Societal Implications I: Suggested Effects of Familiar Technologies

COMPUTERS

Advantages

- Automate many tasks previously performed by people and increases the speed at which these tasks are accomplished.
- Provide easy access to and the ability to work with enormous amounts of information.
- Increase the speed and ease of personal and professional communication.
- Make possible new communities or increased access to existing ones (through the possibility of on-line voting, for instance).
- Allow people new opportunities and media for expression of their views.
- Provide entertainment including game playing, listening to music, emailing, or searching the web for information.
- Allow convenient access to goods and services from home.
- Offer new possibilities to the differently abled, such as the ability to shop or communicate to people who cannot leave their homes.
- Have helped create an entirely new set of career alternatives, such as programmers or network administrators.

Disadvantages

- Enables new kinds of crime – for instance hacking into businesses or banks.
- Creates new annoyances, such as Spam-unwanted emails and messages.
- Allows the spread of viruses that can cause computers to crash or erase information.
- Enormous amount of information available can be overwhelming and often wrong (not all internet sites are accurate).
- Create new health concerns when people spend time using them rather than getting exercise, or because of their role in the increasing occurrence of carpal tunnel syndrome.
- Can threaten privacy by allowing others to monitor your personal activities or steal private information.
- Anonymity opens the possibility of inappropriate information getting into the hands of children, or of adults communicating with children in inappropriate ways.
- Threaten to divide people among nations, classes, races, because not everyone has equal access to their benefits.
- May lead to a more impersonal and less interactive world, in which automated telephone systems and e-mail replace conversation.

CELL PHONES

Advantages

- Easy and convenient communication-people can always be in touch with one another.
- Useful in emergencies, such as if your car breaks down.
- Can use to access other means of communication, such as sending emails, checking messages, browsing the internet.

Disadvantages

- Use of cell phones during driving can lead to car accidents.
- Create pollution concerns because some materials used to make them may be harmful or toxic if disposed of in landfills.
- Use may cause or increase chances of brain cancer.
- Disturbing in classrooms, movies, or restaurants.

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Education and Outreach

ANTIBIOTICS

Advantages

- Used to treat and prevent diseases, resulting in people living healthier lives.
- Lengthened the life span of human beings.
- Increase confidence in medicine.

Disadvantages

- Improper use results in development of resistant microorganisms.
- Not everyone has access to antibiotic or can afford them.
- Expense of antibiotics has led to a black market as well as people traveling to other countries for purchase them.

TELEVISION

Advantages

- Provides entertainment.
- Provides information equally to everyone who owns a TV.
- Distributes important news almost immediately, unlike newspapers.
- Recent developments in cable and satellite TV allow people to choose the channels that suit them and their lifestyle.

Disadvantages

- Can lead to health concerns when people watch TV instead of being active and exercising.
- The ease of watching television may discourage reading or time spent with friends and family.
- Raises concerns about children's exposure to inappropriate information, such as violent images, adult language, sex, etc.
- Because of its accessibility, rapidity, and appearance in the home, people may trust television news more than they should – like all sources of information, it can be misleading or inaccurate.

AUTOMOBILES

Advantages

- Allow increased mobility.
- Have created a series of new industries, from building cars to tourism, and therefore new jobs.
- By transporting cargo, have made products available that were not before – for instance, fresh vegetables in winter.

Disadvantages

- Create pollution problems through exhaust fumes or the disposal of old tires.
- Provide a new opportunity for accidents, injuries, or even death.
- Have contributed to urban sprawl, suburbanization, and the abandonment of inner cities.

Societal Implications I: Possible Effects of Select Nanotechnologies

Nanotechnology may, in the future, provide a large array of new products. Many of these might now sound like science fiction, and a large number of present day ideas and proposals will meet with serious technical obstacles and turn out to be fantasy. In the meantime, we can try to exercise our imaginations and our understandings of nanotechnology to predict the future.

By re-building the world at the atomic or molecular level, nanotechnologies may one day be able to make:

- Materials with atomic arrangements designed to give them new and useful properties. Such materials, such as Amorphous metals or Ferrofluid, are currently being made with traditional manufacturing techniques. Constructing them with new, bottom-up methods may allow greater control over their properties and as-yet undiscovered behaviors that could lead to entirely new uses.
- Substances whose atomic structures can be modified at will – perhaps by exposure to electric or magnetic fields or changes in weather. The walls of houses, for instance, might be made to allow a breeze through in the spring or insulate the inside from cold air in the winter. The shape-altering properties of memory metal were discovered accidentally. In the future, the ability to adapt might be engineered on purpose at the atomic scale.
- Devices (e.g. nanobots or nanites) made with parts that are as small as molecules. These tiny devices could be used for a variety of tasks.

CARBON NANOTUBES

Advantages

- If formed into a solid mass, offer a material with tremendous strength.
- May be used as wires to make electronics smaller and faster.
- Possess unique electrical properties that can result in better flat screen panels, fuel cells, batteries, or capacitors.

Disadvantages

- Are difficult and very expensive to make.
- Could interact negatively with the environment or with plants and animals, possibly becoming the next asbestos.

FULLERENES

Advantages

- May be used to improve medical care because:
  - hollow insides can be used to carry medicines, such as bone building drugs for osteoporosis or cancer-killing drugs to tumors.
  - Inert, non-toxic, and so tiny that they interact easily with cells, proteins, and viruses – for example, a novel fullerene drug targets HIV protease by easily fitting into the pocket on the virus and disrupts its ability to reproduce.

Disadvantages

- Expensive to manufacture and thus may contribute to increasing medical costs.
- Unexpected reactions in the environment might lead to harmful effect.

MATERIALS BUILT ATOM BY ATOM THAT ARE STRONGER AND LIGHTER THAN THOSE POSSIBLE TODAY

Advantages

- Dramatic improvements in the performance of machines, such as:
  - Power generators that are more efficient resulting in reduced pollution.
  - Vehicles that are lighter, faster, and more fuel efficient.
- Can eliminate the problems or dangerous and messy byproducts of traditional manufacturing processes sometimes involve, for example:
  - Less waste released into the air or water.
  - Less damage from coal mining or oil extraction.

Disadvantages

- May have unforeseen and harmful effects on the environment.
- Older industries, such as steel or plastic manufacturing, may be downsized or eliminated, causing many people to loose their jobs.
- Access to and benefits of new materials may vary considerably by wealth or location.

UNIFORMS THAT CAN INSTANTLY CHANGE COLOR

Advantages

- Can be used to protect the lives of soldiers by providing the ultimate camouflage.
- Might allow increased ability to gather information or intelligence.

Disadvantages

- Could result in injuries from friendly fire due to invisibility of soldiers.
- May be used for sneak attacks or terrorism.

BUILDING MATERIALS THAT ALTER THEIR INNER STRUCTURES IN RESPOND TO WEATHER CHANGES

Advantages

- Can increase the overall comfort of homes.
- May result in lower energy use and reduced utility bills.
- Will make homes more a part of the environment, like trees that change color with the seasons.

Disadvantages

- Changes in building materials may not always suit the comfort of all occupants.
- Could reduce the necessary to repair houses and businesses, reducing the need for construction workers or repair-men.
- Might increase the cost and complexity of repairs that are needed, preventing home-owner from doing the repairs themselves.

MEDICAL NANOBOTS

Advantages

- Will increase health and life-span.
- Can be used to destroy disease organisms or cancer cells and tumors.
- May be able to repair damage done to bodily organs, such as:
  - Clean out arteries by destroying arterial plaque.
  - Repair injured tissue at the site of a wound.
  - Re-build missing limbs or damaged organs.
  - Repair cellular damage caused by aging.

- Could monitor bodily processes and warn of danger, including:
    - Traveling through the circulatory system and monitor vital signs.
    - Measuring blood cholesterol levels.
    - Collecting information about a person that otherwise would require chemical analysis of blood and urine samples.

Disadvantages

- May be very expensive and only available to a few, while those that cannot afford them suffer.
- Might encourage irresponsible behavior on the assumption that nanobots will fix the damage.
- Raise privacy concerns about who has access to personal medical information.
- Open the possibility of overpopulation as people live longer.
- May be used, in the wrong hands, to do harm.
- May provoke unexpected reactions in the body, particularly if used over the long term, thus becoming a threat to health.

ENVIRONMENTAL NANOPARTICLES / NANOBOTS

Advantages

- Can help clean up polluted environments, for instance:
    - Through catalysts that weaken pollutants in the ground.
    - With nanoparticles in water systems that react with pollutants, toxins, and hazardous organisms.
    - In pipes coated on with nanoparticles that might degrade pollutants as they passed through the pipes.
- May be used to monitor bio-chemical threats and therefor increase public safety.

Disadvantages

- May get out of control once released into the environment.
- Could cause unexpected and dangerous reactions among plants and animals that makes them a form of pollution.
- By gathering information, may infringe on personal privacy and freedom.

NANO-ENGINEERED COMPUTERS

Advantages

- May be trillion times smaller than today's machines.
- Also potentially much faster processing speeds.

Disadvantages

- Amount of information available on any single machine might be overwhelming.
- Might increase people's reliance on machines.

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