

# Intensive data at CREATE

Research approaches & future directions

Susan M. Letourneau

IPORT Postdoctoral Fellow



NEW YORK UNIVERSITY

THE  
GRADUATE  
CENTER  
CITY UNIVERSITY  
OF NEW YORK

# Understanding Engagement & Learning

- Engagement with educational materials can be:
  - Affective: motivation, enjoyment, frustration
  - Behavioral: overt activity and responses
  - Cognitive: mental effort, information processing, attention
- How can we capture all aspects of engagement during learning tasks?
- How can we measure them in an objective and reliable way?
- How can we relate behavioral/cognitive/affective states to specific learning outcomes?

# Intensive Data at CREATE

## *Goal:*

To combine multiple streams of data to understand attention, effort, and excitement during learning.

## *Data sources:*

Self-reports

Pretest/posttest comparisons

Activity logs

Time-on-task

Number and timing of interactions

Eye-tracking

Number and duration of fixations

Fixation transitions

Sequences of fixations over time

Biometrics

Skin conductance

Heart rate

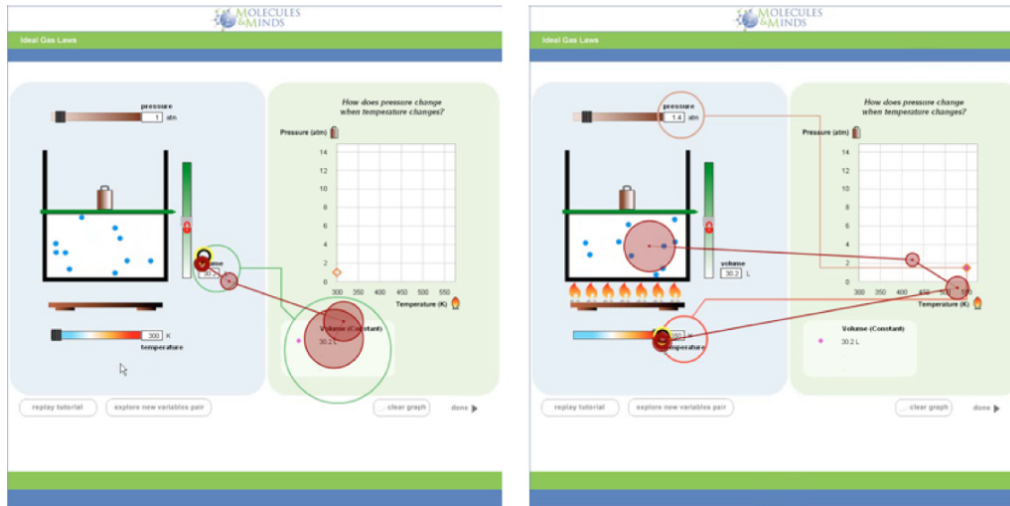
Respiration

EEG

Posture

# Ongoing Work

Fixation time, gaze sequences, pre-/post-tests, and activity logs in chemistry simulations



Fixation time, pupil size, and behavior in an advanced theory of mind task



*In each case, we make connections between larger classroom/lab-based studies (breadth) and smaller eye-tracking studies (depth), with each informing the other.*

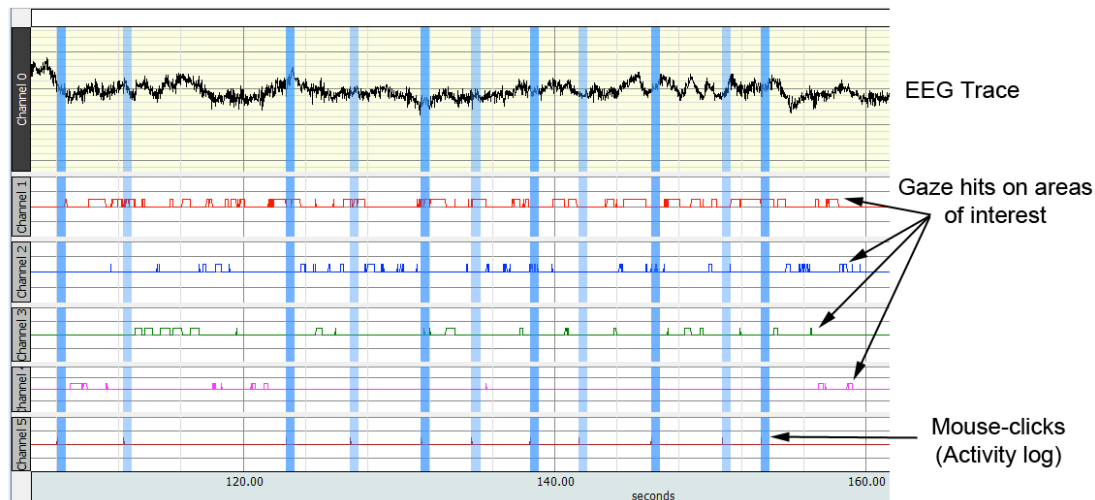
## Future work: Measures of engagement

- Different measures can indicate different aspects of engagement
- Behavioral:
  - Activity logs: amount and type of action
  - Nonverbal “on-task” behavior (posture, direction of gaze)
- Cognitive:
  - Eye-tracking: focused & selective attention
  - Pupillometry: mental effort
  - EEG rhythms: states of attention, alertness

# Approaches to data collection

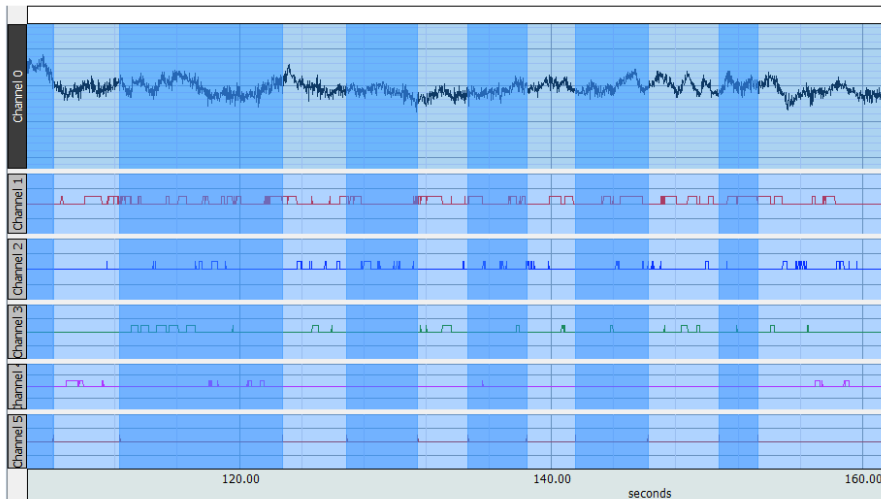


Collecting multiple physiological measures at once using wireless receivers. Can be collected alongside activity logs, video recordings, screen captures.



Importing eye-tracking data and/or activity logs as “hits” on particular areas of interest

# Approaches to triangulating multiple measures



*Behavioral interactions used to segment eye-tracking and physiological recording*

After synchronizing physiological measurements with eye-tracking and behavioral recordings, any channel can be used to demarcate events or segments of activity

...or continuous measurements can be taken across channels at regular intervals.

*Measurements taken in regular 2 second windows*

# Approaches to Data Analysis

- Using behaviors or physiological responses to parse eye-tracking data
  - Where is attention directed *at the moment of* an interaction/event/response?
  - Where is attention *during a segment of* an activity, or throughout a physiological response?
- Using eye-tracking data to parse physiological data
  - What physiological responses occur when attention is directed at a particular object?
- Sequence analysis: Longer patterns of gaze and behavior over time
  - Do interactions predict a shift in attention or a change in physiological state?
  - Do physiological responses precede particular interactions, shifts in attention, overt emotional reactions?



# Benefits and Challenges of “Intensive” Measures

+

Measures are objective and continuous  
Not under conscious control  
Sensors are minimally invasive  
Record aspects of engagement that are otherwise invisible (cognitive processing)

—

Lab-based studies, small samples  
Presence of sensors can influence behavior  
Data requires filtering, processing, averaging to be meaningful  
Synchronizing multiple data streams with different equipment, sampling rates, timescales of responses

