Dan Jurafsky, an associate professor of linguistics at Stanford University, made the newspapers himself when he was among the 2002 winners of the MacArthur Fellowship, commonly known as the “genius grant.” The prestigious fellowship is awarded to individuals across the sciences, arts and public policy whose work has demonstrated singular vision and makes a unique contribution to their field.

The MacArthur Foundation selection committee cited Jurafsky for his work establishing “the foundations for developing systems that use natural language to interact with people.” Jurafsky’s research is in the field of computational linguistics and focuses on using computers to model how people use language and on getting computers to understand humans. He has worked to identify patterns in syntax that provide clues to the underlying semantic structure of communication.

The MacArthur Foundation was not the only organization to acknowledge his work. Jurafsky, 40, has already received a Career Award from the National Science Foundation and published a highly respected textbook on the subject of computational linguistics.

No one, Jurafsky included, could have predicted this level of achievement in the early 1990s, when he found himself mired in the post-doc blues after earning his PhD in computer science from UC-Berkeley. With a provocative, but admittedly “messy,” dissertation behind him, Jurafsky saw his field suddenly and dramatically take a detour.

"The early 90s were discouraging,” Jurafsky recalls. “All of a sudden everything I knew went out the window. Natural language processing changed dramatically. Before that it was based on logic, and after that it became based on statistics. So I had all the statistics and probability theory to learn.”

One option was to take a break and teach. Jurafsky had been thinking about Hong Kong. Jerry Feldman, then ICSI director, had other ideas. He saw a keen intellect and a great breadth of scientific work in the thesis.

"I was a reader on his thesis committee and he had some remarkably good things in it,” says Feldman. “I was very impressed. It was deep in both CS and psycholinguistics. He understood it as well as anyone.”

Continued on Page 5
It's New Year's Day as I write this column; an artificial boundary, to be sure, but nonetheless a good time to reflect on the past and coming year. I was struck recently by the good spirit that is evident in small things around here – as in the fun and games that the financial administrators put together for this year's Winterfest party, the foosball games that I've seen the students and visitors play in the hall, the weekly movie night, and the Kapla blocks in our reception area that the Networking folks use so much (and which the Speech researchers seem to periodically knock down). As is often observed in basic research environments, great science can be accompanied by seemingly unrelated fun. I thought about the spirit of ICSI that results from these two parts as I put together this blend of newsworthy items and reminiscences.

ICSI's character changes slowly, despite the more rapid shifts in visitor population and specific topics of study. The study of Information Society (covered by the new BCIS group) expanded to a range of projects in 2003. As noted in previous newsletters, this group's work marks a radical change for ICSI, particularly as its focus is at least as much societal as it is technological. However, as in previous years, most shifts in 2003 were within groups that already existed. For instance, in the last few months, the Networking group began a new project in cybersecurity, and the Speech group began working on speaker identification. And in 2003, the Speech group also ramped up to a major effort in the DARPA-funded Effective Affordable Reusuble Speech (EARS) program, the focus project in this issue of the Gazette. We will also feature an interview with Dan Jurafsky, who had a key role in earlier successes for the ICSI spoken language effort. I want to say a few words about Dan, but thinking about his effect on us started me wandering a little bit further down ICSI's memory lane ...

Speech processing (and particularly recognition) has been a major research area at ICSI since its official inauguration in 1988. The catalyst for this was Hervé Bourlard's visit that year. At the time, my own focus was on the realization of connectionist systems for pattern recognition, and we needed to choose an application area. I had worked in speech as well, primarily in speech analysis and synthesis. Hervé was filled with enthusiasm, both for the topic of statistically based speech recognition, and for a set of new ideas about using connectionist systems to generate probabilities that could be used in recognition systems. He and I began working together on this topic, and ultimately developed a number of related approaches. Just as importantly, we developed a strong working relationship that was the core of the partnership that exists today between ICSI and the Institute he now directs (IDIAP in Switzerland).

A few years after Hervé's initial visit, a key contributor to the development of speech science and technology at ICSI was Dan Jurafsky, the subject of our Alumnus Interview in this issue. Dan was a primary designer (with Chuck Wooters and Gary Tajchman) for the Berkeley Restaurant Project (BeRP), a mixed initiative spoken query system allowing users to find restaurants in Berkeley. At the time he was a postdoctoral Fellow at ICSI, but soon moved on to a faculty position at the University of Colorado. There he developed what many consider to be the best textbook for natural language processing. Last year, as noted in this Gazette, he received the MacArthur Foundation award (the so-called “Genius Grant”). He has continued to work with ICSI researchers since his move to Colorado. This month he joined the Stanford faculty, and we are looking forward to many more collaborations with him.

In other ICSI news, this year we are welcoming several new members to our Board. Scott Shenker, our Networking group leader and corporation Vice President, has agreed to be a Trustee. Additionally, Shankar Sastry, current Chairman of the EECS Department of UC Berkeley, will join us, and has already had a number of useful discussions with me about improving the campus-ICSI relationship. Finally, we are very pleased to have recruited David Nagel to our Board. Dave was formerly the President of AT&T Labs and CTO of AT&T, and currently is the CEO of PalmSource, Inc., the software spin-off of Palm. He funded our networking work while at AT&T, and also has a strong understanding of human-machine interface research, having led human factors research at NASA in an earlier role. In addition to these new members, Trustee Cliff Higgerson of ComVentures has agreed to be the new Chairman of our Board.
**news briefs**

**Hayden George Hodson** was born at 4:22 p.m. on Friday, October 24, 2003 weighing in at 8.1 pounds and 21 inches long. The proud parents are ICSI’s XORP researcher, Orion Hodson and his wife, Heather. Hayden is the couple’s first child.

Researchers in the Speech Group as well as BCIS will be participating in a UC Berkeley project called “Information and Communication Technology for Billions” which aims to provide affordable computer technology for third world countries.

**Michael Ellis** has joined the ICSI SysAdmin Staff as its new Manager. **David Johnson** will be moving to a new role leading infrastructure projects. **Scott McComas** also started as a full time SysAdmin.

**Jaci Considine** joined the Admin staff as the new person at ICSI’s front desk.

**Jenny Nguyen** joined the Accounting department and will be taking the place of **Mary Penilla** while Mary is out on maternity leave.

ICSI has several new permanent staff researchers. **Nikki Mirghafori**, a former Ph.D. student at ICSI, has returned to work with the Speech Group. **John Moody** is working with the Algorithms Group. Finally, **Mark Allman** is working with the ICSI Center for Internet Research (ICIR). We look forward to the contributions our new researchers will bring to ICSI’s research projects.

ICSI’s FRAMENET project was featured in the September 2003 issue of the International Journal of Lexicography (Volume 16, Number 3). The publication, focused entirely on FrameNet, features several articles by current and former ICSI researchers.

ICSI alumni **Sven Behnke** and **Klaus Wehrle** were two of seven recipients of the Action Plan in Computer Science award from the DFG, a German national research foundation. The grants will facilitate the foundation of a junior research group in Germany.

ICSI welcomed three new board members in 2004. **Scott Shenker**, **David Nagel** and **Shankar Sastry** all started their service to our board in January. **Cliff Higginson** has taken over Chairman of the Board duties as well, as our former Chairman **Elwyn Berlekamp** has retired.

ICSI hosted an Open House on February 27 that included posters, demonstrations presented by ICSI Research Staff, a brief overview of the Institute by director Nelson Morgan, and a lecture by Vern Paxson called “The Threat of Internet Worms”.

**Richard Karp**, leader of ICSI’s Algorithms Group, has been selected to receive the 2004 Benjamin Franklin Medal in Computer and Cognitive Science for his contributions to the understanding of computational complexity.

**Scott Shenker**, leader of ICSI’s Networking Group, has been selected as an ACM Fellow for his achievements in the field of information technology.

Speech Researcher in the news: **Liz Shriberg**, a senior researcher in ICSI’s Speech Group

Continued on Page 6
Effective Affordable Reusable Speech-to-text: EARS

In 2002, DARPA initiated a major speech research program called EARS (Effective Affordable Reusable Speech-to-text), which aims to radically improve speech recognition by machine using Novel Approaches (new and innovative methods) and Rich Transcription (improving word error rates and increasing readability and value to downstream processing through automatic punctuation and other forms of markup). Researchers at ICSI are working on both major components of the program.

Novel Approaches

The goal of the Novel Approaches aspect of EARS is to examine closely the standard methods currently used for speech recognition, and to try to improve upon them by figuring out which aspects of the technology are limiting its improvement, and to develop new methods to either replace the old ways or use in conjunction with them.

ICSI, in conjunction with SRI, University of Washington, Columbia University, and IDIAP, is taking a perception-based approach to solving this problem. Current speech recognition systems analyze very short (10-25ms) chunks of sound, computing some simple function of a short-term spectrum. From this analysis statistical models generate probabilities for what speech unit is being uttered at that time. Sequences of these probabilities are combined according to possible hypotheses of what might have been said, along with probabilities of each word given a hypothesized word history. All together these probabilities are used to determine the most likely word sequence.

While this is a logical approach that has led to many successes, it is also limited. In particular, the short-term spectrum is extremely fragile with respect to sources of variability that have nothing to do with the linguistic message. ICSI is working to transcend this limitation by looking at the problem from the point of view of how humans recognize speech. The window of time that current recognizers use for analysis is much shorter than anything that the human ear can hear and make sense of. Humans recognize entire syllables and even words all at once; therefore, a key part of the ICSI Novel Approach is to use longer chunks of time that correspond to about 1-2 syllables (about half a second). More generally, the human auditory system appears to compute a much broader range of functions of the input signal over time and frequency than is done in short-term spectral analysis, and this is likely to contribute to the robustness that is observed in human recognition of speech. In particular, ICSI is developing methods inspired by the apparent capabilities of the human system to take advantage of temporal properties of speech, which are quite complementary to spectral measures. This is primarily being done in the context of improving the recognition of large vocabulary conversational speech, which is one of the main goals of EARS.

Rich Transcription

The Rich Transcription EARS project aims to make transcripts generated by automatic speech recognition systems readable and provide extra value to both human and machine users of the data. There are several specific areas for improvement. At the end of three years, word error rates (WER) for broadcast news are targeted to improve from around 20% to 5%, and after five years, the WER for telephone speech is targeted to improve from around 30% to 5%. Additionally, the rate of transcription needs to be improved so that it works in real time on 1 cpu (a standard personal computer).

Simply having an accurate string of words does not make a transcript readable, however. Some form of markup is needed to mark pauses, disfluencies, punctuation, who is speaking, etc. All of the non-word features providing auxiliary information to make the transcript readable are called Metadata. ICSI’s participation in the SRI-led Rich Transcription project, a collaboration between SRI, ICSI, and the University of Washington, is focusing primarily on metadata extraction, though it includes speech transcription work as well. Metadata extraction includes cues for speaker segmentation and tracking, disfluency and sentence boundary detection, and incorporation of other prosodic cues.

Rich Transcription has the added challenge of adapting the technology for use in other languages, including Mandarin and Arabic.
featured alum: Dan Jurafsky

Continued from Page 1

The invitation to join ICSI was a turning point. “Jerry said, ‘Take a postdoc at ICSI for a year, and you can teach in Hong Kong next year,’” Jurafsky remembers. The postdoc lasted for three years and was pivotal for Jurafsky and his field of study: “My time at ICSI was very important. This was the key intellectual learning experience for me. Half of what I need to know in my field I learned at ICSI doing my postdoc.” Nelson Morgan noted, “while doing his postdoc at ICSI, Dan was a key contributor in the Berkeley Restaurant Project (called “BeRP”), which produced a spoken dialog system for getting restaurant information in the city of Berkeley. Dan impressed us all immensely despite his modesty.”

Jurafsky has been working at the intersection of computer science and linguistics for some time. “My first computer actually was a programmable calculator my math teacher had when I was in 7th grade. The first real computer I worked on was a PDP-8. DEC was giving away computers to high schools and everyone worked on them. They used paper-tape.”

While he was in high school a friend of his was interested in linguistics and Dan caught the bug, reading all the books on the subject he could find. He also studied languages, including German and French in high school, and Hebrew as part of his religious training.

With feet firmly implanted in both camps, Jurafsky has some insights into the different approaches favored by linguists and computer scientists.

“Linguists like to work away with the data. Which is good. They try to get at the really deep answer about what’s really going on. But sometimes it’s hard to see the forest for the trees. They get the exact answer to a small problem, rather than finding an approximate answer to a larger problem.”

“Computer scientists never want to look at the data. ‘I’m going to build an algorithm and if it doesn’t work, I’m going to tweak it.’ But the math is good. They understand the probabilistic model.”

MacArthur Fellowship notwithstanding, Jurafsky faces the same challenges as any college teacher. “I taught my first freshman course this semester and it was intense, dealing with teenagers. They are focused on fairness. ‘If it’s not fair, it’s your fault. Why didn’t you tell us that question was going to be on the test?’ I wasn’t prepared for that.”

Not every student is destined for a stellar science career and dealing with that realization can be difficult. “The worst part of the job is dealing with students who aren’t doing well. Grad students having trouble with their dissertation, undergrads not getting it. They’re doing something they’re bad at. They don’t like what they’re doing.”

But the flip side, nurturing understanding in promising minds, can make up for those difficult times. “The best part of the job is also working with students. They come to you and say, ‘Remember that problem I was having?’ and they show you how they solved it. And you’re happy and they’re happy because something has dawned.”

Universities across the world are full of talented teachers and researchers. What makes Jurafsky different? Feldman sees three things. First, there is the breadth of his work, which eclipses academic boundaries. Next, there is a seriousness to his science. Instead of just finding a solution, Jurafsky goes after a deeper explanation.

“… he’s extremely smart,” said Feldman. “As a postdoc, he took the lead in the language and speech group, without any background in speech.”
visiting scholars

Since its inception, ICSI has had a strong international program, consisting primarily of ties with specific countries.

Current formal agreements continue with Finland, Germany, Spain, and Switzerland.

From Finland
Andrei Gurtov (Networking)
Pekka Himanen (BCIS)
Konsta Koppinen (Speech)
Vesa-Matti Lahti (BCIS)
Kira Lopperi (Haas)
Maarit Makinen (BCIS)
Tuomo Pirinen (Speech)
Jusso Rantala (Haas)

From Germany
Sven Behnke (Speech)
Jens Gramm (Algorithms)
Till Nierhoff (Algorithms)
Robin Sommer (Networking)
Till Tantau (Algorithms)
Oliver Wendt (Algorithms)
Britta Wrede (Speech)

From Spain
Javier Cardona (Networking)
Chema Gonzalez (Networking)
Javier Macias (Speech)
Sra Palazuelos (FrameNet)

From Switzerland
Sebastien Coquoz (Speech)
Vincenzo Pallotta (FrameNet)

In addition, we often have visitors associated with specific research and projects.

From France
Brigitte Bigi (Speech)

From Israel
Robi Krauthgamer (Algorithms)
Ron Shamir (Algorithms)
Roded Sharan (Algorithms)

ICSI is also involved in collaborative research with colleagues at other American institutions.

From Boston University
Alberto Medina (ICIR)

From UCB
Larissa Muller (BCIS)
Joyojeet Pal (BCIS)
Kannan Ramchandran (Qualcomm)

From UCSD
Sriram Rambhadrann (ICIR)

From Stanford
Balaji Prabhakar (Algorithms)
Devavrat Shah (Algorithms)

News Briefs: (cont.)

was quoted in the New York Times on January 3 regarding disfluencies in spontaneous speech.

The ICSI MEETING CORPUS has been released by the Linguistic Data Consortium.

February 2004 marks the 10th anniversary of ICSI’s WEBSITE.

LIZ SHRIBERG and ANDREAS STOLCKE hosted a meeting for a new ITR project on January 16, 2004 at ICSI.

NICK WEAVER, of the Networking Group, was quoted in the New York Times magazine on February 8, 2004 regarding his research on Internet Worms.

For more information on ICSI News Briefs, see: http://www.icsi.berkeley.edu/Events/newsbriefs.html
publications listing


S. FLOYD. Limited Slow-Start for TCP with Large Congestion Windows. Internet draft, work in progress, July 2003.


THE INTERNATIONAL COMPUTER SCIENCE INSTITUTE (ICSI) is the only independent, non-profit US lab conducting open, non-proprietary, pre-competitive research in computer science. Affiliated with the University of California campus in Berkeley, ICSI’s mission is to further research in computer science through international collaboration, and further international collaboration through research in computer science. ICSI provides a haven for computer science researchers to conduct concentrated efforts towards long-term goals without commercial limitations and with few faculty pressures. ICSI has significant efforts in four major research areas: Internet research, including Internet architecture, related theoretical questions, and network services and applications; theoretical computer science, including applications to bioinformatics; artificial intelligence, particularly for applications to natural language understanding; and natural speech processing.

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