

Future Privacy

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Maria Dailey is a senior in the Bachelor of Science in Computer Security and Information Assurance (BSCSIA) in the School of Business at Norwich University. She recently submitted an interesting essay in the IS455 Strategic Applications of Information Technology course, and I suggested to her that we work together to edit and expand it for publication. The following is the result of a close collaboration between us.

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How would you feel about having a computer insider your body – other than your own brain?

A nanocomputer is one which is invisible to the human eye, but operates like current computers.

“You might stop to consider what the world might be like, if computers the size of molecules become a reality. These are the types of computers that could be everywhere, but never seen. Nano sized bio-computers that could target specific areas inside your body. Giant networks of computers, in your clothing, your house, your car. Entrenched in almost every aspect of our lives and yet you may never give them a single thought.”[1]

Nanotechnology research is proceeding vigorously:

- In 2001, *Wired* reporter Geoff Brumfiel wrote that researchers at Bell Labs reported that they had “built a Field-Effect Transistor (FET) from a single molecule.” One of the researchers “said this special ability might allow computer circuits to become integrated into credit cards and clothing. The fact that the molecule can be stored easily in a liquid solution also opens up the possibility of using ink-jet type technology to ‘print’ processors on sheets of plastic.”[2]
- Brumfiel also pointed to the startling achievement of researchers at Harvard University who “made semiconducting nanowires that assembled themselves into simple circuits.” Luminary scientist Ralph Merkle,[3] one of the founders of modern cryptography, and currently a researcher in nanotechnology, commented explained to Brumfiel that “Molecular processors... could allow computers to see, hear and interact with humans much more directly.”[2]
- In mid-2011, “A group of Turkish researchers at an Ankara university have manufactured the longest and thinnest nanowires ever produced, by employing a novel method to shrink matter 10-million fold.”[4] Such nanowires could play a valuable role in nanoscale computing.
- A Website devoted to monitoring developments in nanoscale computing has the motto, “Small is beautiful; very small is very beautiful.”[5] The current page alone has 30

entries on a multitude of nanotechnology topics, with more than a thousand more archived. Examples include

- DNA Nanotechnology – a basis for biologically-based nanocomputers;[6]
- Augmented Reality – Microsoft and University of Washington scientists are working on contact lenses with digital displays providing additional information on demand;[7]
- Building an Artificial Brain – University of Southern California researchers “have made a significant breakthrough in the use of nanotechnologies for the construction of a synthetic brain. They have built a carbon nanotube synapse circuit whose behavior in tests reproduces the function of a neuron, the building block of the brain.”[8]

The intimate integration of computing technology potentially goes far beyond anything citizens today would be comfortable accepting, if current concerns over data profiling are a basis for prediction.[9] Consumers already shift uncomfortably in their seats when highly personalized e-advertisements update each time they leave a Website.[10] How will they feel about computers that transmit even more intimate details of their lives?

Nanocomputers may challenge current conceptions of privacy, trust, and criminal boundaries. An embedded microscopic computer recording and transmitting details of its host’s location, ambient sound, and perhaps even physiological markers would be a tool of great value for medicine, the criminal justice system, and marketing – and also for a police state’s apparatus of surveillance and control. Imagine what organized crime or individual criminals could do with surreptitiously implanted nanocomputers! That accidental bump in the street could be an undetectable insertion of a tracking or monitoring nanodevice instead of the occasion for mere physical pickpocketing.[11]

Privacy would have to extend to envelop computerization of the human body. Nanocomputers hold the potential to alter cells and target certain diseases and illnesses[12] – but what if they were susceptible to unauthorized dumps of information about the carrier’s state of health? For example, nanocomputers may someday be programmed to monitor, follow, and record individuals and groups for medical treatment or in research studies. The reports could be submitted to authorized health care workers and scientists – or they might be deliberately or covertly directed to marketers with or perhaps without the victim’s awareness of the situation, much as marketers today monitor consumer online activity in social networking sites.[13] Maintaining privacy would require that trusted nanocomputers be programmed to act as firewalls against unauthorized activity, so that unsolicited monitoring and advertising could not take place.

What if criminal hackers attacked embedded nanocomputers in human beings? If a medical nanocomputer were not only recording medical data but, like today’s cardiac pacemakers, providing useful or essential medical services (e.g., controlling heart rate, modifying endocrine functions, affecting brain functions), could unauthorized modification lead to harm? In 2008, there were reports that WiFi signals could interfere with – or be used to interfere with – cardiac pacemakers.[14] Recent reports discuss defensive methods for preventing such problems or attacks.[15]

If such systems were to be used to affect behaviour (think “A Clockwork Orange”[16]), how would one distinguish natural human behaviour and nanomanipulated actions? How would the system of justice cope with a “nanocomputer-made-me-do-it” defence argument?

Integrating security and social implications for privacy and autonomy into the design and applications of embedded nanocomputers must be a priority for all developers and users of this new technology.

These issues give a whole new meaning to the concept of a *small mistake*.

References

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- [9] Privacy Rights Clearinghouse 2011
- [10] Folino 2009
- [11] Anonymous 2011
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