Dynamics of emotion processing in post-stroke aphasia: Insights from continuous valence ratings during naturalistic movie-viewing

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Disclosures

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Learner Outcomes

1. Describe differences in emotional processing between persons with aphasia (PWA) and controls.
2. Explain how continuous emotional reactivity ratings inform language processing.
3. Discuss implications for clinical practice, and identify future research directions in this area.

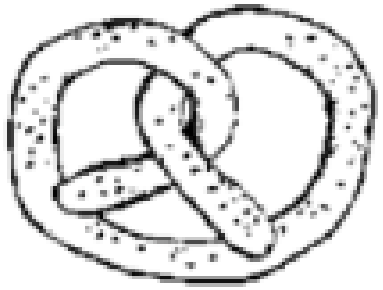
Assessment in Aphasia

- Current Approaches ≠ Real Life Communication
- Traditional Assessment Limitations:
  - Static tasks that don't reflect daily interactions
  - Single modality when communication is multimodal
  - Missing emotional context of real conversations
  - Limited ecological validity

How can we better capture what really matters in communication?

Rethinking Assessment

- How do people with aphasia process language in real life?
- Traditionally:
  - Picture naming
  - Word lists
  - Structured tasks

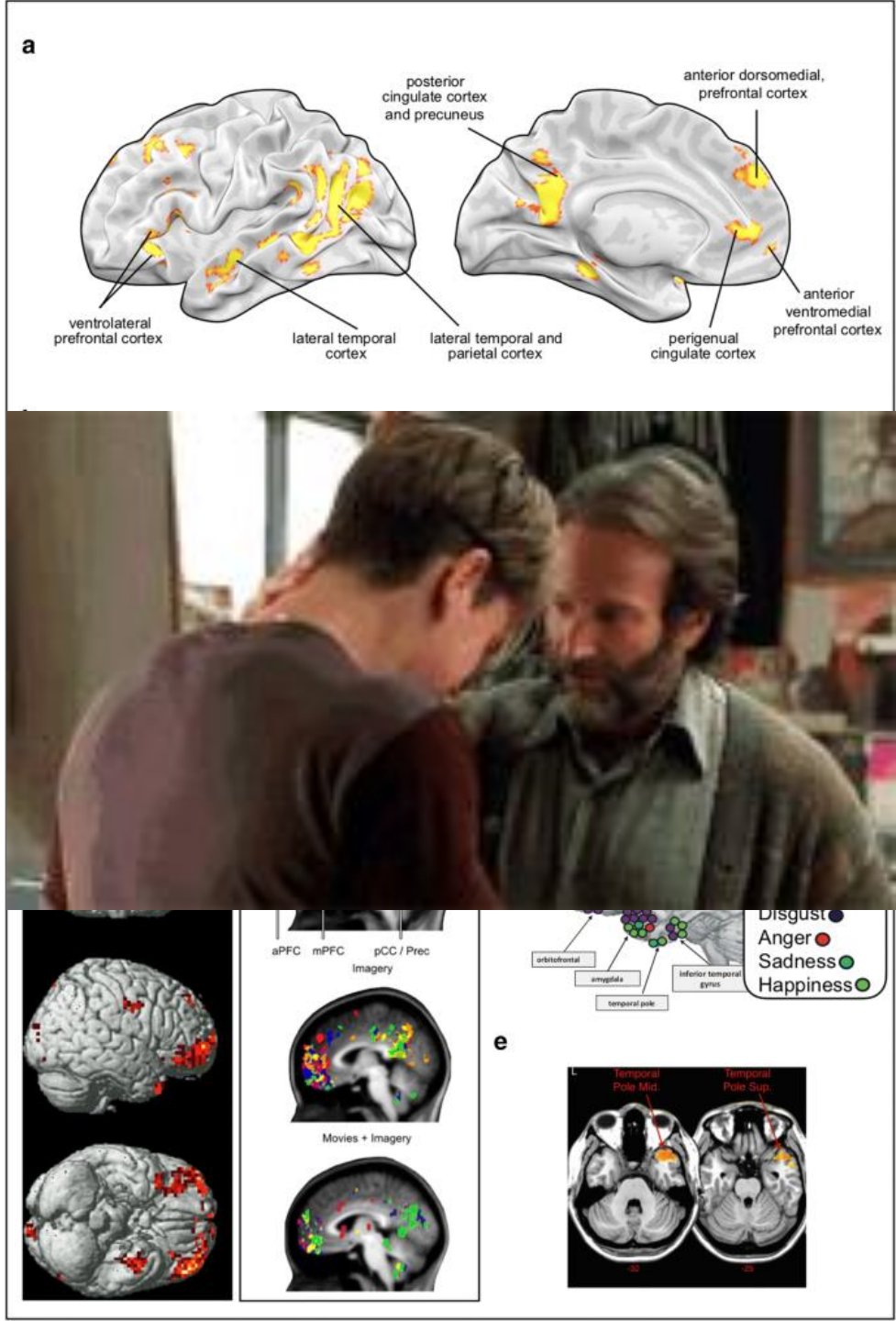


- Real life:
  - Dynamic conversations
  - Multiple speakers
  - Emotional content

Why Emotions Matter

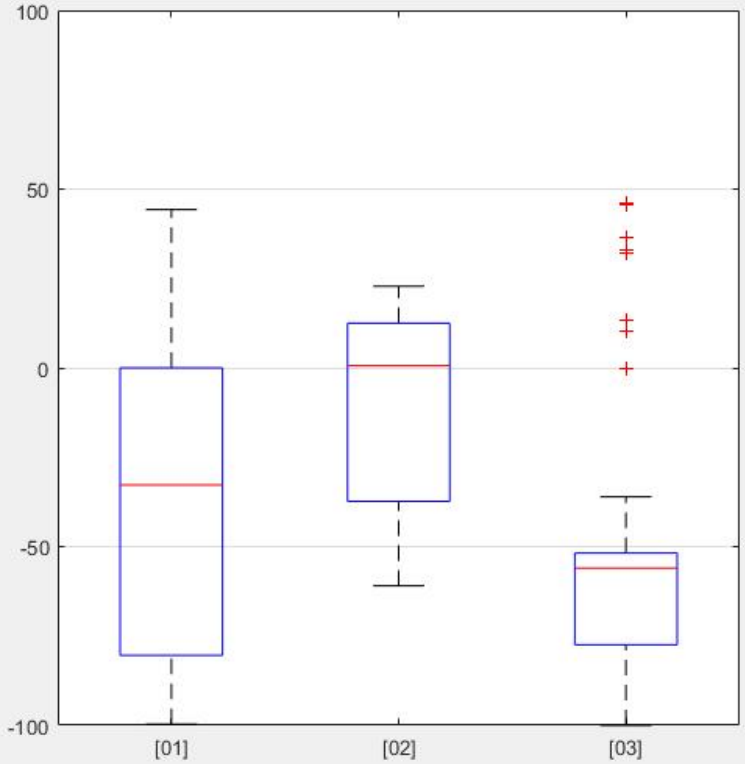
- Emotion shapes how we process language
- Language helps us understand emotions
- Both systems work together in daily life
- ((psych const. acct))

- Clinical relevance:
  - More engaging?
  - More functional?
  - Motivation?
  - Simulated social connection?
- What kind of stimuli?
  - Movies!

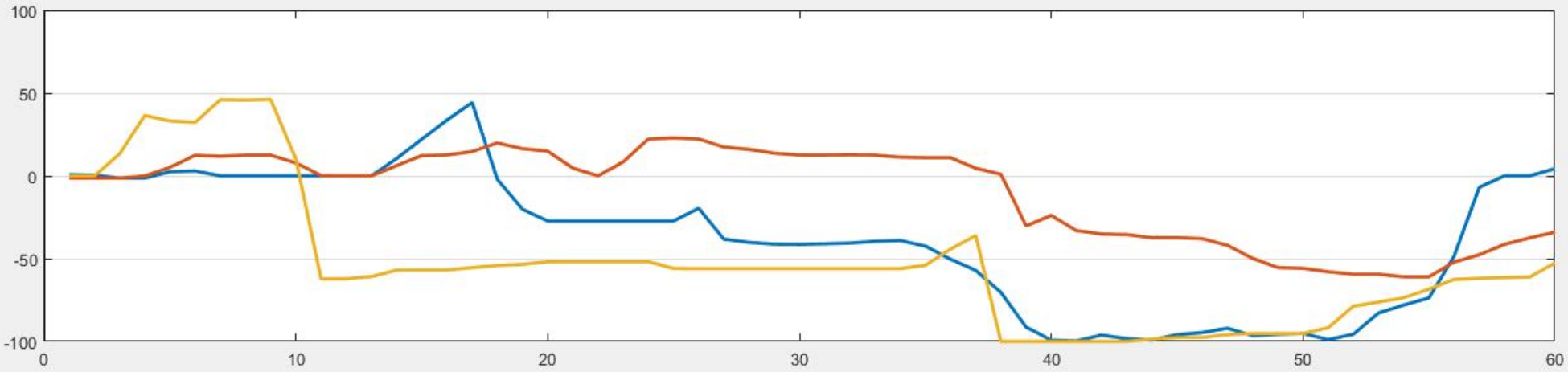


CARMA: Review Ratings

Media Annotations Analyze Help



Annotation Files
[01] Robin-Williams-EH
[02] Robin-Williams-HD
[03] Robin-Williams-JG



Add Annotations

Remove Selected

Remove All Files

Show Mean Plot

Analyze Ratings

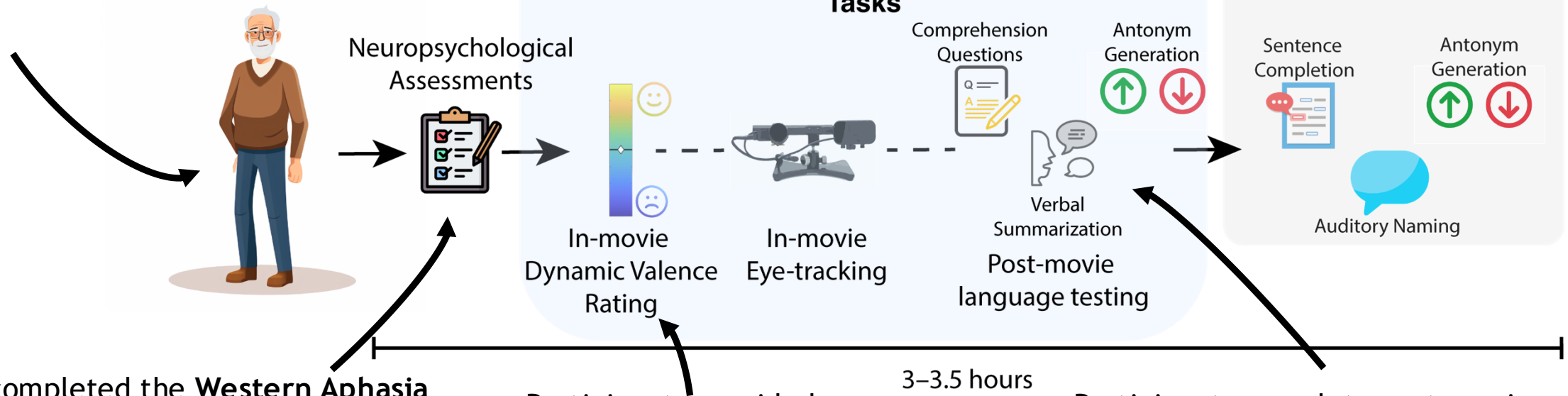
Play

Aims

- Key Questions:
  - Do PWA process emotions differently?
  - How does language processing influence emotional reactivity?
  - What can patient-specific patterns tell us?

Participants: Adults diagnosed with post-stroke aphasia (28 **PWA**; mean age = 58.18 years, SD = 10.60), healthy controls (46 **HC**; mean age = 46.79 years, SD = 15.62).

8 movie clips from DynAMoS (Girard et al., 2023), 2-5 mins each, selected for emotional variety & consistency of response elicited in pilot study.



PWA completed the **Western Aphasia Battery** (**WAB**; mean aphasia quotient [AQ] = 81.00, SD = 18.41), in addition to additional cognitive-linguistic assessments.

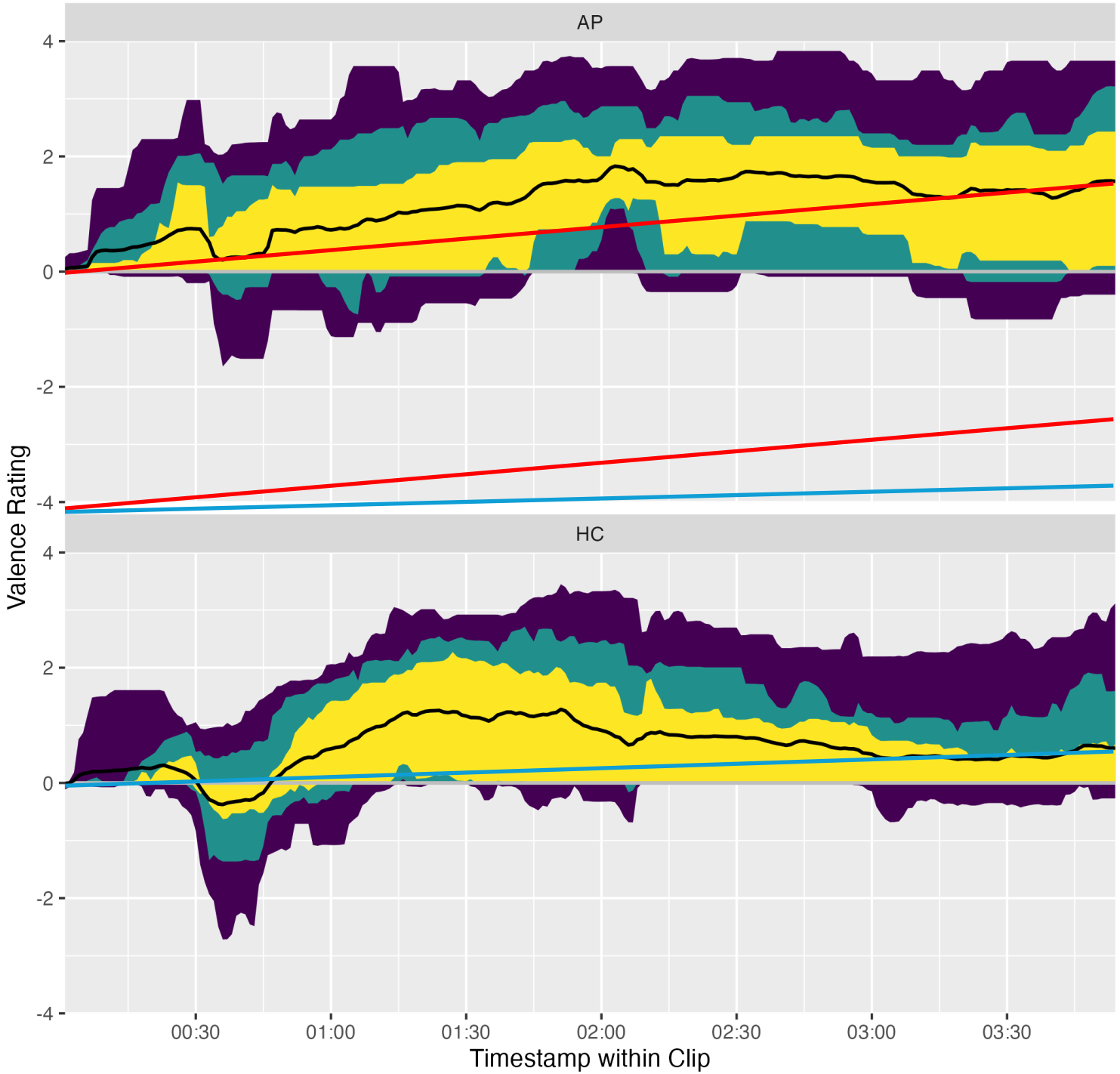
Participants provided **continuous** (-4 to 4) valence ratings using **Continuous Affect Rating and Media Annotation (CARMA)**.

Participants complete post-movie language testing: 1-minute **verbal summarization**, 3 **multiple-choice questions** per clip, and 5 **antonym generation** prompts, derived from subtitle text.

Statistical Analyses

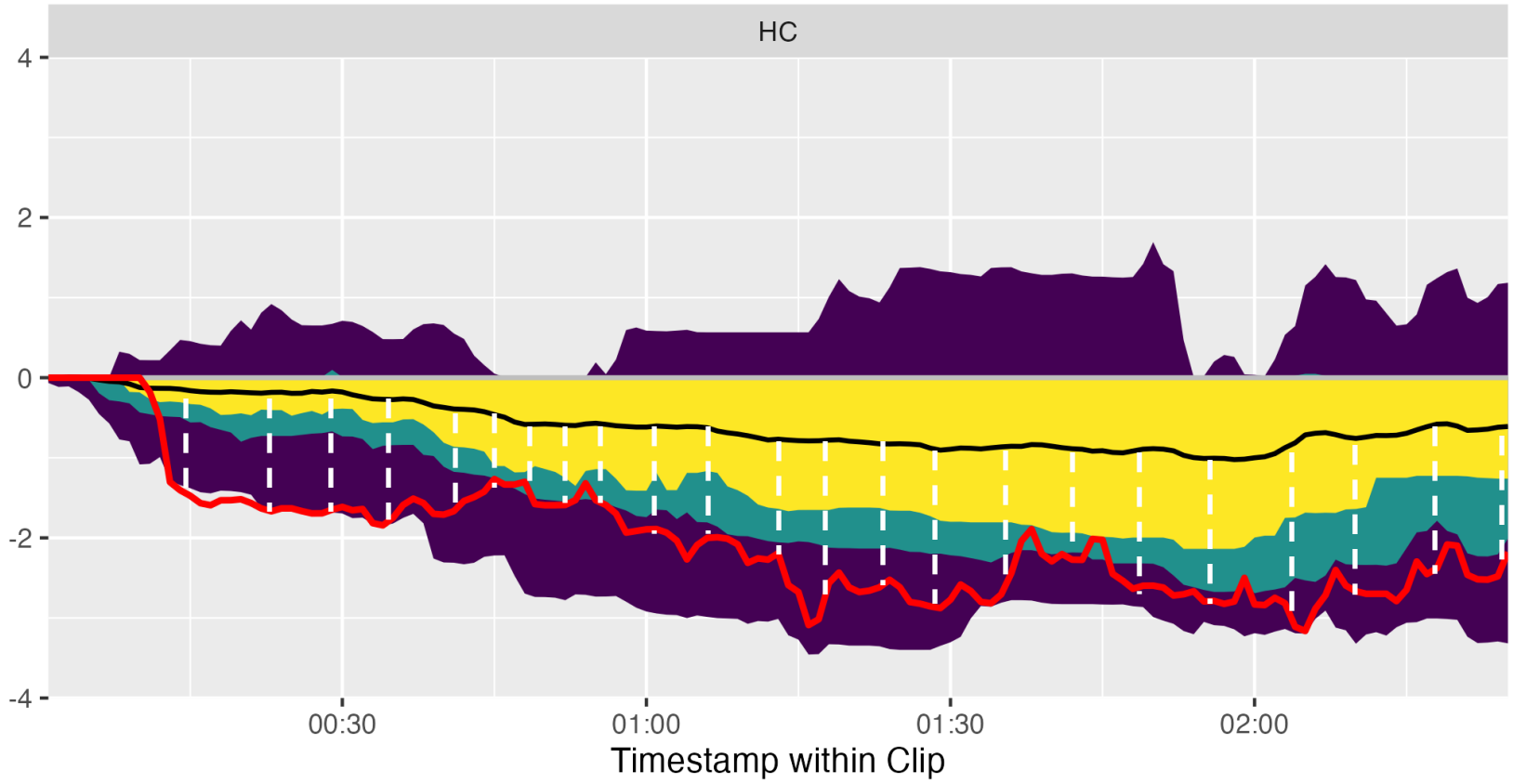
Time-series Valence Analysis:

- Autoregressive linear mixed-effects models (LMEMs).
- Examined group differences in valence ratings over time.



Dynamic Time Warping (DTW):

- Measured dissimilarity (i.e., distance) between each individual and group-level reactivity response patterns.



Multiscale Sample Entropy (MSE):

Series A: (0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, 0, 1, ...), which alternates 0 and 1.
Series B: (0, 1, 0, 0, 1, 0, 1, 0, 0, 1, 1, 1, 1, 0, 0, 1, ...), which has either a value of 0 or 1, chosen randomly, each with probability 1/2.

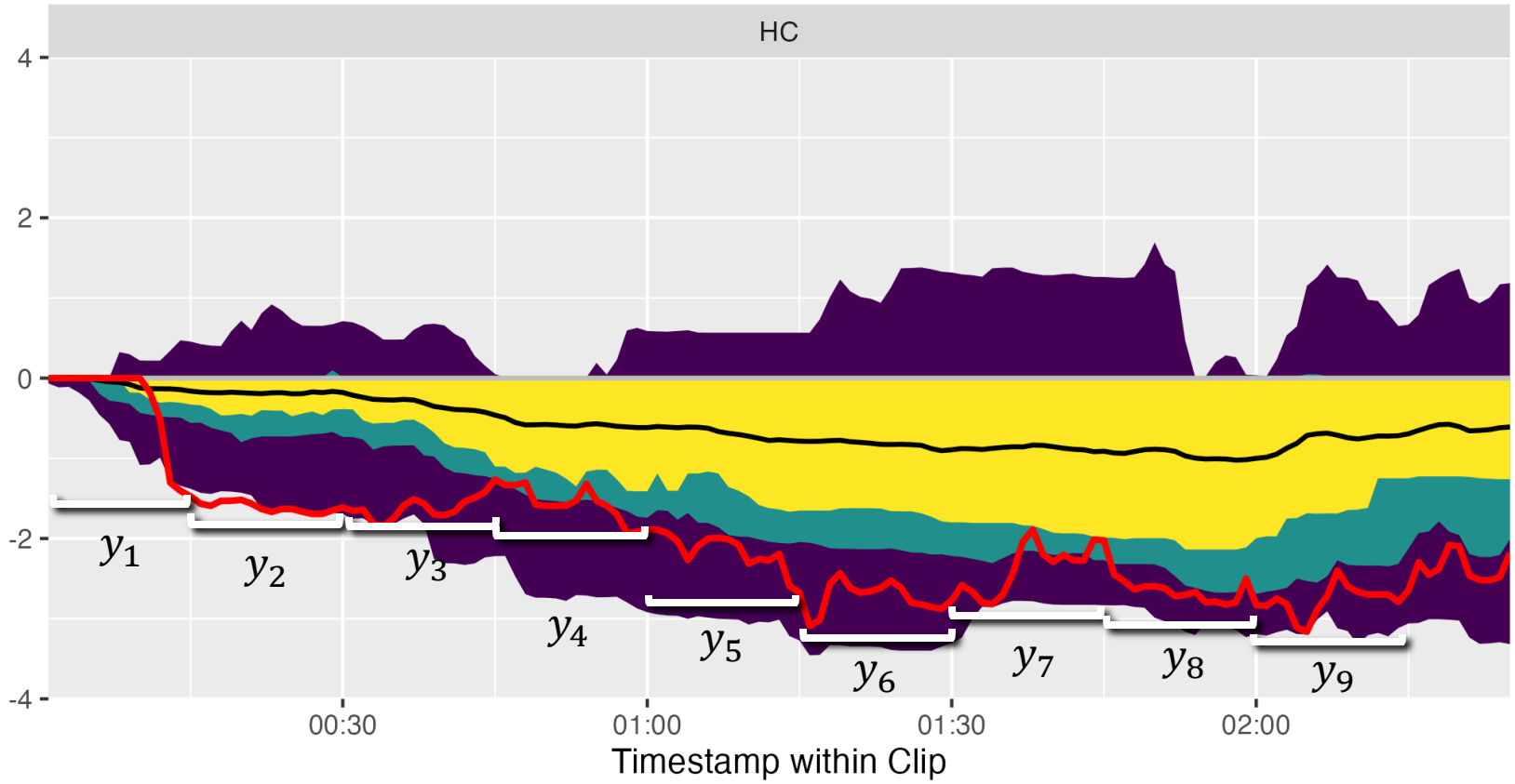
These will have the same mean and variance! Yet A is perfectly regular, and B is random…

So what we need is a measure of predictability or regularity… *entropy*.

Multiscale Sample Entropy (MSE):

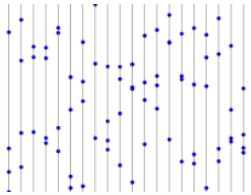
- Quantified complexity of emotional responses across time scales.

Fine (5s-30s)
Medium (30s-60s)
Coarse (60s+)

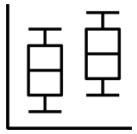


Statistical Analyses

Intraclass Correlation Coefficient (ICC):
• Assessed inter-rater reliability within groups.

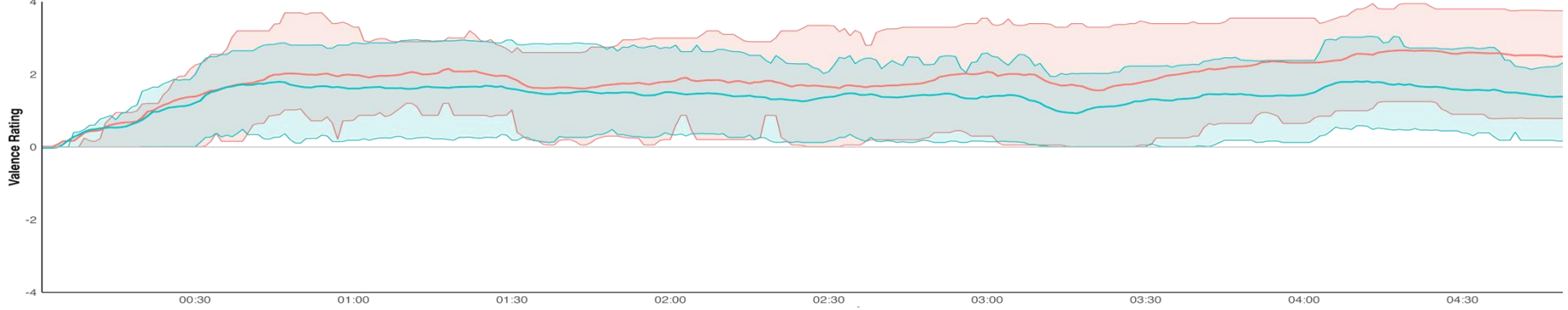


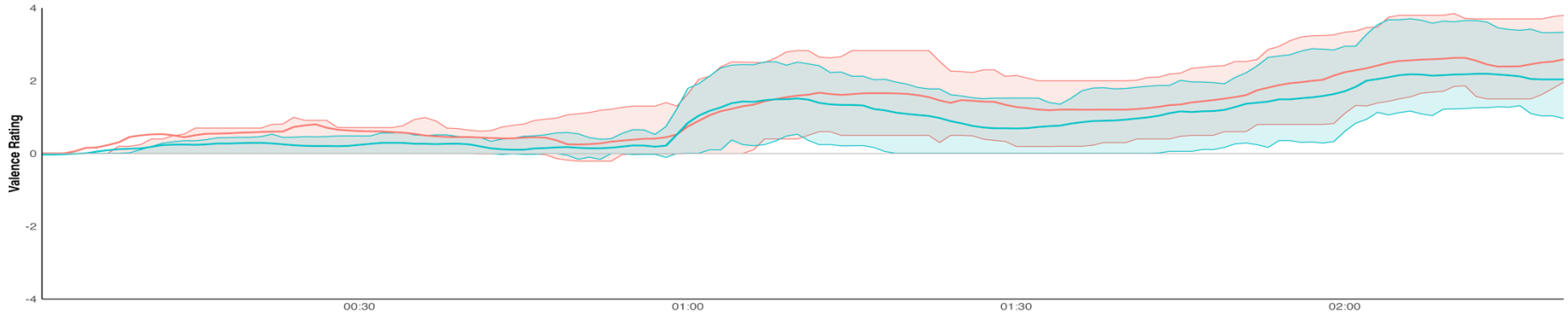
Language Task Performance:
• Generalized LMEMs for accuracy on comprehension and antonym tasks.
• Compared performance between PWA and HC.



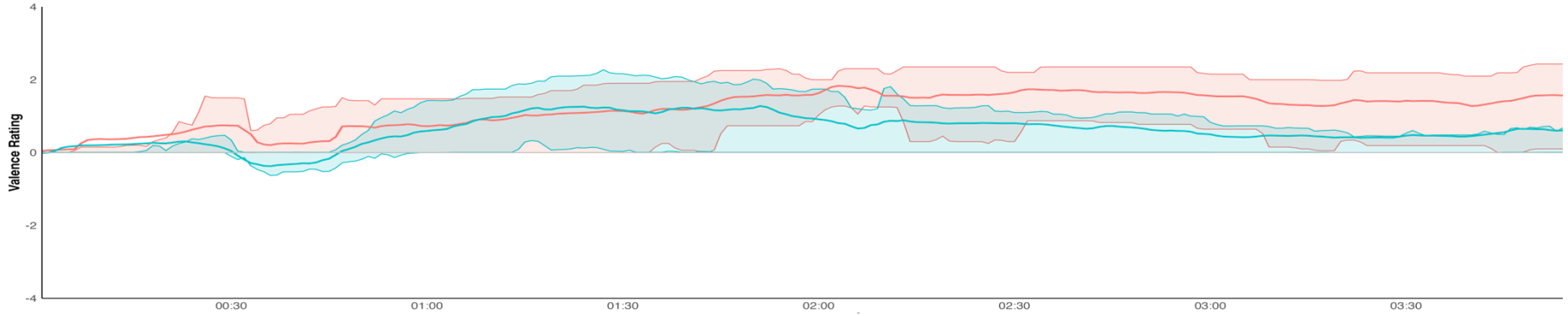
Relationship Analyses:
• LMEMs examining associations between emotional measures, task performance, and aphasia severity.

Group HC AP


Valence Rating
4
2
0
-2
-4
00:30
01:00
01:30
02:00
02:30
03:00
03:30
04:00
04:30


Valence Rating
4
2
0
-2
-4
00:30
01:00
01:30
02:00


62
Woodland Hills, California


Valence Rating
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-4
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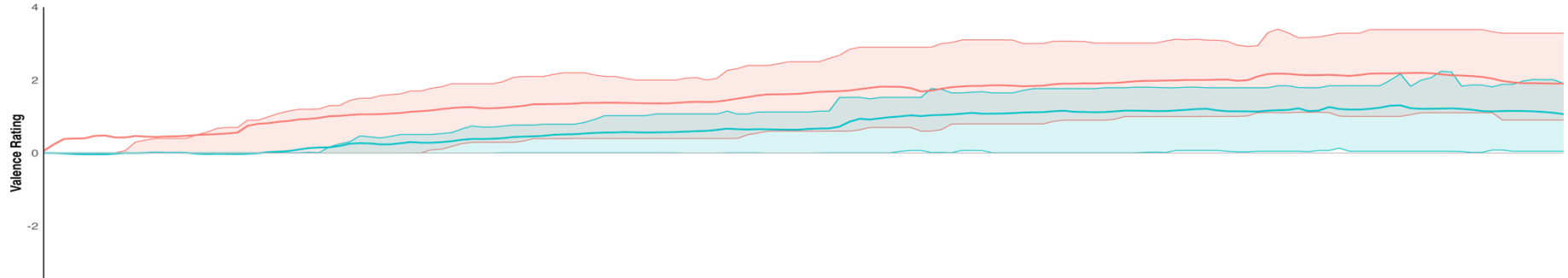
Valence Rating
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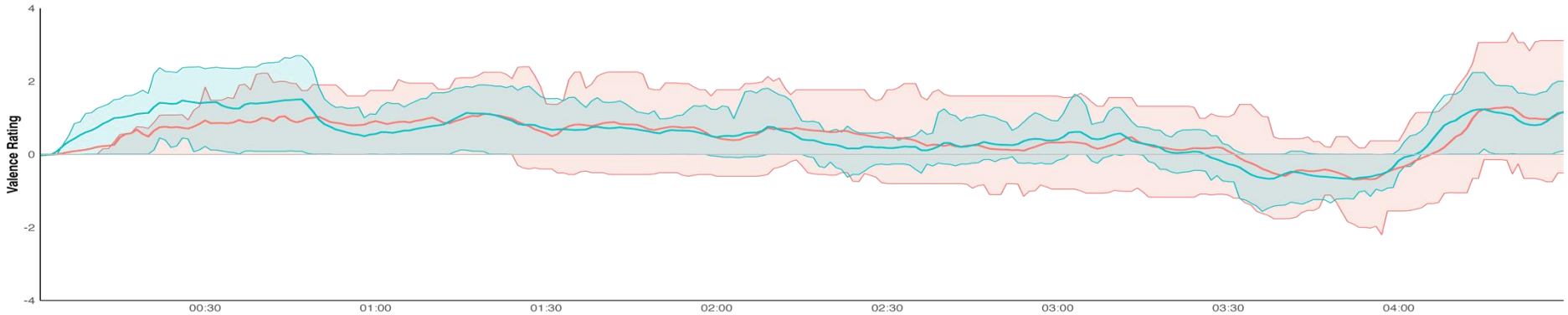
Valence Rating
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02:00
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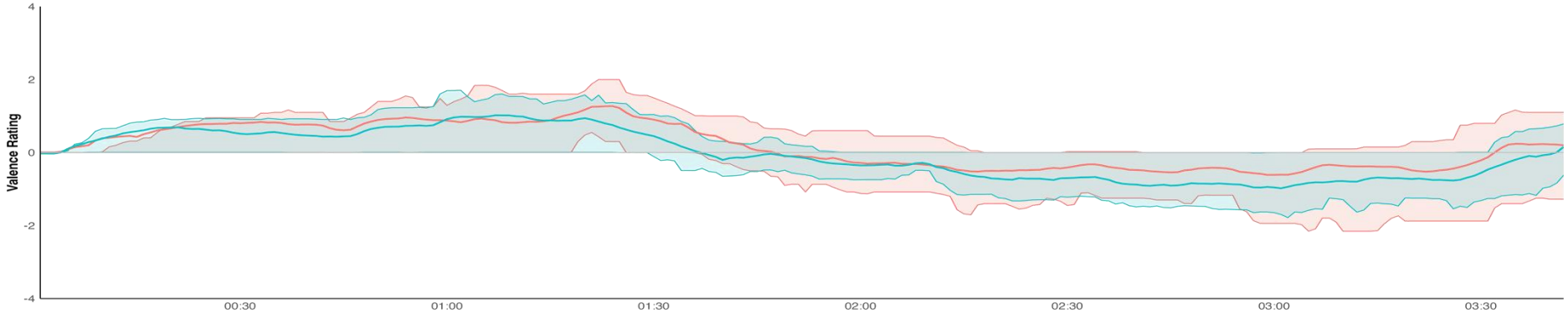
03:30
04:00


Valence Rating
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-4
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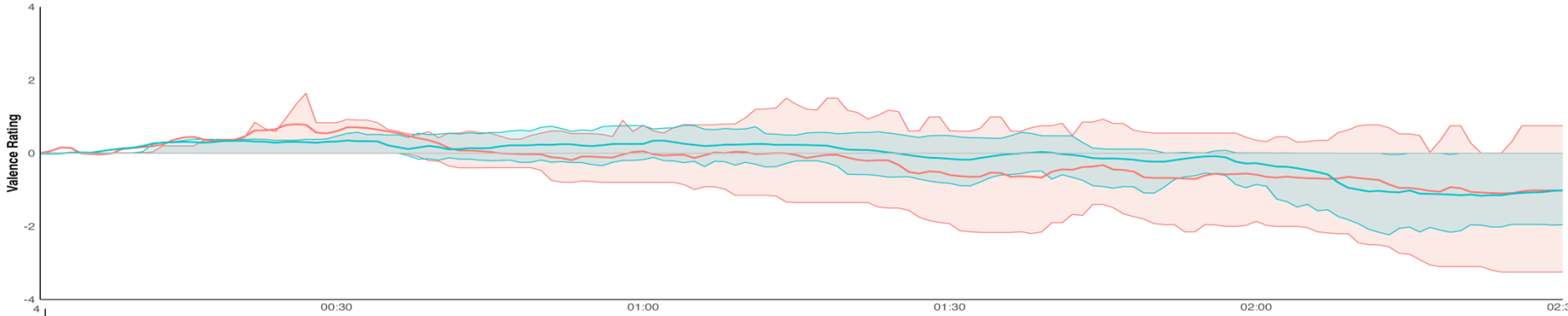
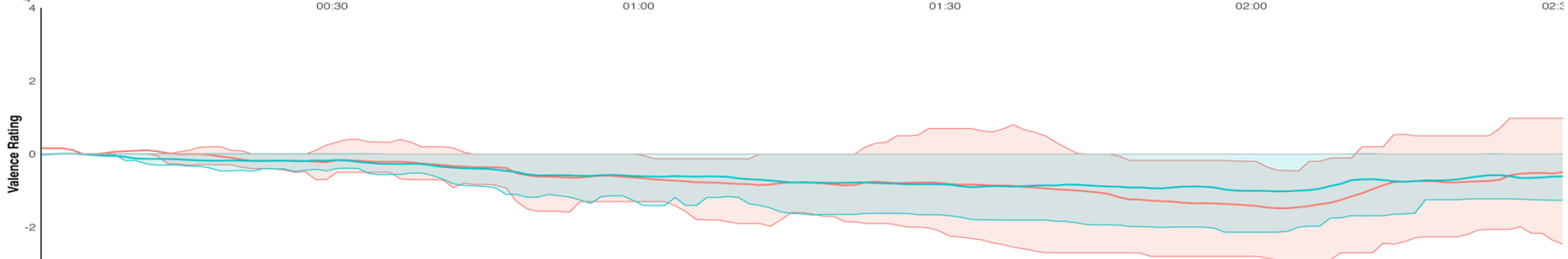
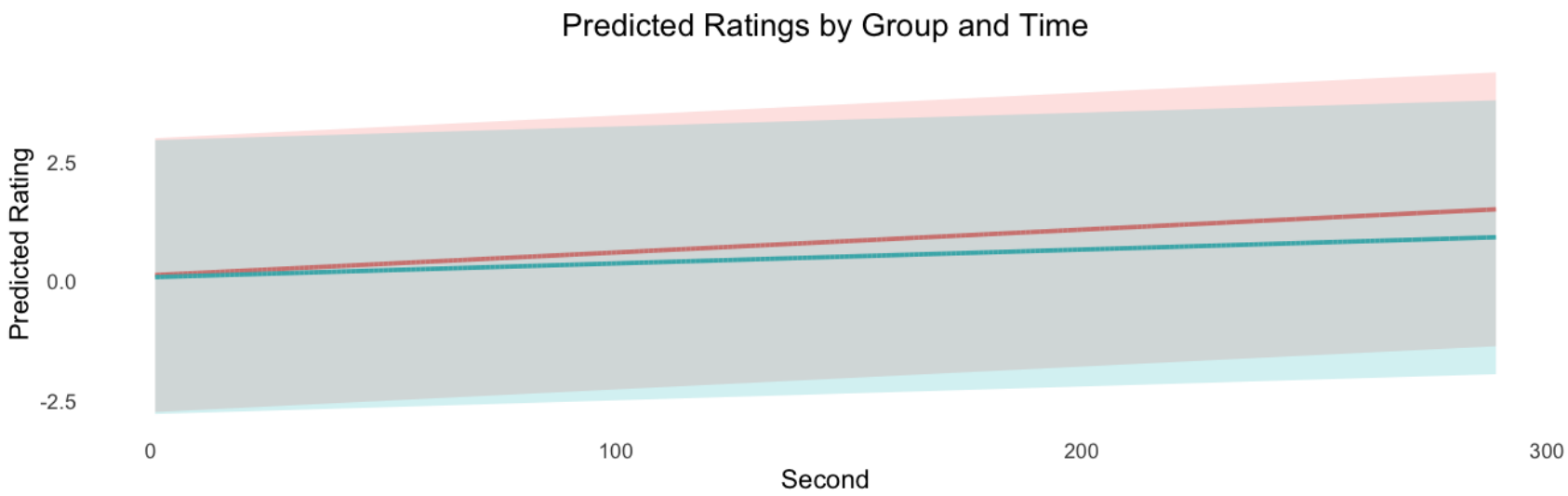
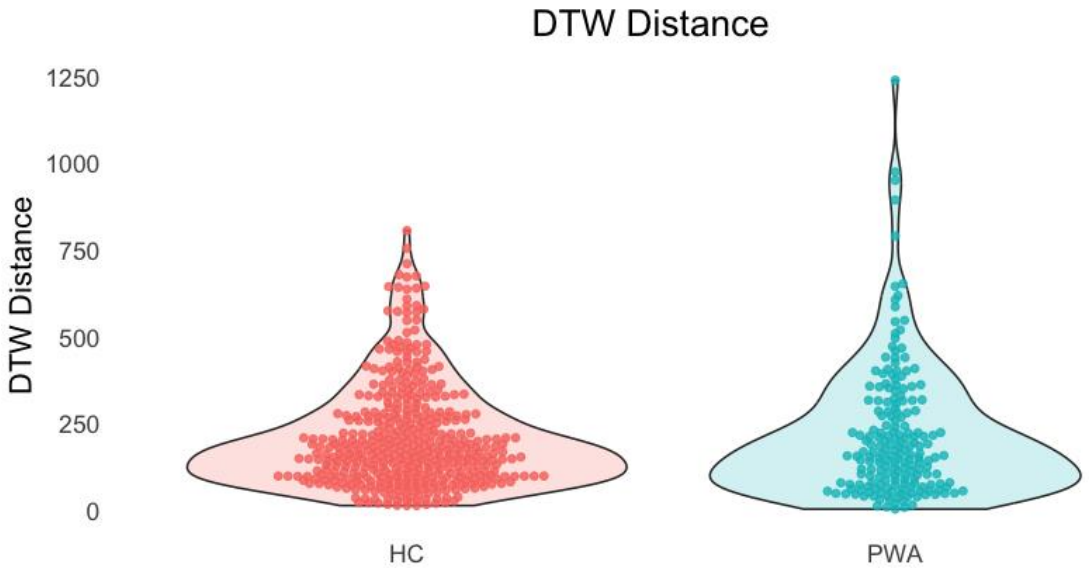
01:30
02:00
02:30
03:00
03:30

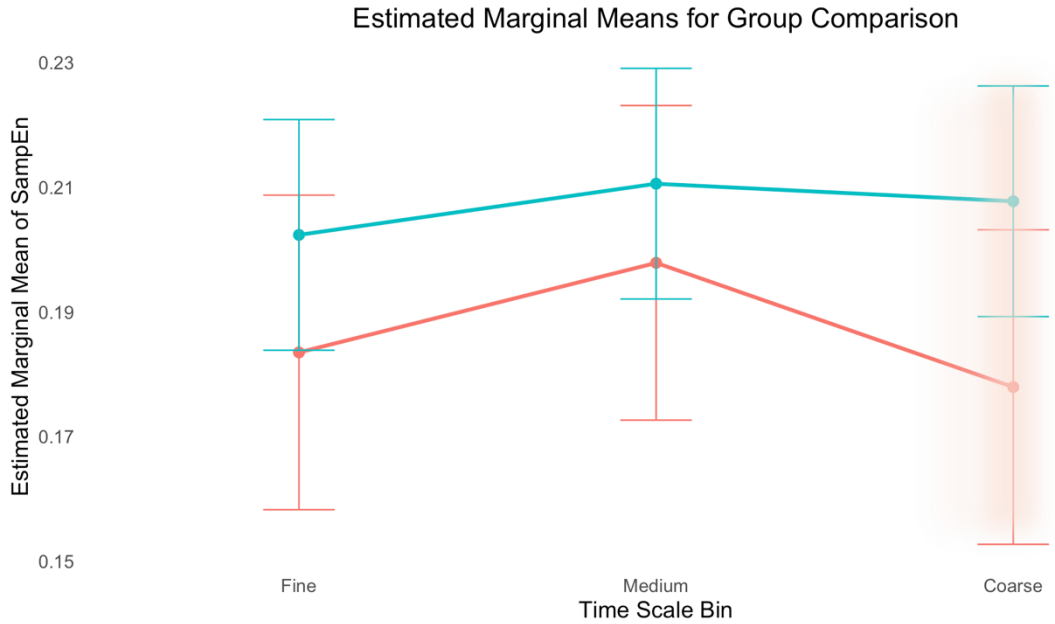

Valence Rating
4
2
0
-2
-4
00:30
01:00
01:30
02:00


Valence Rating
4
2
0
-2



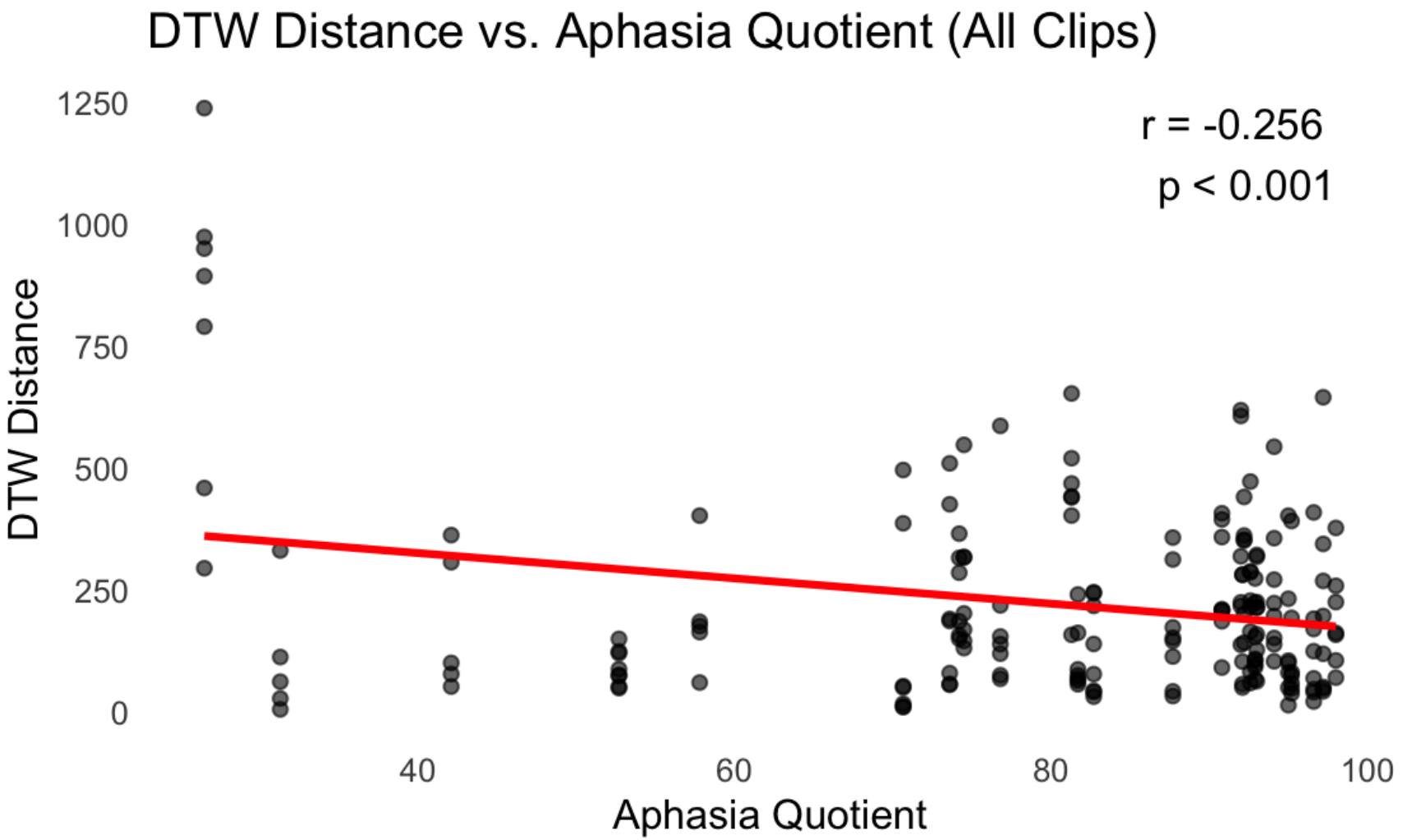
PWA show a **positivity bias** in emotional ratings compared to HC (p = 0.0232).



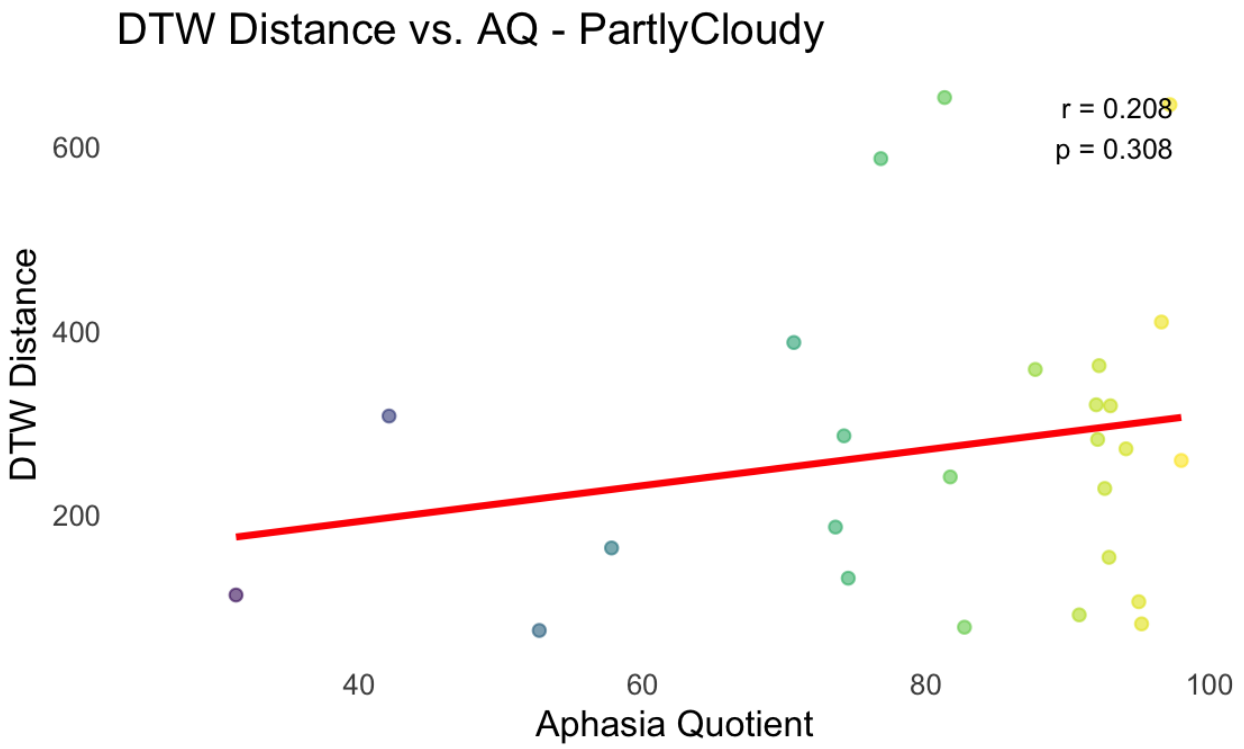


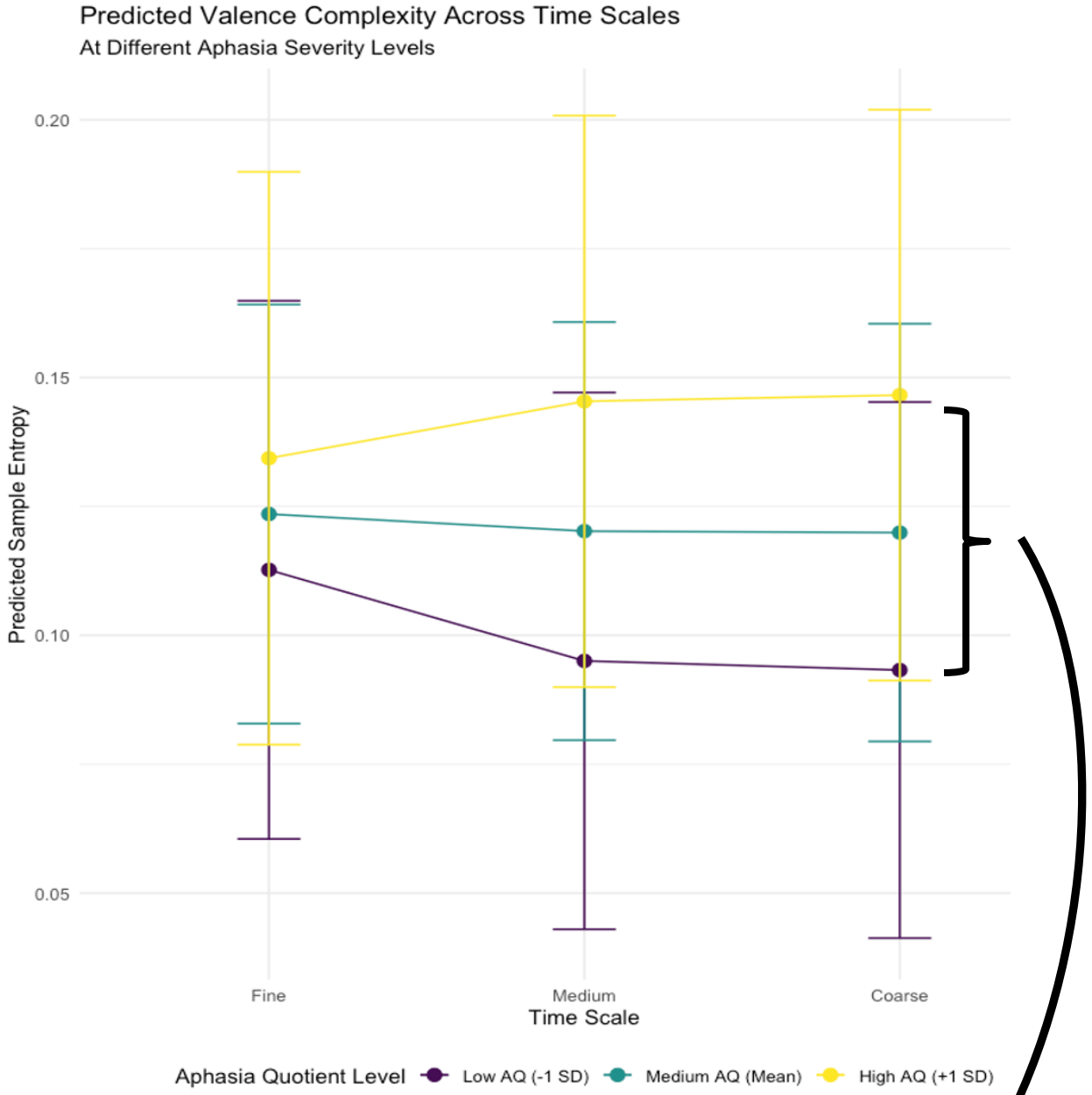
PWA and HC show **no significant differences** in **atypicality/distance** in emotional reactivity (p = 0.6234).

PWA exhibit **less complex emotional responses** over time, particularly at **coarse** time scales (p = 0.0285).



Aphasia severity tends to predict **more atypical emotional responses** correlationally ($p < 0.001$), though not significant in an LMEM ($p = 0.084$).


DTW Distance vs. AQ - PartlyCloudy
r = 0.208
p = 0.308
600
400
200
DTW Distance
40
60
80
100
Aphasia Quotient



Complexity is significantly different across aphasia severity levels; **less impairment** is associated with **greater complexity** ($p = 0.006$).

Additional Findings

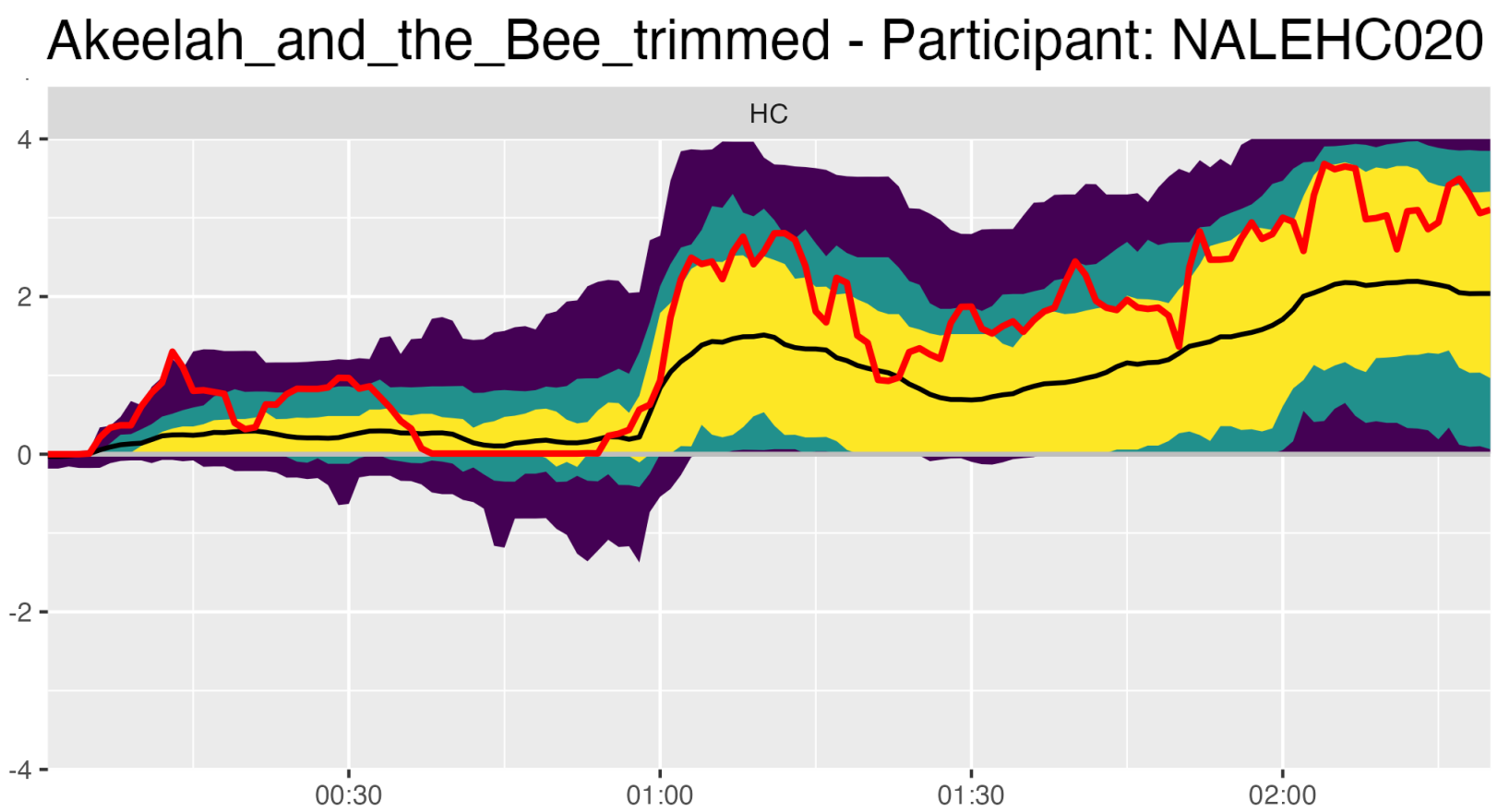
PWA exhibit **lower inter-rater reliability** in emotional ratings:

- Agreement (single rater): PWA ICC(A,1) = 0.182, HC ICC(A,1) = 0.201
- Consistency (single rater): PWA ICC(C,1) = 0.288, HC ICC(C,1) = 0.224
- Agreement (average of all raters): PWA ICC(A,khat) = 0.883, HC ICC(A,khat) = 0.932
- Consistency (average of all raters): PWA ICC(Q,khat) = 0.910, HC ICC(Q,khat) = 0.939.

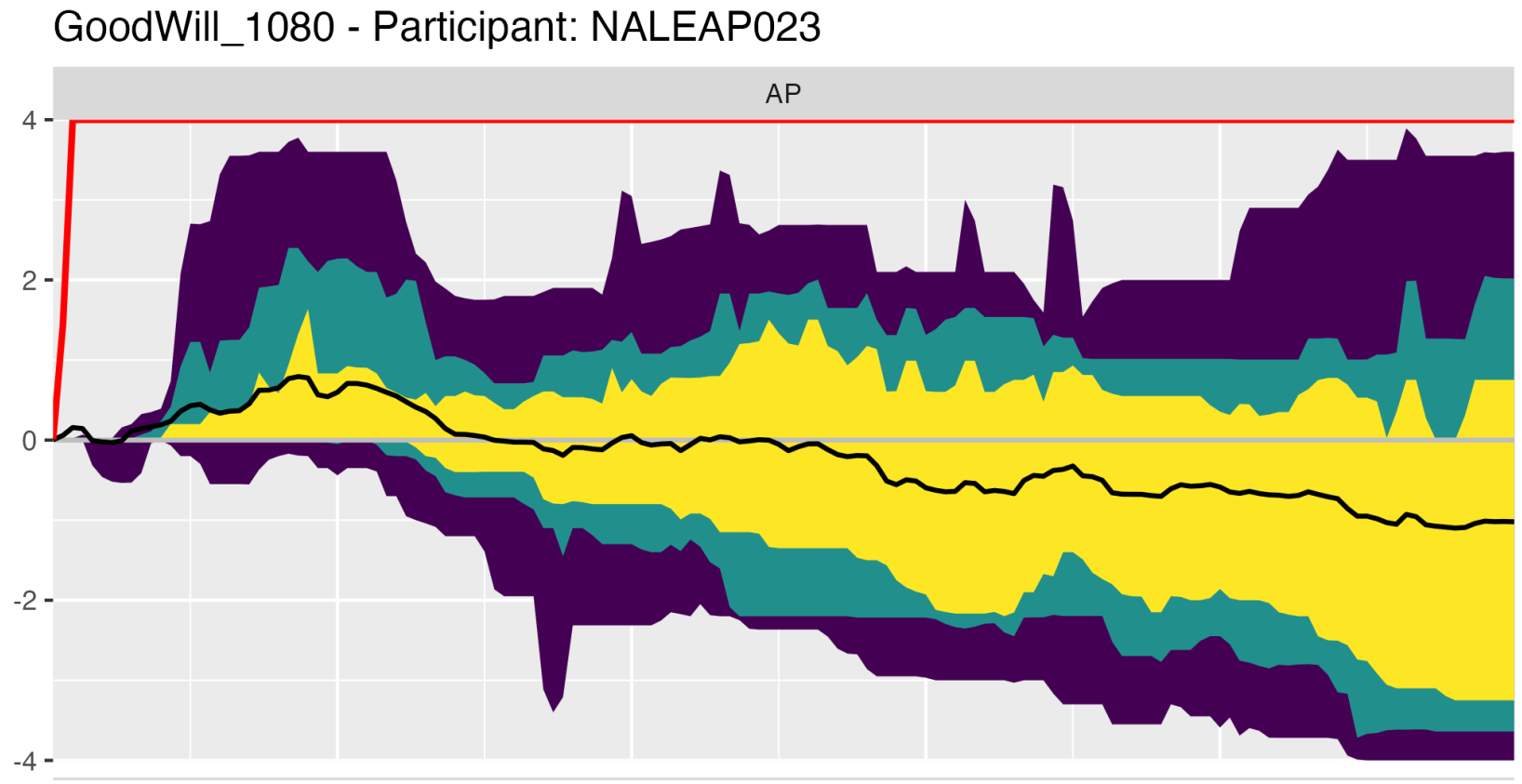
PWA demonstrate **lower accuracy** compared to HC on comprehension and antonym generation tasks within movie-watching paradigm (both $p < 0.001$).

Emotional complexity (i.e., sample entropy) is associated with **better comprehension** and **antonym generation** performance in PWA (both ps ≤ 0.019).

Aphasia severity modulates comprehension and **antonym generation** performance (both ps ≤ 0.001), but not **valence ratings** over time ($p = 0.482$).


Akeelah_and_the_Bee_trimmed - Participant: NALEHC020
HC
4
2
0
-2
-4
00:30
01:00
01:30
02:00

NALEAP023
Age: 53
Sex: M
WAB-R AQ: 26.5
Trail Making
Ratio: 2.51
NAVS SCT: 53%



NALEAP023
Age: 53
Sex: M
WAB-R AQ: 26.5
Trail Making
Ratio: 2.51
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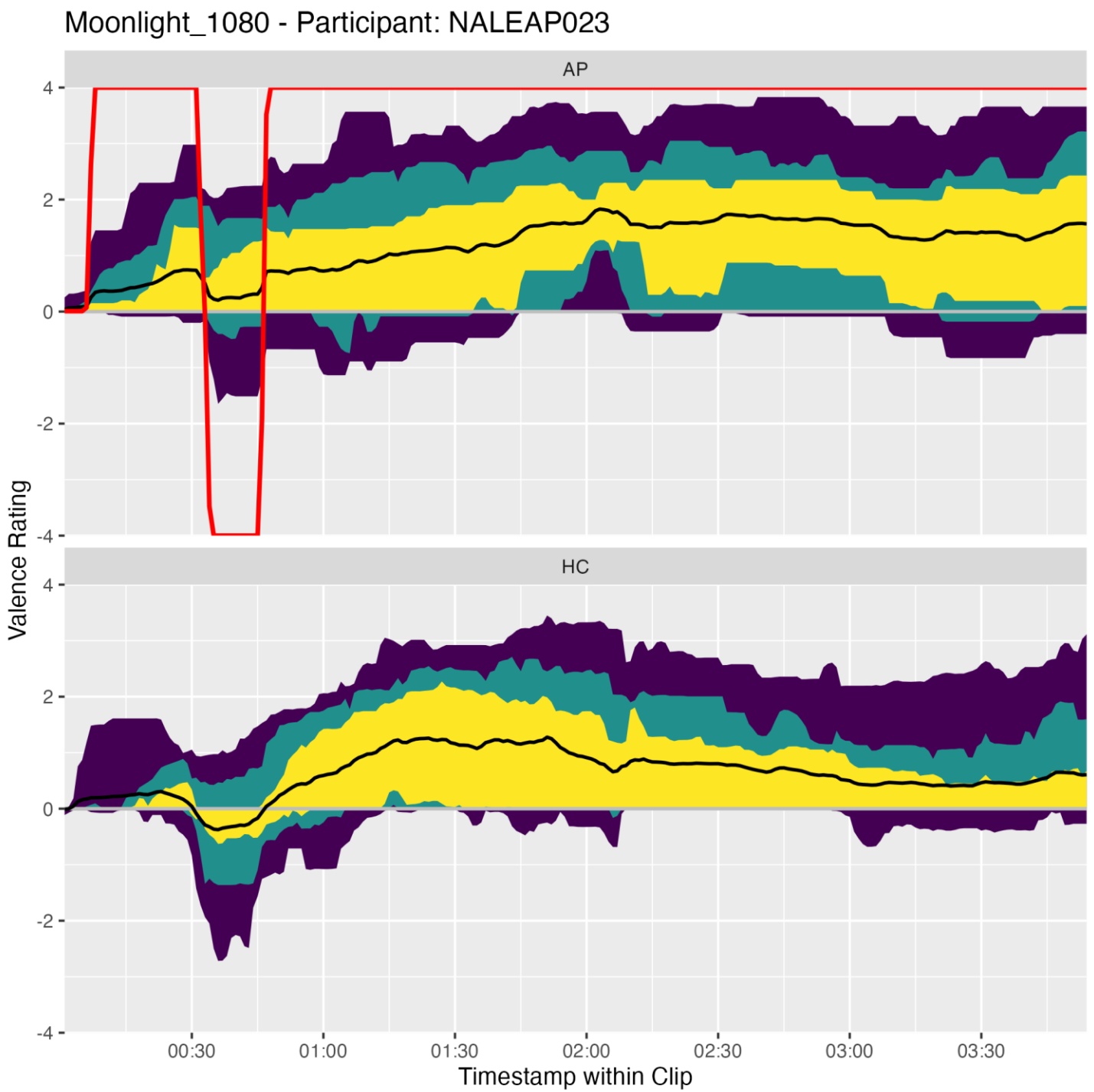
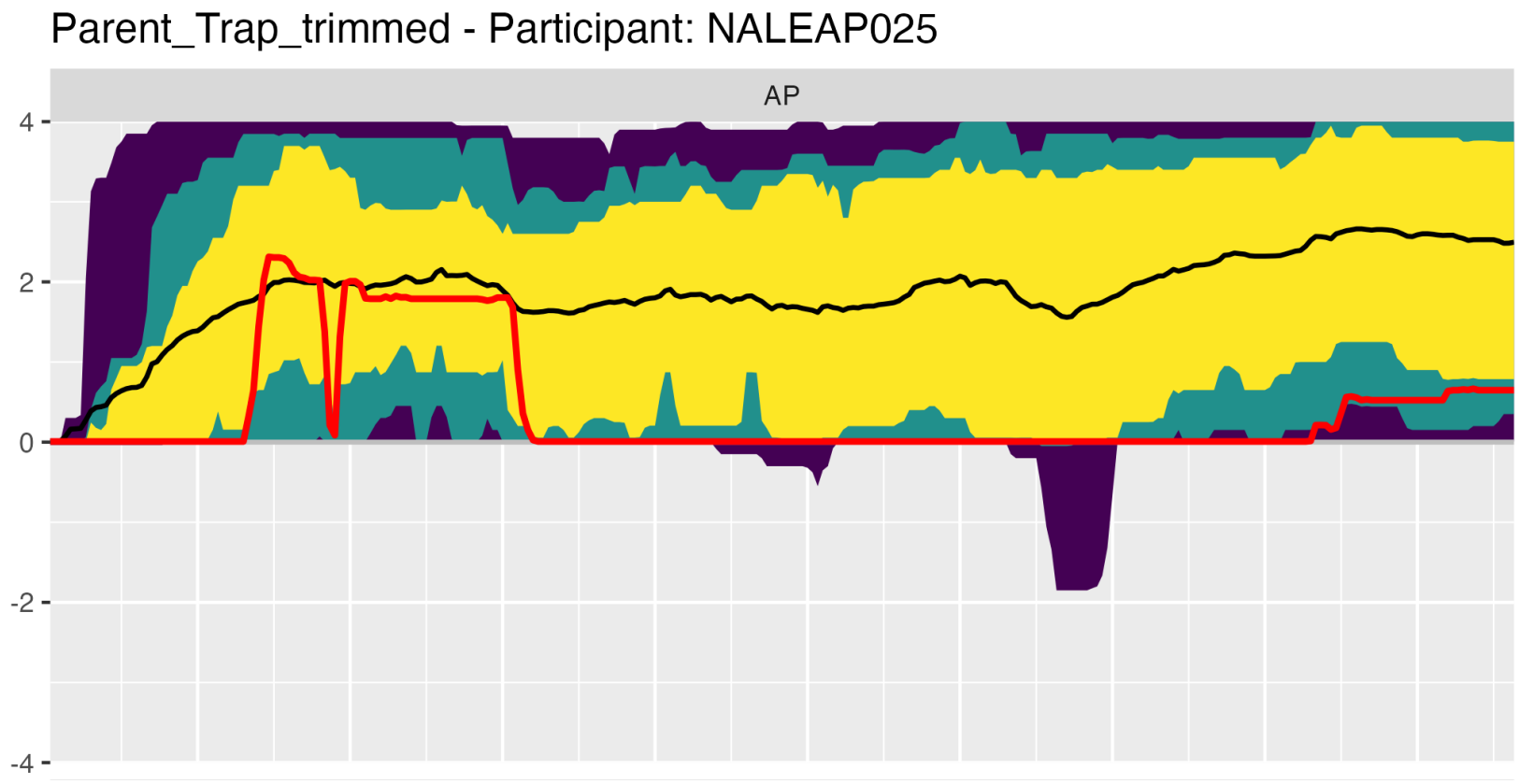
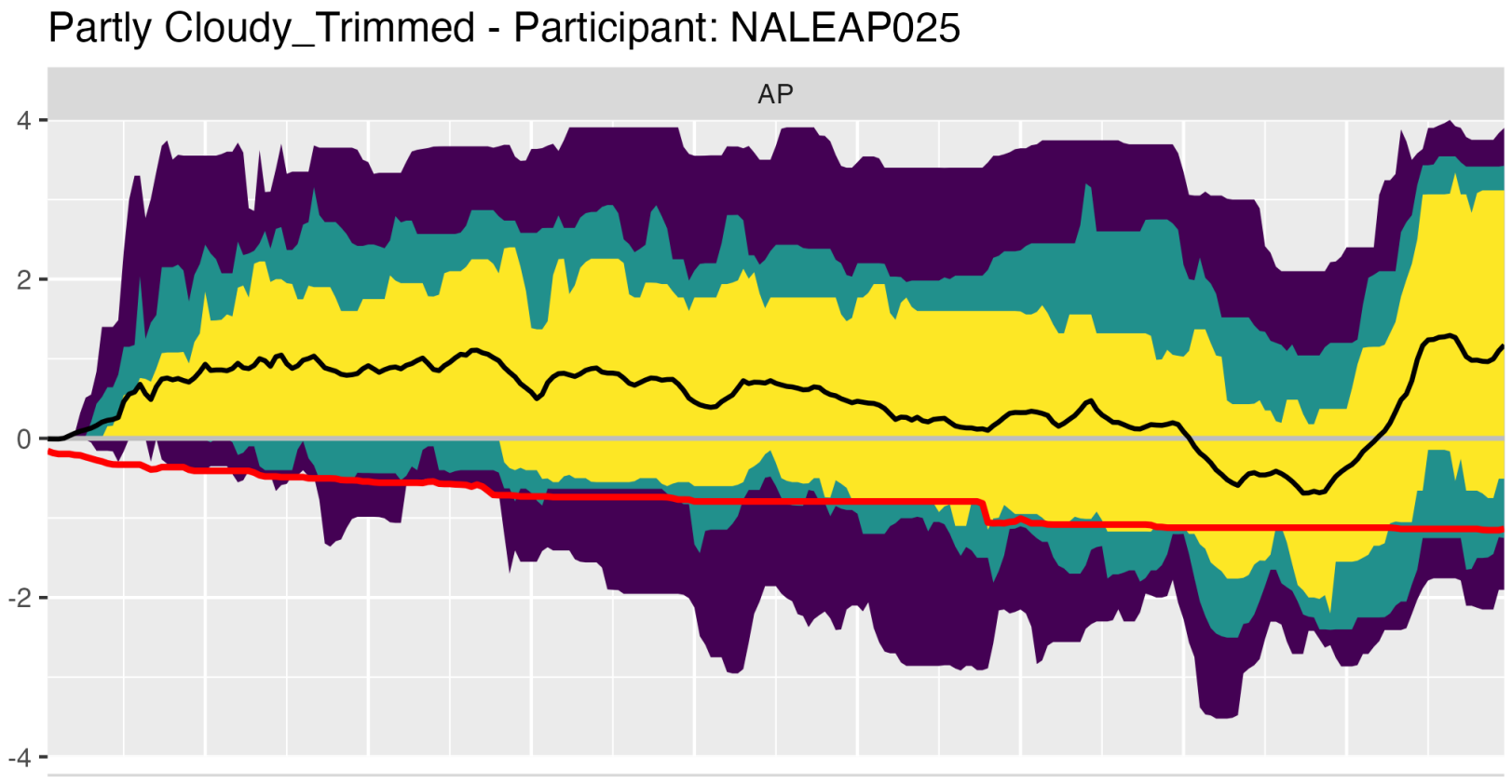


NALEAP025
Age: 73
Sex: M
WAB-R AQ: 92.1
Trail Making:
Could not complete
NAVS SCT: 80%



NALEAP025
Age: 73
Sex: M
WAB-R AQ: 92.1
Trail Making:
Could not complete
NAVS SCT: 80%



NALEAP025
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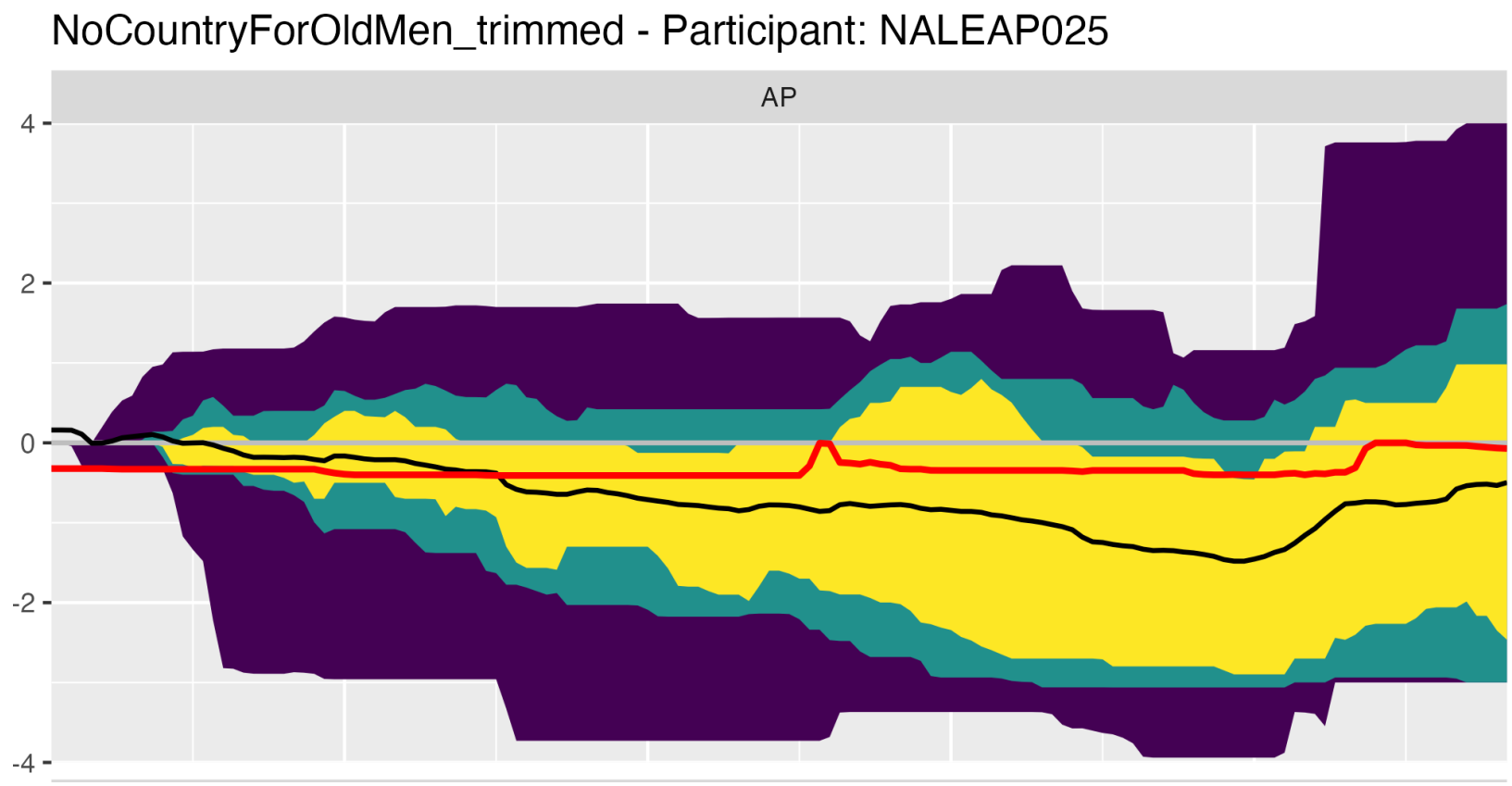
Sex: M
WAB-R AQ: 92.1
Trail Making:
Could not complete
NAVS SCT: 80%



Key Findings

Emotional Processing in PWA:

1. More positive overall ratings
2. Less complex response patterns
3. More complex picture of aphasia

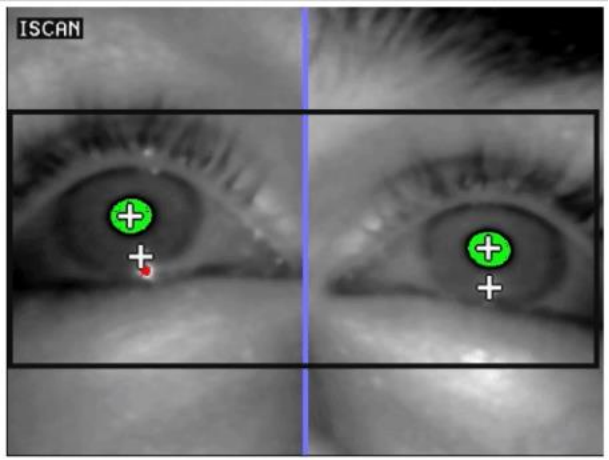
Relationship to conventional assessment:

1. Comprehension better preserved than expression
2. Emotional complexity linked to understanding
3. Severity affects but doesn't determine outcomes

Clinical Implications:

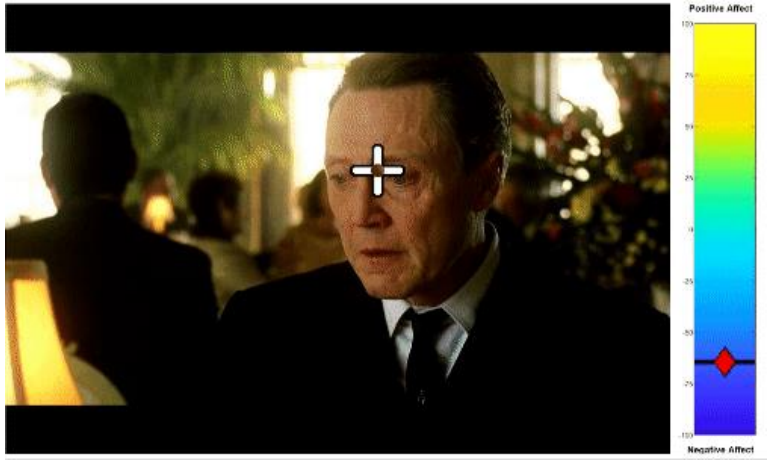
1. Traditional tests may miss impaired abilities
2. Real-world stimuli reveal different patterns
3. Individualized assessment crucial
4. Misc. – PWA *really enjoy* participating

Future Directions



Comorbidities

1. Depression and anxiety are common in PWA
    1. How do these comorbid disorders interact with reactivity?



Eye-gaze

1. Are deficits in language processing evident in eye-gaze patterns of movie-viewing?
2. Do PWA accurately anticipate conversational shifts in dynamic conversation?
3. What compensatory strategies might PWA employ?

HARVARD CATALYST

Thank you!

Questions?

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