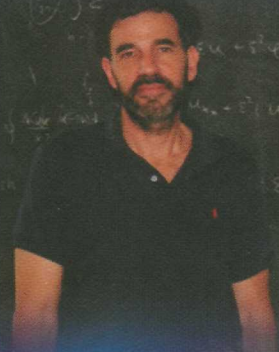


# Colorado Engineer

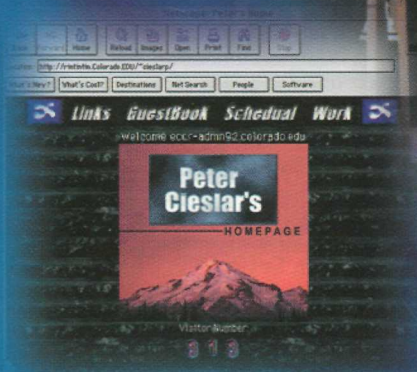


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# Renaissance Man

## Interview with Ken Goldberg

by Ted Zeiger

that those really helped me later. Having an academic position, you spend a lot of time and a big part of your life talking to people. If you've read books and seen films you can talk to people about just pretty much anything. And



Dr. Ken Goldberg of U.C. Berkeley

this panel [Conference of World Affairs] is a good example of that. I was totally winging it. But that's a product of years of going into classes where I didn't know what I was really doing but I just threw myself and tried to sort of feel comfortable doing it.

**CEM:** Did you always want to teach?

**KG:** No, I thought I was going to be a multimillionaire. I had this idea that I really wanted to be a business man. I never stopped to question what my motives were, but I knew that I wanted to make enough money to be comfortable. But the problem was that I didn't

like business classes. I didn't like the materialistic world or the type of people I found in that racket. Well things gradually evolved after I took a year off and went to Scotland after my junior year. I ended hanging out there with philosophers. They converted me and convinced me, after a year, that I should be something more academic. I should use my head instead of just making money, thus I took that route. I think everyone has to choose for themselves, you don't have to listen to high school guidance counselors. Its usually in graduate school that you say il like this." That's when you work really close with professors and see how they're working and you can say il want to do this."

**CEM:** Of the projects you've worked on, what was your favorite?

**KG:** Well, it's hard to say. I'm reminded of my uncle who died few years ago, he was an artist. I went to visit him and he had all his paintings sitting around in the living room and I said iWhat's your favorite?" He replied iDo you think I could tell you with all of them listening." I liked all the projects, in fact, sometimes I find that I see something in an older project that I hadn't seen at the time. So I see how it led to a new project. It's hard to rank them in any particular way. The one thing I feel proud of is I invented this robot gripper, called Kinematically Yielding Gripper, which we got two patents for after graduate school. It's nice because I did my thesis around it, the theoretical analysis of the mechanics of the gripper. I had hardware and software together.

**CEM:** What sort of projects are you working on today?

**KG:** We are getting into some very small stuff. We're looking at things made of silicon. Have you heard of micro-electrical mechanical systems?

**CEM:** You mean like micro-motors?

**KG:** I'm very interested in this. The first time I saw them, they caught my eye and I said "This makes perfect sense." And the technology has devel-



oped enormously in the last ten, twenty years. To the point where there's big industry out there where people are developing it. My background has been in assembly and assembly lines. I started to think of the problem of how do you assemble these small things. If you have a motor, a lot of times you make everything out of one piece of silicon just by electric stages. But now we're talking about more complex things where there's a motor, a crystal, a mirror, a laser diode, and an oscillator. All these things have to be fabricated separately and then put together. Like these LCD displays that they're talking about, that are all MEMS or mirrors, but they still require assembling the electronics onto them. And at this point it is fascinating because nobody knows quite how to do it. We've been looking at some new ideas of how to apply some of the things we've developed for the macro-scale to the micro-scale. Things are very different. For example, with the macro-scale one of the hardest things to do is pick something up without dropping it and with the micro-scale one of the hardest things to do is let it go. In the micro-scale things are electrostatic and stick to the hand. It involves a whole new thinking about manipulation and that's been an area my students and I have just started in the last year and we are getting increasingly excited about.

We don't think of it as any substitute for a real garden, it is meant to make people stop and think about all this "internet surfing" and say, "wait a minute, I gotta smell the roses."

**CEM:** Of your projects, which do you think could be applied to industry today?

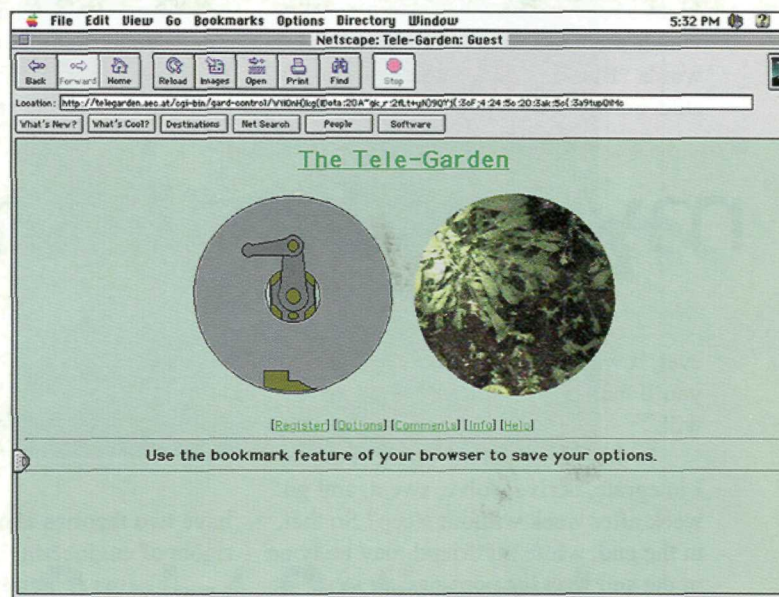
**KG:** We've been doing some software projects for General Motors. One thing we are getting involved in now is simulations of assembly lines, so we have been working with Hewlett Packard. They have some really nice problems where they are trying to assemble small

parts. But now they want to gear up and do this very fast. They have a very complex mechanism that they want to sell commercially, so they need to turn them out in high volume. In the short term, we've found that by simulating these processes we have been able to get vast improvements in their throughput and efficiency. This is a new area because rather than modeling the low level geometry of a gripper we actually model the flow of parts. And that's more of what an industrial engineer does.

**CEM:** You've gotten a lot of publicity regarding your Tele-Garden. What was your inspiration for getting involved in that project?

**KG:** We had a project before that called the Mercury Project which is where you look around a sand box. We had a bunch of technical ideas, we wanted to improve on the technology. We wanted to use a faster arm and a color camera and we had all these ideas for improving the interface. But I also thought that instead of doing another sand box we wanted to do something else. I have some friends who are artists in LA, and I brought them into the lab one night. We got a six pack of beer and we sat around and just talked about things. I was trying to get some ideas stirred up. And in that evening one of the guys there was an artist named Joey Santa-Armana and he at one point in the conversation said what about doing a garden. There were a number of other ideas that evening but I went home that night and over the next three months the idea of the garden kept bubbling up. I really thought this is it, there was something about it. It wasn't until we actually started building it that it started to occur to me that it was a evolutionary metaphor beyond the desert [Mercury Project] to the garden stage. I think more people identified with the garden at a fundamental level. They don't get upset with a garden, it's not going to

bite you. The Internet and the Web all seem scary, not to us, but to someone who doesn't deal with technology. But you give them a garden, and that's something they could know. What's interesting to us is that we have listings in all kinds of gardener newsletters and magazines. Gardeners think of it as a



The Tele-Garden web page

real kick. We don't think of it as any substitute for a real garden, it is meant to make people stop and think about all this "Internet Surfing" and say "wait a minute, I gotta smell the roses."

**CEM:** So this wasn't a prototype for an automated agriculture type garden?

**KG:** No, but we've had that confusion a lot. Many people have seen it like that and criticized it for having a biosphere mentality, as if we were trying to find the future of gardening. Nothing could be further from the truth, we do not want people to think this is a substitute. If anything we want people to get away from computers once in a while. Ultimately the purpose is to underline the difference between this world [the Internet] and the natural world, and to say "Hey, we need the natural world."

Ted is a senior in Mechanical Engineering. He enjoys rollerblading.