Judy Estrin
”Sustainable Innovation”

JOYCE OSLAND: Good evening, I’m Joyce Osland from the College of Business and the Lucas Graduate School I’m also the Director of the Global Leadership Advancement Center, which is your host for the evening. I’m delighted to see so many of you here at our Global Leader Speaker Series. Our purpose is to advance and disseminate global leadership knowledge and best practices. And tonight’s speaker, Judy Estrin, is a perfect example of a global leader. She is a thought leader on innovation and someone who cares passionately about something, and that something is Silicon Valley and Innovation in our country. But, before introducing Judy, let me bring you up to date on some of the activities and opportunities we have for students in the area of global leadership and innovation. Iran Corporation study said that we would have a shortage of global leaders in all three sectors: in business, in non-profit, and in and in the public sector. And they encouraged Universities to add global leadership to their curriculum, which San Jose State really quickly did. We have courses at both undergraduate and graduate school in global leadership and we also have special programs that prepare students for global work. We have one program that’s for everyone on campus; it’s uh it’s called the Passport Program. It’s a co curricular program where you earn stamps for taking foreign languages, studying abroad, coming to lectures like this and writing up reflection pieces, and when you finish, when you meet the program requirements you get one of these nifty little passports that you can show to perspective employers that you have gone out of your way to prepare yourself for today’s work place. We also have a brand new interdisciplinary minor in global leadership and innovation, which is again for all students on campus. So students if you’re if you’re interested in things that we’re doing, when you leave we have a a table, our center’s called GLAC and you go to your left and you can pick up information on these programs and others. For those of you from the business community, if you’re interested in our programs for you uh please pick up a corporate guide on your way out the door.

I would like to uh introduce one of our recent MBA students, in fact one of our very best MBA students who used Judy’s book in a class and she went on to on to become one of our best, uh we call them global leadership lab associates and she actually contributed, among other things a wonderful interactive game that identified expert global leaders. So I’d like to introduce Diane Robertson, who works in stock accounting at Google.

DIANE ROBERTSON: Thank you Joyce. When I think of Judy Estrin, the first thing that comes to mind is ‘remember the post-it’. Why? Because in the post-it story, Estrin tells us that innovation can happen anywhere at

anytime, even when we least expect it. In the post-it story we had a lab that invited curiosity, a scientist who unintentionally found a special glue and someone who needed a sticky bookmark. Estrin reveals to us how the post-it turned into the daily necessity that we cannot live without, simply through accidental innovation. As a San Jose student, MBA student last year I read that and thought, 'Wow, I can be innovative and I'm not an engineer. I can look at my mistakes differently and even find a solution.' Before I read that story however, I thought 'how can I be innovative, my job involves paperwork, email, meetings, daily processes.' After I read this post-it story in Estrin's book and other inspiring antidotes that she wrote about, I thought to myself 'don't be afraid to take risks or make, even make mistakes'. So I thought about the post-it story to remind myself to do those things, to take risks, take things that go unplanned and move forward, even amongst the emails and the daily checklists, perhaps I can think of an innovative solution to help my colleagues learn more about stock at Google.

Judy Estrin identifies the following as the core values of Innovation: questioning, risk taking, openness, patience and trust. She even notes that freedom is a major contribution to innovation, she says and I quote, "people reach creative potential that is not restrained when we have freedom." So you know what, mistakes are okay, failures are welcome, examine and retest ideas and solutions, remember the post-its.

Judy Estrin is CEO of JLABS, which is previously known as Packet Design Management Company where she teaches, advises, and writes about innovation. Three times Fortune has listed her as one of the 50 most powerful women in business. She is also the former CTO of Cisco, a wealth of knowledge to leading Innovation companies and Universities Estrin is on the Board of Directors of the Walt Disney Corporation and FedEx Corporation. She is on the advisory counsel of Stanford's school of Engineering and the school's Bio-X initiative. She graduated from UCLA with a BS in math and computer science and later earned her masters in electrical engineering at Stanford. In fact, while she was in school she even worked on the research team on the development of TCP internet technology, which is the underlying technology of the internet as we know it today. She worked under Vint Serf who is now known as the father of the internet. In an interview with computer world a few years ago, Estrin said that her job was to do a lot of testing. So one of the things she did is she would comment at three a.m. and send hello messages to London. Judy is actually still a bay area local, in fact if you visit the dish in the Stanford foothills you may just find her taking a stroll, thinking about Innovation stories and talking to other people about how they can be innovative. So, students, faculty, alum and community members, it is my pleasure to introduce Judy Estrin.

Judy Estrin: Thank you, that was a great introduction and I don't need to

give my presentation anymore. I think uh, I, I think you've got the jist of it, but um, but I will. Um, thank you all for coming tonight and um I'm going to talk about various areas about innovation. I'm going to start off talking a little bit about the framework of understanding innovation that I introduced in my book, I'm going to talk a little bit about uh opportunities for Innovation that I see a head of us and then it, the the third part of the presentation is uh a little less uh positive, i.e. some of the challenges that I see uh us facing and what I think we can can do about it. So there's uh hopefully a little something for everybody here, the idea of this presentation is really to just provoke your thinking, getting you to think differently about innovation and the reason I call it sustainable innovation is this is actually a play on words. Um one is that it is not enough to have an idea, you really need ongoing sustainable innovation and what innovation means is having the capacity for change, being able to come up with something new. So as an individual, as a company, as a country, as the planet, the world, the uh the global economy, we need sustainable ongoing innovation. You can't just have peaks, or you can have bubbles, but bubbles uh burst as we uh as we now know, but the other reason I call it sustainable innovation is like other issues having to do with sustainability, and the environment, water, food, it's at risk and so we need to think about innovation and protecting innovation and the environment for innovation the same way we need to be thinking about other resources that are so critical to uh our country and again, the planet.

Um I won't go through my bio, uh I was just introduced, but I do like to uh give people a sense of where I come from so that you have a sense, a filter for my biases. And I think one uh one of the differences when I talk about innovation is that I actually throughout my life and my career have spanned different areas. I grew up in academia and did research at Stanford, some people are Navy brats or Army brats, I was an academic brat. My uh father started the computer science department at UCLA and my mother was one of the first biomedical engineers, she too uh had a PHD uh in electrical engineering. I spent most of my career, although Cisco is the name people often remember because it's a large company, that was really only two years out of my career and most of my career was spent as an entrepreneur um co-founding uh seven companies in total uh in the span of time and I also have had experience with the challenges of innovating at scale through uh Cisco as well as my board seats, currently Disney, but I also uh was on the board of FedEx um for 21 years just recently did not run for reelection as well as Sun and Rockwell. Um and then a couple of years ago I uh interviewed over a hundred people for my book so in in the uh thoughts that you hear today it is uh uh a synthesis of my experiences as well as the people that I talked to. And then you'll notice that uh mother is up there because I consider one of the most important uh innovations or or achievements of my life is my son who is now um a third year USC student

at USC and you notice it's in the entrepreneurial uh circle because you need a lot of the flexibility and entrepreneurial spirit to parent for those of you uh who already are, those of you haven't gotten there yet, you'll learn so. Um so the the the first thing I want to say and I think um this is uh sounds obvious, but way too many people think of innovation as a soundbite. Everybody, nobody will disagree with the fact that innovation is important and especially after the State of the Union Address, um we, even more people are talking about innovation. Um but, I think it's really important to get it uh and to really get it, as my son would say, as opposed to just using the term and um because it is innovation that is going to drive economic growth, it is innovation that um is going to help us solve any of the and many of the problems that we have from energy to the environment to uh security. Um but, innovation is also very personal: you innovate in your life, in your career and um a lot of the concepts I am going to talk about actually apply to us as individuals as well as um uh to to organizations or or to countries. And one of the reasons why innovation is so hard is that innovation is actually very messy, innovation is one of those things that is not predictable, you have to be willing to invest or make decisions or take risks without knowing the outcome, without knowing whether you're going to succeed. And in fact, uh most people don't like messiness, they like things nice and neat, they like to know how something is going to work. And the world, and I will get to this, has been increasingly driven by metrics. And as we become increasingly driven by metrics and putting things in their place, actually innovation tends to suffer.

So um, I like to talk about three different types of innovation because I think it's very important when talking about how to encourage innovation to realize that not all innovation is the same. And um I'll come back to this when I talk about where I think we have challenges because many people all say we don't have enough innovation, and especially in Silicon Valley I will get uh people standing up and saying how could you possibly say that, look at all of the innovation around us. Well, the reason is is there are different types of innovation and you need a balance of the different types of innovation. Um there are three main types, there is uh breakthrough or disruptive innovation which means coming up with something completely new, so the transistor or the discovery of DNA are examples of breakthrough innovation that usually comes from the result of uh basic research or basic science. The second is incremental innovation, uh incremental innovation is necessary to um essentially take breakthroughs and turn them in to something that's usable. Incremental innovation means improving on something that already exists and typically breakthrough innovations are not uh ready to solve a problem so you need incremental innovation to keep things going and to actually apply uh discoveries to to problems. Many people talk about disruptive or breakthrough innovation and incremental innovation, but there's actually a third type of innovation that often people

don't talk about and that's what I call orthogonal innovation and orthogonal innovation is comes from combining innovations that exists in a different way to solve a problem. And the reason I call it orthogonal is it really comes from looking at a problem differently, so those of you who remember your geometry if you turn your head at an angle, orthogonally, um then you're looking at problem differently, and probably the best example of orthogonal innovation is what Apple has done. When Apple came out with the Ipod it wasn't that it was uh sleek and uh a better MP3 player that made it such a success, it was that Apple decided to not make an MP3 player, but design a completely new music experience, and it was looking at the problem differently that made it so significant and created a new market. So, orthogonal innovation can also be very disruptive and create new markets, and in fact, only breakthrough innovation and orthogonal innovation can create new markets, incremental innovation is necessary, but not sufficient to create new markets it's about sustaining the market that you're in um and so we really need balances of all three of these. The other interesting thing is uh as a uh a overall the business community has become more and more customer driven and customer focused and as we collect more and more data about our customers, that allows us to become even more tuned in to what the customers are asking for; what the customers want. Now, that is phenomenal and I would never suggest to any CEO or any marketing executive that they do anything but respond to that customer data, but it's not enough because actually if you are customer driven you will end up with only incremental innovation because the customer knows what they want now, they know how they want things improved, the customer is not going to drive you to disruptive innovation or even orthogonal innovation cause they don't even know what's possible. So, it is very very important in an organization, if you want anything but incremental innovation to make sure that you have some set of people that are actually not driven by that customer data, and thinking outside of the uh results that the customer data give you.

So one of the things that um I wanted to do when I uh wrote the book was to try to get uh give people a feeling for uh what innovation was really all about other than just a new product or a new process and in fact, um what does it take to have innovation um thrive? And I came up with the metaphor of thinking back to uh my first science classes of um a biological ecosystem. Now, any of you who have taken business classes or in the business world, if I say ecosystem, you will generally think that an ecosystem is partnerships and and who are the vendors and who are the suppliers. I'm not talking about that type of ecosystem. I'm talking about a biological ecosystem, and the definition of a biological ecosystem your communities of organisms that interact with each other, exchange nutrients, and interact dynamically with the environment, so think of uh in the book I used actually the Stanford dish to as a description of an ecosystem, but

think of a tide pool; where there are different organisms that uh sometimes get along and sometimes don't, but exchange nutrients and interact with sunlight or air or water. Well, what is an innovation ecosystem? There are three communities in the innovation ecosystem required to sustain innovation, the first is the research community and the research community is about furthering understanding, uh that's really what research is all about. It is not about products, it's about furthering understanding and, as important, it's about training young minds. It's about training people who then go out in to the rest of the ecosystem and innovate in other communities or stay within the the research community. The second is the development community innovating in new products uh new services um and last is the application community, innovating in the way you apply those new products and new uh services. So two quick examples of how these communities interact, if you think about Google, Google started out in the research community – two very smart guys who came up with an interesting algorithm, they then created a company and were in the development uh community where they developed a search engine and that was a new type of product that was very successful, but actually the real breakthrough innovation, the real success of Google, comes from their innovations in the application community because it was the application of a new business model of how to tie advertising to search and the application of computing infrastructure that allows them to scale profitably that really allowed Google to take off. So that's an interesting example of one company that went between these and how these uh communities interact. Maybe a better example is think about the problems we have with renewable energy, with energy in the environment, so we need research to on, to to come up with new alternative energies, to understand uh better uh uh how to protect the environment, we need new products that are more energy efficient that use alternative forms of energy that uh uh are lower emissions, but we also need to change our behavior in how we behave in terms of the use of energy or our impact on the environment. So if we are going to solve that those sets of problems, you need balance, you need investment and activity in all three communities of the ecosystem and they need to communicate with each other. There there's a reason why each one touches each other, it isn't a line, it is not research, development, application, it is a cycle because once you develop something and apply it you often come up with unintended consequences that you then need to study and do research on to figure out how to uh then develop uh new products to to solve.

So I mentioned in a biological ecosystem that there are environmental factors, well in a in the uh the innovation ecosystem those environmental factors are leadership, funding, policy, education, and culture. And the most important two are leadership and culture because if you have the right leadership then in the end you most likely will end up with the right policies, education and funding. And culture is important, because in the end it's a

leader's role to set a vision, to help establish a culture, to take down the barriers to innovation and get out of the way because innovation in the end is bottom up and so culture is probably the most important thing uh in driving innovation. So, how do you create a culture to innovation? Um and when I was writing the book one of the things that my publisher kept coming back to me is um she kept wanting me to come up with rules, formulas, tell them how to do it and I kept going back and said, can't there is no rules, there are no uh you know ten uh key steps to succeed in innovation, but as I was interviewing people and as I thought back on the most innovative environments that I had been part of and that I had had exposure to I did realize that there was uh a set of common, what I call, values, implemented in different ways, but that that what I came to call the five core values that together and this is important, together and in balance create that capacity for change. Um so what are they? The first is questioning, I think that's probably the most obvious, everybody knows that uh curiosity, leads most often to innovation, but questioning is not just about curiosity it's not just about asking questions, but how you frame the question is really really important. If you ask a very narrow question you will get narrow innovation. If you ask a broad question then you will get a broader set of answers, so the framing of the question will very much lead to the type of response and the type of thinking uh that is done. The other thing that is very important is questioning the status quo, self assessment, um how many companies, how many countries, how many societies have we seen fail because they have stopped self assessing; they have decided they are successful and they stop questioning themselves so really honest self assessment is absolutely critical to change cause if you're not willing to question the status quo, then nothing will ever change. And last um you how you ask the question is not just about framing it, but the tone. And again, whether you're a teacher, a parent, a friend, or talking to yourself if you ask a question judgmentally, you shut down, you become defensive. If you ask inquisitively then people open up their minds so the the tone in how you ask the question is absolutely critical uh to innovation. The second core value is risk, what is risk? Risk is being vulnerable to failure, so being able to fail and learn from failure is an absolutely critical element in innovation because if you can't allow yourself to fail you won't try something new. And if you take aside failure of competence and failure of ethics, then failure actually should be celebrated in organizations, not punished. So how you treat failure and how you incorporate that, the reason Silicon Valley is Silicon Valley is because you can fail here and go on to just pick up and start the the the next day and that's probably the single most differentiating uh factor of our culture here than any place else in the world. So um uh learning from failure and allowing people to talk about failure means that you will find problems early as opposed to uh uh having them blow up and and going on too long. The third is openness, um openness to imagine, to collaborate, to serendipiry,

serendipity, um uh to sharing information which is uh same as collaboration, uh patience - this is probably the hardest for most of us. Uh patience in an innovator is tenacity, patience in a funder or a leader is patience, you have to give things time, you have to give people time. Um and last is trust because if you don't have trust in yourself or if you don't have some level of uh trust in your environment, some level of safety net, then you won't uh take risks. And that's why a safety net in in a country or in an organization uh is so important. Now interestingly enough, when kids are born they're born with all of these, maybe not patience, um as we educate our kids we actually educate and and as we parent our kids we uh drill this out of them. So inherently we should be doing the opposite and I'll come back to this at the end of the presentation. Now, you're not allowed to just pick one and say I'm patient and therefore I'm innovative, you really need to have the five values together in balance and let me just give you a uh uh a couple examples of this. If you have trust without questioning, that's blind faith and actually blind faith does not lead to innovation, blind faith leads to doing things the same way that you've been doing them uh before, but probably more uh important and apropo and unfortunate is that it was impatient people who took risks without asking questions and without the openness or transparency to even understand what they were taking risks on that led to the financial crisis. And then once things started failing we lost trust, we lost trust in in companies, banks lost trust in each other's balance sheet, we lost trust in the government and everything came to a halt. So, that is a perfect example of what happens when you don't have these core values in balance, and again not enough to just pick one. Risk alone, um if you come out of here saying risk, risk, risk, risk, that's what we need to do and you don't remember the others, again there is some risk which is gambling and not innovation.

So, let me talk a minute about leadership um and I think it's really important when you're leading an organization when you think about innovation that you think in three horizons and some companies can't do this for instance small start ups, but overall you want to at least acknowledge these three horizons and figure out how to organize around them in that you want to be thinking about continuous improvement on today's products or services, what is your next generation product or service, and then what are you doing to think about that disruptive innovation that's going to lead for the future. And how you manage these different areas is very different and those of you who um come from the business school or have taken business classes um one of the phrases that is very popular is you can't manage what you can't measure, well that is absolutely fine for the type of innovation which is about continuous improvement or next generation product, that things like six sigma are great for continuous improvement and uh ongoing businesses where you want tight metrics, you don't want surprises; you want to be able to ship things

without defects, but for that third horizon, and even sometimes that second horizon, those tight metrics will kill any hope you have of breaking out with new ideas because they will keep you confined to your current business. And so really what you want to have is little gardens that are nurtured, and I've gardened small organizations, that are loosely connected to the mainstream businesses that are managed differently and there you want to manage with a green thumb, which is more by instinct um and more with uh according to the core values that um I talked about before. And successful scaling, the place where things get hard, is how do you transplant these little seedlings from this garden whether it's in academia or in your organization to a mainstream business and that making those decisions of how and when to scale are really keys to success as you kind of move through uh this.

There are many many opportunities for innovation out there so as we look um at the state of innovation today, in this country, it is not for lack of opportunities. Um when I think about, and I often get asked what's next, what what should I be as a student, what areas should I be looking at as an entrepreneur, where might I do business, what should I invest in. And so um I just thought it would be worth while to talk briefly about what I see on the horizon as I look out over the next 2,5,10 years. Um and I think what we're going to see is a combination of creation of new industries as well as disruption of some of our current most um mature industries. Be it education, food, transportation, commerce, entertainment. And what will be the what will that disruption come from? If you think about innovation over the last couple of decades, it was driven by mostly IT and communications and uh biotech or biotech and medtech. As you look towards the future there will really be an expansion of the drivers that are driving these new opportunities from uh the need for energy and independence and uh sustainable environment. Health, up until now we've dealt with health care as uh the whole industry of health care has been about curing illness. I think as we look towards the future, the notion of health care is going to be expanded not just to look for cures to illness, but focusing on wellness, focusing more on changing the delivery of care so that we uh think about affordability, and also um focused on taking care of both uh the disabled and the elderly so there is a lot of uh uh expansion of the healthcare market that I think will drive new opportunities. Other applications, um that other areas that require touch and when I mean touch, I mean either direct touch i.e. you're cutting someone's hair or you're a doctor taking care of them or cultural touch, um uh an entertainer. And why do I single those out? Because anything requiring touch means jobs stay here as opposed to things that don't require touch, those are things that often, the jobs will are harder to keep here, in in the U.S. Technology will still be a driver, but the focus will be on uh affordability, mobility, and security. And most important is the most exciting things are going to happen at the intersection of all of these uh different technologies and I'll come back to this in a minute when I talk

about education, but bio, nano, IT, social sciences, design, all of these things are coming together in phenomenal ways, which means we have to change the way we are learning, and thinking, and educating, and uh I'll come back to that in a minute.

So, uh let me shift in to the the last part and take about some of the uh the challenges that um that face us and first I want to talk a little bit about culture and education because I think in fact, both our education system and our popular culture are are working against innovation. And not against incremental innovation, but against a sustainable healthy innovation ecosystem, and why do I say that? Well, um I am going to say something, especially in a room filled with uh students that is some what contrarian, which is um that we have these unbelievably powerful uh technology advances and tools, which uh I'm I'm as passionate about as the next one as as uh you were told in my uh introduction. I started my career building the internet both doing research and my first company was uh shipped the first commercial router so I'm as into the internet as anybody however, as is true with any really significant technological advance there is often and probably always some unknown and unintended consequences that come from those tools and um that you don't know until you start using them. And um in the case of where we are today I think there are significant unknown social consequences um of the use of of um or the absorption in the online world. So, everybody knows the phrase the world is flat and the world is flat and it is the uh the advances in technology that has made the world flat. Good thing? Yes for the most part, but I would contend that with that flatness it is also become more and more uneven, and what do I mean by uneven? I mean in terms of income. And whether it is within a company uh within a country, or between countries the the level of unevenness has led uh things like what is going on in Egypt today. So um and we are not Egypt, but we have a level of unevenness here in this country that is um is not far enough behind for I think any of us to feel comfortable. Um the other thing is that um I believe that we've become increasingly shallow, as the world has become flat our culture is becoming increasingly shallow. The encouragement to think deeply is not there, starting in middle school kids don't write papers they do powerpoint presentations and I will tell you having spent years giving presentations on innovation, before I read, wrote my book, the way you think about something when you are doing it in a powerpoint presentation is very different when you actually have to write something down, and not in 140 characters but in longer than that. So the depth of thought, our our technology tools are actually causing us to think less deeply rather than more, and this is going to seem counter intuitive, even though we all think we are more connected then ever before I would argue that we are are are have gone for quantity over quality; we have more connections, but the substantiveness of that connection is not what it used to be. And even if you have 100 text messages with some the same

person a day and you think you're incredibly connected, I would say that that would, is not a replacement for an hour face-to-face, or a half an hour face-to-face. So it it it, we are being lulled in to a sense of connectivity or even sometimes over connectivity, but we are losing the depth of many connections in um in the meantime and it's interesting, we uh have five senses right? But the Internet only exercises two of them, sight and sound. And so, if you spend more and more time in the online world and less and less time in the offline world, taste, touch, and smell are used less and less. And interestingly enough those are the three senses that are most connected to our emotions. And as we know from other cases that when you go gen, evolution causes your brain to evolve. So over generations if we continue to underutilize certain senses, we will underutilize certain parts of our brain and suddenly we wont even miss it. And I think for me, the touch, the human contact part here is is really really important. So I don't think we understand the consequences on um our emotional development because it's all too new. And why am I saying this? Am I suggesting that everybody to turn off their blackberries and shut down Facebook? No I have my blackberry, my Iphone, I you know I am as guilty as everybody. What do I do first thing in the morning, pick up my blackberry see what's there. But, what I am suggesting is that you want to have an awareness of these consequences and a balance, i.e. don't just live in the online world it is really important still to have that face-to-face connection with people; kids need to play and not just play in virtual worlds. And so you need awareness and balance, not denial or rejection. So the extremes would be to try to reject the technology which why would we want to do that, it's a wonderful tool or deny that it has any negative consequences and then we all kinda go like sheep and um you know uh end up talking in 140 characters. Really what you want again is awareness and to think about these consequences so that you have the right balance.

So when you look at education, um uh I I think that uh, I'm not going to spend a lot of time talking about how messed up our education system is in this country, I will say that when I say education system is messed up I'm primarily talking about K through 12. I think our higher education institutions of higher education in this country are in reasonably good shape. I think there are things we need to do to become more interdisciplinary and uh to to think about what 21st century talent requires, but um nothing like how broken K through 12 is and I think the only way we can fix K through 12 is through innovation i.e. trying lots of different things and figuring out what works and sharing best practices and then eventually trying to scale because I there is a lot of interesting things going on in this country, but we're not yet uh sharing that information as much as we should. So what are the key attributes, what do you need what are our goals and if you're a student what should you be doing to try to uh do to prepare yourself for uh the the market in the 21st century. The first is adaptability, um the ability to

learn and the capacity for change cause if there's one thing we know the world is changing faster and faster and faster and faster then it ever was. So there may be interesting jobs out there that look like the interesting jobs now, they can be completely different in ten years or in fifteen years; so that ability to change that ability to learn. Learning how to frame questions and not just answering them, we are way too test driven because unless you can actually learn how to frame questions, you can't uh really lead in innovation. Um playfulness, exploration, experimentation those are critical elements that again we've taken out of many of our environments. Uh I've talked about patience, collaboration and then very important that uh as we are teaching our kids that we get interdisciplinary thinking in very early – uh interdisciplinary across science and arts, across fields of science, across social sciences. Um very often people uh as you think about interdisciplinary and you think about uh, people talk about what they should take in school um there's been a term that was coined between uh the D school at Stanford and IDEO, I'm not sure who coined it initially about "T people" and what a T person is is someone who is a deep expert in one subject, but is has uh uh a broad knowledge of a lot of other subjects so that they can connect with other disciplines and so if you have lots of "T people" they can connect well with each other. So we need a combination of deep experts, some people just want to go deep in their field, of "T people" of actually double Ts, where you have deep expertise in multiple areas, and then there are some people who just will be great connectors – so they have very broad expertise and are the people that are connecting and bringing together uh people in in other disciplines. Now, um throughout all of this some of you will end up wanting to be entrepreneurial, not everybody is entrepreneurial and sometimes in the valley we think there's something wrong with me if I don't want to be an entrepreneur and the answer is no, there is some people that are very successful, very happy never thinking about entrepreneurship, but I am in the valley so I have to put a slide about entrepreneurship and when I think about entrepreneurship I actually don't think about just start-ups, I think entrepreneurship is actually a state of mind because you can be entrepreneurial in a VC funded start-up, you can be entrepreneurial in a big company, you can be entrepreneurial a non-profit. It is a way of thinking. So, what is it? Uh entrepreneurship, and actually if you look at academia, uh professors that run research labs, each one of those professors are entrepreneurs – they raise money, they have their pull their researches together. Um so what is entrepreneurship, it is a combination of passion, flexibility, intelligent risk, not just risk but taking intelligent risk, operating lean, identifying needs, this is often the the most hard part about entrepreneurship which is being able to identify needs and disruptive approaches to uh those needs, discipline and drive. So it takes a lot of different elements I think to really succeed as an entrepreneur and and one of the things that is a hallmark of entrepreneurship is this balance between a

very strong vision and persistence, yet being flexible enough and willing to assess because most often as an entrepreneur you think you're going to go straight to success, but it's really a random walk and you have to adapt along the way. Um the other thing that entrepreneurs, if you want to be an entrepreneur you must be comfort, comfortable with ambiguity because early on in a company you have no hard data to study so very often it is a lot of instinct and it is from your gut because you're creating something brand new that you can't look to something else to copy.
So let me finish by uh broadening out a little bit and uh just uh a couple of slides about our national ecosystem because um this uh someone asked did I wrote the book as a wake up call. Um, I wrote the book for two reasons, one was to educate people about innovation more broadly, but two was as a wake up call because I really do believe that um that we're in trouble. And um uh I don't need to tell anybody that the economy is in trouble. Between um the collapse of the housing market, the financial crisis, uh the economic recession, but you know that was just really the straw that broke the camels back and the fact of the matter is the reason it is so hard to get out where of this hole that we're in is because those um phenomenon were layered on a essentially a decade of zero job growth before it happened and decades of erosion of our innovation ecosystem in this country. And we essentially have what I call an innovation deficit, um we have been harvesting, so this is the answer to the person who says 'well wait a minute, look at all the start-ups, look at all of the innovative things going on.' Well ya, we have a lot of incremental innovation, we are harvesting seeds that were planted 10, 20, 30 years ago, but we're not planting the seeds at the rate that we need to i.e. investing in basic research and science that we need so that we will have innovation 10, 20, and 30 years from now, so again you need that sustainability. And um one of the problems is that um we kind of became hooked on what I call empty calories, um what do I mean by that? Well you know it's fine to eat a donut every once and a while um or have some cake and cookies and if you're a student um or of student age, you can wake up every morning and have a donut and at lunch get some cookies or crackers from the machine and have a coke and then at night go to Innout burger and you know, you'll be fine. You'll be fine for weeks, months, a couple of years, but you're really not getting much nutrients on that diet and so eventually you will have lead to obesity, diabetes, heart disease, some some illness because you're not getting enough nutrients. Um the key here is balance, so if you think about empty calories, what happened to the economy is that too much of our GDP growth was from empty calories i.e. the financial services market because empty calories in the business case are uh industries that don't create jobs and that don't uh contribute their fair share of revenue back to society and it isn't that you want none of it we have to have, the the the economy can't survive without banking, without Wall Street, without financial services, but when forty percent plus of your

GDP growth is coming from “empty calories”, you have a problem and that is what uh happening. We as a society, as a country began to value trading and flipping over building and creating and it is building and creating that creates a sustainable uh economy, it is flipping and trading that creates short-term growth and so that that short sidedness in the economy uh has stopped us, has hurt us in terms of jobs, but it has also has uh hurt us in terms of the level of problems that uh we need to solve. Um there’s no quick fix and anybody; you know it’s interesting how everybody is always looking to now to to uh to everybody else to solve the problem. When I came out with the book and I did about a year of almost constant presenting to all sorts of different groups and people at the end of the year a lot of people said to me ‘what did you learn from the people that you talked to?’ and I said well you know it was interesting and actually my book launched the week of the financial crisis in 2008, it was uh a little bit of hard timing to get uh get on the TV shows, but it was um an interesting time to then be going around the country and talking to different groups. And there was one thing that was consistent with every group I talked to, academics, venture capitalists, entrepreneurs, big companies, little companies – everybody acknowledged that we had a problem and everybody wanted to blame somebody else. So everybody looked you know, uh CEO says it’s Wall Street, VC says its the entrepreneurs, the limited partners, entrepreneurs say it’s the VCs, it’s the government, it’s not the government, you know so everybody wants to point to somebody else and the fact of the matter is we all got ourselves into this and it’s going to take all of us to uh to get ourselves out. So there is no quick fix, uh we have to start planting more seeds for the future um so that over the long-term, and what’s happening now is people don’t want to focus on planting seeds because they say we can’t focus on planting seeds until we get the unemployment problem solved, well you know what, the unemployment problem is only going to slowly correct itself based on consumer demand and large companies. What’s going to get us out of this is new industries and new companies and that comes from planting those seeds. Um the government um can’t solve this problem, but we’ve got to stop thinking about the government as the problem because when it comes to things like investing in basic research, that’s not something that that companies do that’s for the good of society and we need the government uh to be working with the non-profits to do that. When you look at things like smart regulation, actually smart regulation helps innovation, why? Because if you don’t have any oversight on new products, is a doctor going to try a new drug, is somebody going to be willing to get into a new type of car, if they don’t have any confidence that there are some regulations, are you going to try new food? Uh if you want people to adopt new things actually smart regulation can help that, but smart is the word here because too often with our regulation comes unintended consequences that create barriers to innovation. Um we need

new models of collaboration um between the public and private sector and again as I said the significant growth surges are going to come from innovation, they are not going to come from our existing markets. Um and one of the things that we need to do is to break out of our silos, right now there are so many silos I talked about interdisciplinary uh across fields, but it's not just across fields, we have silos when it comes to our communities of the ecosystem between research, development and application, you need to break those silos. Um we have silos between generations, very often you hear about companies saying okay I need to change my culture to adapt to all of the young people coming in, well really what companies should do is get the best of the baby boomers and the millennials and I don't just say that because I'm a baby boomer, but really what you want is to break down those silos because you have something to learn when the two work together and most importantly is breakdown the silos that are uh uh of ideologies because those uh those the the level of uh partisanship and uh extremism uh in various ideologies really uh makes it so that we can't solve any of the problems that face us. Interestingly enough, if you think about the web there's a trend towards increase personalization and that actually is a good thing, it it helps you navigate system, it it is a good thing for advertisers because it helps them know you and know how to sell to you, but over personalization can actually reinforce these silos because suddenly you're only exposed to the things that you know you want to be exposed to and where are the surprises? Where do you learn about something that you didn't know that you might be interested in? So again, this is just one of those unintended consequences to kind of be aware of over personalization or only going to those websites that reinforce your view and your interests and every once and a while look at some new things and open up to some to some new ideas.

And the last thing I just want to say is that um the biggest thing that works against change, which is what innovation is all about, is fear and fear can come in many many forms. It might be fear of criticism, of it might be uh your safety, it might be fear that you're going to lose funding, it might be fear of litigation, but no matter what form it comes in fear um discourages innovation and a lot of people when they think about leadership styles often think that crisis's and intimidation is the best way to get people to innovate, to think differently and um that fear, uh a common saying is that necessity is the mother of invention, well but you need to be careful about how that's done because really great leadership does use necessity or threats to motivate innovation, but not directly. What you really want to do is take a threat or take and and turn it into a challenge and use that to rally people to get involved, not to scare them, not to intimidate them because that's what turns on the leadership or the innovative thinking in people's mind and you want to take threats, turn them into challenges and turn them into opportunities for innovation. When you just take threats and turn them into

fear again, that uh takes us in the old in the other direction. And in fact, not and not all of you will be leaders of other people, but each one of you will be a leader in your own family, in your own community of yourself and so I'll just leave you with the question that 'what can you do?' What can you do to influence your own sphere of innovation or on a broader sense the innovation in the country or uh more globally on the planet? Thank you.