

COGNITIVE THEORETICAL PERSPECTIVES IN STUDIES OF FORENSIC DOCUMENT EXAMINATION

MEASUREMENT SCIENCE AND STANDARDS IN FORENSIC HANDWRITING
ANALYSIS CONFERENCE, JUNE 2013

Investigators

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Acknowledgements

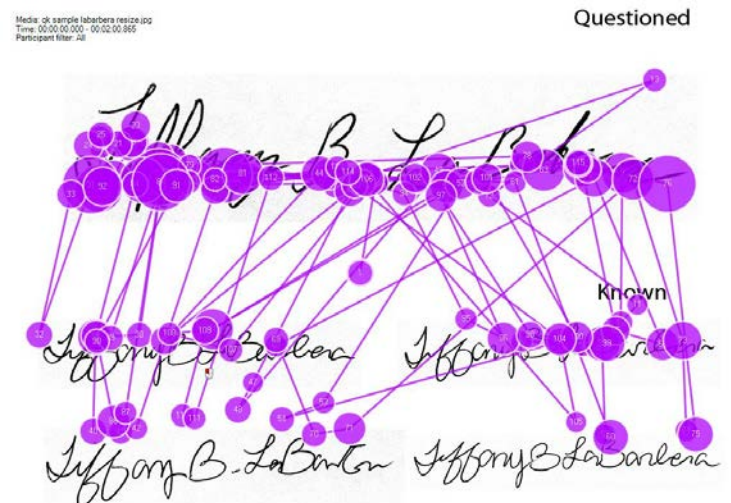
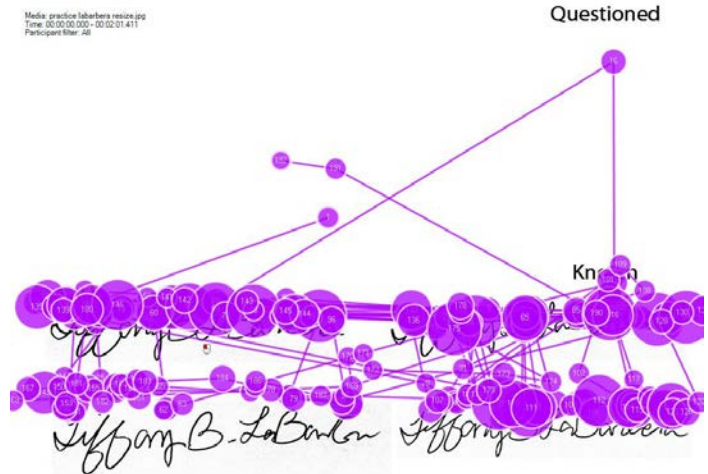
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- Special thanks to our colleagues from the U.S. and Canada for their invaluable assistance with the planning and pilot stages of our project, and to those FDEs who have given their time and expertise as project participants.

The Comparison Process

- What FDEs do (decision process)
 - ▣ If Q is suitable for comparison, then
 - Evaluate
 - Compare
 - Determine significance
 - Evaluate quantity
 - Conclusion
- But *HOW* do they do it?

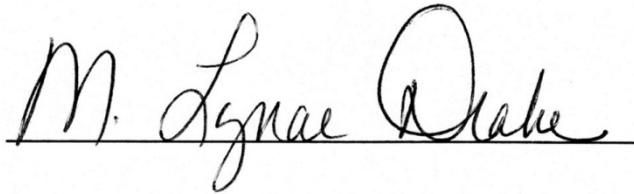
Answering the “HOW” Question

- Attention
 - ▣ Focus and filtering
- What do we attend to?
 - ▣ Attentional and foveal focus
- Why do we attend to it?
 - ▣ Stimulus-driven
 - ▣ Goal-directed



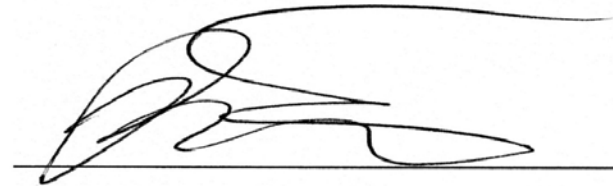
Examine these signatures...

Questioned



M. Lynae Drake

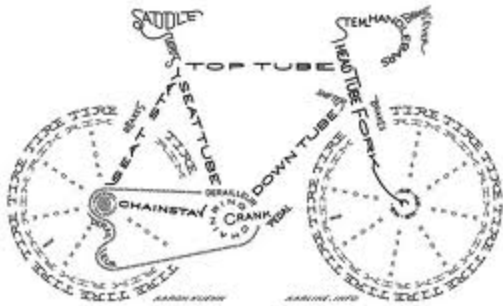
Questioned



What questions come to your mind?

Top-Down vs. Bottom-Up Processing

Top Down Processing



“Large chunk” processing
LARGER CONCEPT

FINER  DETAILS

Bottom-Up Processing



“Small chunk” processing
FINER DETAILS

LARGER  CONCEPT

You Make the Call

How much information does an examiner need to make an accurate call?

Tachistoscope view of a signature:

1. Look at the fixation cross.
2. After 3s the slide will automatically change to a signature.
3. **Don't blink**—you'll miss it!

+

Questioned

Louise Masbey

Process Opinion

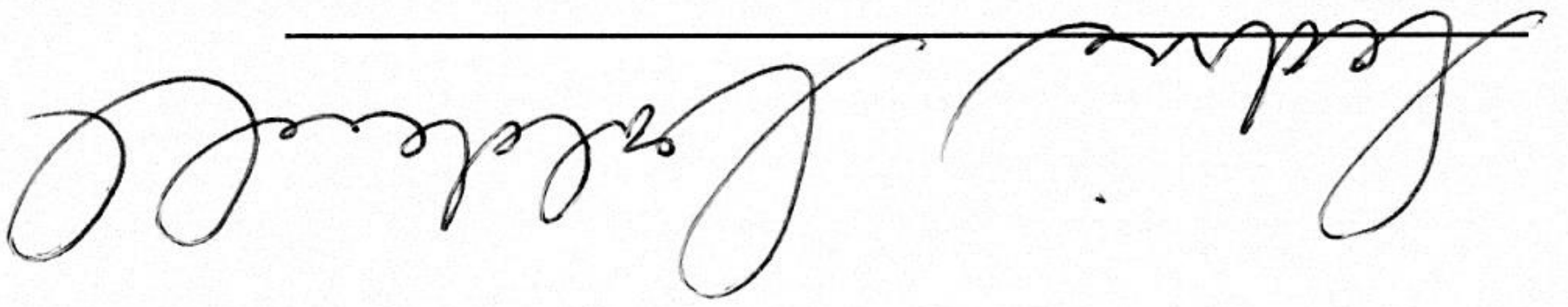
Would you say that this signature is genuine, or simulated?

On a scale of 1 (not at all confident) to 4 (extremely confident), how confident would you say you are in this decision?

- Not at all confident
- Somewhat confident
- Moderately confident
- Extremely confident

+

Questioned



Lester J. Williams

Process Opinion

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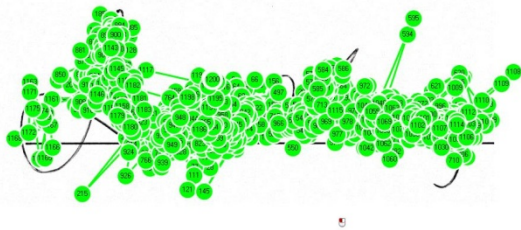
Interpreting Eye-Tracking Data

Identifying diagnostic information using extended view data

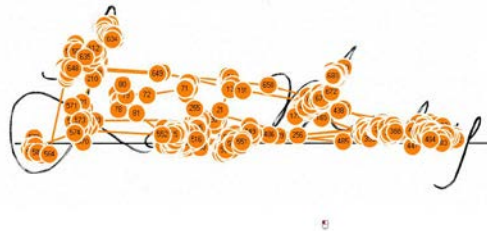
- Unfiltered (raw) data
- Filtered data
- Heat maps
- Areas of interest (AOI)

Signature 1 Raw Data

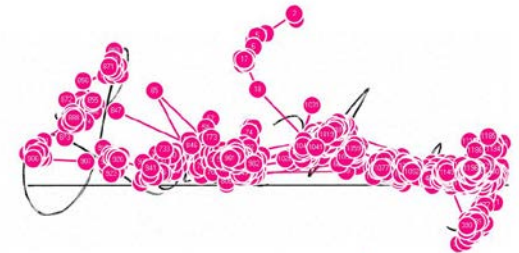
Questioned



Questioned



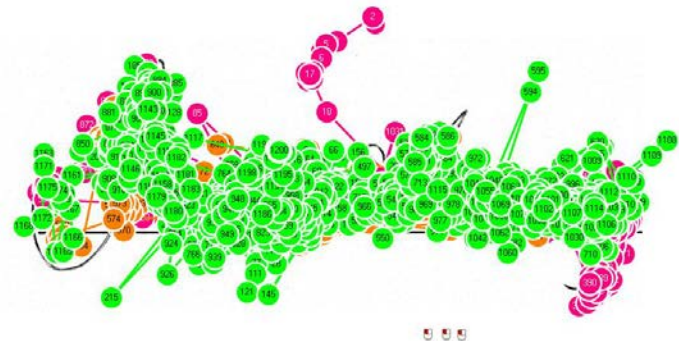
Questioned



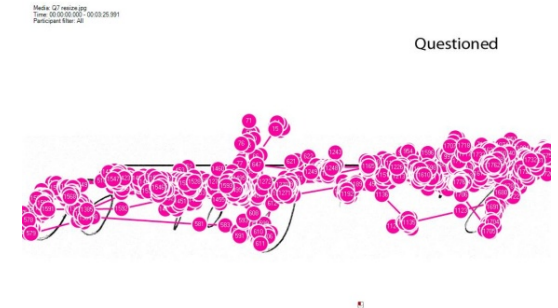
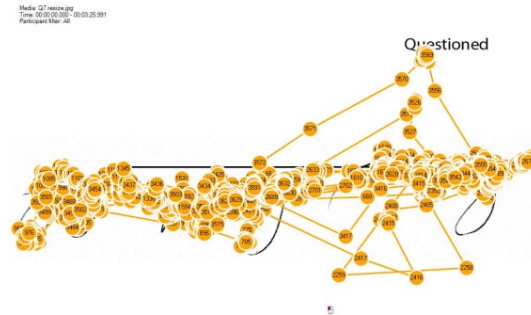
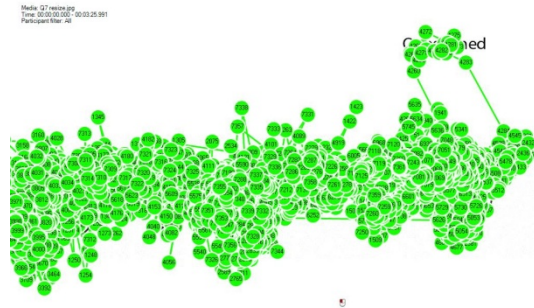
Fixations: FDE1 = 1,200; FDE2 = 683; FDE3 = 1,196

- Raw data without the fixation filter demonstrates all visual activity

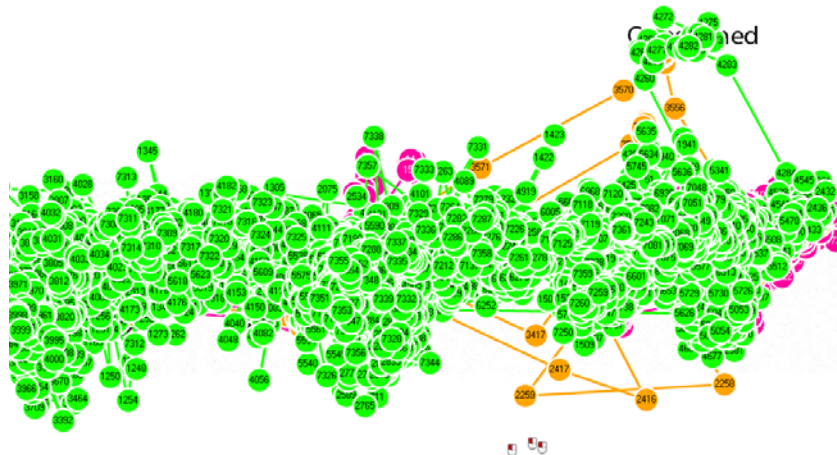
Questioned



Signature 2 Raw Data



Fixations: FDE1 = 7,361; FDE2 = 3,632; FDE3 = 1,706

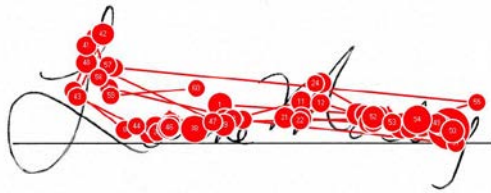


- Some activity is irrelevant, data must be refined
 - ▣ Velocity threshold = 50 pixels
 - ▣ Duration threshold = 100ms

Filtered Signature 1 Gaze Plots

Media: G2 recast.jpg
Time: 00:00:00.000 - 00:00:46.278
Participant filter: All

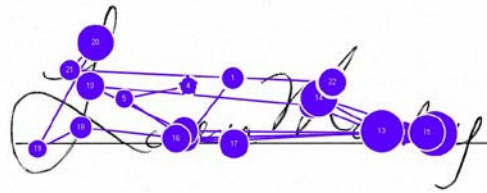
Questioned



5

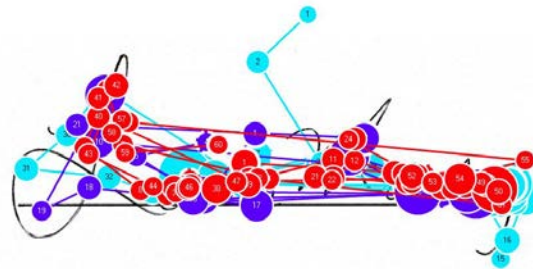
Media: G2 recast.jpg
Time: 00:00:00.000 - 00:00:46.278
Participant filter: All

Questioned



Media: G2 recast.jpg
Time: 00:00:00.000 - 00:00:46.278
Participant filter: All

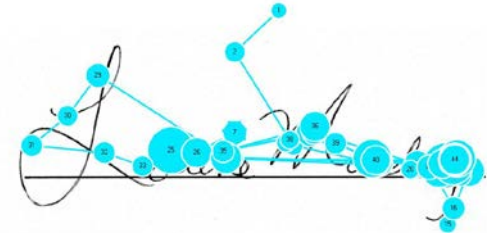
Questioned



5 5 5

Media: G2 recast.jpg
Time: 00:00:00.000 - 00:00:46.278
Participant filter: All

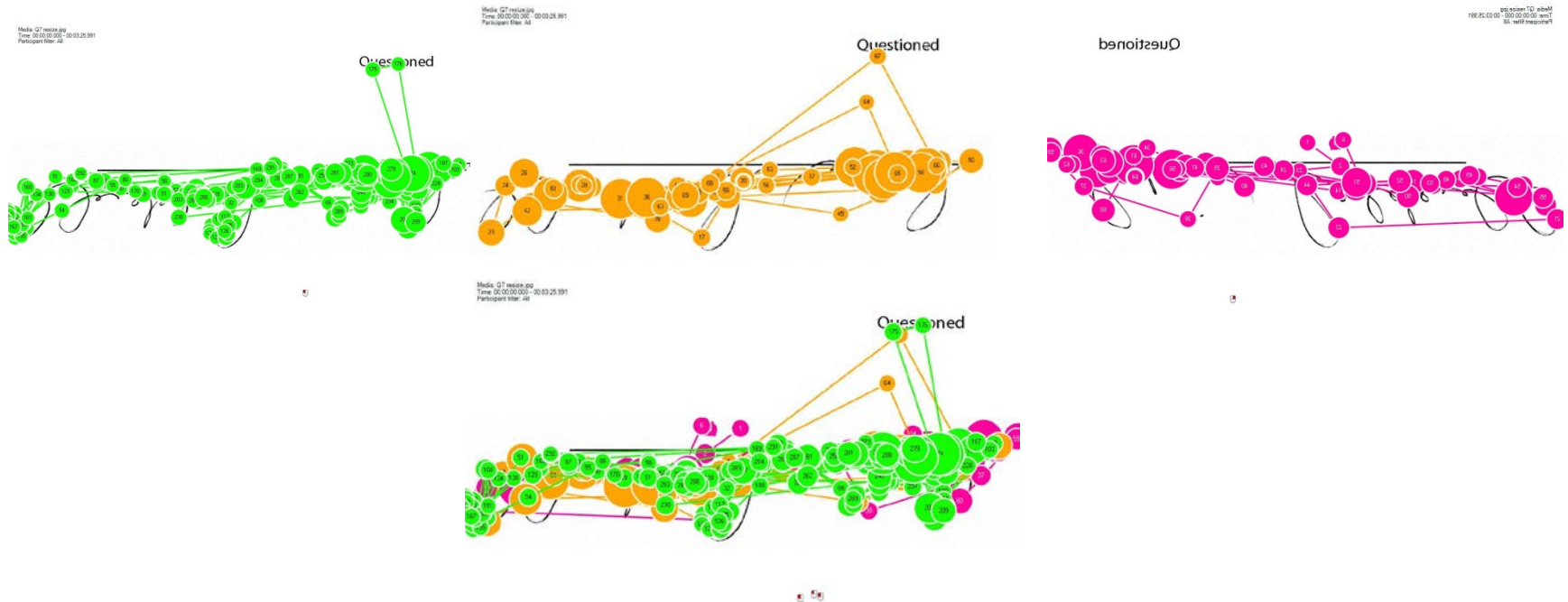
Questioned



5

- Total Fixations: FDE1=60; FDE2=22; FDE3=43
- Fixation Duration: FDE1=30.16s; FDE2=29.24s; FDE3=31.84s

Filtered Signature 2 Gaze Plots



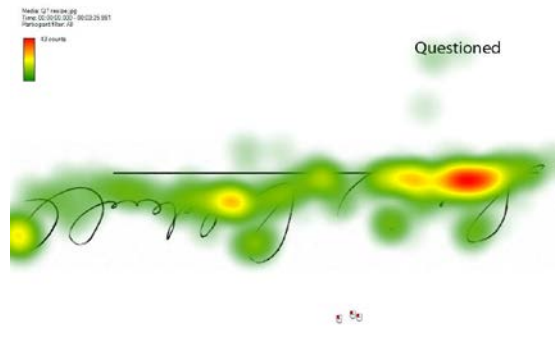
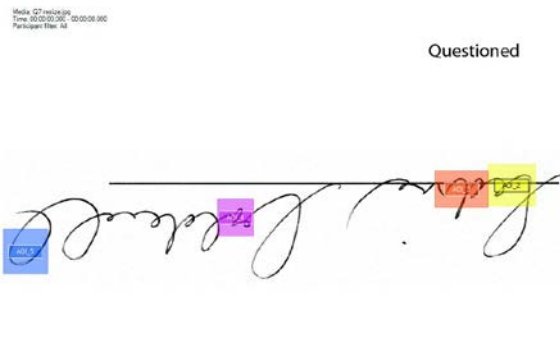
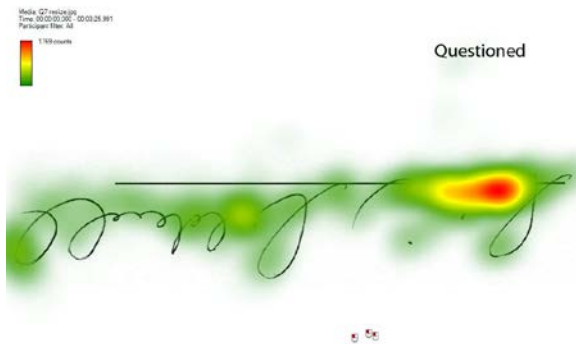
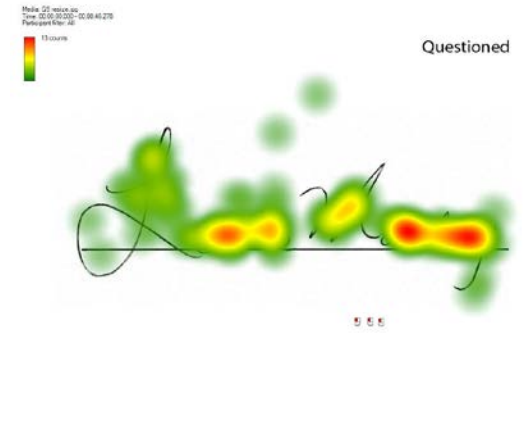
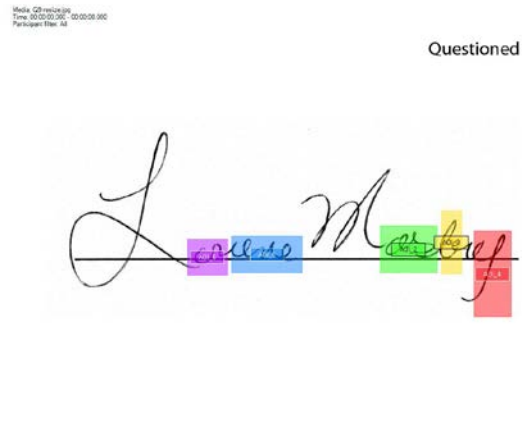
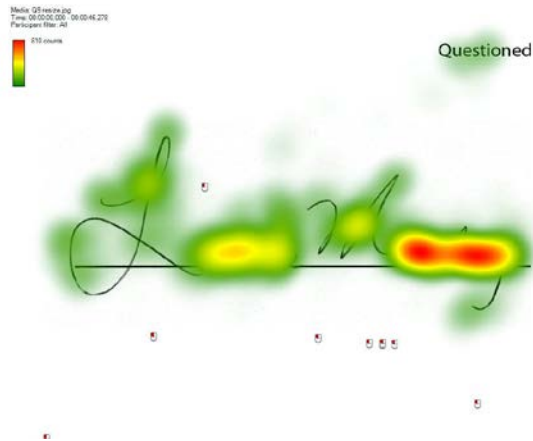
- Total Fixations: FDE1 = 292; FDE2 = 70; FDE3 = 64
- Fixation Duration: FDE1 = 132s; FDE2 = 74s; FDE3 = 44s

Finding the Diagnostic Hot Spots

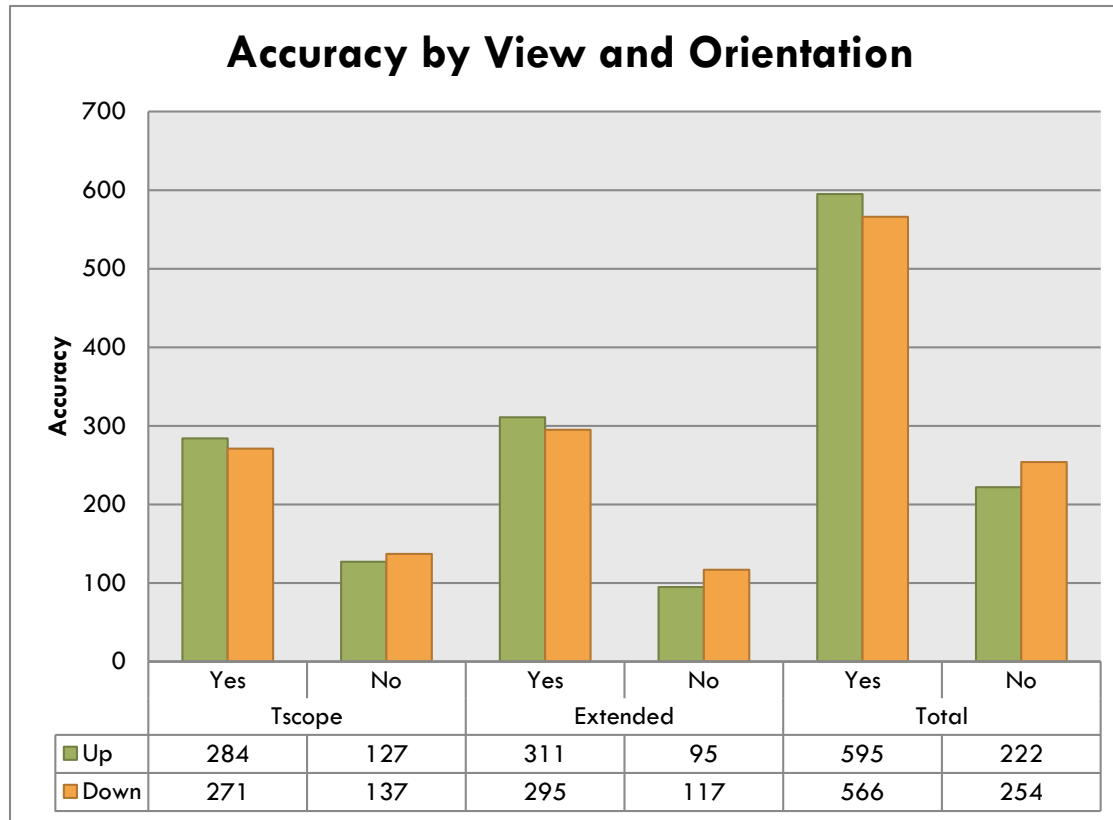
Unfiltered heat map

Areas of Interest (AOI)

Filtered heat map



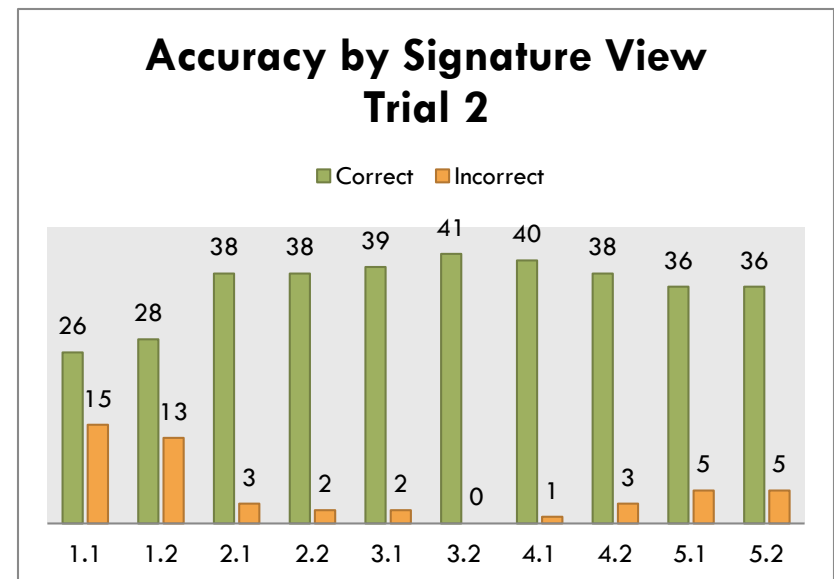
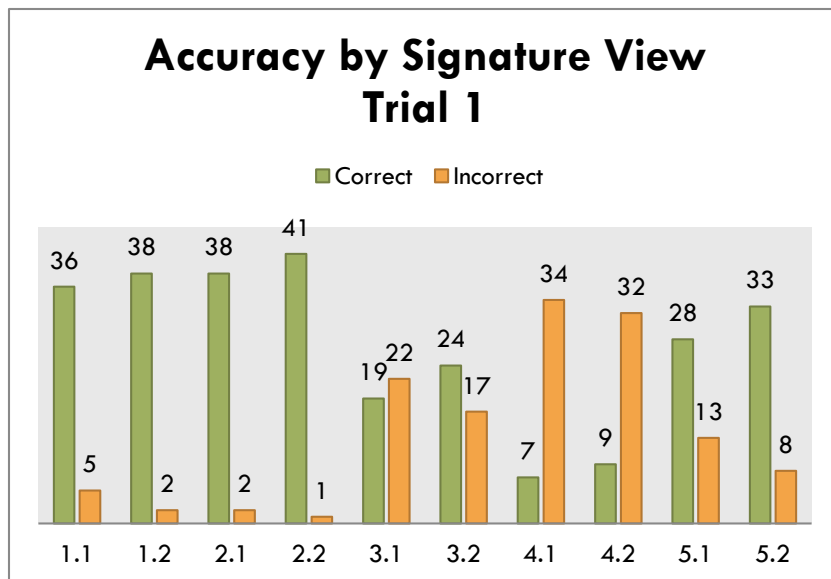
Overall Call Accuracy



- Overall accuracy = $1161 / 1647 = 70\%$
- Accuracy slightly higher for RSU than USD

Call Accuracy by View Duration

- All Trials (N=1 638 calls)
 - ▣ 1 162 Accurate (70.9%); 476 Inaccurate (29.1%)
 - ▣ $\kappa = .416$ (moderate agreement)



Call Accuracy by View Duration

□ Tscope View (N=819)

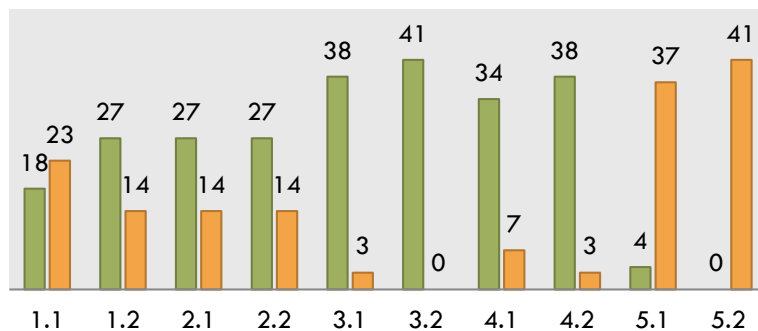
- 555 Accurate (67.8%)
- 264 Inaccurate (32.2%)
- $\kappa = .352$ (fair agreement)

□ Extended View (N=818)

- 606 Accurate (74.1%)
- 212 Inaccurate (25.9%)
- $\kappa = .480$ (mod agreement)

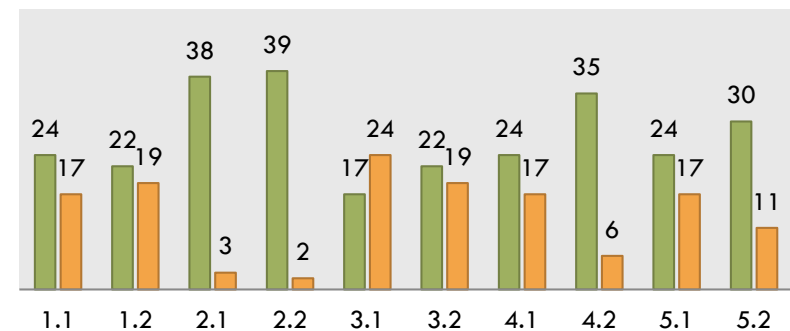
Accuracy by Signature View Trial 3

■ Correct ■ Incorrect



Accuracy by Signature View Trial 4

■ Series1 ■ Series2



Education and Training Implications

□ Practice, talent, and skill development

■ *Some talent + much training = expertise IF practice is deliberate*

- Deliberate practice
- Motivated learner
- Performance feedback
- Performance monitoring
- Elimination of incorrect response

□ Implications of knowledge about expertise for teaching

- Skill acquisition training
- Importance of problem decomposition
 - Componential analyses
 - Mastery learning

Future Directions

□ Expertise

- Stages of development
- Skill organization
- Practice vs. talent
- Education and training

□ The Comparison Process

- Characteristics
- Attention, perception, the comparison process, decision making

□ Judgment

- Probability- vs. frequency-based judgment
- Scale properties

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