

# Focused Site Visit Workshop TDLC

## General principles of the dynamics of learning, and integration of theory and experiment

SDSC Auditorium, UC San Diego  
June 13-14, 2012

This is an assistive site visit focusing on one area of center research. The focus area is general principles of the dynamics of learning, and integration of theory and experiment. We will focus on work that forges theoretical links across domains and levels of analysis. The format is a series of workshop-style presentations which describe, in addition to the research and major findings, the center added value including new questions and findings that were enabled by the center.

### Wednesday June 13, 2012

7:15 [Bus pick-up at Estancia and breakfast on patio](#)

8:00-8:20 *Welcome and Introductions. Center Overview.* Gary Cottrell

8:20-8:35 *Overview of general computational principles of the dynamics of learning explored in the center.* Terry Sejnowski

8:35-8:50 *Integration of theory and experiment in the initiatives.* Andrea Chiba

8:50-9:05 Q&A

9:05-9:20 Executive Session (10 min) and short break

### Integrative research

#### **1. Temporal Dynamics of Learning Across Spatial and Temporal Scales**

A body of research at the center attempts to theoretically link temporal dynamics at different spatial or temporal scales, e.g. using models that predict the temporal dynamics of behavior to predict the temporal dynamics of neurons, or linking temporal difference learning algorithms with spike time dependent plasticity. We present a series of talks on center research that explores these links in the area of active vision.

9:20-9:35 *Cholinergic Modulation of Visual Processing.* Yang Dan  
9:35-9:45 Q&A

09:45-10:00 *Simulating the behavioral and neural dynamics of perceptual decisions.*  
Braden Purcell, Graduate Student, Vanderbilt.  
10:00-10:10 Q&A

10:10-10:25 *Principles Underlying the Dynamics of Active Vision.* Leanne Chukoskie,  
Fellow, UCSD  
10:25-10:35 Q&A

## **2. Learning Representations in Space and Time**

How are representations of temporal dynamics learned? We present complimentary work at TDLC on unsupervised learning theory for encoding the statistical structure of the environment, extending previous work on information maximization across time and levels.

10:35-10:50 *Efficient Coding: From Retina Ganglion Cells to V2 Cells.*  
Gary Cottrell  
10:50-11:00 Q&A

11:00-11:15 *Theory of learning and energy across time and levels.* Tony Bell  
11:15-11:25 Q&A

11:25-11:35 Break  
11:35-11:55 Executive Session

## **3. Optimal Control as a general principle, from motor learning to social behavior**

Motor behavior is shaped by processes (evolution, learning, adaptation) that resemble iterative optimization. We aim to understand and synthesize dynamic intelligence through learning and optimization, including principles of infomax control. The same approach can be used to understand social development in infants and to develop sociable robots. Stochastic optimal control may provide a mathematical foundation for the computational understanding of human behavior, and its synthesis in robots.

11:55-12:10 *Motor Learning.* Emo Todorov  
12:10-12:20 Q&A

12:20-12:35 *Social Behavior.* Javier Movellan  
12:35-12:45 Q&A

12:45-1:15 Lunch with Center Participants [\[Patio\]](#)  
[Site visitors and poster presenters go to buffet first](#)

1:15-2:00 Poster Session on focus area [\[in auditorium\]](#)

2:00-2:30 Site Visitors meet with Fellows (Trainees)

#### **4. Models of Optimal Learning and Teaching**

Computational models are being explored at TDLC to understand what gives rise to an optimal spacing of information in memory and learning in classroom settings. These models can then guide the optimal delivery of new information to the learner. Work is also underway to develop autonomous agents that learn how to teach based on feedback from the learner in terms of facial expressions and performance. These models explore closed-loop adaptive systems using infomax control.

2:30-2:45 *Optimal teaching machines.* Presentation by Javier Movellan

2:45-2:55 Q&A

2:55-3:10 *Optimal learning and retention of declarative knowledge.* Presentation by Michael Mozer

3:10-3:20 Q&A

3:20-3:30 Break

3:30-3:50 Executive session

#### **Sustainability and Institutional leaders**

4:00-4:05 *Importance of Science of Learning and Sustainability.* Mark Weiss, Division Director for Behavioral and Cognitive Sciences, NSF SBE.

4:05-4:15 *Sustainability and directions for the future.* Terry Sejnowski

4:15-4:25 Q&A

4:25-4:40 *Institutional leader's remarks.* Sandra Brown, UCSD Vice Chancellor for Research

4:40-5:00 Discussion

5:00-5:10 *Synthesis:* Gary Cottrell, Andrea Chiba, Terry Sejnowski

5:10-5:25 General Q&A

5:25-6:00 NSF Executive Session

6:15 [Bus to La Estancia](#)

**Thursday June 14, 2012**

- 7:30-8:30     [Breakfast at La Estancia \(NSF and Site Visitors\)](#)
- 8:30-9:30     Optional: Response to evening questions (if any) and general Q&A with Executive Committee.  
[La Estancia, Meeting room Eucalyptus](#)
- 9:30-5:00     Executive session at La Estancia, meeting room TBA
- 12:30-1:30    Lunch at Estancia (NSF & Site Visitors)