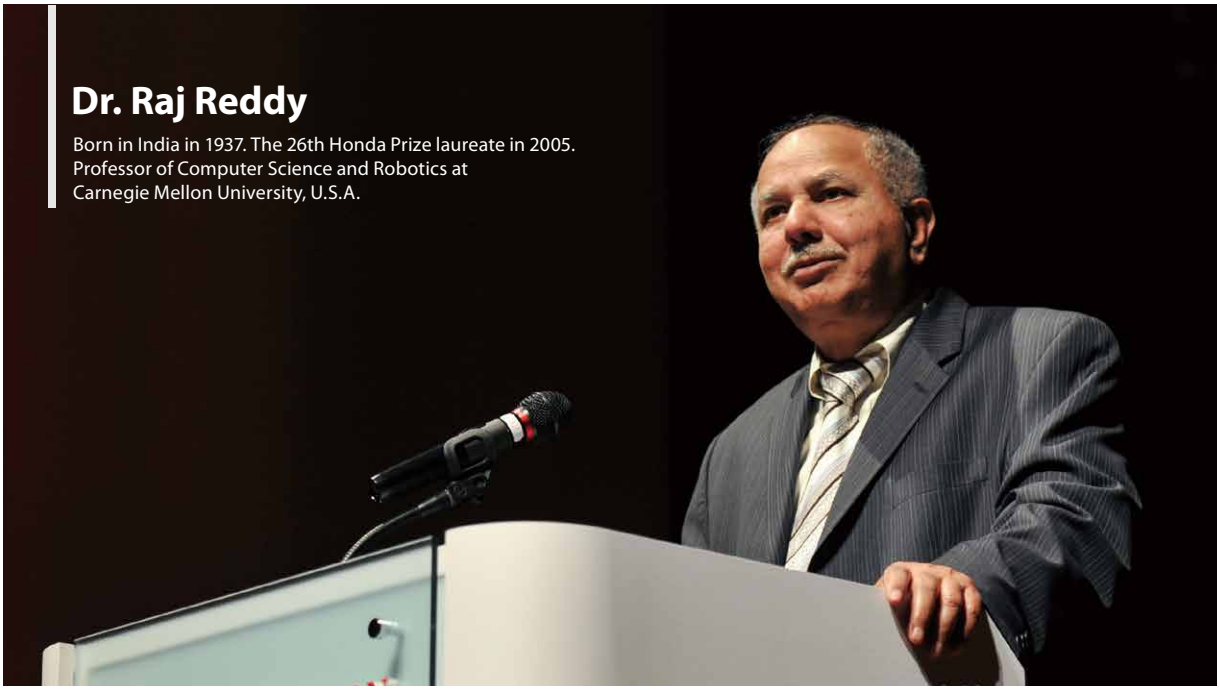

Dr. Raj Reddy

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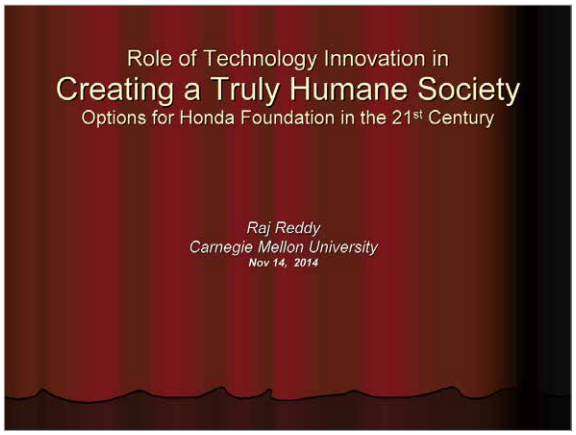
Professor of Computer Science and Robotics at
Carnegie Mellon University, U.S.A.

Innovation

Role of Technology Innovation in Creating a Truly Humane Society



Good afternoon. It's kind of late, but I'm sure we'll have an exciting panel discussion so I recommend that we get there quickly. It's an honor to be back here and participating in the Honda Memorial Symposium with distinguished laureates.

The theme of the symposium today is how to create a truly humane civilization and to review and explore solutions to the issues facing modern society from an eco-technology perspective.

Technological innovation in the past has largely been responsible for the improvement of quality of life. If you look back 200 years ago, women spent all day in the kitchen cooking. That's all they did. And men spent all day in the fields working in agriculture. Today, as Dr. Andersson pointed out, we probably spend less than 20% of our daily hours in work, and it's supposed to go to 7% in another 10 or 15 years. That's amazing.

Technological innovation comes in many forms, not all of which are eco-technologies, but the closest thing I can think of that is a good eco-technology, but it doesn't quite fit Mr. Soichiro Honda's definition, is the invention of the self-driving car, which is just around the corner.

I've been working on it since 1982 and we knew it could be done 15 years later. We went to General Motors and said we should start working together to do this, but they said, "No, no, no, no, we're already doing it. Don't bother us with your

ideas." Now it's 20 years later and they haven't done it yet, but we do have Google doing a self-driving car. I also hear that Honda is about to release their self-driving car and I hope it will be the best selling car.

Unfortunately, however, this particular technology doesn't quite satisfy the requirements of scalable, sustainable, and affordable. Only less than 15% of the population has cars today and out of those, who can afford a self-driving car? Maybe half, and even those may have to wait another 10 or 15 years for the cost to come down.

So that was affordability, and now the issue of sustainability. The pollution and various other problems we have with all cars, including fossil-fuel cars, makes it not quite the eco-technology that Mr. Soichiro Honda talked about.

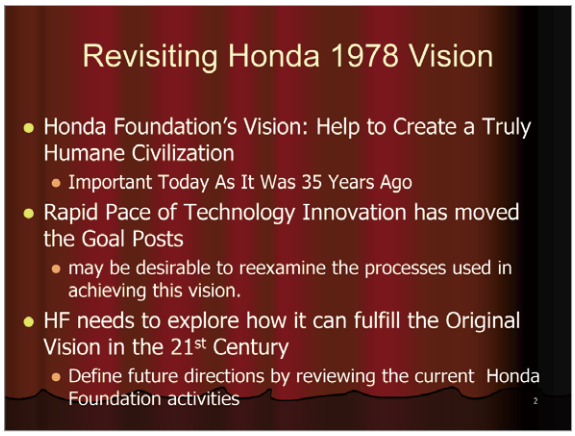
Today, I'd like to talk to you about one magical technology, or at least to me it seems like a magical technology, that I think would enable a truly humane society for every man, woman, and child on the planet, and for the issue of whether it is affordable by every man, woman, child, I'll try to convince you it is.

The topic is to create a "Guardian Angel" that is always with you, knows everything about you, and is able to give every person the right information in the right timeframe. The right information for you is not the same as the right information for me. It has to give the right information to the right people at the right time.

The assumption is if each of us knew the right information in the right timeframe, then we could make appropriate decisions to avoid catastrophes like Fukushima, the recent Mount Ontake explosion, and all kinds of things that are knowable. This whole presentation is to convince you that this can be done; that it is affordable for every man, woman, and child; and that it's a truly magical technology that fits Soichiro Honda's definition of eco-technology.

So let's re-visit the definition of Soichiro Honda's 1978 vision. The Honda Foundation vision of helping to create a truly humane civilization is as important today as it was 35 years ago. However, given the rapid change of pace in technology innovation over the last five decades, it may be desirable to re-examine the strategy and tactics needed for achieving this vision.

To create a truly humane society, we must aspire to create scalable, sustainable, and affordable solutions to provide for the basic needs of all the human beings on the planet. This is a very important sentence: a truly humane society will provide the basic needs of every person on the planet.



So what are the basic needs of every person on the planet? We all need water, we all need energy, we all need food, we all need shelter, we all need clothing, I can go on, but the point is that these are not negotiable. Everybody needs them. And insofar as we can work towards making sure that every human being has them, then we will come towards creating that humane society.

And it is not only material possessions. If you look at all the things I said, food, energy, water, transportation, various other things, they are all what I call atom-based, physical things. But there are also information solutions. When you get information, then there's a whole set of things, as Dr. Andersson

talked about, and an information economy. So we need to kind of look at the societal needs.

There's also a set of needs of every human being that are related to human rights. Every person has the right of freedom from slavery. Every person has the right of freedom from torture. I went through and got this list of 30 basic human rights that we are all entitled to that the United Nations collected in 1948.

This was a major philosophical discussion in the 18th and 19th centuries where it was decided there are certain inalienable rights for every human being or for the right to "life, liberty, and pursuit of happiness" as Jefferson and Madison wrote in the Declaration of Independence.

To me, I can live without many of them. Even if I don't have freedom of religion, I may be able to live with it, not completely but you know, religion turns out to be one of the biggest sources of friction in the whole world today when it should not be.

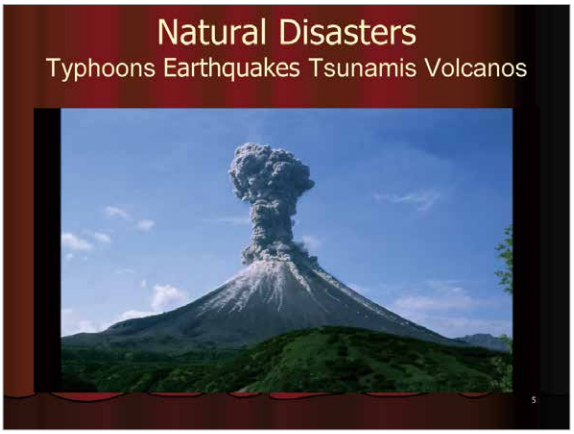
You take Muslims. There are two sects, Sunni and Shia, and they are constantly fighting and killing each other. It should not be the case, and it's not at all obvious to me what it is that we can do, but at least slavery and torture are things that we should try to eliminate or abolish.

There are 30 million people today that are under some kind of slavery-type conditions. There is an index called the Global Slavery Index, if you go to Google and type it you'll find it, and there are 30 million people under slavery conditions.

And, unfortunately, I'm ashamed to say, I come originally from India, although I've been in the US for 50 years, and India has the largest number of people under slavery. Modern slavery is not like the old slavery. It's defined as indentured labor, where because of debts or something you sell your son or daughter into another family and they're there for 20 years or 30 years or something. That is slavery.

There is also trafficking and all kinds of examples of this kind. They collect these things and it's amazing to me because I never saw slavery when I was growing up, but there are parts of the country, India's a big country with 1.3 billion people, which are tribal areas where there is no education, where they are still living like they were living 500 years ago, and indentured labor is an accepted form of settling disputes.

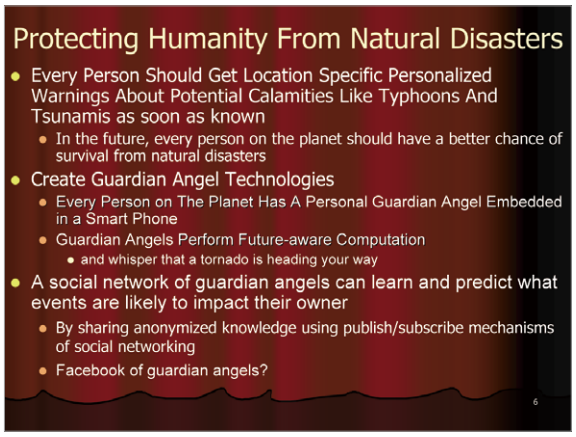
So the issue here is for us to understand and define what we mean by a humane society. I said a human society must provide the basic needs and it must provide the basic human rights, and the question is how can we, the Honda foundation, and all of us together, make that happen? What do we need to do to create a humane society?



To give you some examples of the kinds of things I'm talking about, typhoons and earthquakes and tsunamis and volcanoes seem to be the bane of Japan. All of these things you seem to have more than your share of. The most recent explosion of the volcano in Japan was so dramatic even those of us in the United States were surprised.

No part of the world is immune to death and devastation from natural disasters, but Japan does seem to have more than its fair share of calamities, and what I'm proposing is if we had Guardian Angel

technology that got the right information to the right people at the right time, 80% to 90% of the deaths could be avoided and that would be something that a humane society would do if it could do it using its technology.

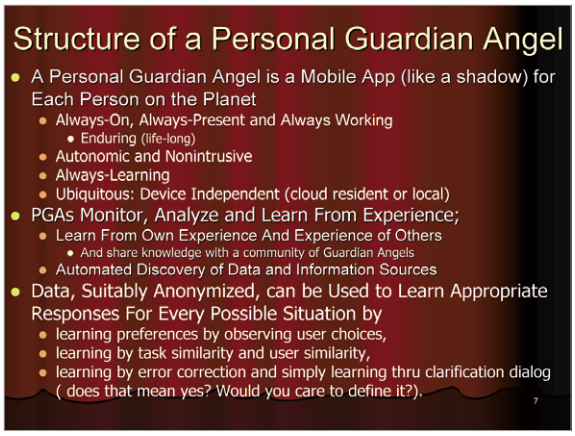


So the main thesis of this talk, then, is that mobile technology is sufficiently advanced today that it is now possible to envision that every person should get a location-specific personalized warning about potential calamities like typhoons and tsunamis as soon as they're known or knowable.

It assumes that we can create and deliver a personal Guardian Angel to every person on the planet embedded in a smartphone. Guardian Angels will perform future-aware computation and whisper personalized warnings in your ear about potential problems. It assumes that a Facebook or a social network of Guardian Angels are able to talk among themselves to discover what is known and what is knowable to all of them. If every person on the planet has a Guardian Angel and they're all on Facebook, they can discover.

The only problem is privacy. I may not want my Guardian Angel discussing all my details with everybody else, but it's a solvable problem, I assure you. We understand anonymization. We understand what kinds of things are already available. For example, the traffic system in Tokyo is controlled by cellphone location and traffic jams are identified and predicted by cellphone location, so this is doable.

So let me say a little bit more about what this personal Guardian Angel looks like. A personal Guardian Angel is a virtual avatar that is assigned to protect and guide a particular person. It knows everything about her, except possibly her deep dark secrets that she has not even whispered to anyone else in the world. If you've said something to somebody, the Guardian Angel knows it. If you haven't told it to anyone, then the Guardian Angel doesn't know it.



From a technical perspective, think of a personal Guardian Angel as an intelligent agent or an app on your cellphone that is on steroids. It would not reside on your cellphone, you don't tap it and activate it, but it's always on, 24/7, autonomic and nonintrusive, it never asks you anything, it never tells you anything, it doesn't bother you.

It's always learning and self-adapting to users' habits, preferences, and commands. A personal Guardian Angel is expected to monitor, analyze, and learn from experience, and then share the knowledge with a community of Guardian Angels. It is capable of automated discovery of data and information sources.

The personal Guardian Angel must communicate with human users. The publish/subscribe mechanism of social networks is adequate if you know what you want and from whom. Who do you ask when you don't know who to ask? What if you don't know who to "friend?"

These technical problems are solvable, so that a Guardian Angel in a Facebook-type environment can declare and decide what kinds of knowledge it needs and assign them as your "friend" so that you are actually getting all the knowledge not only that you have but that everybody else has that might

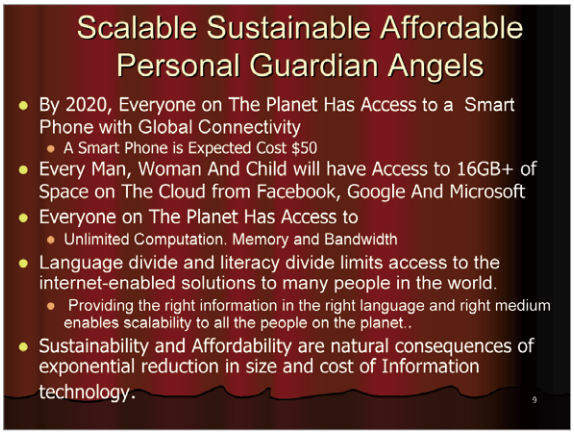
impact you in the future.

Data suitably anonymized can be used to learn appropriate responsible responses for every possible situation. The system non-intrusively learns. This is very important. It must never ask the owner anything. It must learn by itself, and we know how to do it, believe me. These days, for example, if you go to Google you can translate from Japanese to Chinese or Hindi or anything you want. It's not perfect but it's almost good enough for you to understand what the message is. It is derived by learning from data of literally billions of characters, trillions of characters collected from large numbers of people.

When you have that much data, what we call "big data," data analysis makes it possible to predict almost everything. When you're typing, you see predicted words. It is not just the word in the context you have just typed, it is using engrams, the four or five words before and after, so that it's able to predict in the context of what you just said what the most likely word is. Most of the time, even before you type, the word appears, so the predictive power in languages is amazing these days.

A humane civilization should be able to use the personal Guardian Angel to get the right information to the right people at the right time in the right language, and, importantly, in the right medium, because not everybody knows how to read. There are many illiterate people, and not everybody knows English. There are people that may need another language, so the right medium, text and multimedia, turns out to be very important.

At the right level of detail. All of these things are already possible to be done today. We call this the "Bill of Rights": the right information to the right people at the right time in the right language in the right medium at the right level of granularity. Six "Bills of Rights."



By 2020, a smartphone can be expected to cost about 20 dollars. That's about 10% of what it is today. That's what makes it scalable technology. Today, at the cost therein, like smartphones cost 200 or 300, almost half of the population of the world cannot afford one.

But by 2020, when the cost goes down by 90%, then it turns out that every man, woman, and child will have at least 16 GB, maybe more, of space on the cloud from Facebook, Google, and Microsoft, which is enough to host all of your personal information.

So the information is gathered from your daily activities, the Guardian Angel saves it there, it looks for patterns of behavior, and then it asks are there any other people among my friends having the same behavior, and given that behavior, what did they do? Then it predicts and tries to help you do the right thing in the right timeframe.

The language divide and literacy divide are problems that we just discussed. Sustainability and affordability are natural consequences of an exponential reduction in size and cost of information technology.

Now let's go to affordability because I just said "believe me everybody will be able to afford one." Have you thought about roads and water and systems that have infrastructure like sanitation that all of us have? Somehow society decided it is

necessary to have those fundamental things as a public good, so the government builds the roads and the airports and the sanitation systems and the water supply systems.

Conversely, there are certain things that society decided should be in the private sector, and one of them is the telephone. When the telephone came in they said it was very expensive technology and that it was only for rich people so they didn't need to make it a public good.

Guess what? Now every man, woman, and child needs a phone and needs to be able to communicate and cannot do without one, and therefore we just need to ask the question if it's good enough to build an electric grid and roads and other infrastructure, why is it not the case that governments and society are able to provide every person on the planet with a smartphone, especially if they only cost 20 dollars?

Just so that you know, 20 dollars is like less than 0.1% of the per capita income of most countries. If you take the United States and Japan, they are both at 40,000 to 50,000 dollars per year per capita income. One percent of that is 500 dollars; 0.1% is like 50 dollars. It's less than 0.1%. Why can't we, society, provide every person with a smartphone if it is as powerful as I'm claiming it can be made to be.

So the big elephant in the room is the cost enabling the Guardian Angels. We begin with the assumption that every person will have to have a free, sensor-intensive smartphone. It's very important. One of the major innovations that happened in computer science in the last 15 years is the arrival of the smartphone. Before then, all computers, all laptops, everything had computation but it did not have sensors and activators. Today, if you buy any of the smartphones, Samsung or anything else, they even have a barometer and all kinds of sensors.

There are about 10 different sensors, GPS being the most important one, location sensing, and it has cameras and microphones. Most of the systems didn't have that 15 years ago, and these are essential parts of building a Guardian Angel.

If you don't have sensing capability in your environment, all you have is computation and it's not useful for building a Guardian Angel. A Guardian Angel must constantly monitor what's happening to you. What you're doing, how you're doing it, and then it has to discover for itself how it can adapt the system.

In that kind of situation, a smartphone costing, let's even say 50 dollars because I want a sensor-intensive smartphone, I want every sensor in there, an iPhone 6 let's say, then it may be even 50 dollars. I'm saying there are lots of beneficiaries of this technology, the people that make the phone, the people that provide the service, the government, and the IT industry, and therefore each of them should pay one quarter of the cost so that everybody has a smartphone.

There are all kinds of distribution issues and other kinds of things, so I'll have to talk to my friend Dr. Andersson to come up with an economic model so that people don't game the thing, but it's possible. I can work out systems where everybody can have one and everybody can upgrade if they can afford better systems and so on.

If you don't believe what I have there on the slide, you will just have to trust me; otherwise, I'll be happy to answer questions, but I believe we can think of a way of doing it without any problems.

The other biggest problem is privacy. If a Guardian Angel on my body knows everything I'm doing, are there no secrets at all? Is there a way I can turn off the phone? It turns out you cannot. With this phone, even if you turn it off, if there is an emergency it will turn the phone back on and warn you.

Current phones don't have that capability because they are trying to save energy, but in the future, phones will turn on every five minutes or so and get warning systems without losing too much energy.

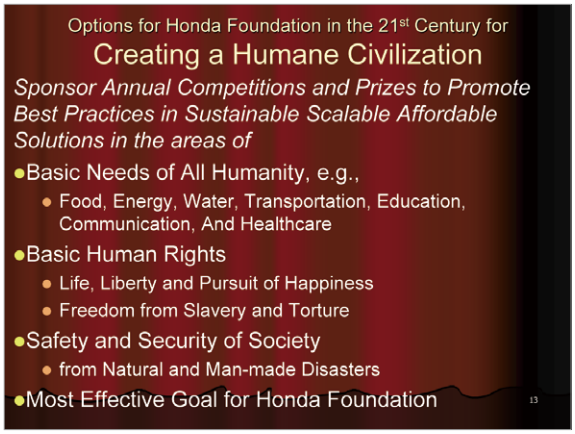
It turns out this is a new feature that will come. I've been talking to phone manufacturers and they shake their heads, but I'm sure it will happen. They did the same thing when I was saying we need cameras and microphones in every phone and every laptop, and it only took 10 years for that to happen.

So for privacy, a Guardian Angel knows the location information of the owner at all times so as to be able to provide alerts and detailed notifications. If needed, it must be able to turn on the smartphone. There is no privacy breach because every Guardian Angel only shares the information already known to other people. For example, the service provider already knows where you are, so location information is already there.

So, in conclusion, creation of Guardian Angel technologies for providing the right information to every man, woman, and child on the planet in a timely manner can eliminate surprises and reduce human suffering and misery. While the cost appears to be prohibitive, on a per capita basis it represents less than 0.1% of the gross work product.

A social network of Guardian Angels that can anticipate potential disasters and incidents in the life of each person on the planet and warn and take protective actions might be able to save 50% to 80% of all accidental deaths in the world. This would result in savings of over one million lives and hundreds of billions of dollars of damage to property.

This is certainly the most important research that we computer scientists could be doing in the 21st century, and it is certainly the most important research project that the Honda Foundation could be doing and undertaking to create a humane society.



Finally, here are some options for the Honda Foundation in the 21st century for creating a humane civilization. The foundation could sponsor annual competitions and prizes and promote best practices in creating and identifying sustainable, scalable, and affordable solutions in all areas of basic needs of human society such as food, energy, water, transportation, education, and so on; in protecting basic human rights, life, liberty, and the pursuit of happiness; in providing freedom from slavery and torture, and in ensuring safety and security from natural and man-made disasters.

In general, the Guardian Angel concepts, systems, and solutions can be applied not just to some natural calamities like the ones I showed you but for almost any problem you can think of that would affect each individual. It can be used to identify potential violations of basic rights and ensure the basic needs and rights of human beings and all

individuals in the humane society. Therefore, I submit that this is the most important technology towards creating a humane civilization.

Thank you.