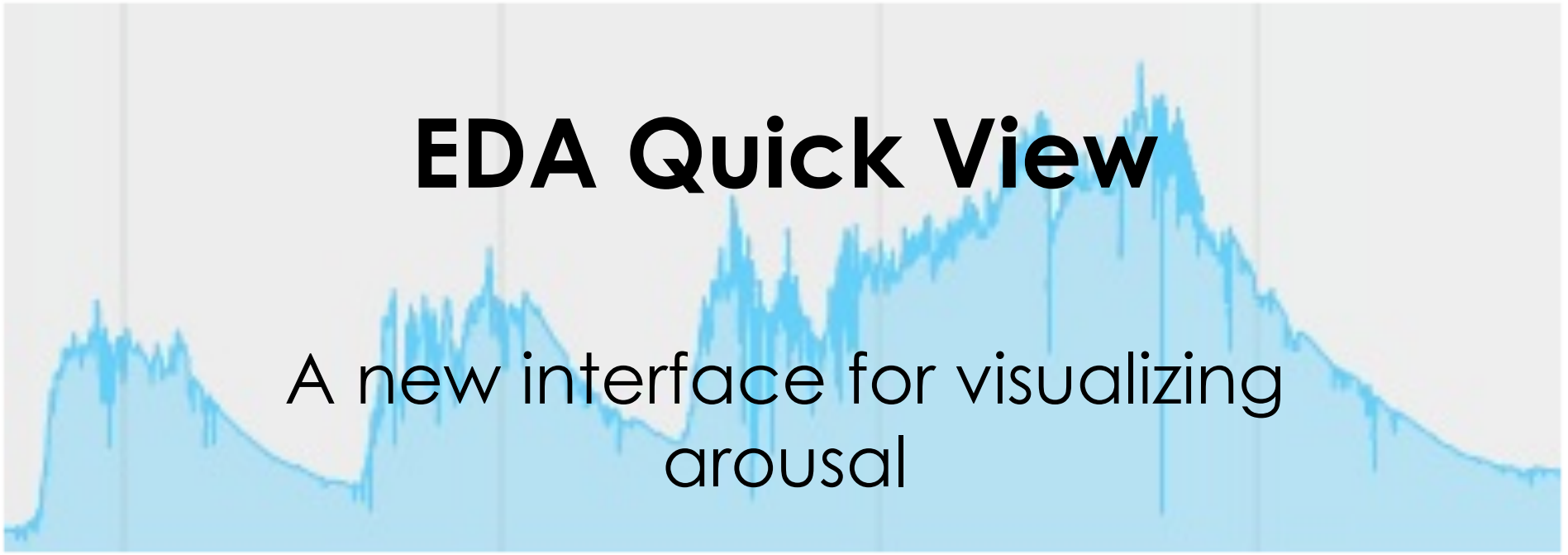


EDA Quick View

A new interface for visualizing arousal

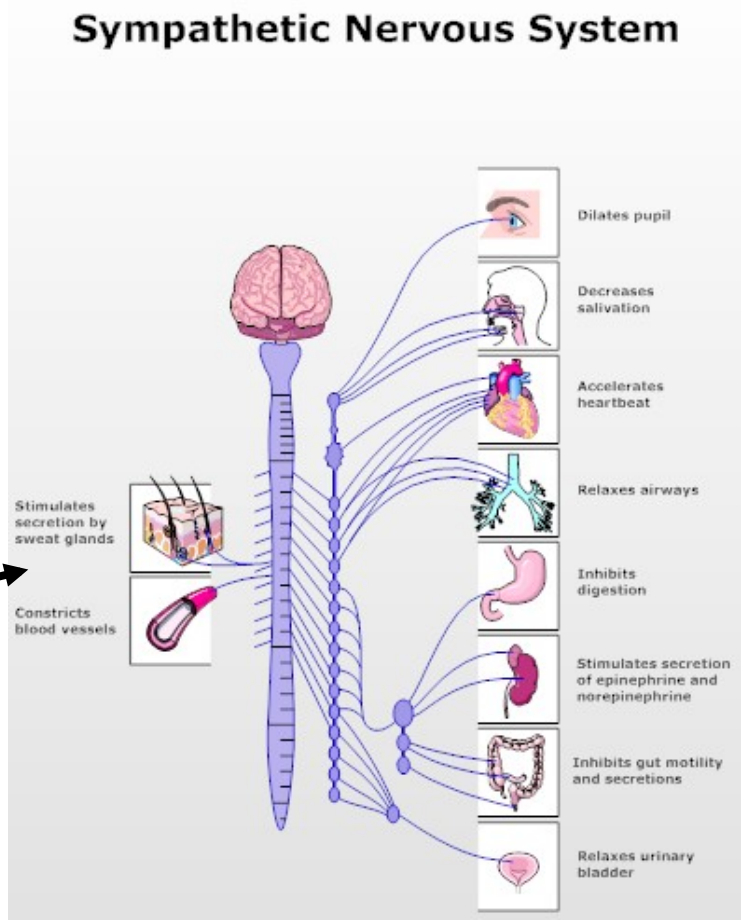
Elena Agapie & Caroline Pires

The Problem

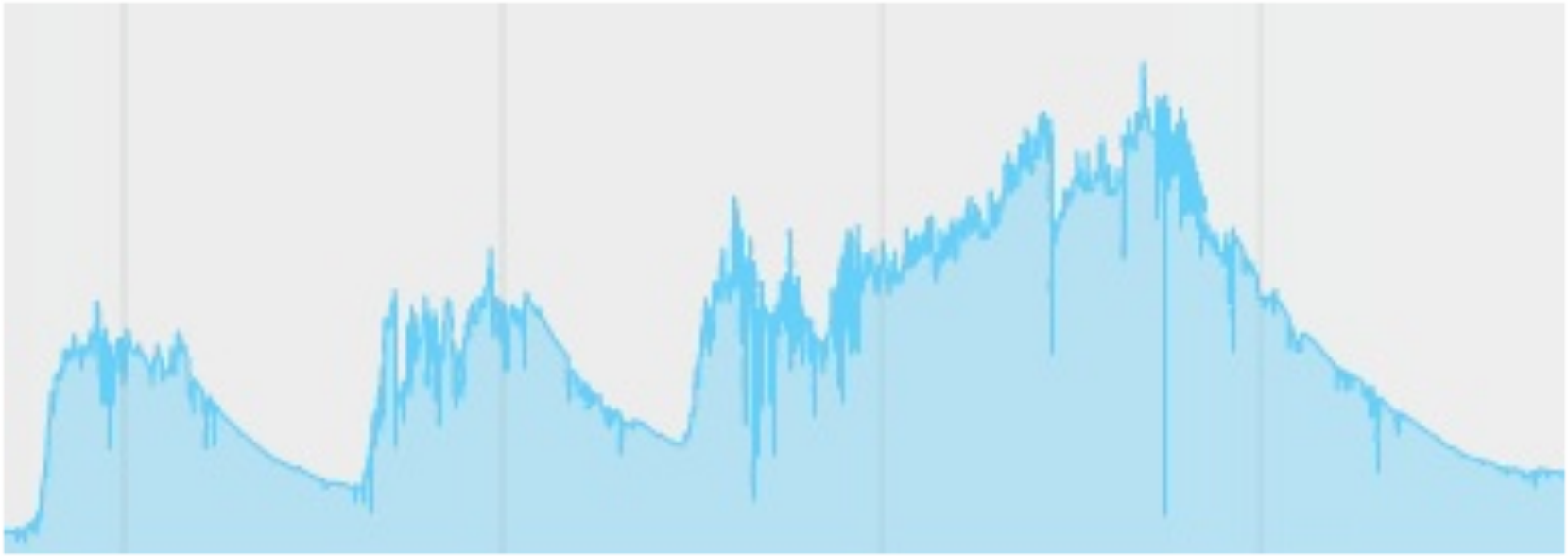
- How to make live arousal data more accessible?
- Make EDA data intuitive to non-scientists
- Real time arousal monitoring
- Preventing problem behavior in children

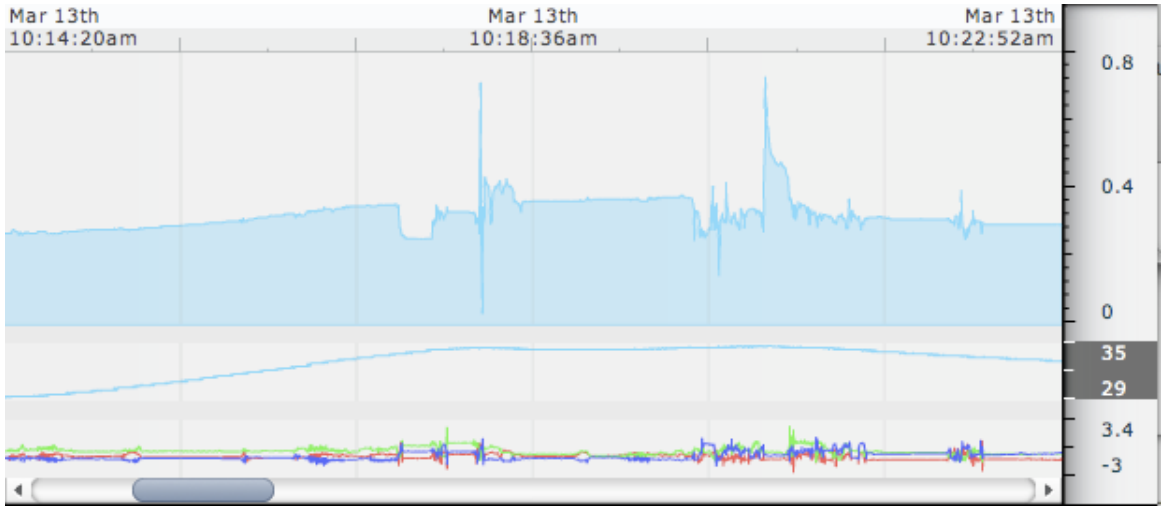
Electrodermal Activity

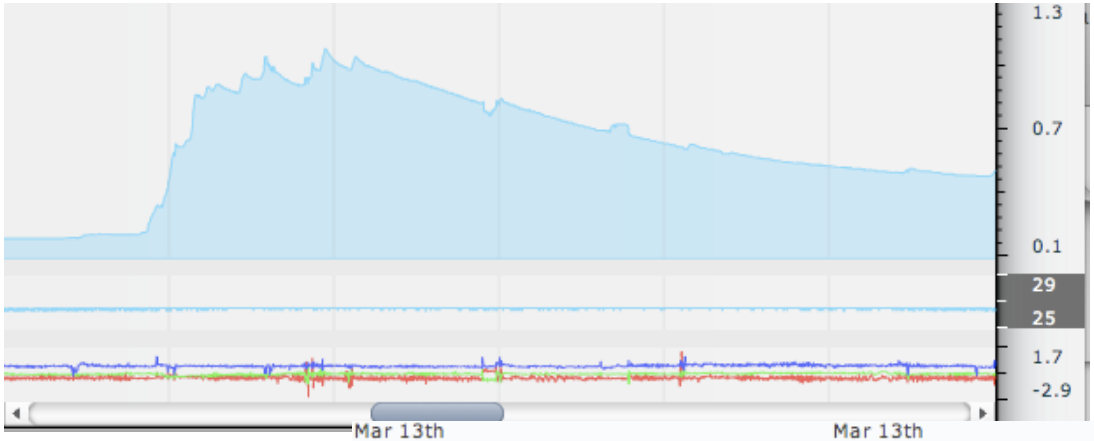
- Measure of skin conductance
- Sympathetic ANS activates
- Skin becomes more conductive

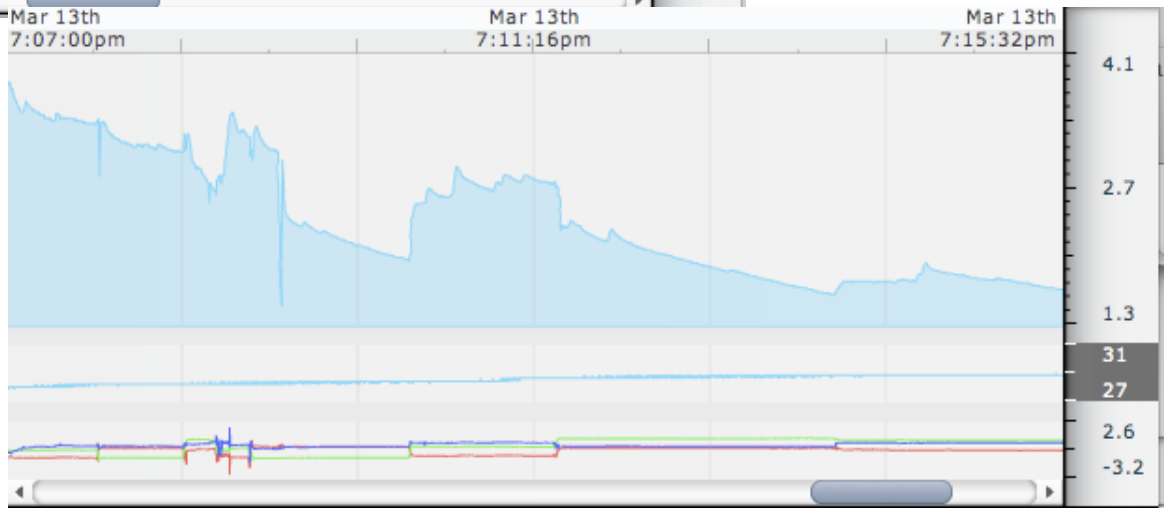


EDA Signal




Mar 13th
10:14:20am
Mar 13th
10:18:36am
Mar 13th
10:22:52am
0.8
0.4
0
35
29
3.4
-3

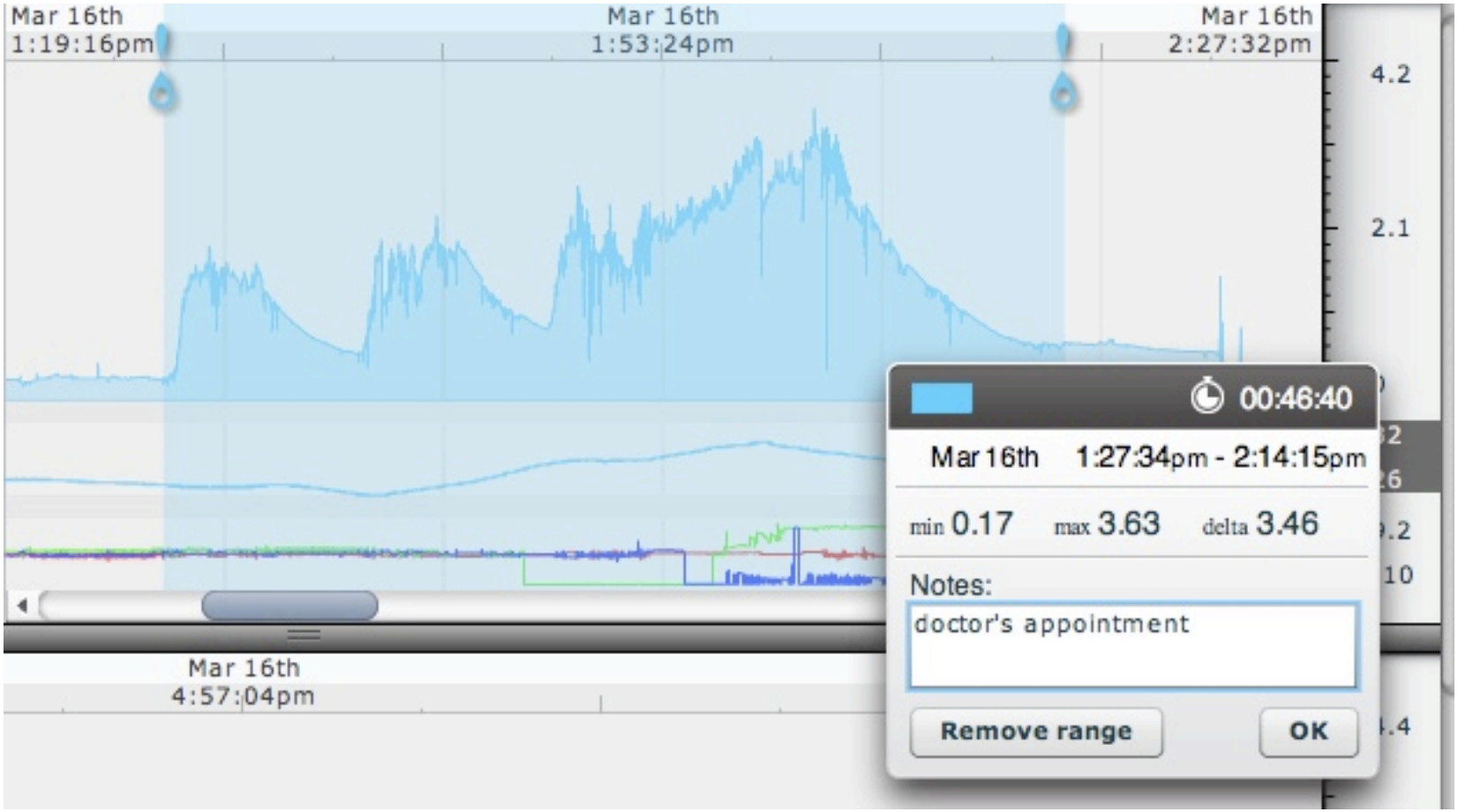

1.3
0.7
0.1
29
25
1.7
-2.9


Mar 13th
7:07:00pm
Mar 13th
7:11:16pm
Mar 13th
7:15:32pm
4.1
2.7
1.3
31
27
2.6
-3.2

Early Conceptions

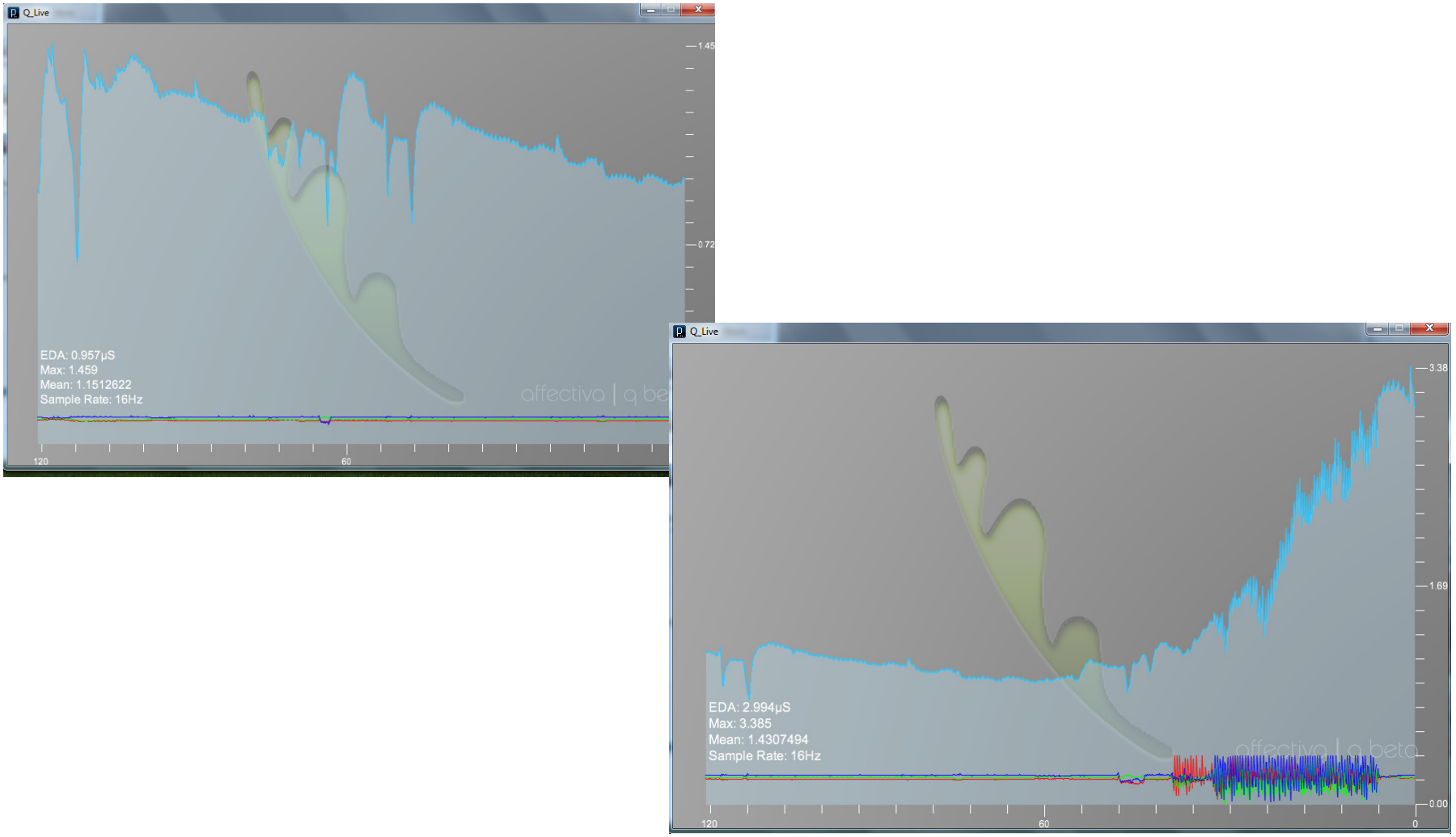
- Goal
  - Measure and represent arousal level
  - Indicate high and low arousal
- Target user
  - Teachers in centers for autism
  - Children on the spectrum
- Data
  - Difficult to understand
  - Hard to correlate with visible arousal

Related Systems



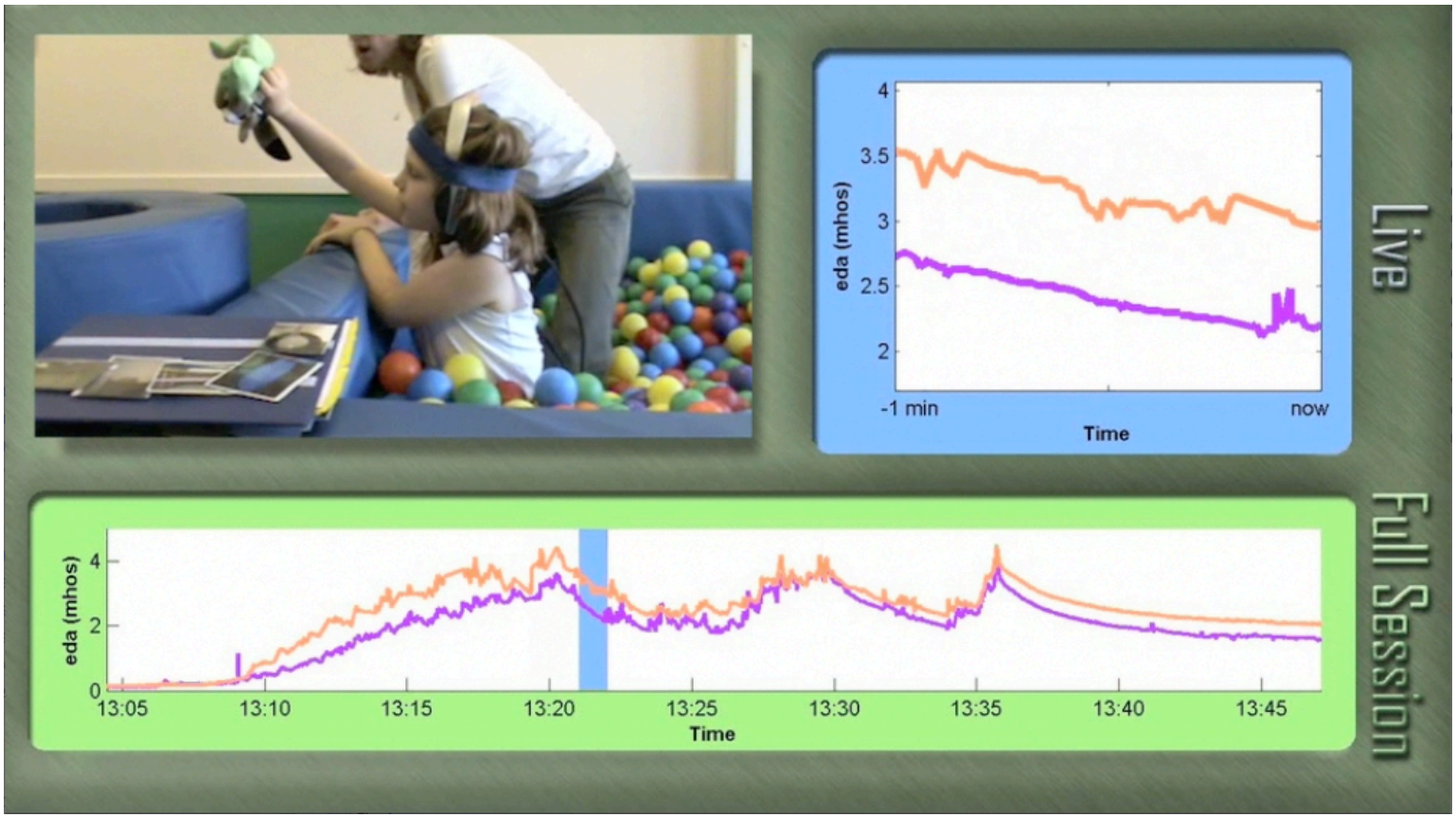
Affectiva Software

Related Systems



Affectiva Software

Related Systems



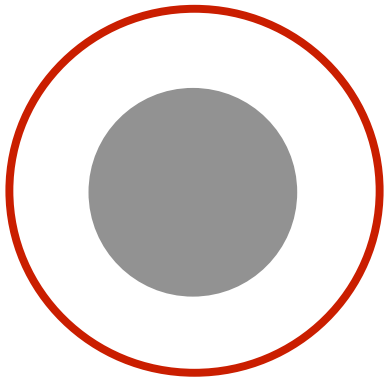
Elliott Hedman et al

Our Approach

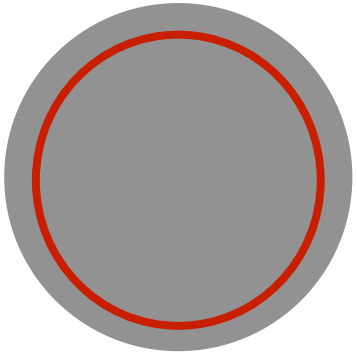
- Use colors and shapes to represent arousal level and arousal change
  - Basic information
  - Easy to process
  - Fast to process

Circle Scheme

- Variable #1: diameter of grey circle
  - Represents baseline
  - Function of history
- Variable #2: diameter of red circle
  - Represents current arousal
  - Function of current EDA (perhaps smoothed over some amount of time)



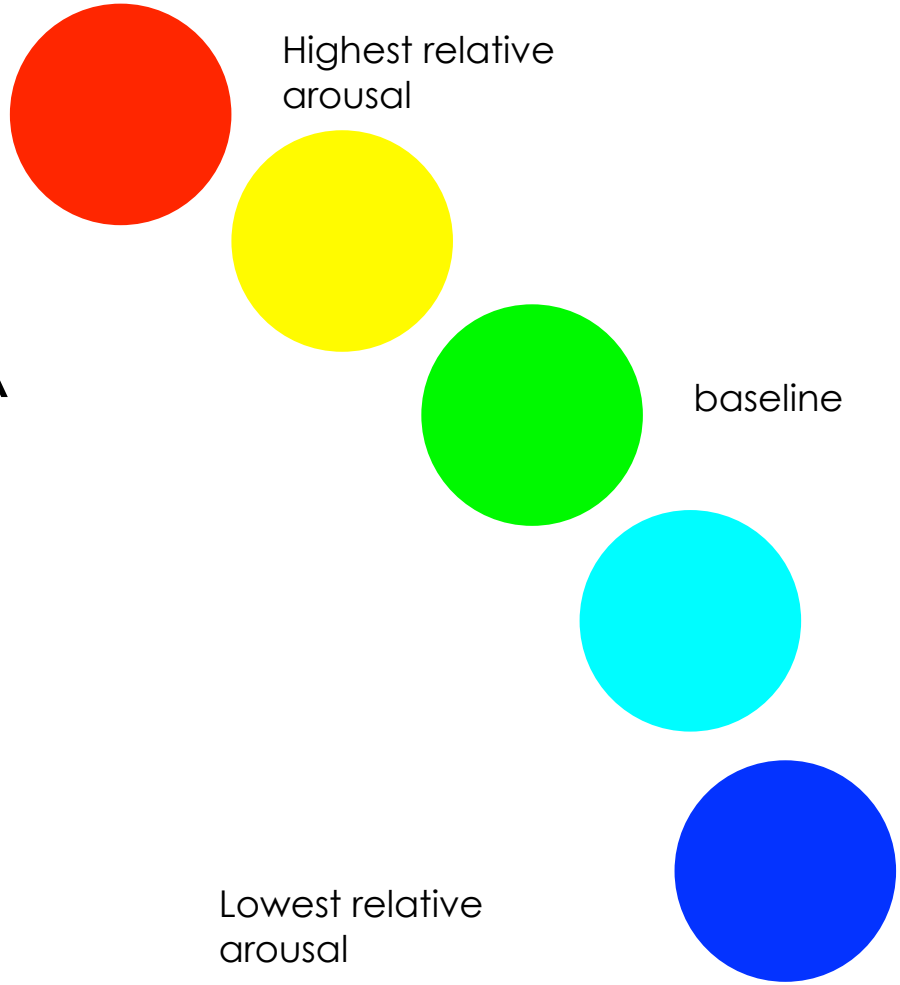
Hyper-aroused



Hypo-aroused

Color Scheme

- Variable: color
  - Function of EDA relative to baseline



Other designs

- Images intuitive for children
- Physical sensor changing state
- Using directionality to show increases in arousal
- Using baselines of signal to determine arousal level

Design decisions

- Focus on direction of the signal (increasing and decreasing)
- Use basic shapes and figures: arrows
- Focus on teachers as a user

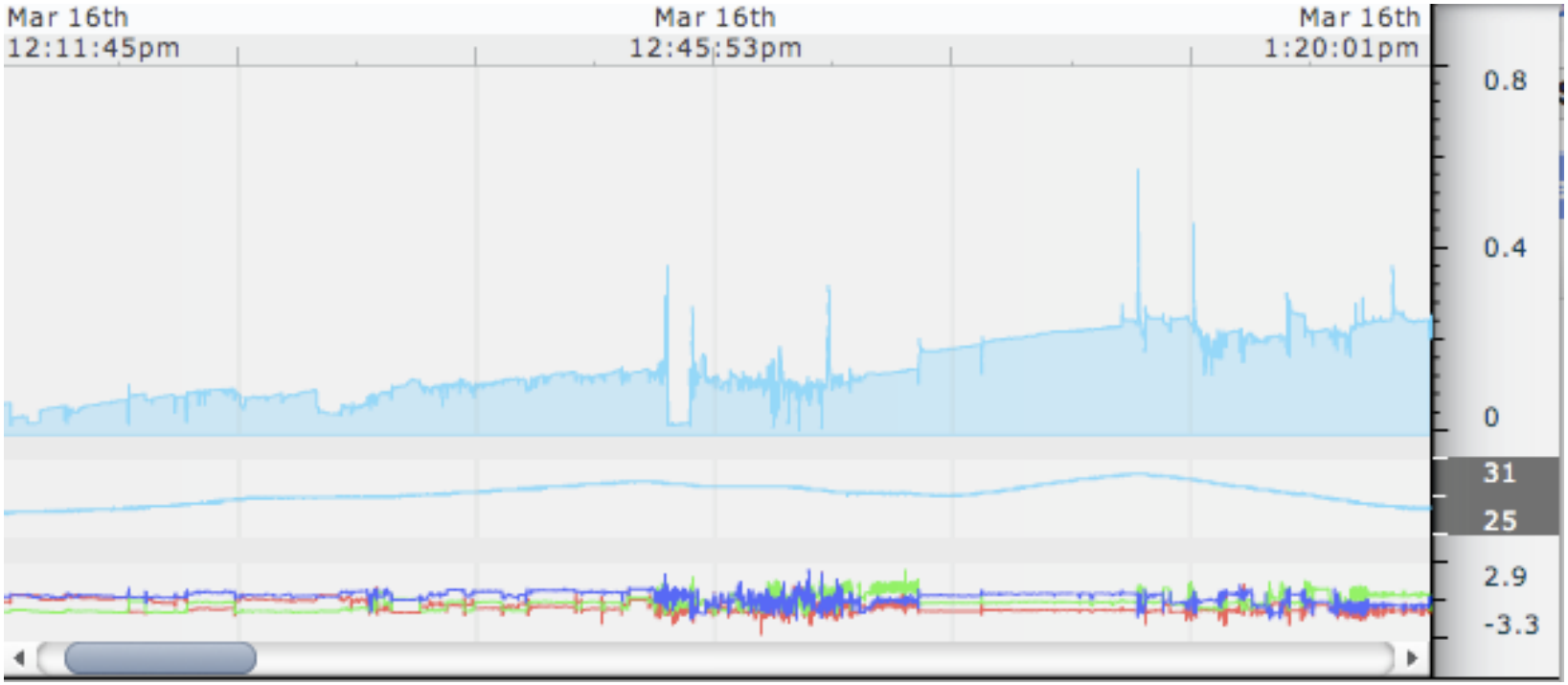
New Design Scheme

- Signal arousal change rather than level
- Eliminates need for baseline*

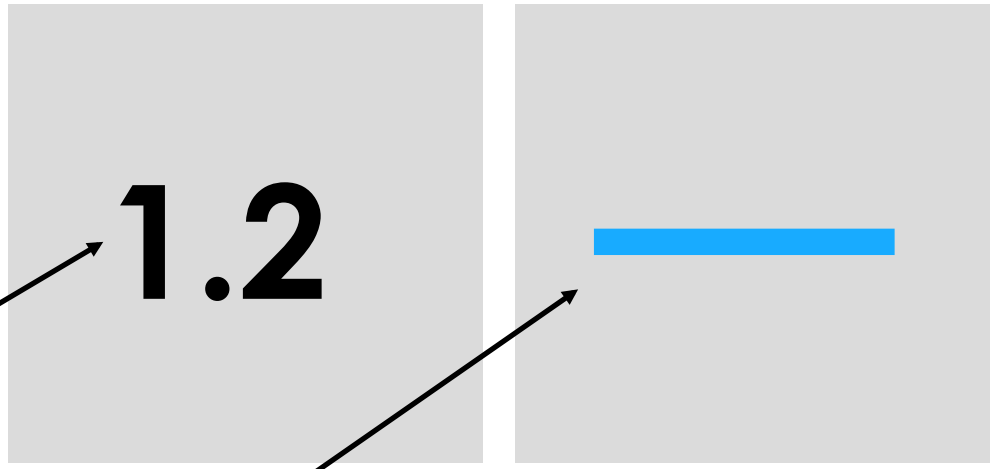
*sort of.. We'll get back to this later

EDA Quick View

.25



This display changes…

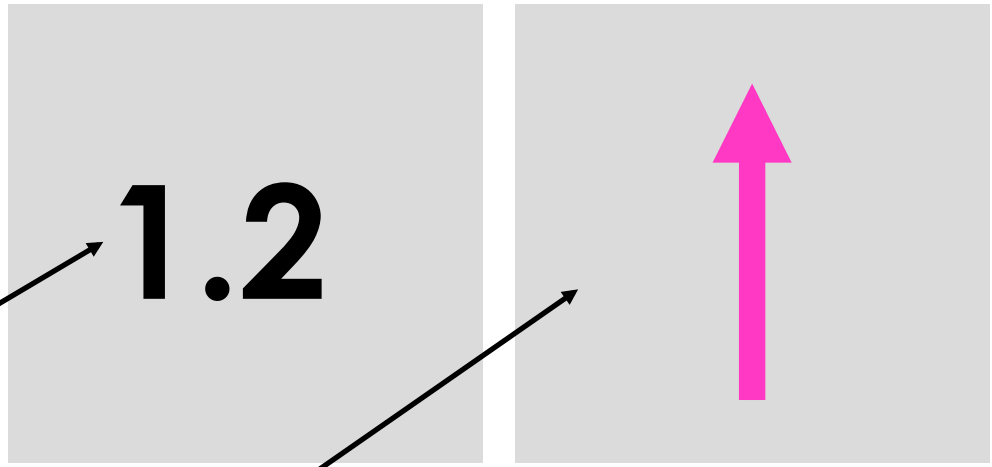


This shows the raw EDA

This symbol shows the recent trend in arousal change

A blue dash indicates no Trend toward rising or falling

This display changes…

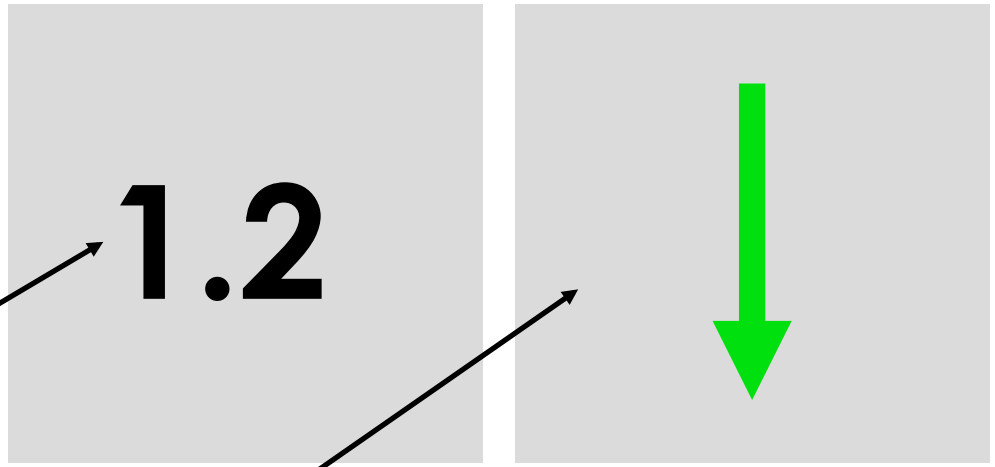


This shows the raw EDA

This symbol shows the recent trend in arousal change

A pink arrow pointing up indicates arousal is rising

This display changes…

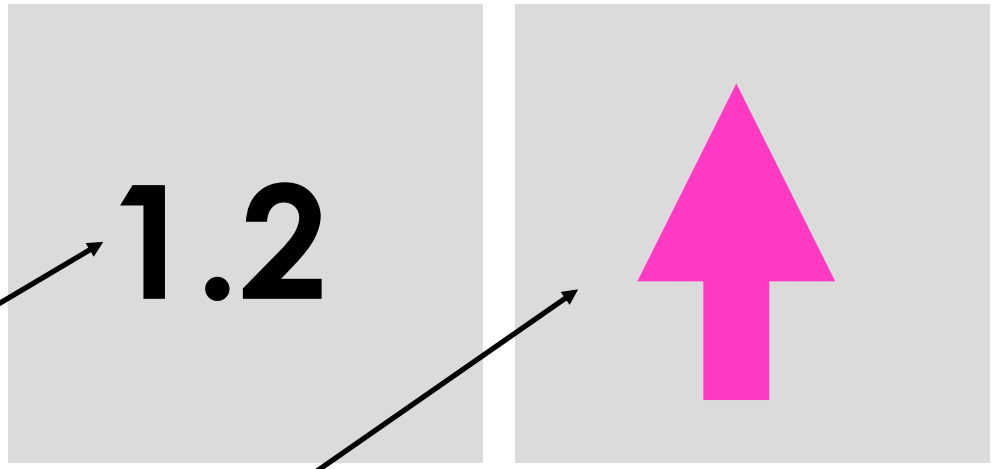


This shows the raw EDA

This symbol shows the recent trend in arousal change

A green arrow pointing down indicates arousal is falling

This display changes...

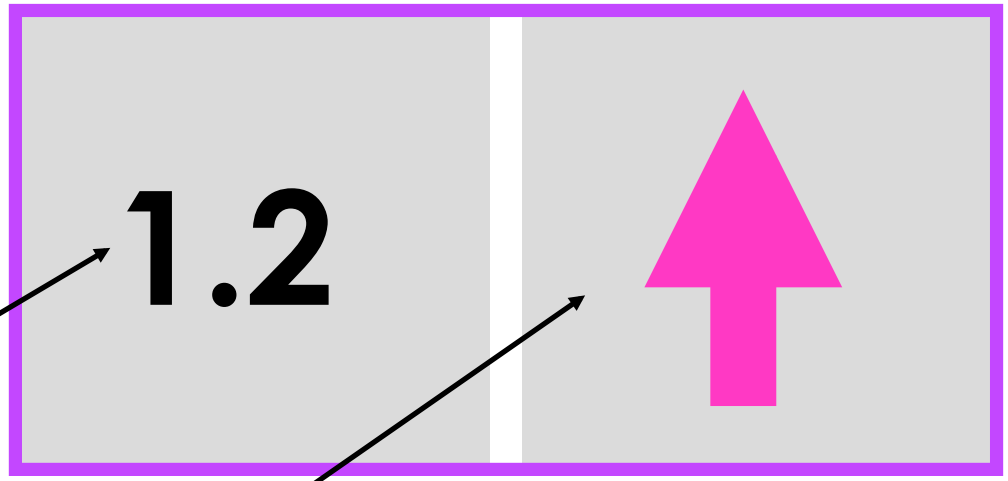


This shows the raw EDA

This symbol shows the recent trend in arousal change

The arrow can be thick or thin.
A thick arrow indicates a rapid change.

This display changes...



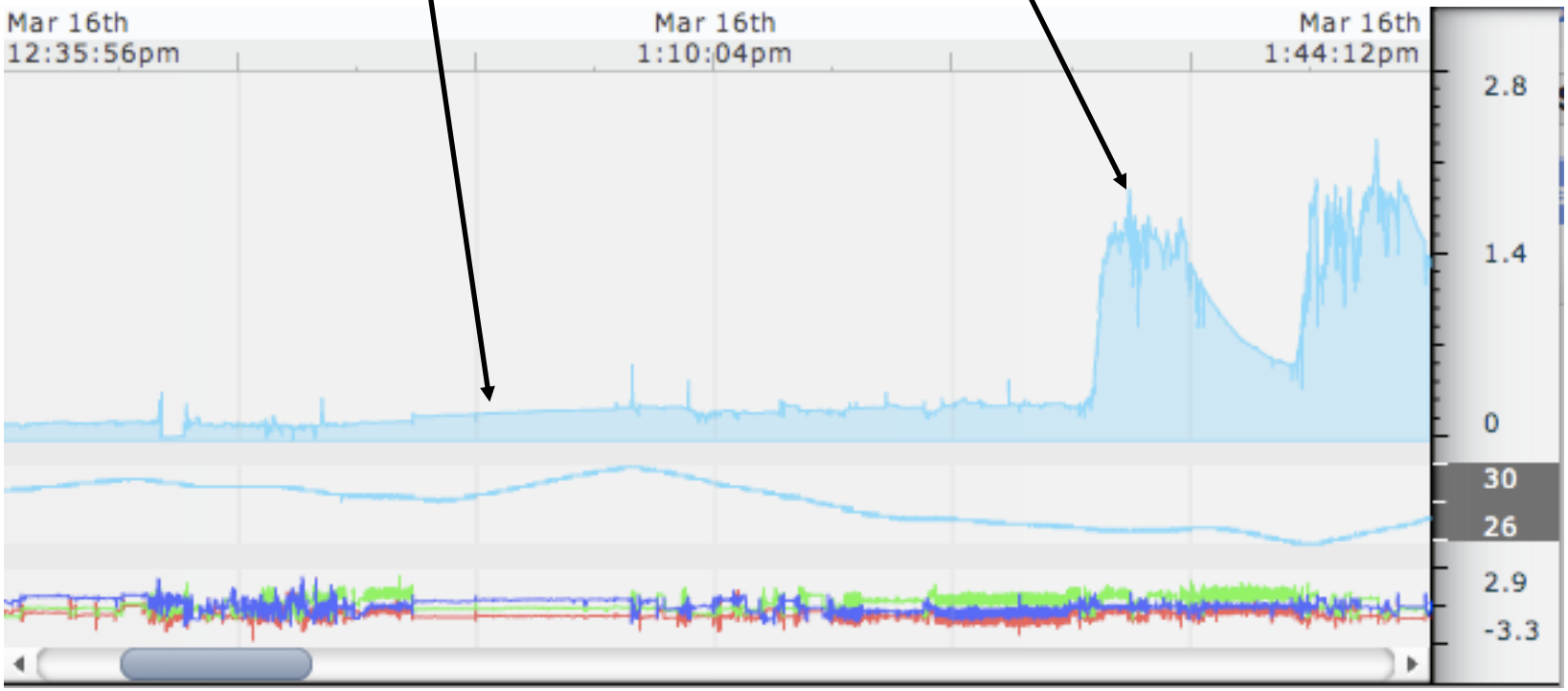
This shows the raw EDA

This symbol shows the recent trend in arousal change

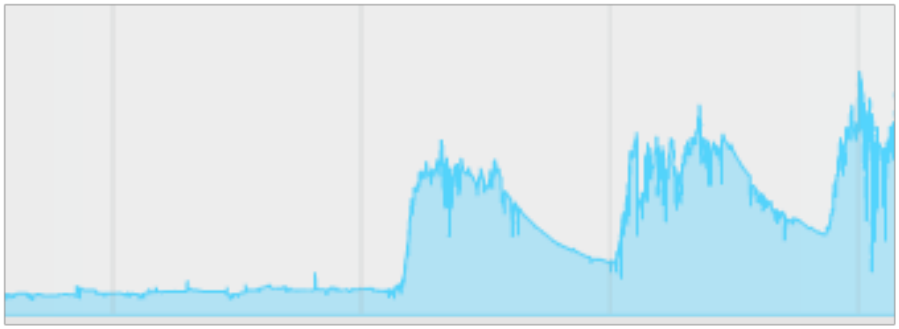
When a purple box appears, this means the signal is very jumpy (labile)

Stabile signal

Labile signal



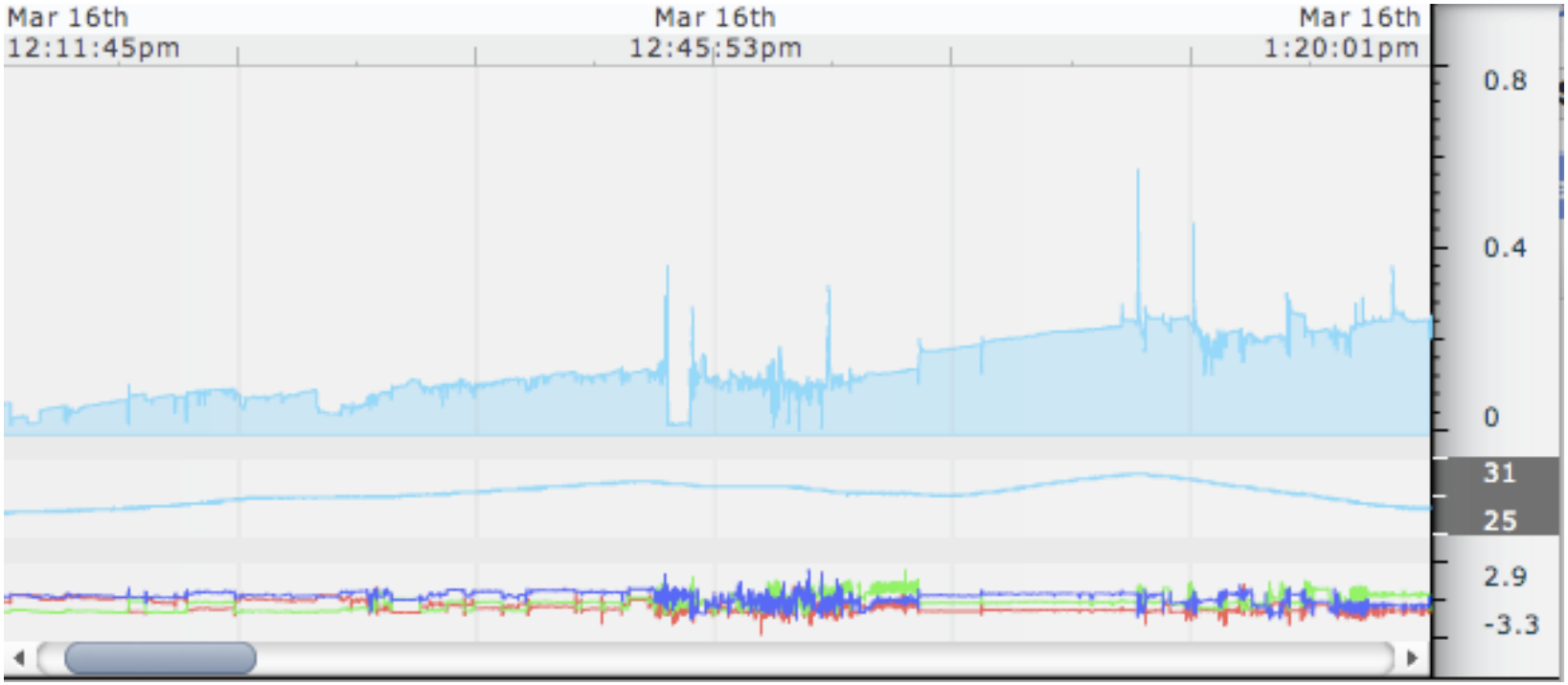
Lability



- Frequency of phasic EDA
- Individuals can be more stabile/ labile
- Associated with high cognitive load
- Also stress

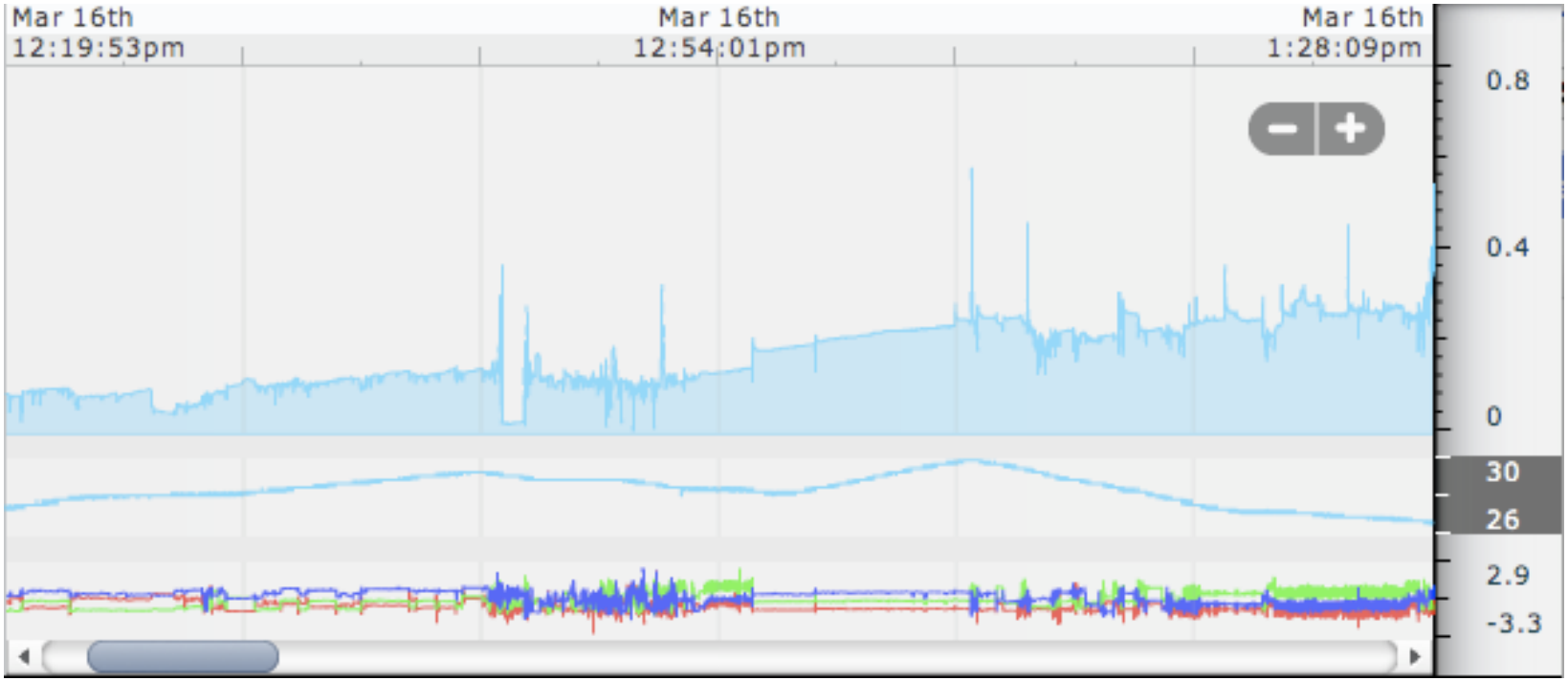
EDA Quick View

.25



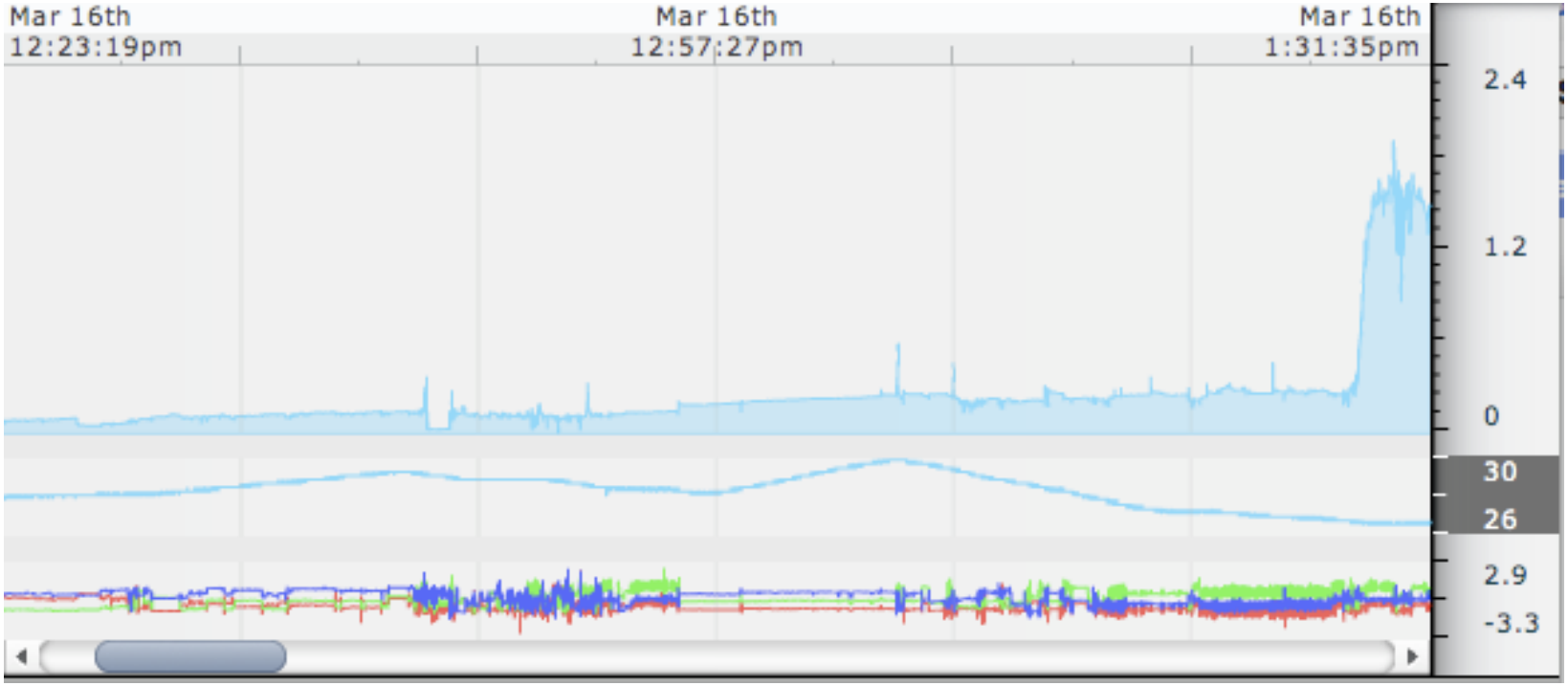
EDA Quick View

.37



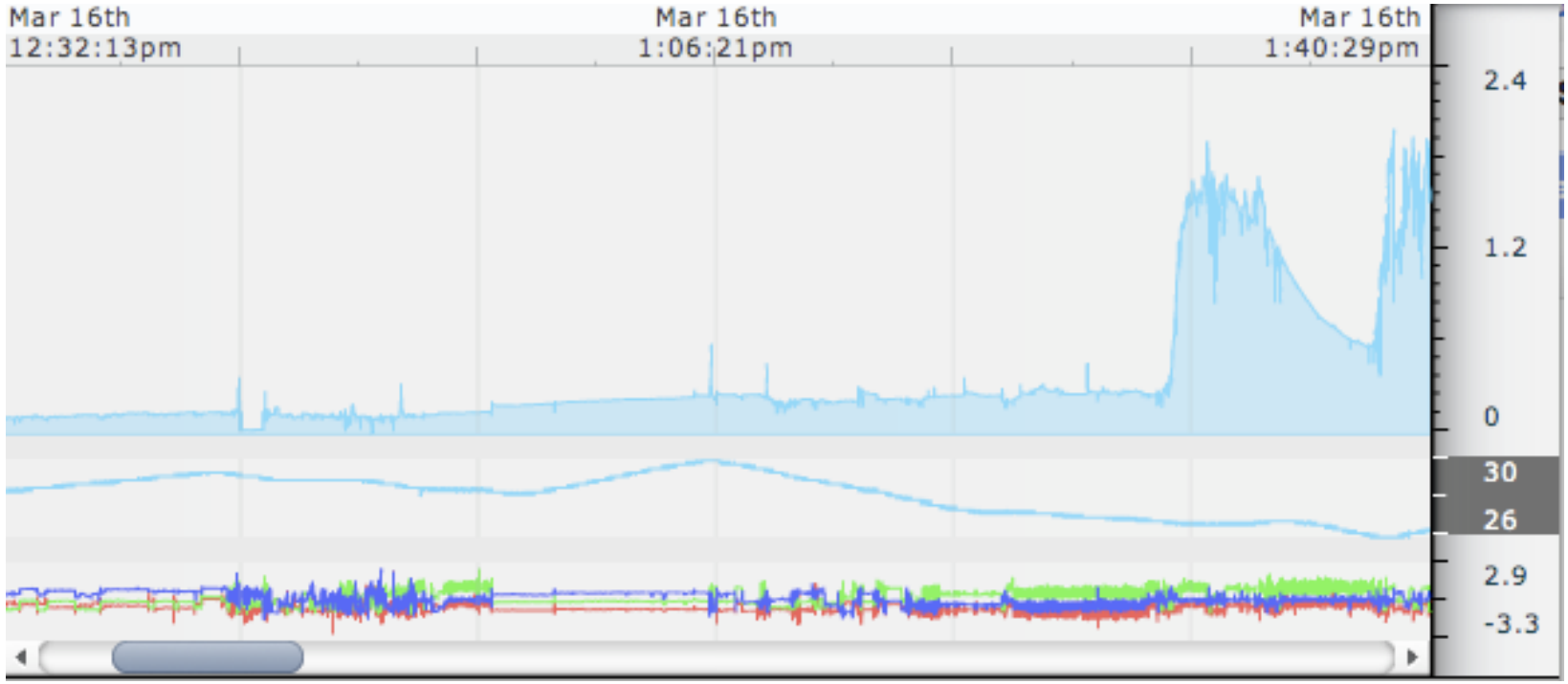
EDA Quick View

1.54



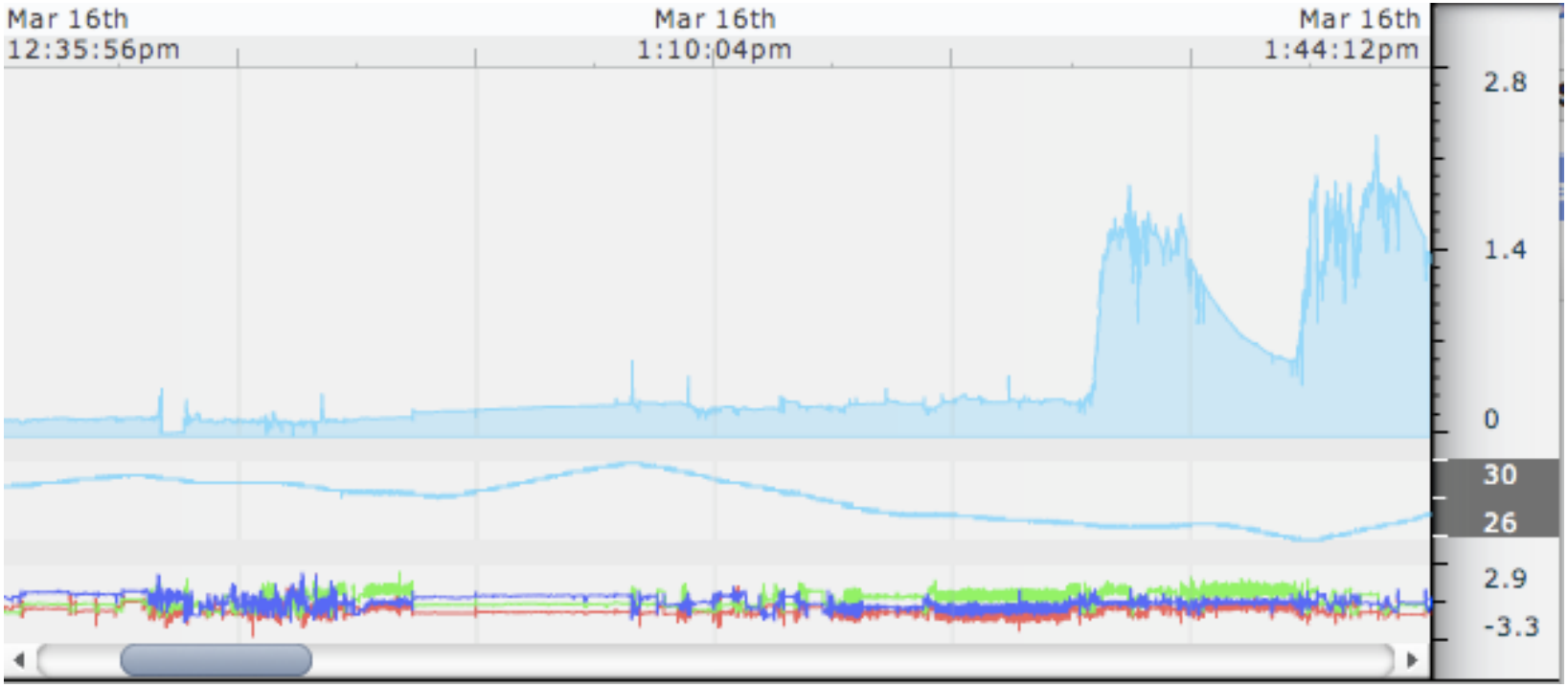
EDA Quick View

1.62



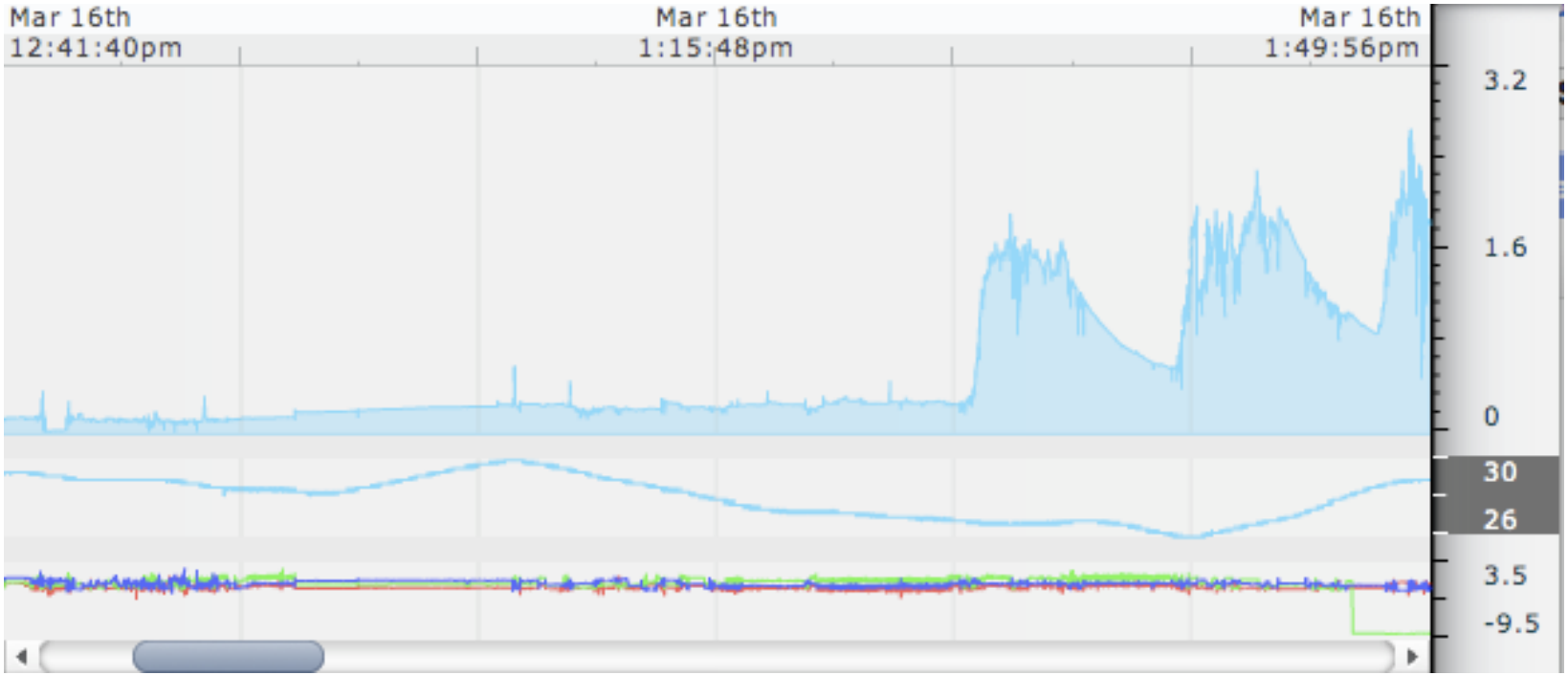
EDA Quick View

1.4



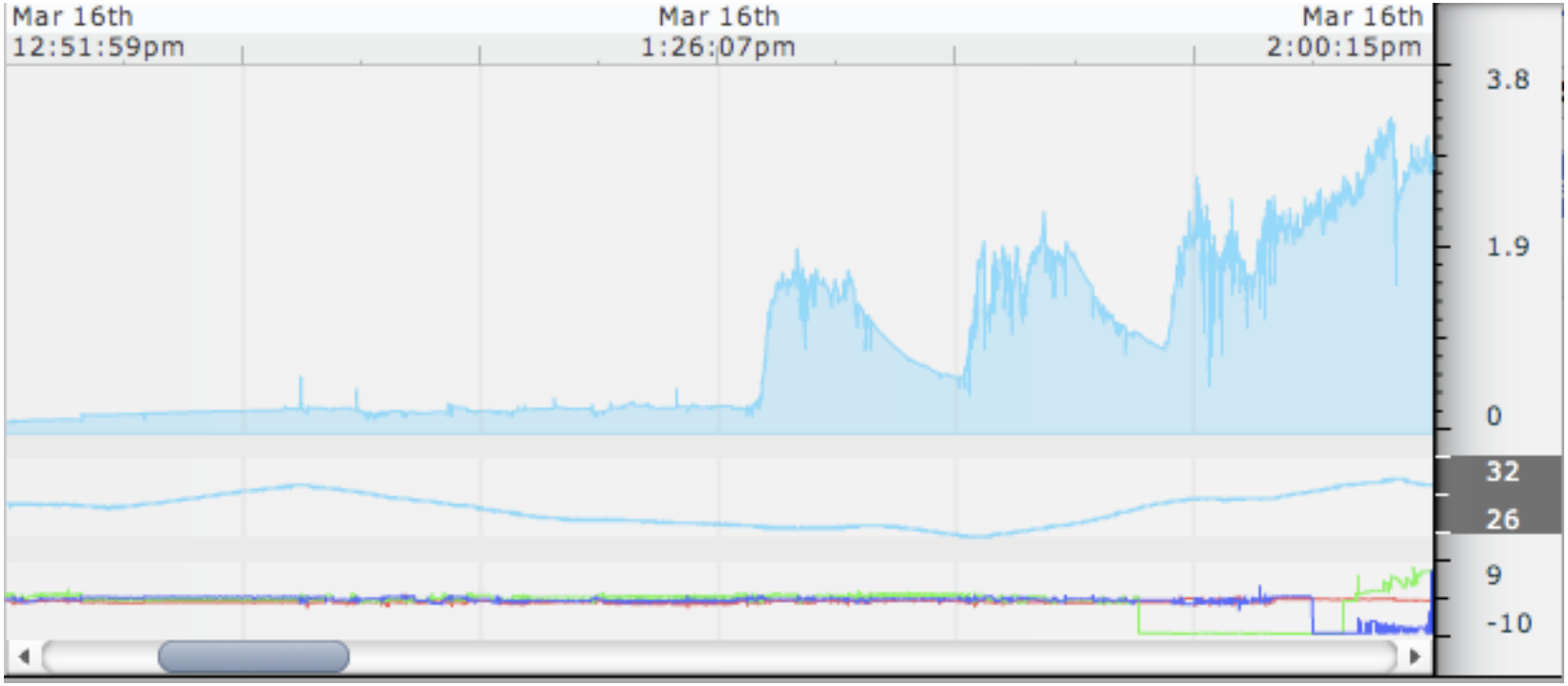
EDA Quick View

1.4



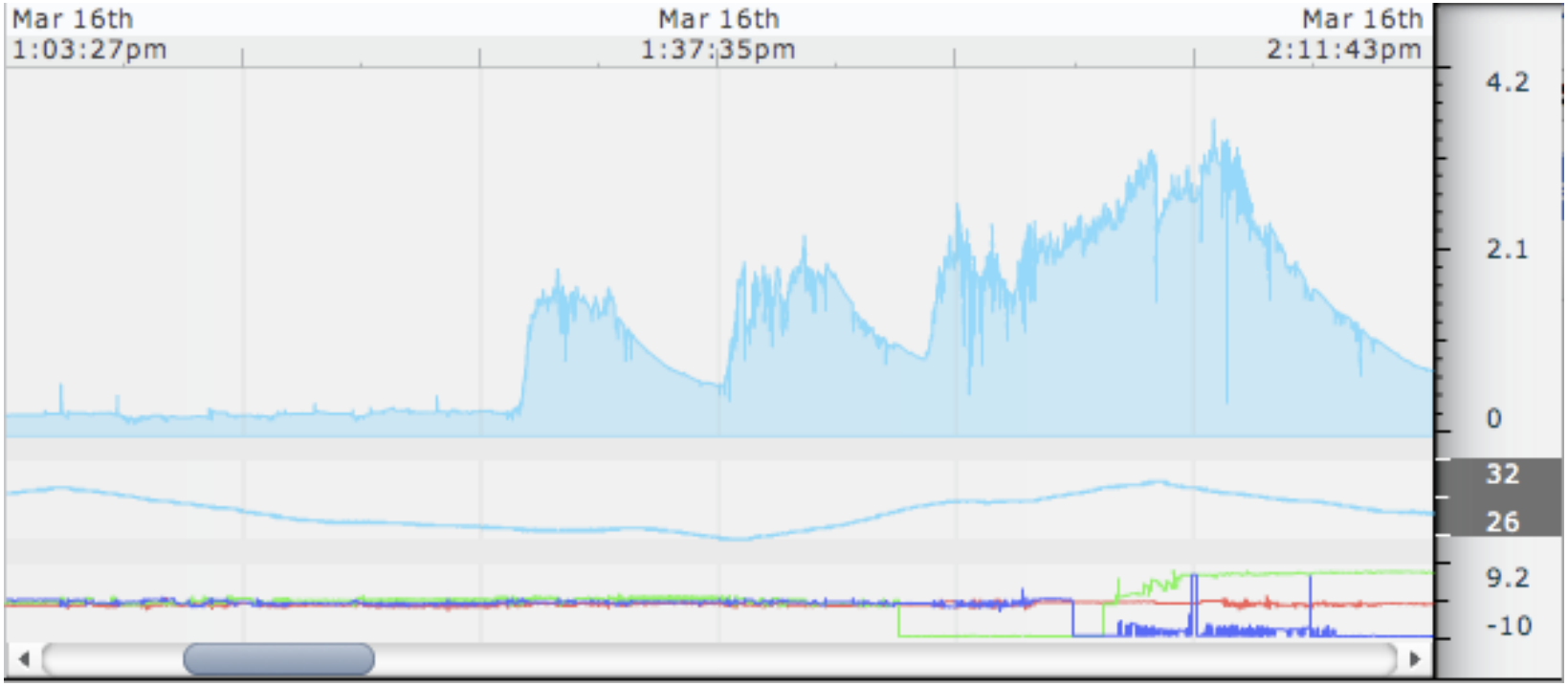
EDA Quick View

2.88



EDA Quick View

.74



- Information available:
  - Rising or falling
  - Fast or slow
  - Stable or labile
  - Raw EDA

- Information not available:
  - Context, how current state fits into individual's history

Testing with Dot Lucci

Director of Consultation for MGH/YouthCare

- Former teacher and school psychologist
- Works with teens with Aspergers
- Consults on how to make spaces and systems more compatible
- Clinical interest in anxiety & relaxation

Initial Reactions

- Distracted by graph
- Hard time remembering significance of colors
- Found thick-thin system for arrows non-intuitive
- Not complicated, just would take some time to learn

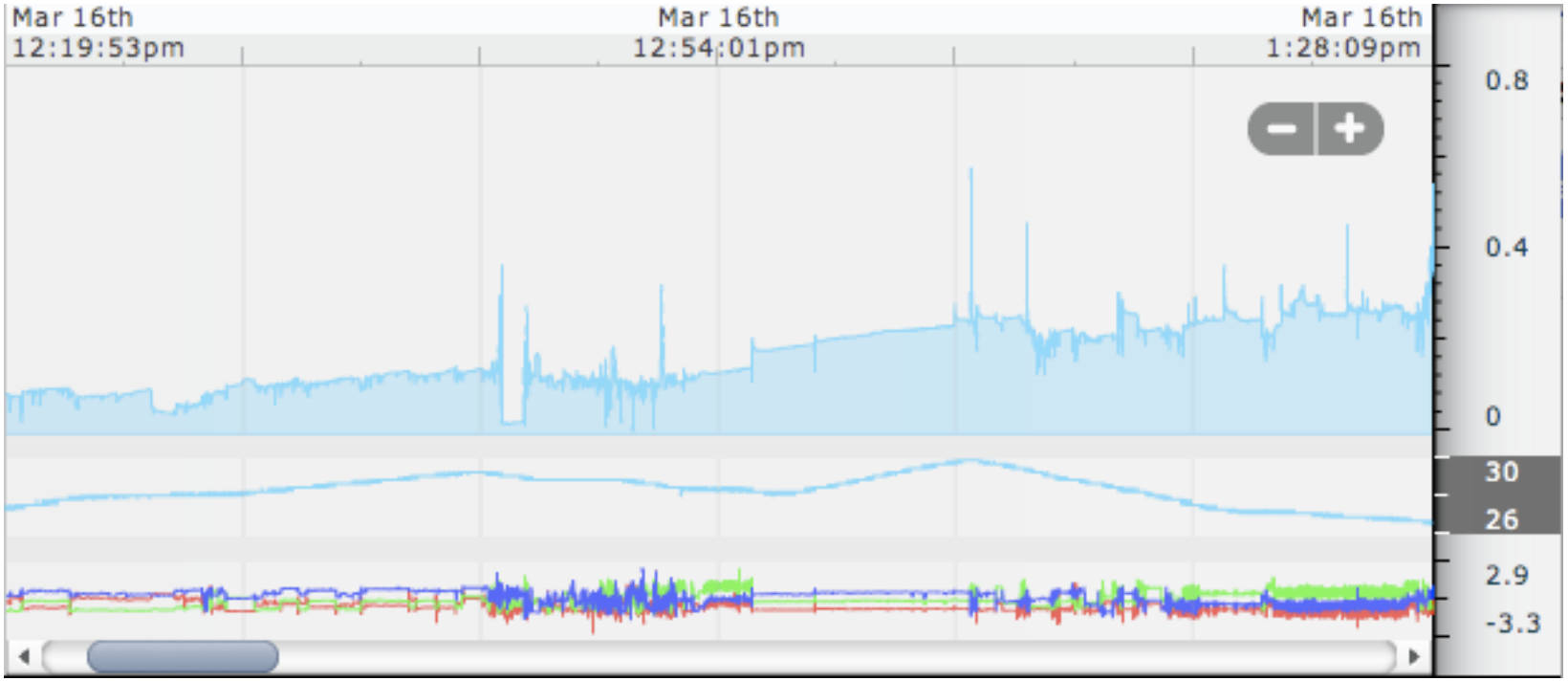
- **Need to find a way to capture gradual change** (particularly rise)
  - Feature where you can see net change over x amount of time
  - Allows for “antiseptic bounce”

- **Interface should be customizable for user**
  - Option to hide graph
  - Graph windowed to different time spans
  - Option to measure across different time spans

- **Interface should be customizable for monitored individual**
  - Calibrated to kid's own normal range
  - Name and photo of child next to display

Caroline

.37


Mar 16th
12:19:53pm
Mar 16th
12:54:01pm
Mar 16th
1:28:09pm
0.8
0.4
0
30
26
2.9
-3.3

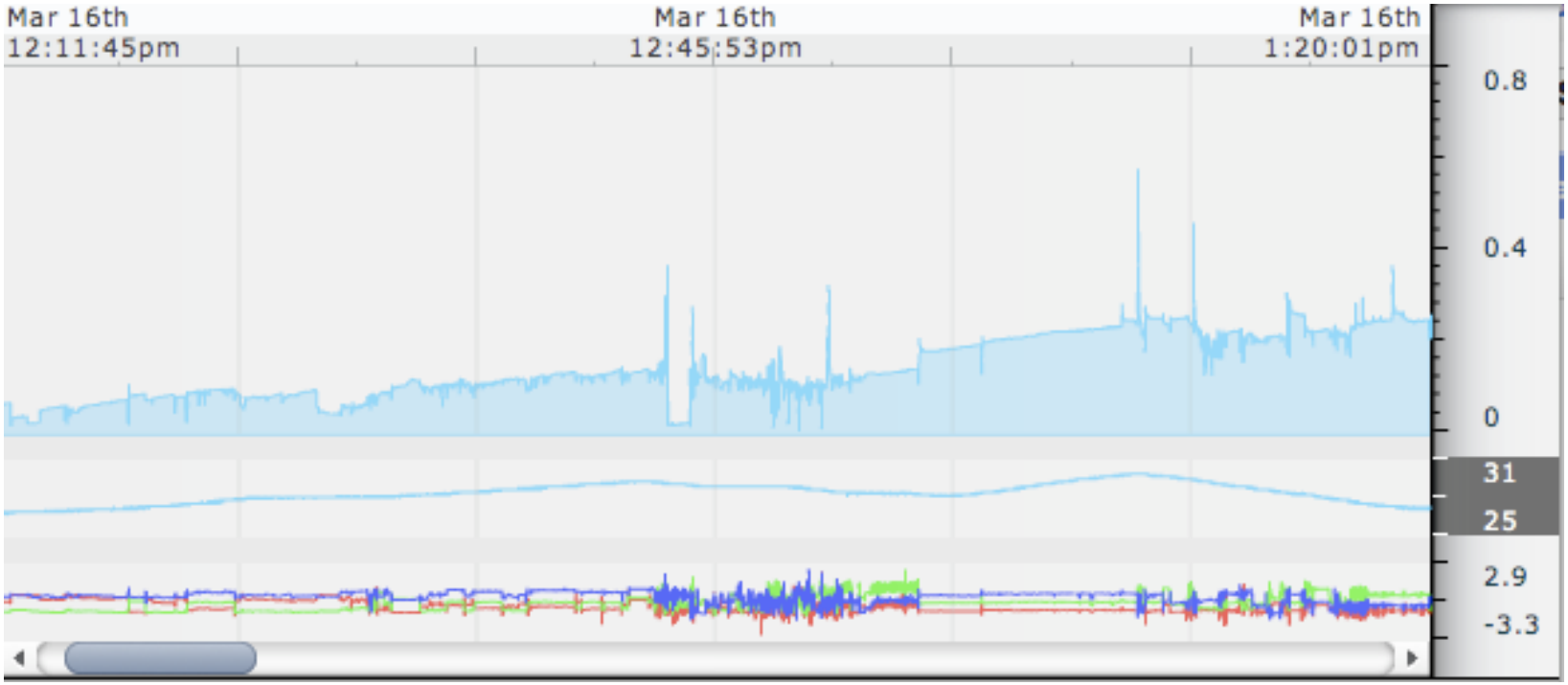
Ultimately teacher's choice how to use the information

- Match optimal arousal with setting
  - Higher for PE
  - Lower for reading
- Still need for learning, attention to other cues

Other possible ways..

EDA Quick View

.25



EDA Quick View

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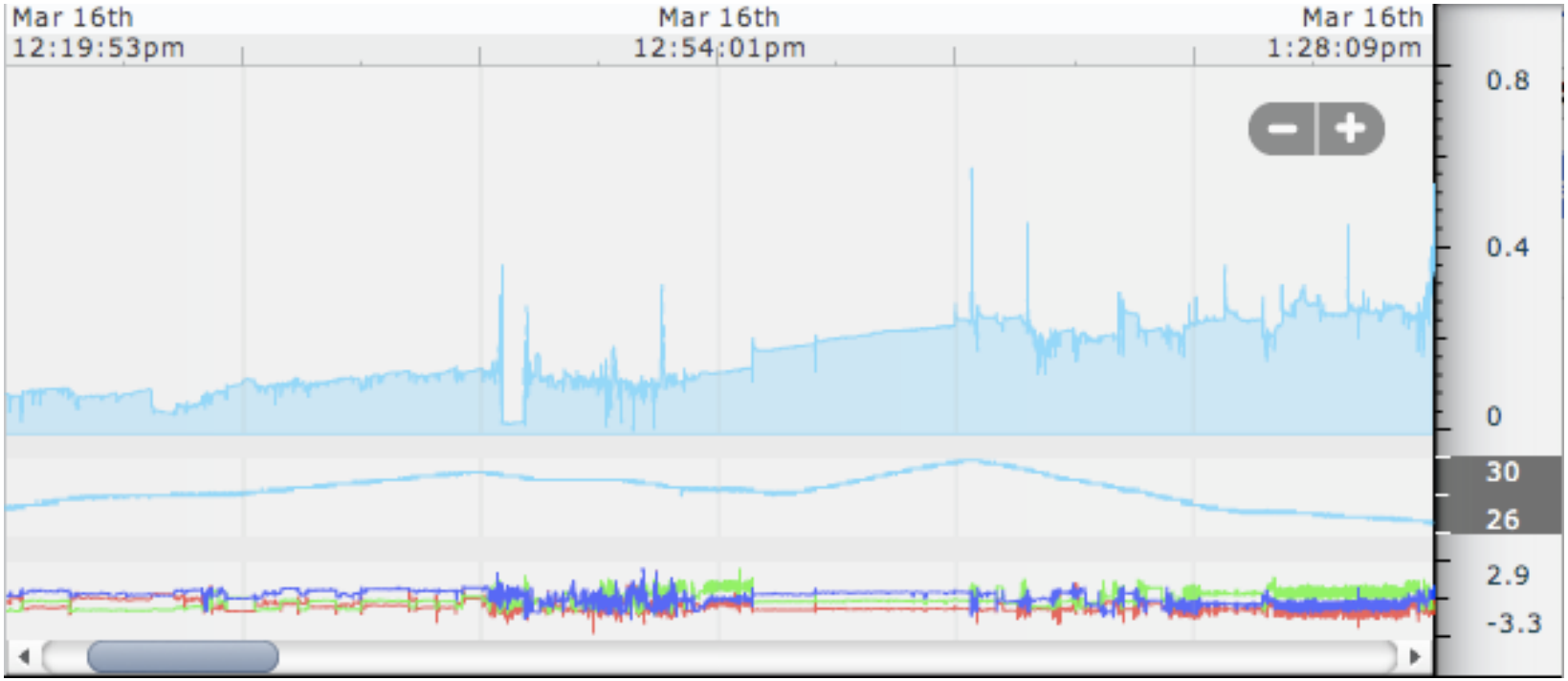
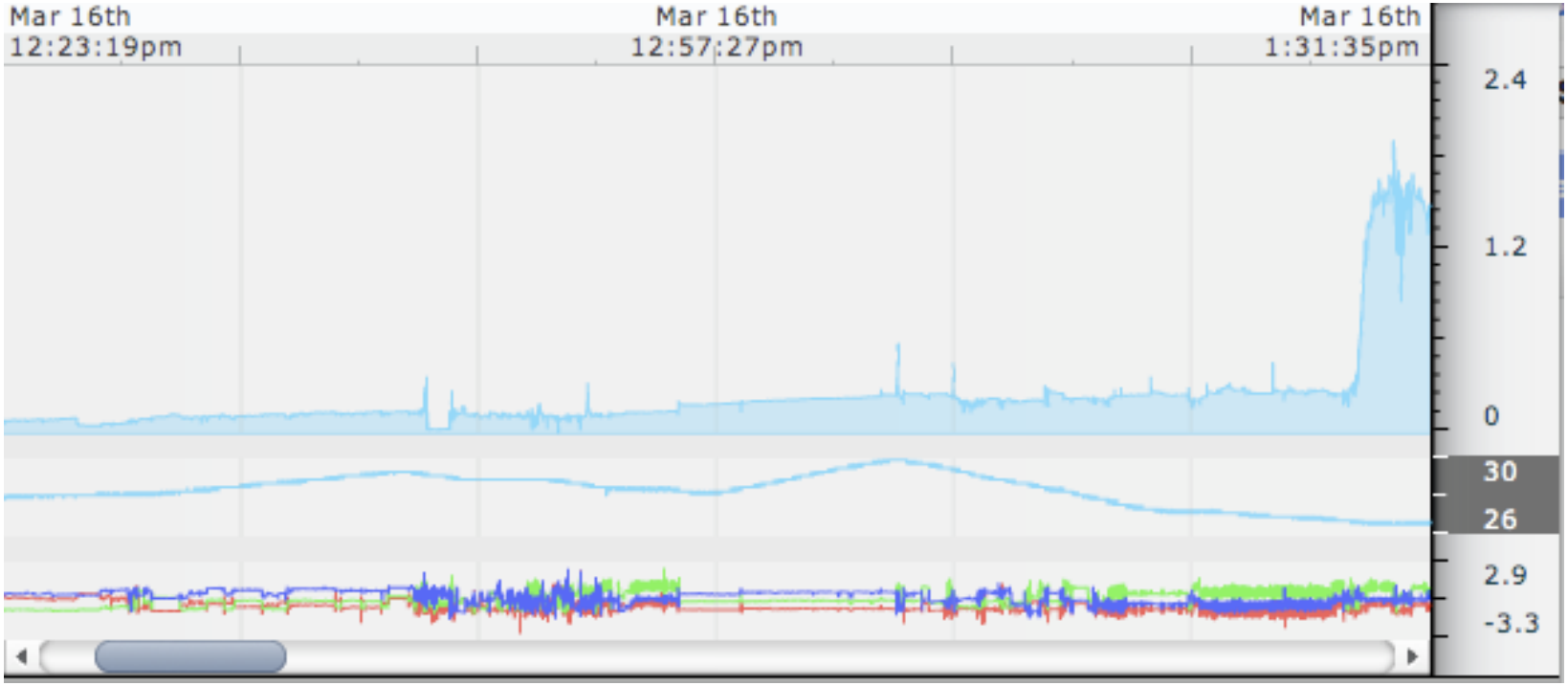


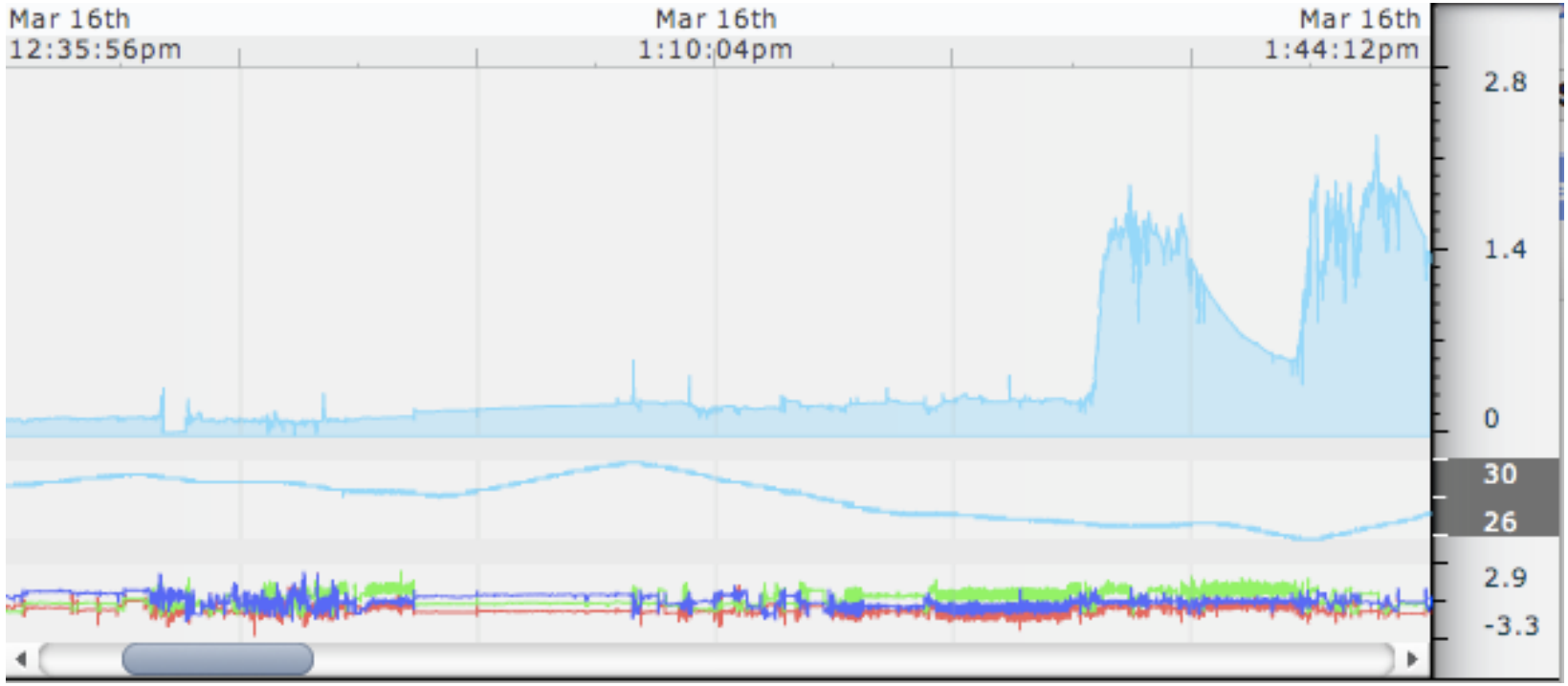
EDA Quick View

1.54



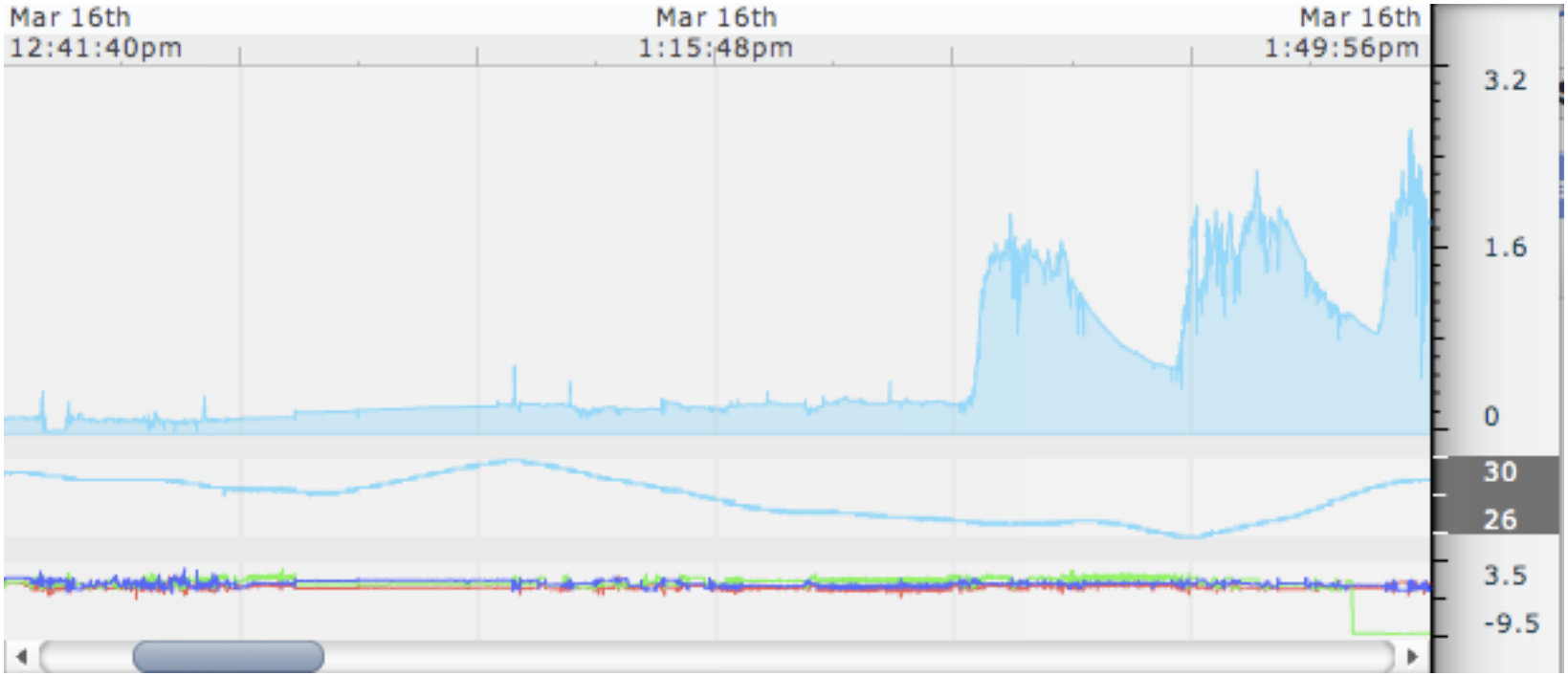
EDA Quick View

1.4



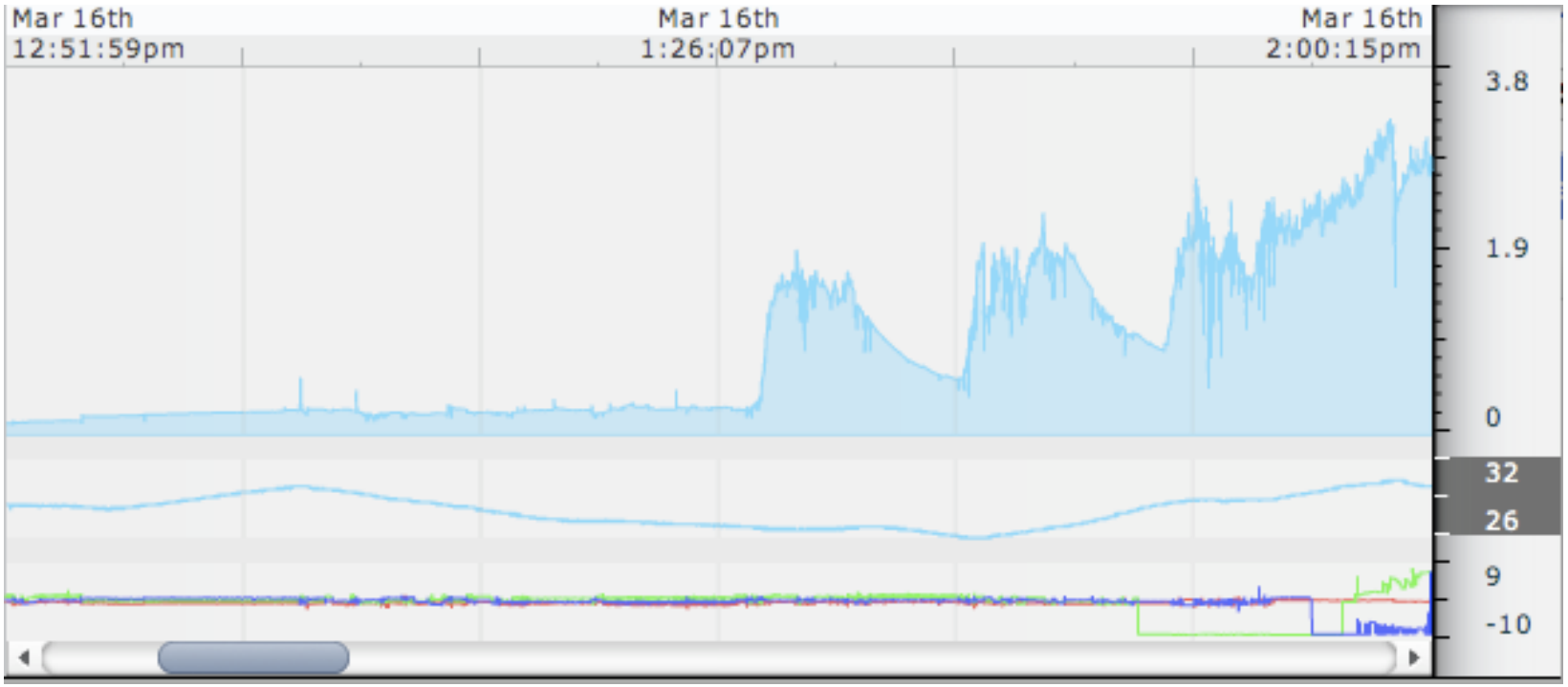
EDA Quick View

1.4



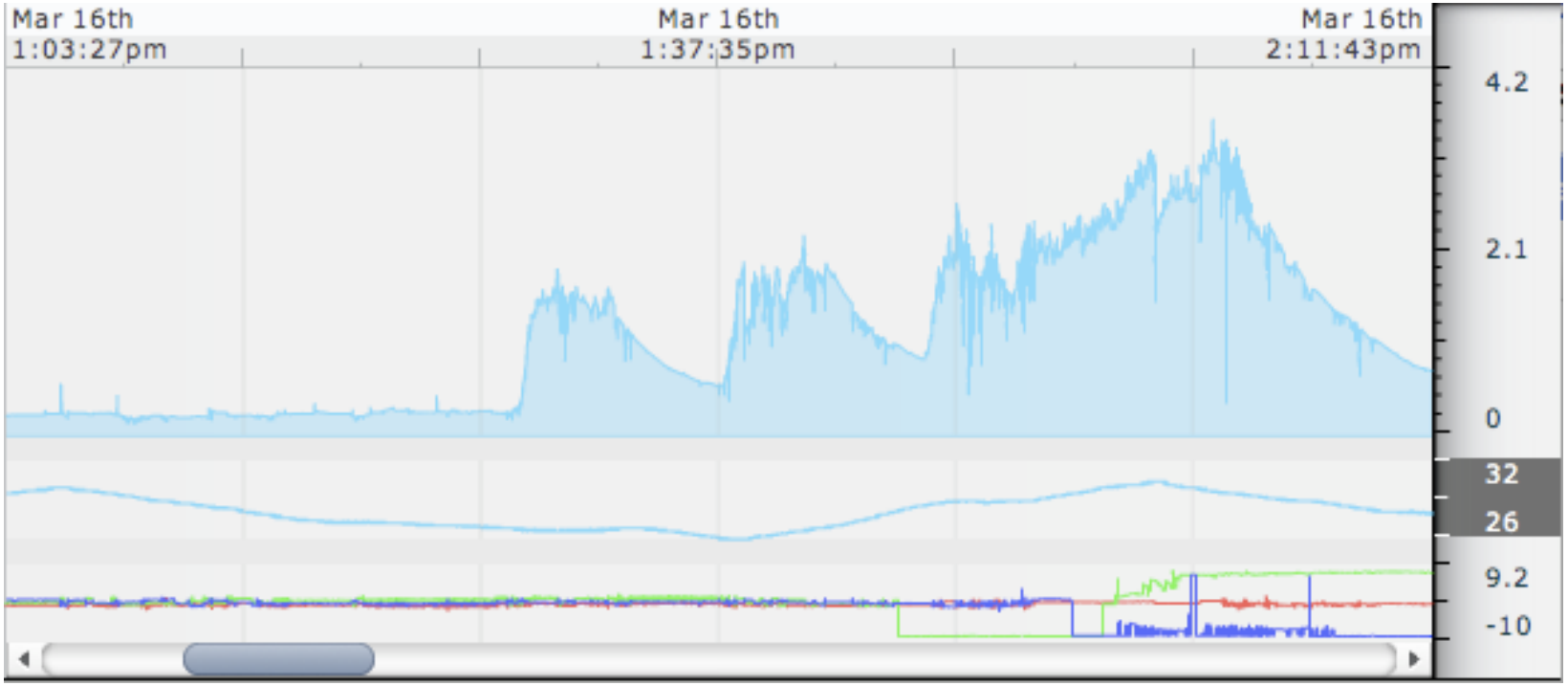
EDA Quick View

2.88

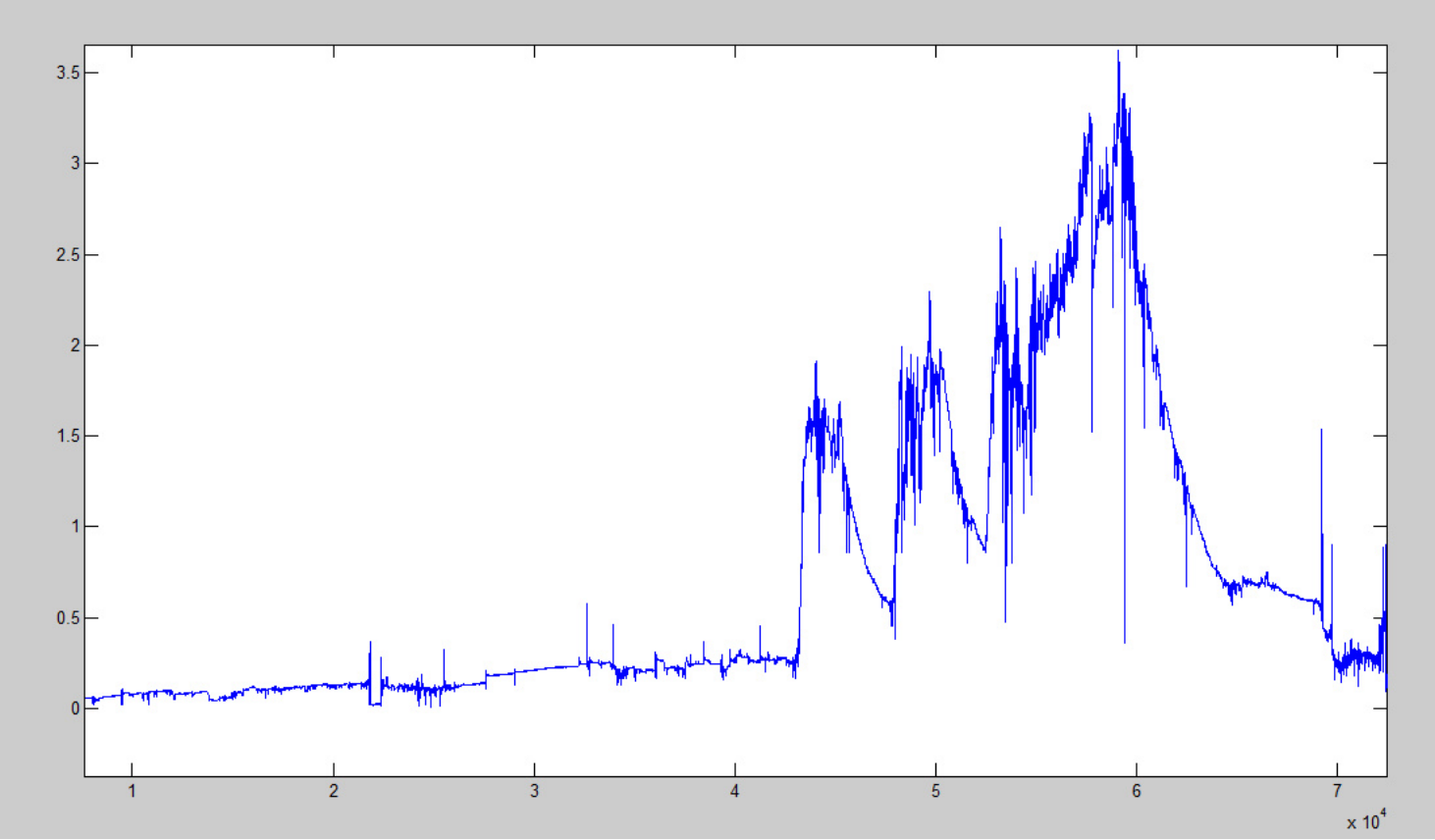


EDA Quick View

.74



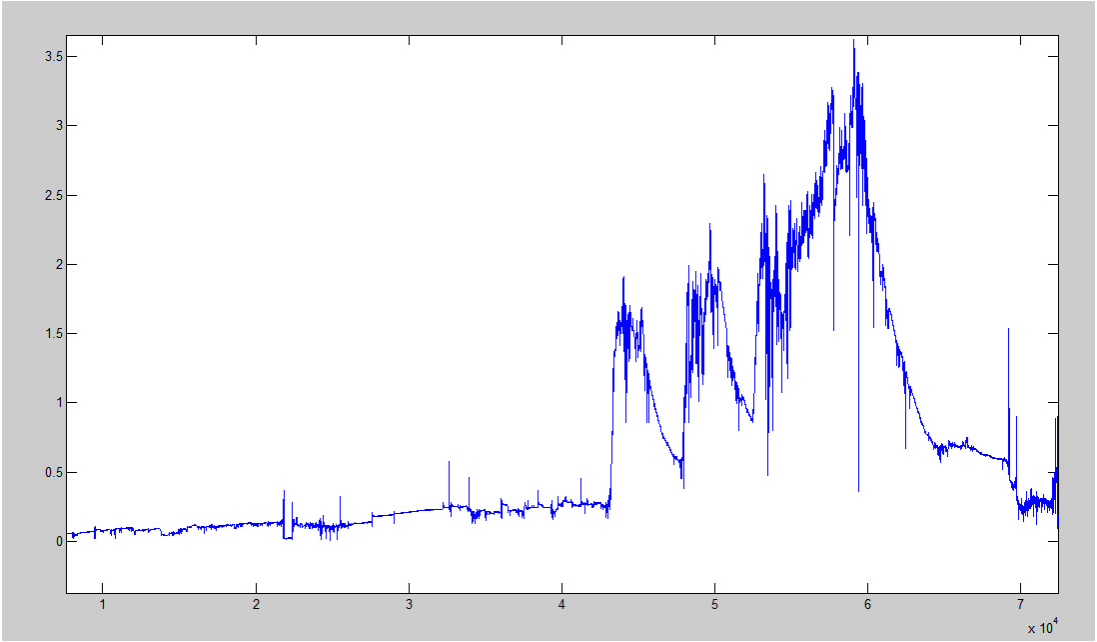
Data Processing

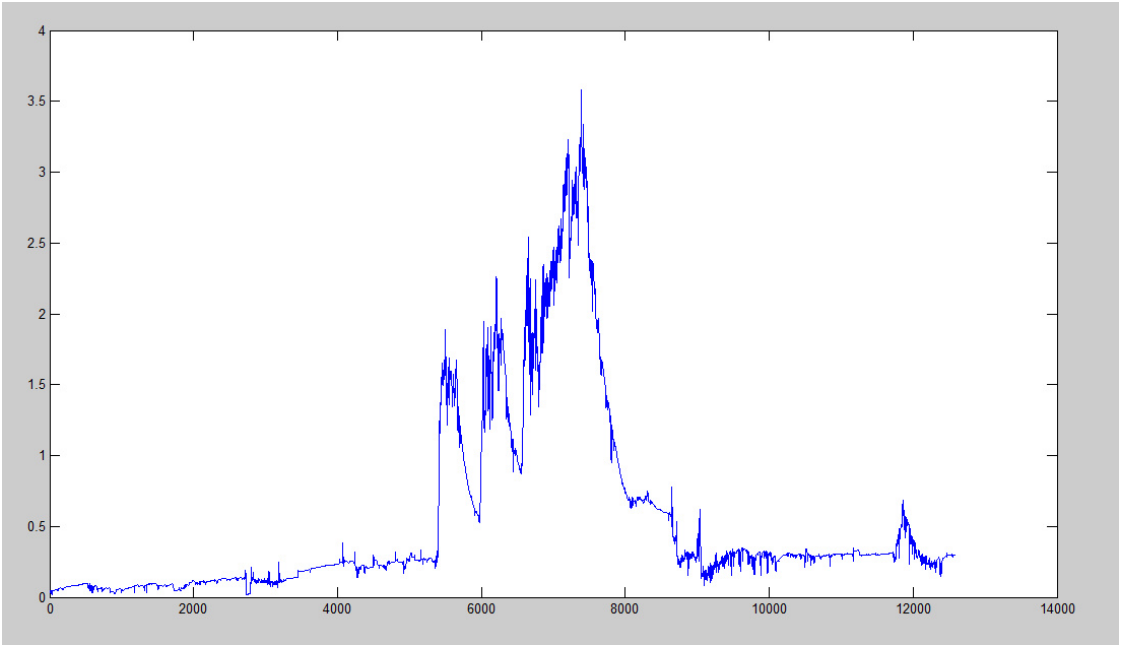


Cleaning up the data

Filtering

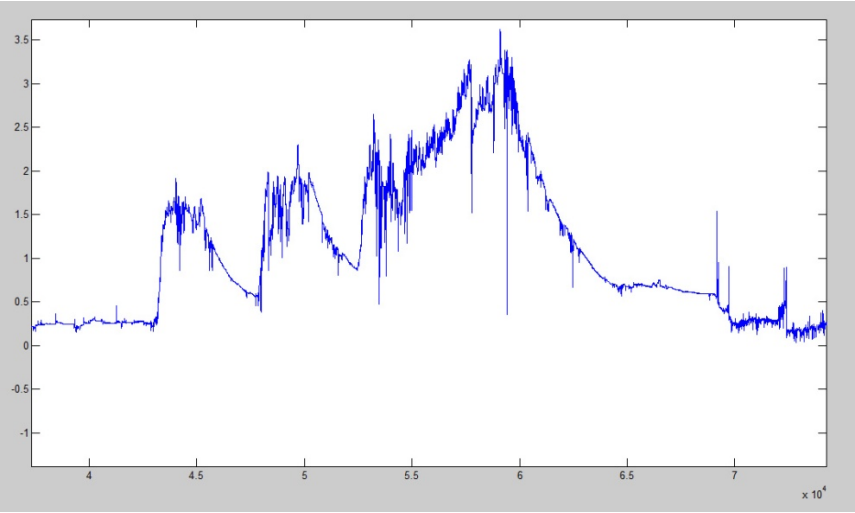
33 size filter

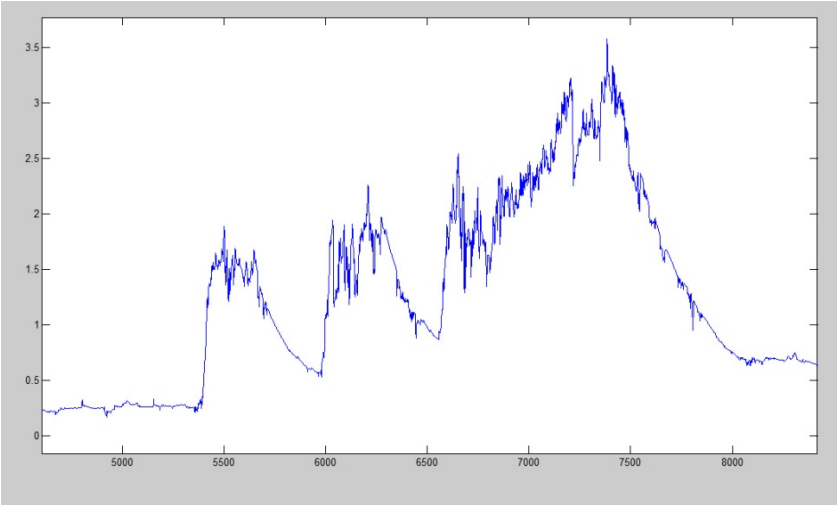


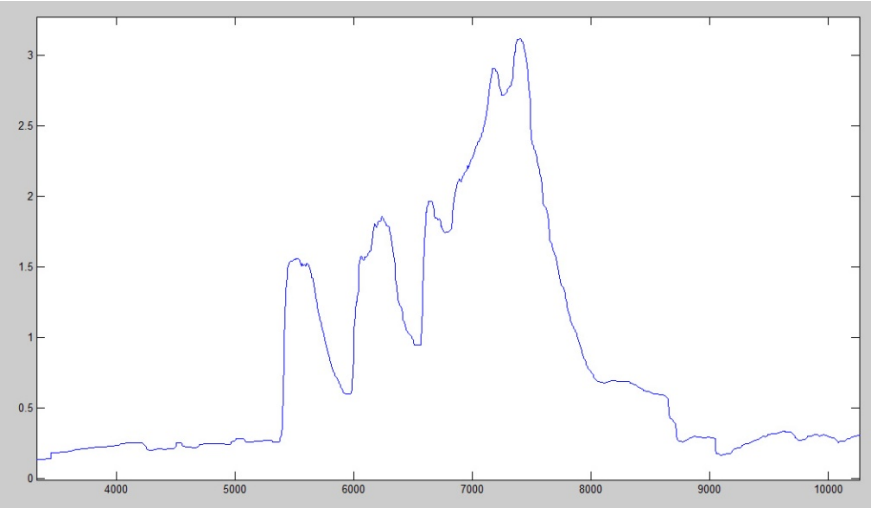


More Filtering

Median filtering

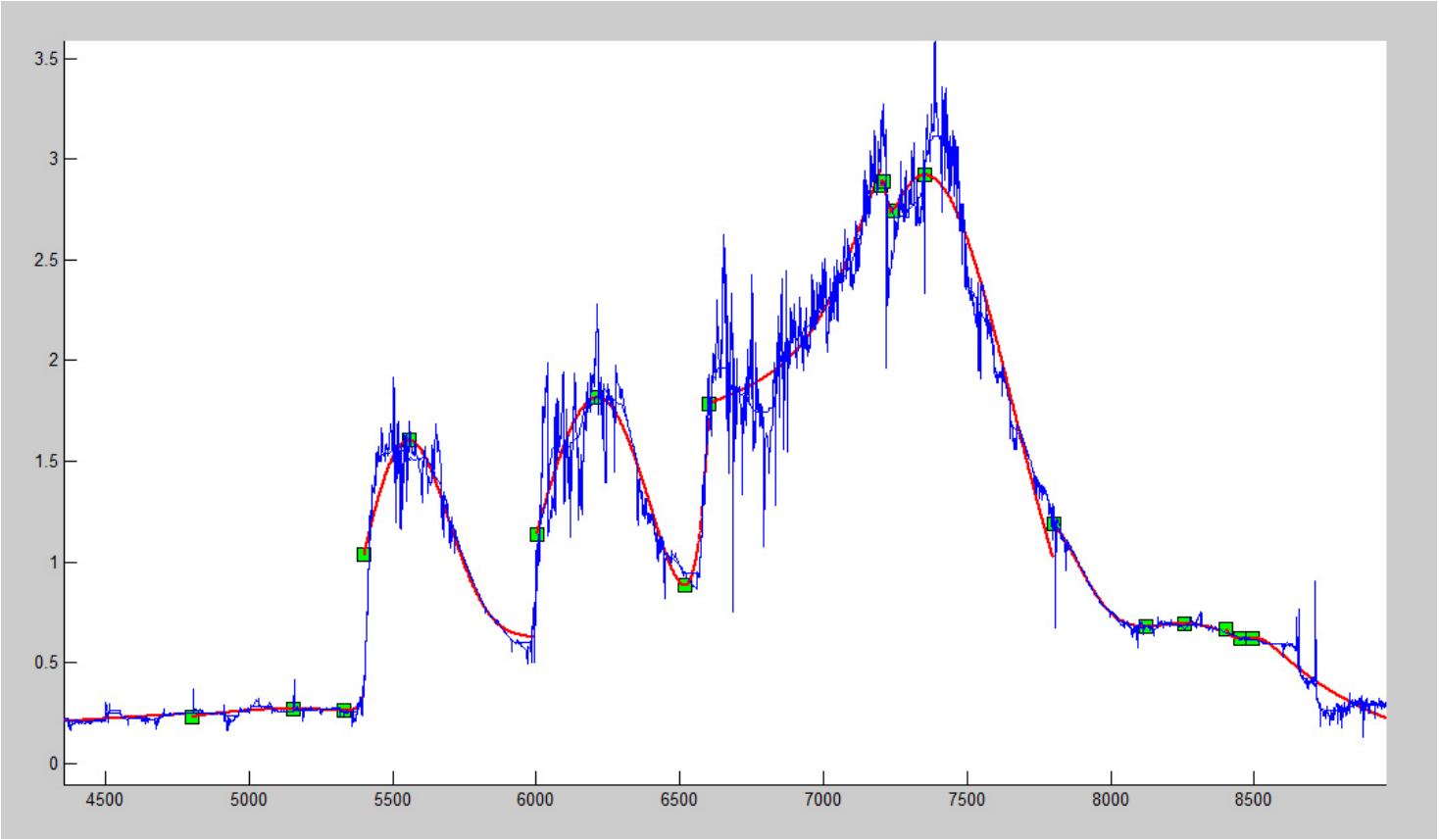




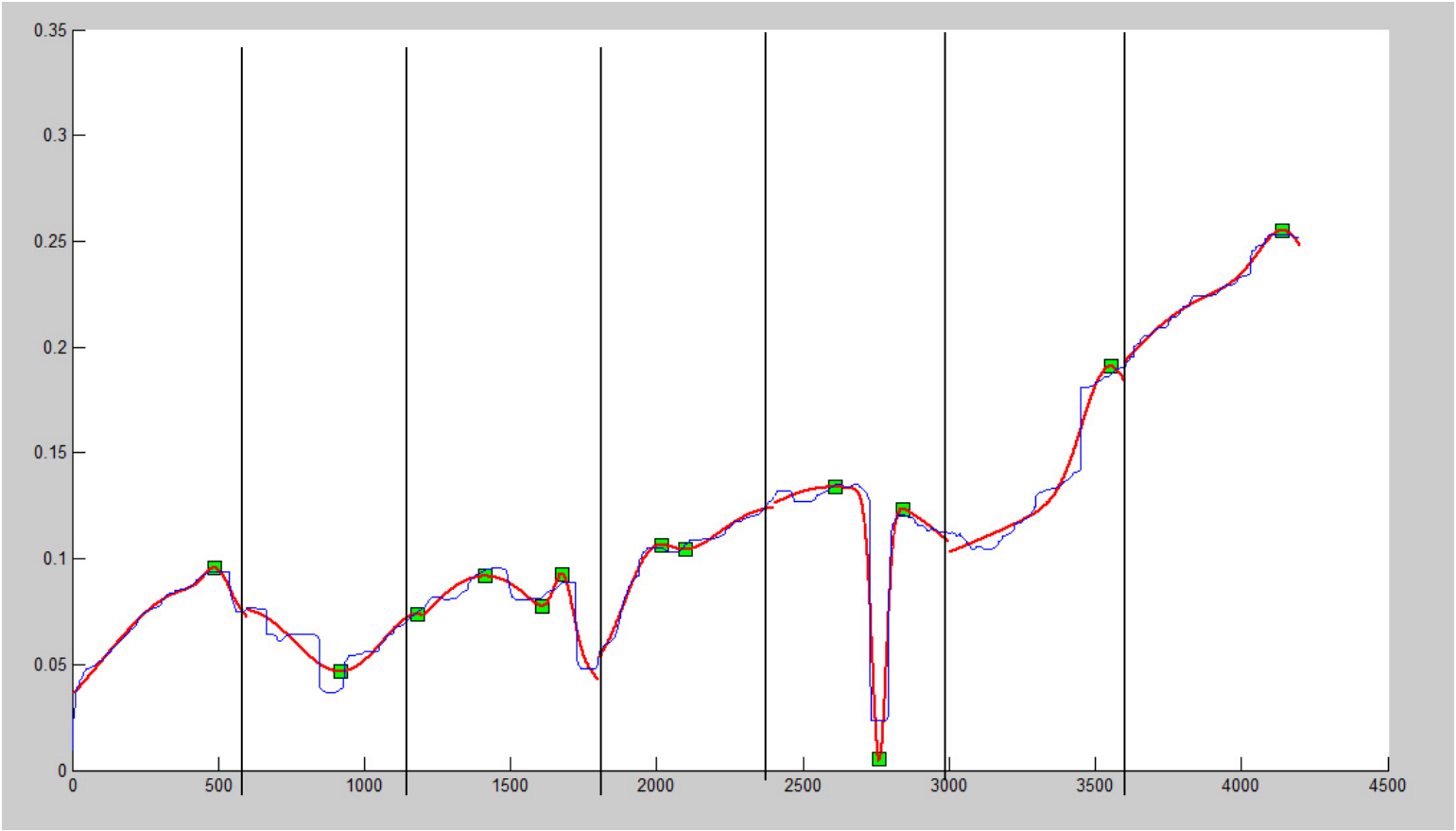


Cleaning up the data

Curve Fitting - Gaussians

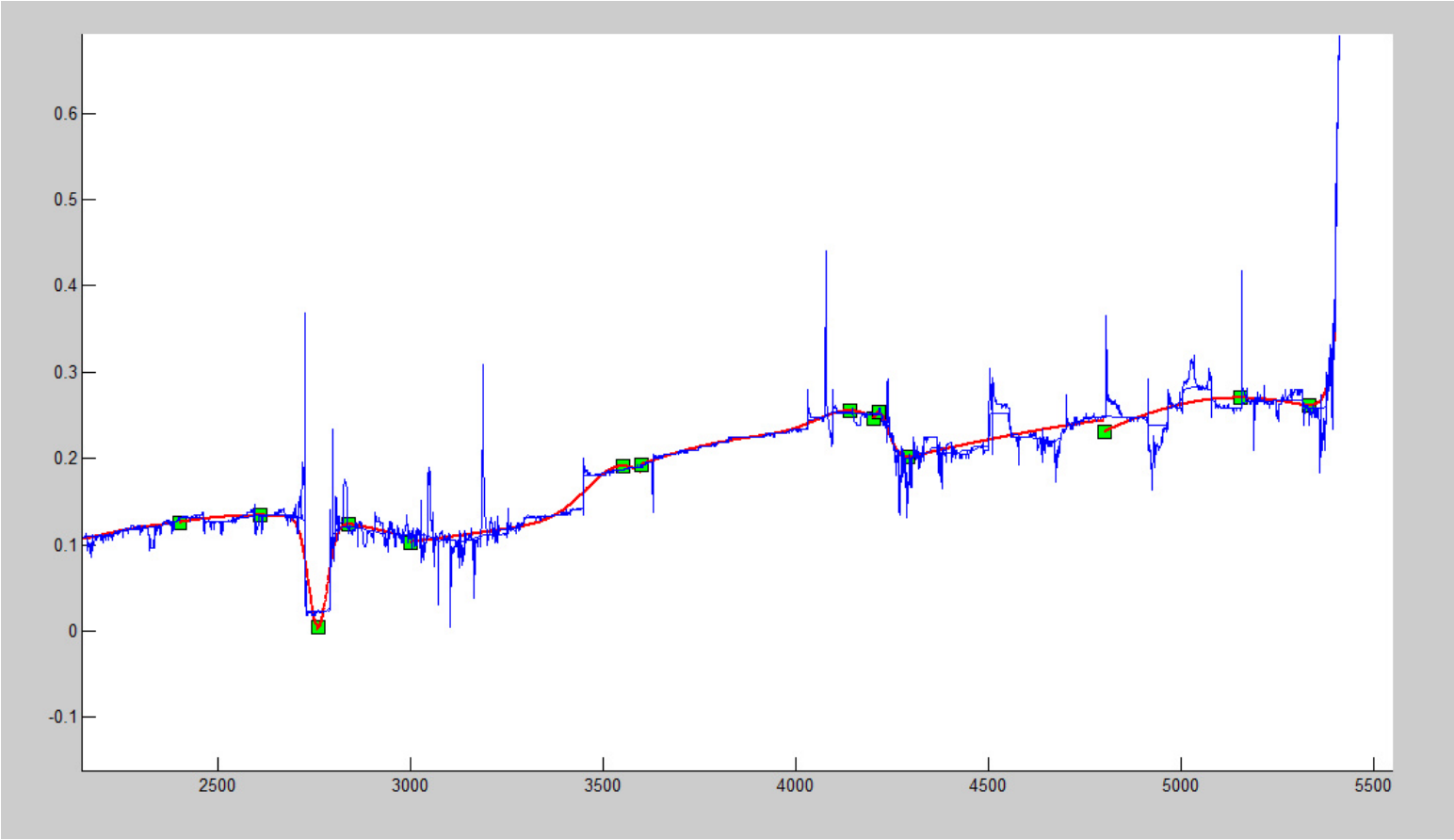


Curve Fitting - Gaussians



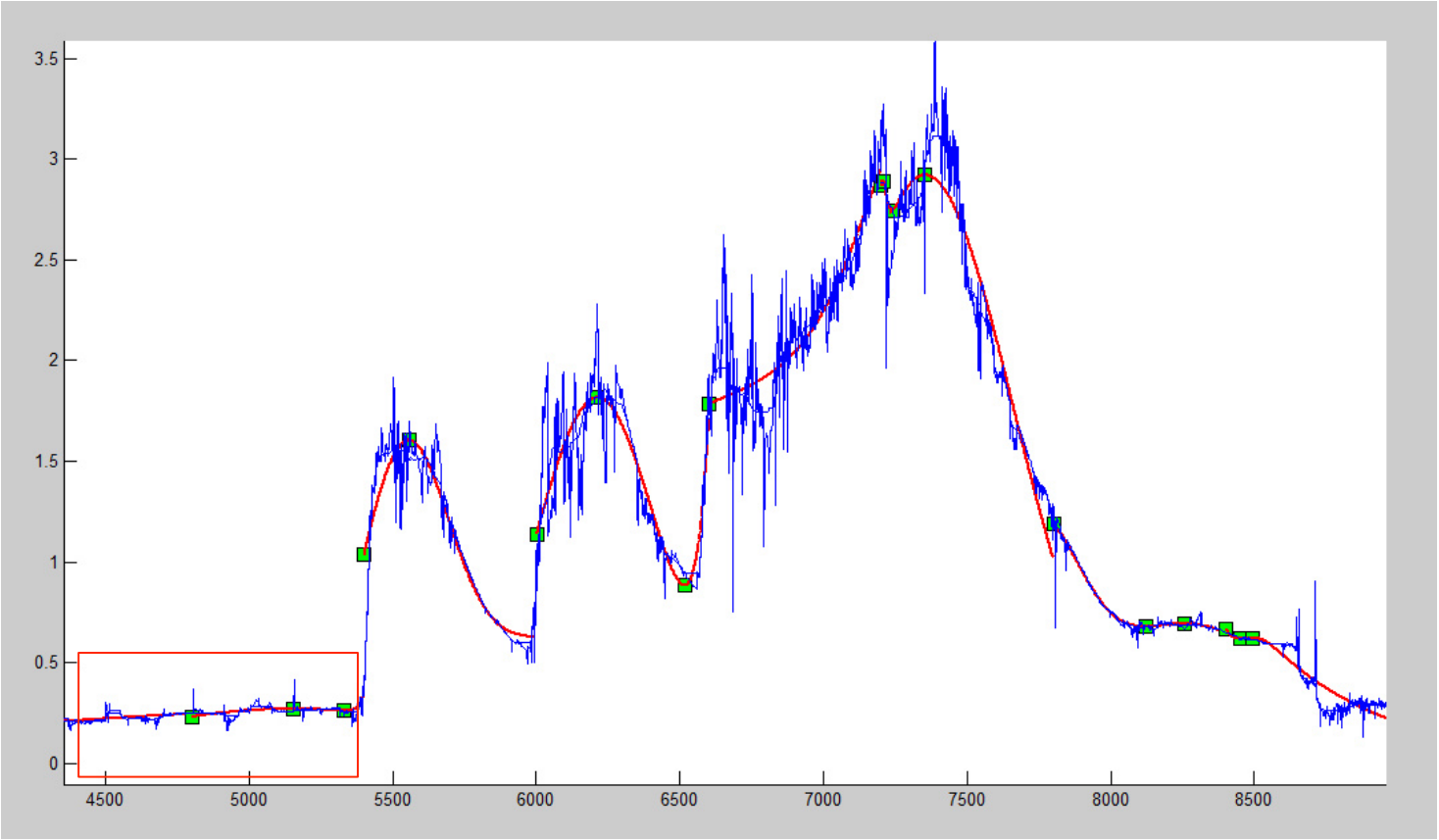
10 minute intervals – 2 Gaussians/interval

Curve Fitting - Gaussians



40 min of data - Arousal increasing? Decreasing? Constant?

Curve Fitting - Gaussians



40 min of data - Arousal increasing? Decreasing? Constant?

Future Work

- Testing Session with teachers and parents
- Next system prototype
- Reiterating the design process
- What kind of rises in arousal to focus in the real setting?

Thank You

- Matthew & Roz
- Dot Lucci
- Elliott Hedman
- The Groden Center
- The rest of our class!