

## The Three Tsunamis

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*The Future ain't what is used to be – Yogi Berra*

We often talk about how different our world is from our parent's world. We then extrapolate this thinking to our children and try to imagine the world they will face. This is hard enough. However, change is changing! The rate at which change is occurring is accelerating. These new ideas, technologies and ecologies appear to be coming at us like tsunamis. Our approach to responding to these oncoming tsunamis will frame the future our children will live in. There are many of these tsunamis; I am just going to focus on three really big ones – heading our way.

### Technological Exponentials

One of the reasons it feels like the rate of change is accelerating is because the rate at which technological change is occurring has been recognized as an exponential change. These types of changes begin quite modestly, and stay at only slight growth for quite some time, then as they mature “all of a sudden” they are huge. We have all seen this in the dramatic growth of personal computers, cell phones and even the Internet. If these trends continue computers will be 1000 times faster in just five years. At this speed they will be as fast as the human brain. It is then “just” a software problem to replicate a functioning human brain. We have already done a complete simulation of the cerebellum. Although replicating a complete human brain will not be easy, no one thinks it will not be done – in our kid's lifetimes.

So what happens when a computer can simulate a human brain? How long before we can upload the contents of our brain? Will we be able to “talk” to people whose body has already died? Certainly we will be able to connect these simulations to robotics and then what do we have? Once we connect all of these “brains” together is that megaGoogle? Is this far fetched or are we already seeing the bellwethers in artificial hearts, eyes, legs...are we not cyborgs already? Our kids will be living with this reality.

### Demographic Changes

It has been said that those who ignore demographics do so at their own peril. The world demographics are changing, and with those demographic changes are coming significant impact to the world's economy, health care, education systems, food & water supply and world leadership. The west and particularly the United States has held onto a particular dominance in physical and economic power for quite some time. This may not always be the case, and in fact the demographics show that it will not be the case.

Our children will see China grow to have the world's largest gross domestic product. India will soon after overtake the U.S. in GDP. U.S. imports have already overtaken exports, while China and India have become exporting machines. For a long time the U.S. consoled itself that these were just low-wage jobs that we did not want to do anyway. Well – that has changed. These countries have become serious about education

and, as an example; China is producing 700,000 engineering graduates while the U.S. is producing 70,000. Even if only two in ten of these students were high quality they would be double our production.

How will our children compete on a global scale? How will the U.S. function as a second or third tiered country? How do we take advantage of this global knowledge pool? Where will research be done in the future and by whom? What happens to intellectual property in a global research environment?

### Climate Change

We continue to keep our heads planted firmly in the ground as we tamper with the controls on the planet. Human produced global climate change is a reality. As recently as May 18, 2007 the United Nations Framework Convention on Climate Change repeated this unequivocally. Amazingly, many continue to treat this as insignificant information. It is unclear what it will take to convince the population at large that this may well be the global war that is fought by our children.

Global temperature rise is an undisputed fact. We can look at the temperature record in ice cores and understand that the current temperature rise has not been seen in the last 1000 years. The dramatic upswing in carbon dioxide concentration has not been seen in 400,000 years! There is no quick fix to these changes. Even if we make dramatic changes right now the lingering effects of past will continue to challenge future generations.

What will be the focus of our research in the future? What will we use for energy? What pressure will this place on our standard of living? What impact will the huge rise in industrialization around the planet have?

### Thinking Time

The IRI has put together a Research on Research subcommittee to examine the effects of the upcoming changes on R&D. The R&D "Lab" of the Future Subcommittee would welcome your insights and help. Contact Rich Antcliff at [Richard.R.Antcliff@nasa.gov](mailto:Richard.R.Antcliff@nasa.gov)