

Academic Connections Students Visit TDLC's Machine Perception & Motion Capture Labs at UCSD

Academic Connections at the University of California, San Diego, is a pre-college summer academic and residential experience targeted to highly motivated, high achieving, college-bound high school students entering grades 10-12, to explore the best UCSD has to offer.

The goal of the **Academic Connections** program is to connect select high school

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Cold Water & Facial Expressions

By Carolan Gladden

Begin with pails of icy cold water (37.4° F/3° C) and find participants willing to submerge a hand in it for 3 minutes – all the while being observed on video and analyzed by the CERT mechanism. That is the Computer Expression Recognition Toolbox (CERT) developed by the Machine Perception Laboratory (MPLab) folks to recognize and react to facial expressions – in this case, as one might imagine, the expression of pain!

As a baseline, participants had first plunged a hand into a bath of more

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TDLC Receives Full Funding from NSF

The Temporal Dynamics of Learning Center, founded at UC San Diego in 2006 as one of six National Science Foundation Science of Learning Centers, has just been awarded an additional \$12 million for the next three years to expand its important work studying the role of time and timing in learning.

More than 40 researchers, working closely together through a unique “network of research networks” collaboration, are focused on the role of

TDLC & Reach For Tomorrow Integration of Research and Education

Helping to fulfill TDLC's principle of integration of research and education is outreach partner Reach for Tomorrow, a unique organization that for 11 years has brought to the campus middle school students from across the country in a 7-day Summer Program.

Founded some fifteen years ago by an equally unique individual, the Reach for Tomorrow program at UC San Diego has the students live in campus housing and attend physics, neuro-

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time in learning across multiple time scales – from the exquisite sensitivity to firing time between neurons that causes them to link together more tightly, through the timing of social interactions between teachers and students that leads to effective teaching, to the scale of months in spacing effects in learning.

Gratified with the glowing reviews by
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Face Camp 2008

How do you convince 60 kids to spend a sunny July afternoon volunteering for cognitive research?

Make it fun. Hire a clown. Call it Face Camp.

This summer, under the direction of TDLC cognitive neuroscientist Dr. Jim Tanaka and developmental psychologist Dr. Ulrich Mueller, honors psychology students organized the department's second annual Face Camp for kids, an event with a two-part goal: to collect research data while engaging children in the science of face recognition.

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Academic Connections Visit to MP Lab

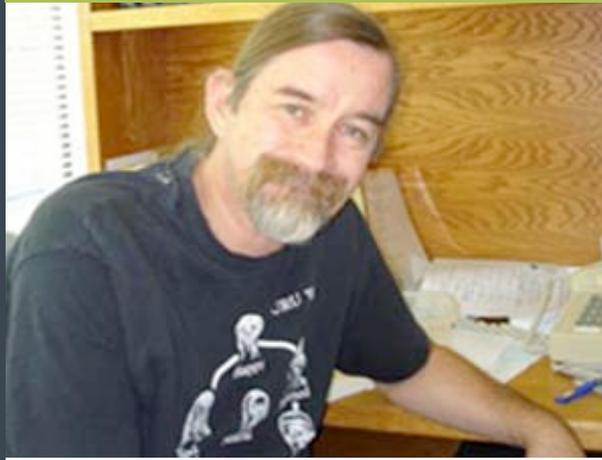
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students with UCSD by providing hands-on college subject matter courses. Program participation provides students with the opportunity to experience life and learning at a top-ranked research university, located in the beautiful San Diego area.

Dr. Movellan arranged for fourteen Academic Connections students to tour the Machine Perception Lab and the Motion Capture Facility. The students were taking a summer course in robotics through Academic Connections. They were able to see a fascinating series of demonstrations including facial recognition software, Computer Aided Machining, infra red motion capture, and brain activity monitoring. The speakers were very engaging and encouraged interaction by the students!



Javier Movellan talks to the students about RUBI, an educational robot designed to interact with pre-school children at the UCSD Early Childhood Education Center.



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the nation's leading science funding and review agency, Center Director and UCSD Computer Science and Engineering Professor Gary Cottrell said, "This funding demonstrates NSF's confidence in our work. In order to receive this level of funding, the National Science Board had to review our Center, and they were very excited about our 'Network of Research Networks' structure and the deep scientific progress we have achieved in a very short time. We have an incredibly talented interdisciplinary group of scientists from over 10 institutions in the US, Canada and Australia carrying out groundbreaking basic research, who are committed to making our work relevant to the classroom. Already our researchers and trainees have developed many innovative programs that fulfill that goal of going from laboratory to classroom."

Cottrell cited several cutting edge advances:

- RUBI-4, a "Teletubby"-style social robot developed over three years whose real-time machine perception abilities allow her to play give-and-take games with the children in UCSD's Early Childhood Education Center, where she teaches colors and shapes, and interacts in a naturalistic way.
- The Computer Expression Rec-

"We are committed to making our research relevant to the classroom. Already [we] have developed many innovative programs that fulfill that goal."

ognition Toolbox (CERT), a remarkable automated real-time analyzer of facial expressions. Based on the appearance of the human face observed in videos of participants, the device is being used in several studies that include interventions for children with autism, assessing real pain versus faked pain and interpreting subject interest during automated tutoring sessions.

- Patterns of activity in the brain that predict future choices have been discovered by György Buzsáki, a distinguished faculty member of the Center at Rutgers. The work, which was just published in *Science*, describes how patterns of activity in the hippocampus of a rat can be used to predict what the rat will do 20

The National Science Foundation Awards TDLC \$12 Million Over 3 Years

We asked Center Director Gary Cottrell about TDLC's continued success and future goals

seconds later. "Now that we are able to predict future behavior choices by rodents, ... the next logical steps are to expand studies to other animals, including humans," said Buzsáki.

- The Motion Capture and Brain Dynamics Facility at UCSD. This laboratory makes possible real-time motion-capture synchronized with electroencephalogram (EEG) recordings of the brain, and its potential uses in research are enormous. Already 12 different projects involving researchers worldwide are ongoing in the lab.

This new funding will allow the Center to scale up its efforts on the computational cognitive neuroscience of the role of time and timing in learning. In their approval, NSF emphasized, "This is a group of extraordinarily able and energetic individuals truly dedicated to an exciting unifying theme."

In underscoring the unusual two-way collaboration between scientists in the laboratory and teachers in the classroom, Center Outreach Director Terrence Sejnowski said, "We are innovating a new way of doing science by networks of researchers that brings classroom concerns into the lab and lab discoveries into the classroom."

"Perhaps the most exciting aspect of the Center is the scientific creativity

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Reach for Tomorrow

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science, engineering and marine biology labs taught by UC San Diego professors and staff. By evening they choose recreational activities, pilot small planes, become CPR certified, visit Navy ships, take sailing or surfing or rock climbing lessons, complete obstacle or leadership reaction courses and meet with motivational guest speakers.

And just how did Reach for Tomorrow come to be?

Peter K. Underwood, now RFT Chairman and a commercial airline pilot, is a US Air Force veteran and former Air Force Academy Liaison Officer. At the Academy he interviewed hundreds of students, as well as developed an exercise program for applicants. The insights gained led him to a comprehensive review of why students often wait until they are nearing the end of high school to prepare for college.

Underwood concluded that the pre- and early high school years are often the period of time that determines academic futures and life opportunities.

So in Chantilly, Virginia he founded his program, where since 1993 it has targeted generally eighth graders with the capacity to excel in school but whose current grades and scholastic achievement don't reflect their potential.

RTF intervenes to help students maintain enthusiasm and momentum toward academic and personal excellence and works with a multitude of corporate, government, non-profit and foundation sponsors, as well as many university partners.

Here, in the UC San Diego Summer Program, groups of 5 students are matched with an adult volunteer, with the aim of improving the three A's of academics – Attitude, Attendance and Achievement – and from all indications, it's working well!

Cold Water and Facial Expressions

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comfortable 68° F/20° C water, their facial expression – now benign – also video'd and analyzed by CERT. And then again into the comfortable water, but this time acting as if they were in pain.

CERT was employed to analyze the data from 26 subjects for three distinct comparisons:

- Between baseline and pained faces
- Between expressions of real pain and fake pain
- Between faked pain – with and without recent experience of real pain

The resulting analysis showed the system correctly differentiated real from faked pain with an accuracy rate of 90%-plus – considerably higher than humans who watched the same videos.

Besides such facial expression recognition experiments, researchers Gwen Littlewort, Marni Bartlett and Javier Movellan are developing tools such as CERT to recognize and react to natural speech sounds and head motions. They are also attempting to discover new relationships between facial motion and state of mind in such situations as fatigue while driving or difficulty understanding a lecture. Paramount purpose in all of these studies is to decipher brain/mind complexities.

Second Annual FACE CAMP

Sporting matching t-shirts labeled "Face Expert," the kids—aged seven to nine—rotated through Cornett building "face stations," where they constructed Picasso-esque cubist faces, pinpointed expressions on Face Bingo cards and—the hands-down crowd favourite—watched their computerized photos morph with celebrity mugs like Harry Potter and Avril Lavigne.

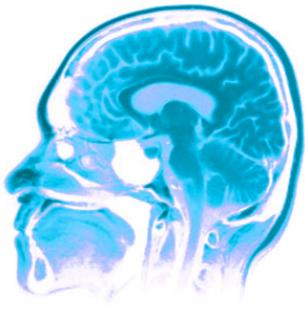
While recognizing faces and understanding facial expressions comes naturally for most of us, this area is a struggle for kids with Autism Spectrum Disorder and Asperger Syndrome, developmental disorders that impair social interaction. Current research suggests that these populations may perceive faces as just another object, with no more significance than a table or tree. In an effort to help these children develop their face recognition skills, Tanaka—in collaboration with the Yale Child Study Center—has spent the last five years developing Let's Face It! (LFI)



A young 'Face Expert' smiles as he interprets facial cues and labels them, using Dr. Tanaka's Let's Face It! software

a series of computer games that involve labeling facial expressions and interpreting facial cues. Initial use of the games by autistic kids has shown positive results, indicating for Tanaka the importance of further research.

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NSF Funding

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and progress that is enabled by pooling the expertise of so many fantastic scientists,” said Andrea Chiba, the Center’s science director.

Through the now famous “network of networks” the Center incorporates scientific participants from many academic institutions and disciplines, including Brown, Carnegie-Mellon, the University of California, Berkeley, the University of Colorado Boulder, the University of Pennsylvania, the University of Pittsburgh, the University of Queensland, Rutgers Newark, San Diego State University, the Salk Institute, Vanderbilt and the University of Victoria. The researchers are from departments as diverse as biology, cognitive science, computer science,

neuroscience and psychology. Their educational partners include Curie Elementary in San Diego, the Preuss School at UCSD, the Early Childhood Education Center at UCSD, Reach for Tomorrow, the San Diego Cooperative Charter School, Scientific Learning Corporation, the Jensen Learning Corporation and The Science Network, a web-based outlet dedicated to bringing science to the public.

More information about the Center can be obtained at <http://tdlc.ucsd.edu>



Brain Trivia

Which of the following is not one of the 4 lobes of the human brain?

- a) Frontal
- b) Medial
- c) Parietal
- d) Occipital
- e) Temporal

Look for the answer in the next newsletter, or log on to tdlc.ucsd.edu

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Face Camp (Continued from Page 3)

“We want to understand how the development of face processing unfolds with age and experience,” he says. “To understand the deficits of special populations like kids with autism, and how to improve that, first we have to know how face recognition works in typically developing children.”

Funded by the National Science Foundation and held three times this summer, the one-day camp also featured prizes, a closing-ceremony slide show and a clown called Amigo, whose step-by-step make-up application revealed how to emphasize facial expressions. Twenty volunteers, including members of the TDLC affiliated Visual Cognition Lab, community professionals and high school students, pitched in as camp leaders and station presenters. According to a follow-up survey, the event was a hit. “The kids felt important from the beginning,” said Natalie Huxtable,

a psychology honors student. “They didn’t want it to end.”

Interest in Face Camp has already been expressed by both Burnaby’s Down Syndrome Research Foundation and Recreation Integration Victoria, a group that helps people with disabilities participate in community recreation. Ideally, Tanaka hopes to hold future camps that integrate kids with and without deficits.

“We’d like to take Face Camp on the road,” he says. “The goal has shifted from purely data collection to sharing the science, getting kids excited not only about face recognition, but about psychology and cognitive science.”

“There isn’t a lot of extensive research that establishes facial recognition trends in children,” says Huxtable, “so that’s our main focus. The more we can practice putting Face Camp on, the more potential we have to make it something that can continue for years. If it can help kids with autism, that would be even better.”

Upcoming Events



TDLC All Hands Meeting

February 20th & 21st
San Diego, CA



2nd Annual Brains R Us - Town Hall

The Science of Educating: from synapse to schoolroom, neurons to neighborhoods.

April 4th & 5th
San Diego, CA

Our Mission

The Temporal Dynamics of Learning Center (TDLC) will develop a science of the temporal dynamics of learning that treats time as a crucial element in the learning process. We will integrate the study of learning dynamics across multiple time scales - from milliseconds, to life-long learning. This new science will inform educational practices and result in better learning outcomes.



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