation will be a reality.
Automation results in tremendous job displacement. Most clerical, administrative and middle-management jobs will be replaced by robots or by standardized computer programs.
There are tremendous labor shortages for mathematicians, engineers, physicists, bio-physicists and pharmacists.
Limitless power generation will re-shape most industries, especially transportation industry.
The utilities will be the greatest users of computing resources as they will include grocery, transportation, power and communications facilities.
Companies will compete for customers based on the size of their yearly business.
Companies have done away with physical buildings.

## COMPUTING IN 2051

Optical computers will run at a blinding 10 Terahertz (THz) speed, literally making light work of most business and other applications [10]. Industrial applications such as factory simulations will still occasionally crash the system's resources. Following UNTO resolution#1/10, the Personal Identification Device (PID) is developed and issued to every citizen in the world. The device will serve as telephone, fax, computer, communications device and videorecorder. The main processing unit will be reduced by nanotechnology to about the size of a campaign button [ 11]. The devices store personal information and are able to instantly initiate communications or exchange information with any one or with any other computer. Subatomic storage will ensure sufficient memory to last a person's entire life time. Some information about a person such as his/her address or current utility company will be publicly available to others. Personal information such as photos or video records of events will be protected with biometric security, allowing only the owner to release the information to the party/he/she desires. The PID will communicate extensively with corporate and administrative computers. The interfaces to allow such seamless computing will be embedded in all public places such as Transcabs (utility-company-provided cabs), mass transit stations, airports, malls etc. For security reasons, the interfaces will limit transactions to casual business exchanges such as buying tickets for a soccer match. The more serious business such as designing new materials will take place in the IT centers.

Superconducting media will be the basis for the new Internet 3, the I3. To avoid crowding the already crowded airwaves, data traverse the media physically, traveling at near light speed, mounted on self-guided sub-atomic particles. In regions of high power availability, the media will be intentionally subjected to intense magnetic fields to enable faster-than-speed-of-light travel. The I3 will connect businesses and governments with the IT centers (please refer to figure 1). As mentioned earlier, houses, hospitals, hotels and recreational centers are connected through the “Play Grid,” one of the numerous sub-branches of the I3<sup>16</sup>. A more highly developed version of the web will support all on-line activities through a comprehensive web intelligence, also a product of collaborative effort between industry and academia. It will be capable of answering all questions ranging from cooking recipes to sports statistics. The web will also be used extensively for online conferencing.

An unexpected breakthrough at a European electronics company leads to a new generation of AI chips. Unlike traditional hardware, AI chips combine the functionalities of memory and processor chips. In their memories, the chips incorporate special databases corresponding to the application such as the structures of chemical compounds, building codes or maps of cities along the route of a robotic freighter. For the processor function, the chips incorporate basic AI operations such as string/text/image comparison, making inferences from data etc. Depending on their function, the components can check for example if an image contains an employee or whether the molecular structure of a given compound matches with those in memory. Applications include property, navigation, security, distress etc. Customized and highly specialized variants of PID devices will be used to interact with these chips.

Most business applications such as ordering, payroll, benefits, financial transactions are standardized by industry agreement<sup>17</sup>. The Uniform Transaction Exchange Protocol (UTEP) and the Digital Object Library (described subsequently) become the basis of such applications. All transactions are now standardized across different industries. The standardization of transactions and processing has a major impact on businesses and IT services in particular. Companies routinely outsource their processing and data handling activities, concentrating more on strategic and office applications. The transactions and updates are executed by third parties in “Transaction” and “Data Centers” respectively (please refer to accompanying figure). Thus if Jane were to buy a sweater in a mall, the transaction is routed to the Transaction center which verifies whether the account and purchase are valid and updates the account to the Data centers. When the update is completed a picosecond later, the transaction is confirmed.

The UTEP has another unforeseen benefit. Database design for routine processing is now standardized thanks to uniform product, transaction and personal identifications. But, the sheer volume and complexity of data force researchers to seek alternative methods of handling it. A hybrid hierarchical-relational (known simply as “H-R”) paradigm is introduced. The basic organization is hierarchic, with a warehousing-style [12] interface for queries. For instance, customer data is organized into a hierarchy by the customer PID’s (which themselves are in a geographical hierarchy) and *transaction types* which in turn are temporally broken down into individual transactions. Different relational views are easily available such as the volumes of a particular type of transactions carried out across customers, the sum total of a customer’s yearly consumption of a particular product/service etc. The H-R database environment proves to be a boon to planners, decision makers, marketers and policy makers.

Board room applications costing millions of dollars emerge as one of the new segments of the industry. These applications incorporate the latest in virtual conferencing technologies, provide complete access to organizational records and an advanced level of decision support. Parameters in a decision can be fed with live data, displayed three dimensionally, visually manipulated with special hardware and the results compared to historical numbers. Thus, a decision maker is able to receive a live video feed from a remote factory, obtain a count of the actual number of items in production, conduct optimization analysis and send instructions to control output.

Business, governmental and personal computing will be seamlessly integrated with the help of seventh generation office applications (SGOIS) [ 13]. These voice-driven applications are ubiquitously accessible, provide functional support<sup>18</sup>, interfaces to data centers, access to on-line databases and corporate/legislative computing. Thus an engineer can design a Docking Interface online with data and standards provided by the system and when the design is completed, the system can automatically store it in the corporate database and file a patent electronically with the patents and trademark branch of the UNTO.

Industrial applications such as transportation-planning, robotic drivers, factory automation and spaceship controls take up the lion’s share of software development resources. The object libraries of the late ‘90s are still useful. A large scale collaborative effort by the leading *Information Science* institutions results in a comprehensive definition of most high level business and industrial objects. Standard objects such as input, output, send/receive, user etc. are micro-programmed

into the hardware. The University of Arizona Digital Object Library (DOL) becomes the basis for most applications. The royalties are shared by participating institutions.

**Table 3: Key Technological Trends**

Optical computers	Optical computers will run at a blinding 10 Terahertz (THz) speed literally making light work of most business and other applications. Scientific applications such as factory simulations will still occasionally crash the system's resources.
PID devices	These will serve as telephones, faxes and computers and will be reduced by nanotechnology to about the size of a button.
Superconducting media	Superconducting media will be the basis for the new Internet 3, the I3.
Holographic projection and data analysis	The sheer volume and physical complexity of data has forced scientists to develop low intensity interactive laser projections for visual manipulations.
AI chips	The basic AI operations such as testing membership in a list, string comparison etc. are incorporated at the hardware level.
Business Applications	Most business applications such as ordering, payroll, benefits, financial transactions will be standardized.
Superfast databases	A hybrid hierarchical-relational database coupled with Terahertz hardware makes dealing with global customer databases a snap.
Seamless computing	Business, government and personal computing will be seamlessly integrated.
Industrial applications	Industrial computer applications such as transportation-planning, robotic drivers, factory automation and spaceship controls take up the lion's share of software development resources.
Development environments	The object libraries of the late '90s are still useful. A large scale collaborative effort by the leading computer science institutions results in a comprehensive definition of most high level business and industrial objects.

### **EDUCATIONAL/CAREER TRENDS IN 2051**

The educational industry is thriving due to a universally mandated four-year degree for all citizens. The Tech effects percolate to the high school, where all teachers are required to have Ph.D's. Calculus is taught despite protests from parents and teachers alike. The typical high school project will be a space station component such as an oxygen filter or the design of a new

biological organism. Military-style games of strategy involving constantly varying mix of students [14] will be standard training as it is considered vital to be able to join a team of strangers scattered across the globe and to become instantaneously productive.

Classroom education continues into graduate school as it were in the late twentieth century, although educational establishments will be lax about time and location constraints. The stereotypical professor delivering a lengthy seminar to inert students has been long forgotten. Students are mesmerized through a combination of historical and live video records, demonstrations and simulations made available through generous corporate grants. Graduate assistants collaborate with others in different universities to develop standardized supplementary materials. Professors will be encouraged to alternate their tenure with work assignments in industry and vice versa for employees in industry. Company sponsored field trips for extended periods of time are common. All of this naturally creates a tremendous rush to the degree programs leading to a high degree of selectivity.

All careers require extensive screening and psychological profiling. Taking examinations becomes a part of life for every career minded individual. IQ and creativity index measurement are standard practices used by employers and endorsed by the government. These are reluctantly accepted by all as a necessary evil of the T-society. Reaction times, fluency in languages, problem solving ability and parallel processing ability are also part of the standard Employment-Employability exam (em2 for short). Those who do not clear the exams will not be able to enjoy the prestige and benefits that a Hi-Tech engineering or management job brings. Some will opt for a life of state-supported leisure, some will be assigned non-critical jobs such as care of elderly while some will seek solace in various organizations. Those who opt for a life of leisure will be free to pursue hobbies of their choice, but will not be able to vote. This is accepted as another “new evil.” Others keep attempting to pass the exams again. The very talented will enjoy a highly-privileged fast-track education in a locale of their choice (along with any family members who wish to accompany) [15].

Highly sought after occupations will be CEOs, CTOs (Chief Technical Officers), Molecular Engineers, Astrobiologists, Rocket Scientists, Data Librarians, Information Security Specialists, Space Station Engineers, Gene Therapists and Chip Designers who will all be in short supply<sup>19</sup>.

The complexity of work will force slow induction of employees into the workforce, leading to the old-fashioned practice of apprenticeship. The top employees in every profession will now

have the luxury of leaving the details to the “semis” (as the apprentices are affectionately called). Companies will require their top employees to go to company-sponsored finishing schools that will increase their social and cultural-IQ [16]. The lack of cultural-curiosity/knowledge is viewed as a major shortcoming in a global society.

**Table 4: Key Educational/Career Trends**

The educational industry is thriving due to a mandatory four year college degree.
The T-society results in highly specialized/highly advanced job positions. Highly sought after occupations will be Astrobiologist, Rocket scientists, Data Librarians, Information security specialists, Space station engineers, animal husbands, chip designers who will be in short supply
The technology effects filter down to the high school where calculus and molecular biology become required courses. The typical high school project will be a space station component such as an oxygen filter or the design of a new biological organism.
High school teachers will be required to have Ph.D's.
All careers require extensive screening and psychological profiling. taking examinations becomes a way of life for the career minded.
IQ and creativity index measurement are standard practices used by employers and endorsed by the government. Reaction times, fluency in languages, problem solving ability and parallel processing ability are also part of the standard employment-employability exam.
Classroom education continues into graduate school as it was in the late twentieth century, although educational establishments will be funded enough to allow professors to take his/her students on field trips and to teach them along the way.
Apprenticeship system is re-introduced into almost all professions.
Companies will require their top employees to go to company-sponsored finishing schools that will enable them to learn the graces and knowledge of cultures required for doing business the 21 <sup>st</sup> century.

**KEY SOCIAL TRENDS IN THE NEXT 50 YEARS**

The biggest influences on society arises from exposure to an unprecedented level of art, culture, music, religion, sports and technology. Coupled with increased prosperity and an increased level of education, it leads to a renaissance in the arts. New art forms such as Robotic Dances, Laser-Lithography, Holographic Animal Design and Liquid Expressions<sup>20</sup> abound. Different sounds and musical styles are synthesized, from traditions around the world, to the delight of music lovers everywhere. Many of the traditional art forms such as sculpture, poetry and writing continue to exist. Rock music is popular with the Morons. As there are millions of artists, works of art now have to pass muster in order to be accepted into the art community (i.e. in order to be “published”). Artists whose works are abhorred can still contribute to the

community, by paying to have their work included! Hollywood will have the status that Vaudeville had in 1930's following the advent of the "Talkies". It will be replaced with 3-D interactive games, many of which involve adventure and romance. Die-hard old-timers will still prefer their older form of entertainment.

Television and radio are still very much in use and have survived the consolidations which have swept other industries. The content is a mixture of local, national and global programming. The usual sports, talk shows and news programs are overwhelmed by hundreds of exclusive channels, catering to every interest, ranging from Hungarian cuisine to Middle Eastern Art. World news is very popular because of live-coverage of events as they unfold. One counter-reaction to the homogenizing influence of the new global culture is the need to preserve cultural identity. This will spawn a minor industry in dramas, dances, historical re-enactments, Geneology and perhaps even the occasional troubador. This trend will mushroom as space colonization increases the demand for *Cultureware*<sup>21</sup>. The golden age of the automobile is revived as Retro looks, Retro cars and Retro theme parks gain popularity. Cultural and sporting events will be sold out as soon as they are announced, thanks to the ubiquitous PID and in many cases a global audience.

Science will be a greater part of everyday life due to the general level of educational accomplishment in the population. Moreover, adults in any household will spend their working lives dealing with the complex problems posed by science and its application. High schoolers will be able to participate in interactive, scientific conferences broadcasted through special channels. Sixth graders will be able to rattle off the names of all bones in the body and will be clamoring for spaceship-construction kits at Christmas time.

With the decline in the use of the automobile, and a technology-driven homogenization of housing, ownership of personal property gradually diminishes in importance. Intellectual property, tagged by its owners PID, is however, protected by a world-wide agreement and its usage is tracked very carefully. For instance, making use of an artist's work in an interactive game will automatically accumulate royalties to the artist in question. Wealth and achievement are still a mark of distinction. The Super-rich, the top athletes, scientists, explorers, designers, philosophers and architects will enjoy media attention.

Society's affluence can be measured by the choices it affords its members. The hi-tech genie society can instantaneously provide its members, the world's best<sup>22</sup> in clothing, food, music,

recreation and tourism. There are stressors in the form of calamitic changes, constant education, the ever present em2 exams and psych profiles. Failure on these tests could, depending on the magnitude, result in anything from a benign “demotion” to assignment to a non-critical task. A Chief Engineer who misses the grade could become a Chief Consultant or a Chief Archivist depending on the degree of the miss. The stakes in the business world are too high to allow any outcome but success. In general, people are happier, healthier and less burdened with the daily chores of life. The average life span has increased to a biblical four score and ten years. It is too soon for complacency and eunni to set in, as the disruptive changes will continue into the succeeding centuries.

The very choices contributing to society’s affluence will also be its bane as humanity gropes its way for meaning in an artificial society. Are we born to die or is there somehow a deeper purpose to life? The study and practice of different systems of religions and philosophies is undertaken seriously. Coupled with cultural revivals, the insights from these studies and discussions lead to fundamental changes in the way people live. Prospective parents are routinely asked to consult philosophers or religious leaders before they make the genetic choices for their children. People will crave work, challenge, creativity, human interaction and above all, answers to the age-old questions of existence and its ultimate purpose.

**Table 5. Key Social Trends**

Personal property in the physical sense has diminished in importance. Intellectual property is taken very seriously and its usage tracked electronically.
Wealth and achievement are still a mark of social distinction. Athletes, philosophers, designers will enjoy fame.
The preservation of cultural identity is perceived as extremely important to society.
The study and practice of different systems of religions and philosophies is undertaken seriously.
The golden age of the automobile is revived as Retro looks, Retro cars and Retro theme parks gain popularity.
Science will be a greater part of everyday life since adults spend their working lives dealing with the complex problems. Sixth graders will be able to rattle off the names of all bones in the body and will be clamoring for spaceship-construction kits at Christmas time.
Health, wealth and leisure turn out to be the bane of society. People will crave work, challenge, companionship and above all answers to the meaning of existence.

## **A MORE ENLIGHTENED SOCIETY**

A new level of achievement and prosperity has an enlightening effect on humankind. There is a special concern for the welfare of animals which have suffered much mistreatment at our collective hands [17]. Factory farming and the killing of animals for sport is abolished. Additionally, *Familial Responsibility* laws are passed to protect the welfare of children during their critical growth period (0-10). Companies cannot accept *full-time* applicants for any position if they have children in this category. Similarly, marital partners and prospective parents are required to undergo psychological screening before they can assume their roles. Couples who do not meet the criteria may have to undergo counseling or demonstrate eligibility through community service. Many career-hungry men and women forgo the establishment of a family for the sake of pursuing a plum full-time management position (or an equally good technical position).

A more advanced stock market allows investors to share in the profits of the few by allowing them to invest in individuals. This of course implies that certain private information about the individual will be made public such as age, years with a company, projects completed, psych profiles and em2 scores. The system is made popular by a few flamboyant socialites, who do it initially for publicity and later for the rewards.

In international relations, Age-old rivalries and prior aggressions are forgotten by the new generation of team-trained bureaucrats and peace leaders<sup>23</sup>. Wars are virtually non-existent due to the greater role played by the U.N. Simulated combat and semi-realistic military games take the place of wars<sup>24</sup>. Some countries eager to generate hard currency have gone to the extent of opening “Mad Max” Theme parks [18]. These are surprisingly popular among a broad range of professional types, including those who pride themselves on being “survivalists”. “Homo domesticus” will have to wait for a few more centuries.

Beauty in all its forms will be valued and appreciated. Many urban landscapes are transformed by the leading architects into the dream cities of their forebears. The whole of Egypt, Greece, Iraq, and Italy will be declared world heritage sites and will enjoy Tier1 environmental protection status. All factories, heavy/polluting industries are removed from these countries at a tremendous cost. They will be replaced by environmentally-soft industries such as research laboratories, architecture, design, crafts, horticulture and education. The only access to these countries would be through non-polluting forms of transportation. Some of the ancient cities such as Alexandria and Rome are lovingly restored to their former glory and attract visitors by

the millions. In return for their co-operation, the citizens of these countries receive a percentage of royalties, which are periodically credited to their bank accounts. They are also free to immigrate to any other country. These moves will be regarded as shortsighted by future civilizations<sup>25</sup>. However, not even 21<sup>st</sup> century civilization is advanced enough<sup>26</sup> to protect its heritage from the ravages of nature.

Humankind is temporarily enraptured in its material prowess and its ability to shape destiny. The philosophical dilemmas which have plagued generations of thinkers will now gnaw at an intellectually mature homo sapiens. Is man free to choose his own destiny? Or is he a cog in some vast, unseen cosmic machinery? If he is indeed a cog, what are his marching orders? When can these be transcended? Are the natural laws an enigmatic code of behavior for human beings [27]? Conversely, if woman is free to choose her destiny, is she the mistress of all that she surveys? Can she exercise her free will regardless of consequences? The introduction of genetically developed organisms at this stage will introduce fresh dilemmas. Foremost among them is: "what does it mean to be human? Religious leaders will claim that the meaning lies in the soul and its constant development, while technologists will claim it as the right to make a free choice. Confrontations are likely, but the technologists will prevail as they have done historically. Human kind will not invest in religion unless there is a material reason for it.

The frenetic pace of development will continue into the succeeding centuries. Some tasks, such as controlling of space ships and giving instructions to thousands of robots in real time will become too complex for humans to handle. Cybernetic beings with intelligence exceeding that of man (woman) will be developed and humankind will be forced to adapt itself accordingly [19]. Has Man (woman) gone too far this time? The machine-augmented species will now have IQ's exceeding a thousand. What undreamt dreams would such a species dream? Unfortunately, the ability to dream will be found a priceless human gift that has been squandered away. The new species has none of the other qualities innate in humans until that time: the ability to admire beauty, the ability to empathize with other beings, the longing for companionship, the ability to feel pain and pleasure and the finally the ability to dream. Their behavior will prove to be very unpredictable. A few psychotic beings which cause great havoc will quickly bring humanity back to religion with the realization that progress can and should be achieved within natural limits. The added bonus is the joy of being able to dream of new galactic civilizations.

## **A TYPICAL WORKDAY LIFE**

Jeff arrives at work at a downtown computing center, a concrete megalith that was once the headquarters of a major automobile manufacturer, which now sports a theme park commercial on its public side. He playfully dodges a holographic spa-ride action sequence as he enters the building. His PID device which he wears in the form of a lapel pin has already initiated contact with the building's computer. A Japanese samurai saying "Good Morning Jeff san" bows in front of him in the lobby and then adds, "We've been expecting you. I am Fujimaro. You can use the Hibiscus room today." Jeff had evinced interest in Japanese culture and the building's computer picked up on this. The rooms are named after plants in the building, reflecting the growing concern to reduce the degree of impersonalization that seems to have taken hold of society of late. By the time Jeff hangs his coat, Fujimaro had already projected a display of his investments. Based on an earlier request (to his PID), Fujimaro also recommends investment in a Taiwanese chip manufacturer. Jeff requests detailed information and carefully scrutinizes the display. There seemed to be a surprising regularity to the stock price. The usual cross tabulation (a feature of the system) with stock market activity or economic indexes did not turn up anything. On a hunch, he checks the customers of the company and finds that one of its big customers was NASA and discovers that price peaks lagged NASA launches by two years. Being in a related business Jeff decides to invest the \$200,000, he's been saving for the occasion. The investment is confirmed a picosecond later by his bank followed by an acknowledgement of the transfer of funds.

Jeff is now ready to start work. His job as CTO is to lead the design and construction of Marriott 51<sup>0</sup> 29', the new hotel that Marriott is building in space. It has become fashionable for hotels and other lavish facilities to be named after the latitude and longitude. The new hotel will be located 50,000 feet above the city of London<sup>27</sup> offering a spectacular view of night time London. To add to the attractiveness of the hotel, an ambitious American entrepreneur is building a huge 3-D advertisement on marshland close to London, with an expected visibility of 60mi. However, due to city ordinances, the display can only be turned on only once every evening. If the hotel is completed on time, Jeff will enjoy a week's vacation on the hotel with his family as part of his bonus.

The design of the hotel and approval by various bureaucracies was expected to take five years, while construction and testing was to take another five years. A sketch of the design (see accompanying illustration) was already developed by the Shimizu Corporation<sup>28</sup> and approved by

the Cosmic Priests<sup>29</sup>. The bottom section of the hotel was to house the telecommunications and security equipment. The ring section was to house the power supply, oxygen regenerators, other supplies, emergency equipment, crew's quarters and limited recreation areas. Jeff had been asked to keep costs to a minimum. As it is, the estimated \$500 billion price tag will weigh heavily on the company's finances. The topmost section of the superstructure was reserved for meetings and restaurants while the main section will be occupied by the guests. Today, Jeff is working on the ring section, with Kumar from Vizag<sup>30</sup> and Paula in Milan. Kumar is the technical guru charged with the ring section while Paula is charged with the materials specifications. Fujimaro appears on the screen. "Shall we go ahead with the meeting?" "Yes!" "The virtual image of an athletic young man floats in front of him.

Jeff: "Hi Kumar! Nice to see you."

Kumar: "Likewise."

Kumar: "Here is Paula now"

Paula: "Hello Gentlemen!!"

Jeff: "Do you have the numbers for me?" [*He is referring to the rotational stresses on the struts which hold the superstructure in place*].

Kumar: "Here they are" [*A holo wire-frame display of the rotating hotel appears, with the stressed areas marked in different colors and having labels on them (there are approximately 3,000). The labels are touch sensitive*].

Jeff: "Splendid!"

Paula: "Maria (Paula's computer), Who do you think will get the next promotion?"

[*Kumar's virtual persona flushes a little*]

Kumar: "Thanks for the recommendation!"

Jeff: "Paula, what do you think?"

[*Paula examines some of the critical areas*]

Paula: "I think we would be needing Titanium-Carbon alloys for those numbers."

Jeff: "Fujimaro, is that within our budget?"

Fujimaro: "Many regrets, Jeff San. It would cause an overrun of fifty million."

[*The discussion continues for an hour. Jeff's PID starts to flash, It informs him that his PEV will be in front of the lobby in five minutes.*]

Jeff: "Oops, I almost forgot! The Iron Lady from Manchester is visiting. I have to leave now.

Paula, could you double check the material strength?" [*Paula acknowledges*].

"Kumar, could you run the fatigue tests?" [*Kumar also acknowledges*]. "Lets meet same time next week." [*Fujimaro bows slightly*].

Jeff will be meeting his boss, Mary Whitehead who will arrive from London. Jeff gets out of his office and into the waiting PEV<sup>31</sup> - "Will you be needing lunch today?". "No." Jeff disliked the idea of synthesized food and besides, he would be having lunch with Mary. His PID has already requested the day's news. During the ride, Jeff asks his PID to call the news center to request coverage of the Taiwanese chip manufacturer. The ubiquitousness of computers and advancement in telecommunications makes it possible to cover stories on demand. However, his request is denied due to lack of sufficient demand.

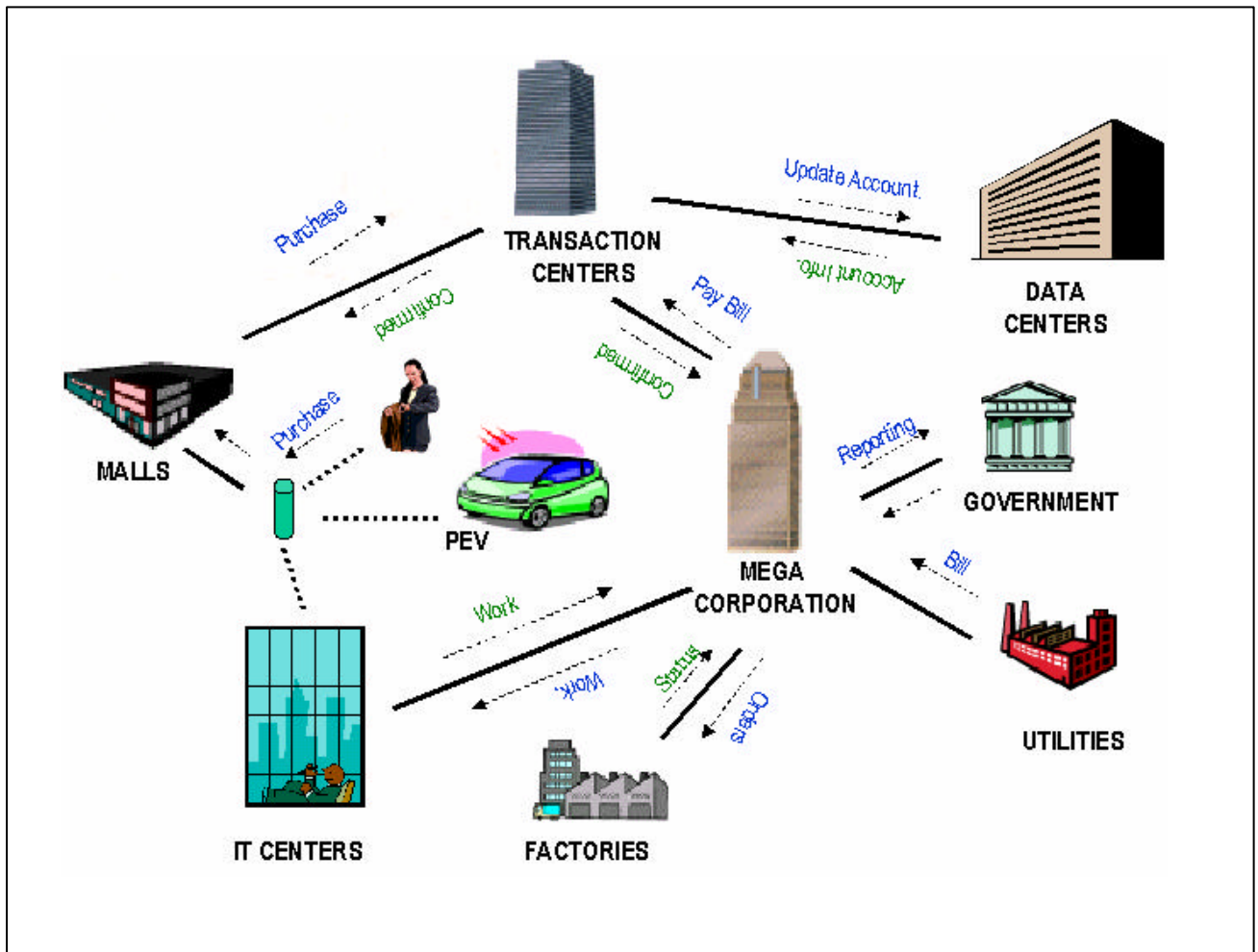
Jeff arrives at the airport in time to see the sleek new British Airways Hyperjet land smoothly on the runway. An attractive lady in a Smart Suit approaches him. He had not met her in person. "Hello Jeff!"

"Hello!" They shake hands and walk to an upper level lounge [20]. "Will you be staying for long?" "No. I'll be leaving in the evening." "I have a couple more meetings." The lounge was crowded with dozens of business men and women engrossed in deep conversation. Many of the tables were encased in a thin, translucent dome. "I went ahead and ordered your favorite lunch" Jeff said, as a waiter led them to an empty booth. Their meals and drinks were already on the table. After being seated, Jeff sees a small button labeled "Piracy on." He chuckles to himself as he presses it. "What is the project status?" asks Mary sipping her drink. "We are working on the center section. Paula thinks we may have to go Ti-c which will increase the costs." "Just remember that our contract will not allow overruns of more than one percent." Jeff was surprised by the Iron Lady's nonchalance. She was known for being ruthless. "Jeff: listen, I came here to tell you something really important. We are moving the launch date ahead by a couple of years. A delegation of dignitaries will be heading to the moon, to officially inaugurate the base there, Marriott wants the hotel to be ready by then." "What about the approvals?" "The IAA<sup>32</sup> and IAU<sup>33</sup> have been informed and they have agreed to expedite the paperwork on this." Their lunch concluded, they head to the underground transit terminal. Mary boards a waiting *Lev*<sup>34</sup> and waves to Jeff as it glides out.

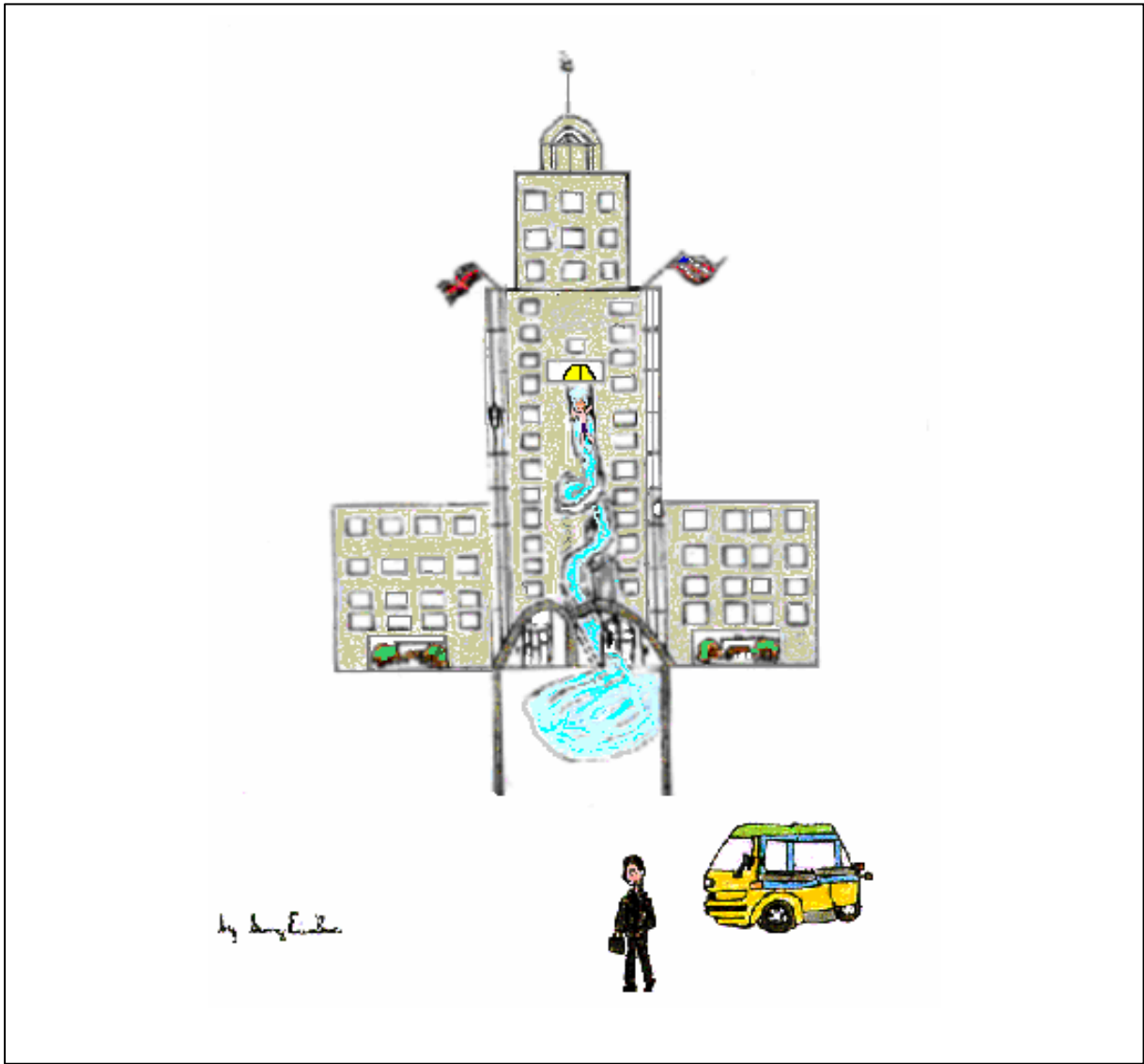
Back at the office, Jeff is mulling over the now accelerated schedule. Fujimaro interrupts him to inform that Prof. Conner is on-line. The image of a distinguished looking gentlemen flashes onto the screen. "Good afternoon Jeff!". "Are you ready for your em2?" "I am." "The company archives tell me that you are working on the center-section trusses." "What is the equation for stresses in a homogenous rotating disk with center hole, under normal external pressure and equilibrium temperature?" "Tensile or radial stresses?" Jeff thought he detected a fleeting smile on Conner's image. "Radial." Jeff felt his mouth dry as he wrote out the equation " $(3+\mu)/8*(R_1^2 + R_2^2 - R_1^2 R_2^2 / r^2 - r^2)*\omega^2 / g$ ." "What happens when  $g = 0$ ?" "The stresses will be infinite." "Good!" "I understand that you will enjoy a vacation on the hotel when its completed." "So the crafty fox is changing direction" Jeff thought to himself. "While you are at the hotel, let's say that a meteorite crashes into the hull, leaving 1 m holes in the dome. What are your initial reactions?" "Whether or not there will be sufficient time to deploy the emergency balloons (to plug the leak)." "Will there be sufficient time?" Jeff quickly performs the calculations. "Yes!" "What is your next course of action?" "To survey the damage." "How?"

“We are planning to have chips installed that can do damage assessment.” The testing goes on for an hour. “Congratulations Jeff! My apologies but the Shimizu corporation wants you for bigger and better things. The company has decided that your next assignment will be the Mars colony! Jeff was too exhausted to be elated but he knew he would celebrate later.

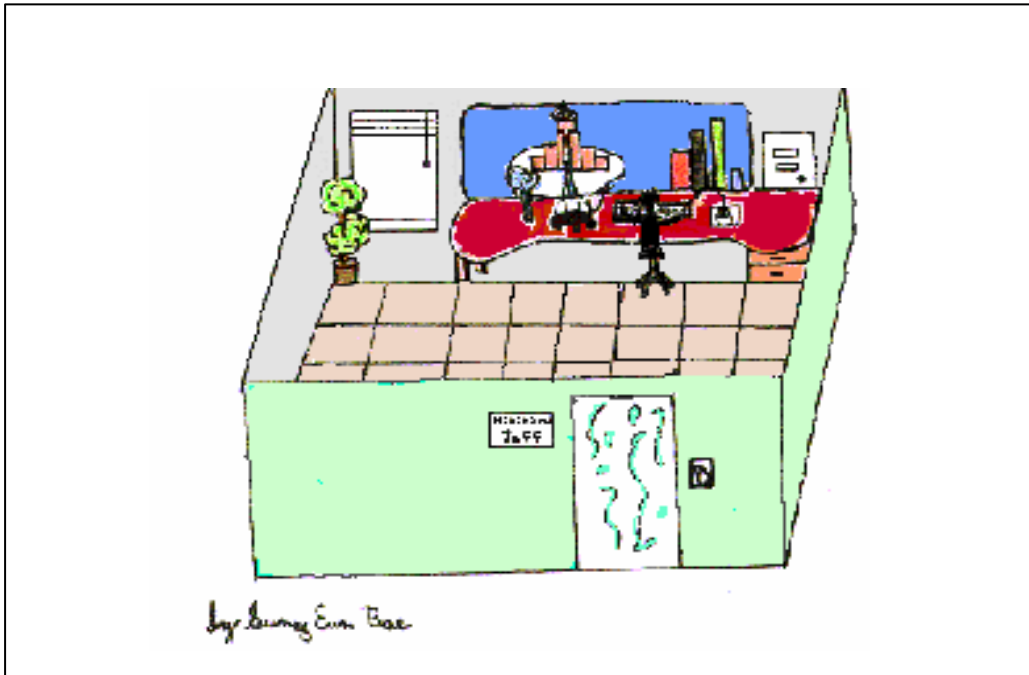
He decides to relieve his stress at the underground race track. The parking lot of the building had been converted to a mini-race track and it was one of the reasons Jeff chose to work in downtown today. “Fujimaro, is my '49 Buick ready? “ Although all cars are electric, they have different exteriors to suit different tastes. Fujimaro briefly checks a file: “You are ok for 2:30.” A few rounds around the track have a very relaxing effect on Jeff. Leaving the building he walks across to the lakefront and takes in the fresh breeze. He needs to think about the accelerated schedule and a way to bring down costs. He waves at an unoccupied transcab which stops. His PID had already indicated the destination. “Should he look for alternative materials, explore the possibility of lunar manufacturing and assembly or should he compromise on the amount of recreational space?” He was scarcely even aware that he had gotten out of the cab and into the mall, until a six year old girl comes bounding into his arms, “Daddy!”



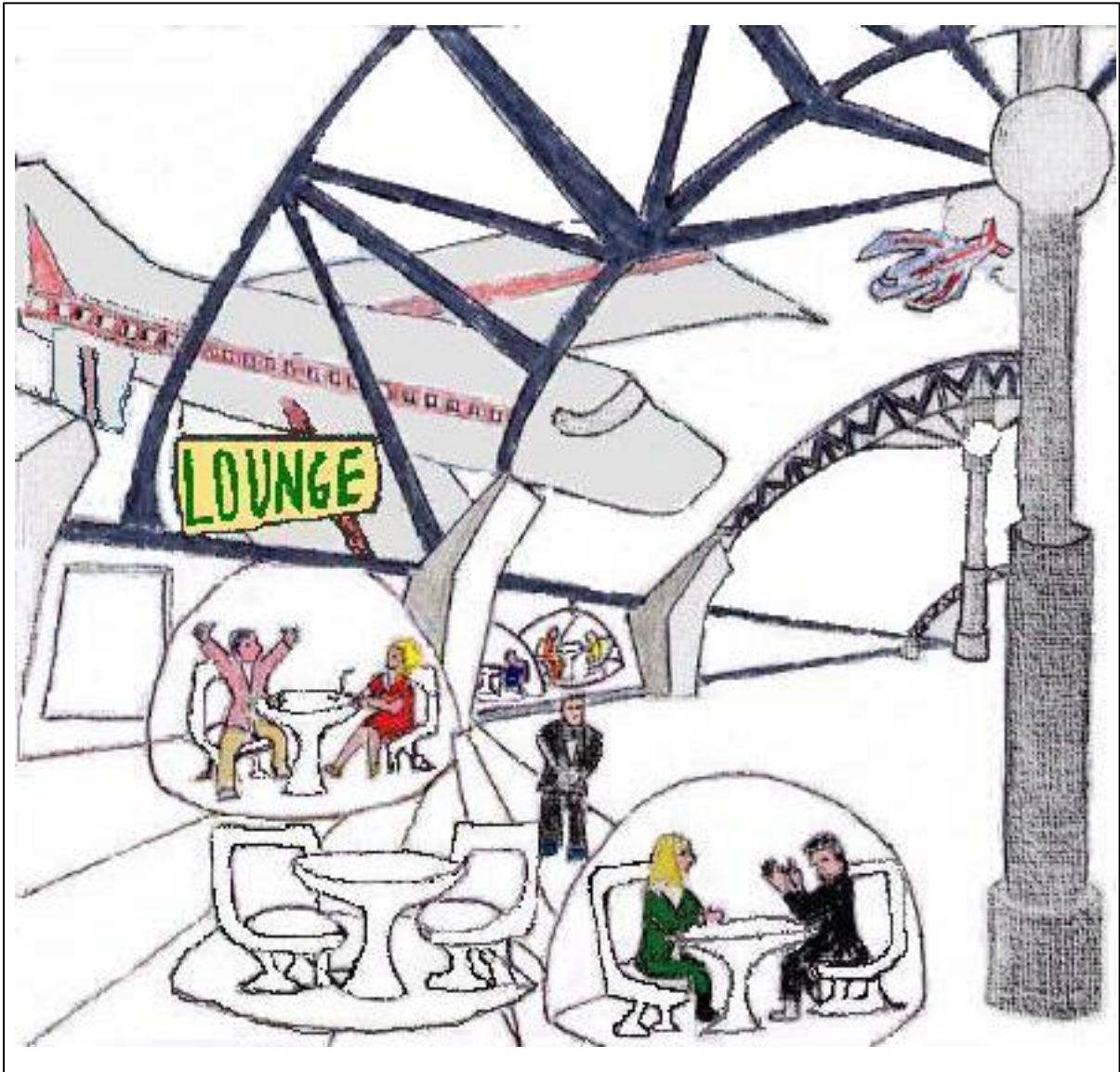
**FIGURE 1.** The Business and Transaction Environment in 2051.



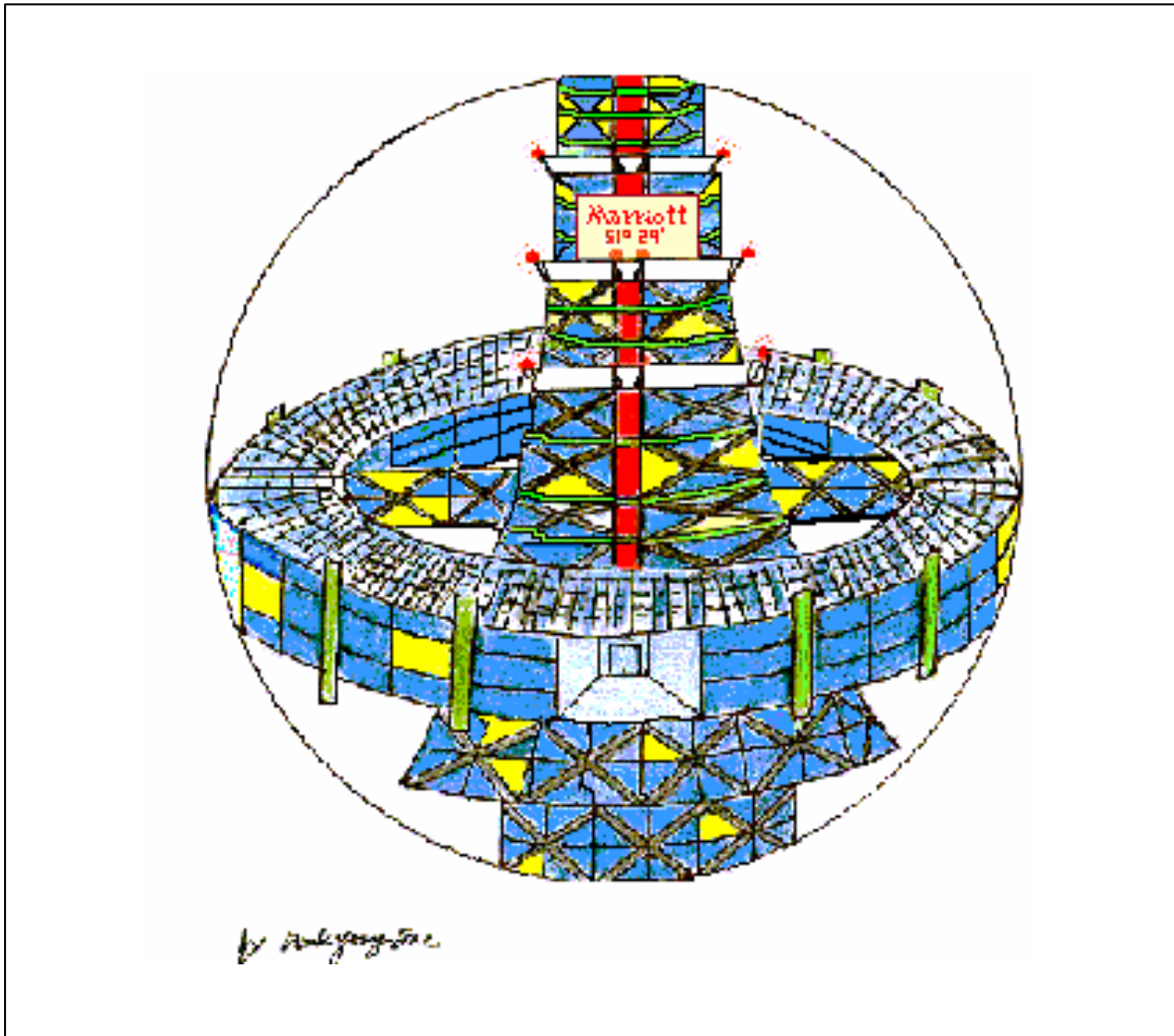
**FIGURE 2.** Jeff arrives at work, at a downtown IT Center.



**FIGURE 3.** Jeff in his office.



**FIGURE 4:** Jeff Meets Mary at the airport



**FIGURE 5.** Shimizu's conception of Marriott 51° 29'

## APPENDIX

**Table 6. Hypothetical stratification of major Industries**

Aerospace	U.S., U.K., France, Russia.
AI Industry	U.S., Japan, Russia, India and Israel.
Biotechnology	U.S., U.K., France and Germany.
Commercial Banking	Hong Kong, Singapore, U.S., U.K. and Germany.
Cultureware	U.K., Australia, Hungary, Czechoslovakia, New Zealand and India.
Fashion	Italy, France, Romania, Korea, Taiwan.
Factory Automation	Japan, Germany, Taiwan.
Eco-tourism	Canada, South America, Africa and India.
Education	U.K., Canada, U.S., Germany and Sweden.
Garment	China, Taiwan, India, Bangladesh.
Historical-tourism	Greece, Italy, Egypt, India, Israel, Iraq, Turkey.
IT Industry	U.S., India, Taiwan.
Non-profit industry	Switzerland, U.S. and India.
Power generation	Russia, U.S., U.K., France, Sweden, China, India, Israel.
Recreation	Spain, Portugal, U.S., Australia, Mexico.
Retail	U.S., Australia, Canada.
Spiritual Enlightenment	India, Italy, France, China.
Sport recreation	U.S., Australia, Middle East and Africa.

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## NOTES

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- <sup>1</sup> The first revolution was caused by steel and steam, the second by electronics, and the third by the Internet.
- <sup>2</sup> Personal transportation provided by utilities.
- <sup>3</sup> According to one source [5], upto 4,000 hereditary human illnesses can be controlled with gene therapy.
- <sup>4</sup> I will attribute this to a science fiction author whose name I am unable to recollect.
- <sup>5</sup> Technologically speaking.
- <sup>6</sup> Some attribute it to an almost genetic need to have a physical constituency.
- <sup>7</sup> Please refer to the Arcosanti [<http://www.arcosanti.org>] and Auroville projects [<http://www.auroville.org>], August 2001.
- <sup>8</sup> See for example [21].
- <sup>9</sup> Internet 2 seems to be on the boards, see [26].
- <sup>10</sup> See [7] for plans on a much grander scale.
- <sup>11</sup> See [22] for an excellent description of a self-replicating factory.
- <sup>12</sup> Many utilities squeezed for profits due to cheap electricity will try to "forward integrate" into the consumption of electricity. Owning electric taxis "Transcabs" is one such strategy. The next logical step is to exploit the synergies inherent in running these cabs and making home deliveries (this idea originated from a 1970's vintage article [23] which the author had come across recently).
- <sup>13</sup> Which are themselves consolidated.
- <sup>14</sup> Since Men's clothing has remained relatively unchanged in the last fifty years, it is safe to assume that the same trends will continue.
- <sup>15</sup> Process oriented industries will have the lab-version of the IT center, equipped with both physical laboratories as well as the accompanying digital magic.
- <sup>16</sup> The other grids are the Political, the Work, Non-profit, Arts and Entertainment, Sports and Educational grids.
- <sup>17</sup> See [24] for a trend in this direction.
- <sup>18</sup> Functional support involves support in job-related tasks.
- <sup>19</sup> Willis forecasts jobs in Robotics, Hydroponics, Power plant, Tourism and Astronomy to name a few [8].
- <sup>20</sup> Recreating human expressions in liquids.

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- <sup>21</sup> Cultureware is colorful documentation of dances, dramas, historical events and other forms of heritage.
- <sup>22</sup> As pointed out elsewhere, not all people in the world share these conveniences, but relative proportion of the have has improved considerably in the 21<sup>st</sup> century.
- <sup>23</sup> Military leader is an old-fashioned term from the pre-21<sup>st</sup> century era.
- <sup>24</sup> Participants are protected from serious injuries by padded clothing and weapons.
- <sup>25</sup> Since they will regard the whole earth as a galactic heritage site. Every piece of history and every bit of stone will be revered by post cybernetic civilizations.
- <sup>26</sup> It should be trivial for a 25<sup>th</sup> century civilization to encase entire countries in an artificial environment.
- <sup>27</sup> The criteria is a major metropolis on the lucrative Atlantic route but one that is somewhat removed from the continent.
- <sup>28</sup> A Japanese construction company renowned for its futuristic designs (See [25]).
- <sup>29</sup> A franchise dispensing advice on religious, astrological and cosmic issues.
- <sup>30</sup> A coastal metropolis in South-Eastern India.
- <sup>31</sup> Personal Electric Vehicle.
- <sup>32</sup> International Architectural Association.
- <sup>33</sup> The International Astronomical Association.
- <sup>34</sup> Magnetic levitation vehicle.