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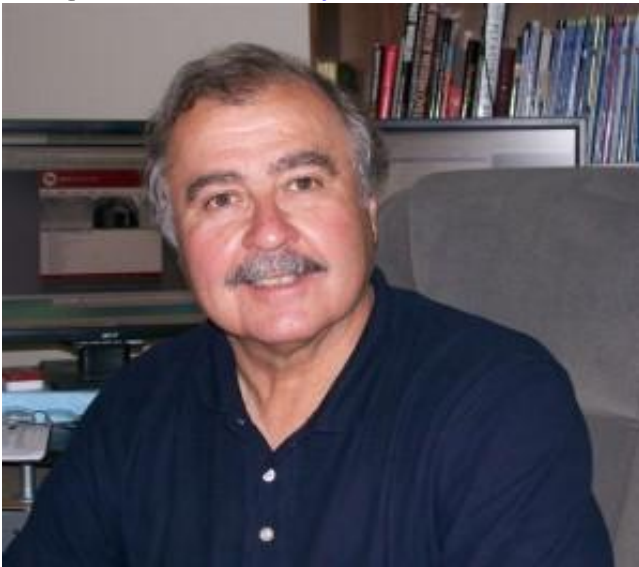
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## Stephen E. Arnold: Google Glass: Are Weaponized Nanodevices and Ultra-Miniaturization Coming?

Categories: [Advanced Cyber/IO](#)



Stephen E. Arnold

### **Google Glass: Are Weaponized Nanodevices and Ultra-Miniaturization Coming?**

Google's earnings for the April, May, June 2013 quarter reminded me that Google faces some challenges. Expenses moved up a couple of billion from the same quarter in 2012. ([Source](#)). More troubling, Business Insider said, "The total number of paid clicks that Google gets continues to go up, but Google gets paid less for each one. In other words, Google's rock is still rolling up the hill but it takes a lot more energy to maintain that momentum than it used to." ([Source](#))

Google may have to do some fast dancing both in its current pricing in the short term and with its innovations over a longer period of time. Google may be looking at the US Federal government as a customer for some of the firm's technology to bolster its revenues. Google and the military? Google and DARPA? Maps, yes, but a computer in your eyeball or smart nanodevices which are undetectable? It might be a trajectory worth considering. Apparently Microsoft is working on a wristwatch smartphone described in "[Microsoft Testing Surface Watch](#)"? But devices are bulky, so very small devices make a great deal of sense to the forward-thinking.

Perhaps the urgency in innovation is the reason Google has been pushing forward with Glass's next version? On the recent quarter's earnings call, Larry Page, Google's senior manager, said: "[I love using Glass because I feel like every time I'm using Glass I'm living that future, that's really, really exciting to me.](#)"

Have I inadvertently glimpsed one possible trajectory for Google Glass? Is Google leapfrogging smartphones as wristwatches and moving beyond contact lenses and belt packs? Is Google looking to make revenue waves in medical diagnostics, nanomachines, and possibly DNA-scale communication devices? Science fiction or the path that Google Glass is now following? Is that \$2 billion jump in R&D an indication that clean rooms, new research facilities, and world-class nanotechnology experts are signaling a new direction for Google—nano-bioengineering and synthetic biology? Could Google become a nanotechnology giant? I found some interesting open source intelligence which may help frame this question, but I only know one thing for certain. Google is not doing much talking in public about self-assembly, bioengineering, and nanotechnology.

A month ago, I was sitting in Hotel Zetta near Union Square watching for Glass owners and reading on my iPad an article about Microsoft's answer to Google Glass. Glass, as you probably know, is a smartphone converted to a heads up display. A Glass user dons a pair of eyeglasses and voilà, the smartphone display is hovering in the Glass wearer's field of vision. The gizmo is controlled with voice commands like "Okay, Glass" or by touching the temple of the eyeglasses. Perfect Glass is not. But Google's clever public relations machine propelled Google's augmented reality prototype to headline news. The tech savvy have been in a frenzy. Google, once again, is delivering the future. Sure, Glass reminded me of the robot's enhanced vision in *The Terminator*, but the form factor was almost a dead ringer for the eye wear of Geordi La Forge in the sci-fi blockbuster *Star Trek: The Next Generation* and its feature films. I wear eyeglasses, so I am not sure how the Google Glass will work with my trifocals.

The person sitting next to me in the hotel lobby knocked a pile of photocopies to the floor. I put down my iPad and helped the person pick up the scattered papers. One photocopy was a big fat book chapter or technical article. I glanced at the title and noticed the word "self-assembly."

I asked the young person whom I assisted if I could copy down the title of the thick photocopy. The person said, "Sure, it's from a textbook."

The chapter was called "Using Biomolecules for Self-Assembly of Engineered Nano-Scale Structures and Devices." I had some time to poke around and I was able to locate a PDF of the information written by Ranjana Mehta, John Lund, and Babak A. Parviz. The "Parviz" name triggered in my memory the fact that the Google Glass project lead was a fellow named "Babak Amirparviz." Was this the same person? If so, why two different names? I remember that in my past research about Google, I discovered that often times when Google hires a smart person, that person for some reason would publish under a modified name. Examples include *Alon Levy* (dataspaces expert) becoming *Alon Halevy* and *Charles Lee* (Glass business development professional) working as *Steve Lee*. Was *Dr. Babak Parviz* (author of the book chapter) the same person as *Dr. Babak*

Amirparviz (head of Glass)? I poked around and learned that it was the same expert. I found that factoid interesting.

When I surfed through my collection of Google open source documents, I noticed that Dr. Parviz/Amirparviz delivered a lecture at a conference about putting electronic devices on a contact lens. The talk was from 2008 and a version of that presentation was published by the IEEE in 2008 as document 978-1-4244-1793-3/08 with the title “Contact Lens with Integrated Inorganic Semiconductor Devices.”

Dr. Amirparviz is the Glass project manager. Does it make sense that a world-leading expert in self-assembly, fluidics, and nanotechnology, would confine his efforts to the clunky eyeglasses form factor? Isn't the trajectory more likely to be from the eyeglasses to a contact lens and then to even smaller devices?

A contact lens may not be what people want or tolerate. Is there a way to put a smartphone or at least most of its components into a much smaller form factor? Could the display required to generate the augmented reality display be presented as part of the eyeball itself? A UK newspaper writing about a Glass engineer stated: “[Thad] Starner met Larry Page and Sergey Brin, cofounders of Google, in 1998, and they talked about how cool it would be to have a computer in your eyeball. Later, Page offered him a job with Google.” Dr. Starner is a member of the Glass team. The *York Dispatch* added, “His doctoral work, titled “[Wearable Computing and Contextual Awareness](#),” dealt with pattern recognition and how wearable computing can be used for purposes such as recognizing hand motions used in sign language.”

But the book chapter continued to suggest a more significant application of the wearable computing idea. What is beyond a contact lens? The answer, in part, may be tucked into the dense language of Dr. Parviz/Amirparviz's work. I tracked down the source of the “self-assembly” chapter. “Using Biomolecules for Self-Assembly of Engineered Nano-Scale Structures and Devices” appeared in *Nanofabrication: Fundamentals and Applications* edited by a fellow with a memorable name, Ampere A Tseng. The book was published in 2008 by World Scientific. A research university's library should have a copy.

The main point of this particular chapter written by Dr. Parviz/Amirparviz and two associates is that nanoscale self-assembly makes possible components and devices. The work of Dr. Parviz/Amirparviz is focused on implementing devices which are at the nano-scale. “Nano” refers to a nanometer, one-billionth of a meter. These can be built using nano assembly. Chemistry and physical properties become the methods for hooking, connecting, and coating nano-scale components. If Dr. Parviz/Amirparviz is correct about nanotechnology, Google Glass and related implementations will follow a miniaturization trajectory which moves toward devices which are small. These can be embedded in a button or swallowed. Google Executive Chairman Eric Schmidt told a conference audience last year that he would swallow robots in the future ([Source](#)), and for those not so eager to ingest them, they can also be injected into a living organism.

Let's assume that this steady march to miniaturization is motivating companies like Google to hire experts like Dr. Parviz/Amirparviz. What are the implications for professionals using computer technology?

First, the traditional devices will not go away, but the manufacturing processes are likely to undergo significant change. Opportunities will be created, but some companies may find that their products and services cannot be easily re engineered to meet the micro-scale and nano-scale future.

Second, the emergence of self-assembly may drive the cost of semiconductors to even lower prices than one can find in the store today. The proliferation of low-cost, powerful computing devices melts away barriers to

ubiquitous computing.

Third, the data generated by large numbers of tiny devices which can communicate means that Big Data will become Bigger Data. One application area alone like medical monitoring creates a flow of high-value data which will require new approaches to collating and analyzing the outputs of nano-scale monitors.

Fourth, the notion of wearing goggles or putting an uncomfortable lens in one's eye to make a phone call or look up a location on a digital map becomes old fashioned. The new approach will be to have nano-devices assemble themselves in one's eye.

The goal is not glasses. The goal may be to put a computer in an eyeball. The military and intelligence applications are easy to identify: covert surveillance, weaponized medical devices which can render a person of interest harmless, and elimination of bulky battery packs for operational personnel, among others.

I must admit that these implementations are likely to be years, maybe decades in the future. I think I will skip the smartphone watch and smartphone contact lens. A nano-device sounds just right to me. The interesting thought is that for many young people, a nano-device will be the obvious choice. Only old people carry a smartphone, wear a watch, or insert a contact lens.

Nano-devices are likely to be hotter than the latest Nike sneaker worn by a special ops team.

Stephen E Arnold, August 5, 2013

*Stephen E Arnold is a consultant providing strategic information services. You can find examples of his copyright free information at [www.arnoldit.com/wordpress](http://www.arnoldit.com/wordpress). For an in-depth briefing on topics related to Google Glass, contact him at seaky2000 at yahoo dot com.*

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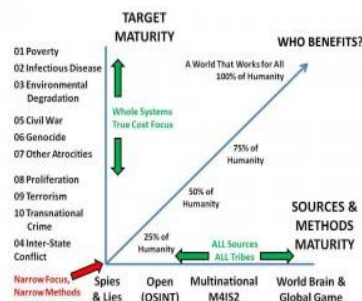
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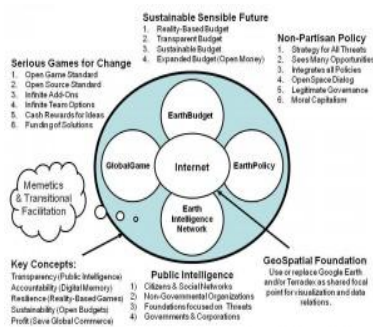
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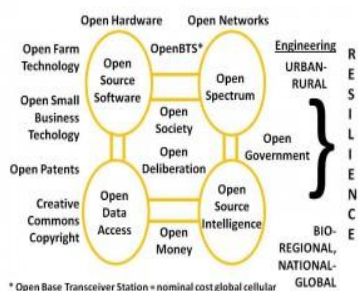
## 05 Holistic Public Governance



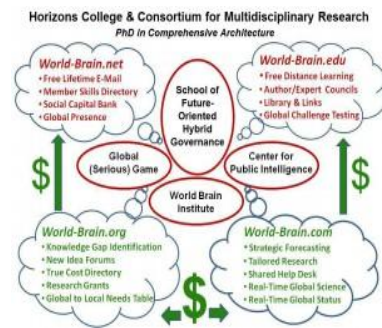
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