# Visual confidence accurately tracks increased internal noise in peripheral vision

VSS 2025

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# Over-/Under-/Accurate Confidence in the periphery

| First-order task | Second-order task | Results |
| --- | --- | --- |
| Signal detection<br>(Performance matched) | N/A | A more liberal criterion<br>in the periphery |

*(Solovey, Graney, & Lau, 2014*
*For subjective inflation, see Rahnev et al. 2011;*
*Li, Lau, & Odegaard, 2018; Odegaard et al., 2018)*

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*(Toscani, Mamassian, & Valsecchi, 2021)*

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| Signal detection | 1-4 rating | Constant M-ratio across eccentricity |

*(Pruitt, Knotts, & Odegaard, 2024)*

# Advantages of Bayesian models with incentivized confidence

- Well-established definitions of confidence:
  - The subjective probability that the perceptual decision is correct

*(Kepecs, et al., 2008; Pouget, Drugowitsch, & Kepecs, 2016)*

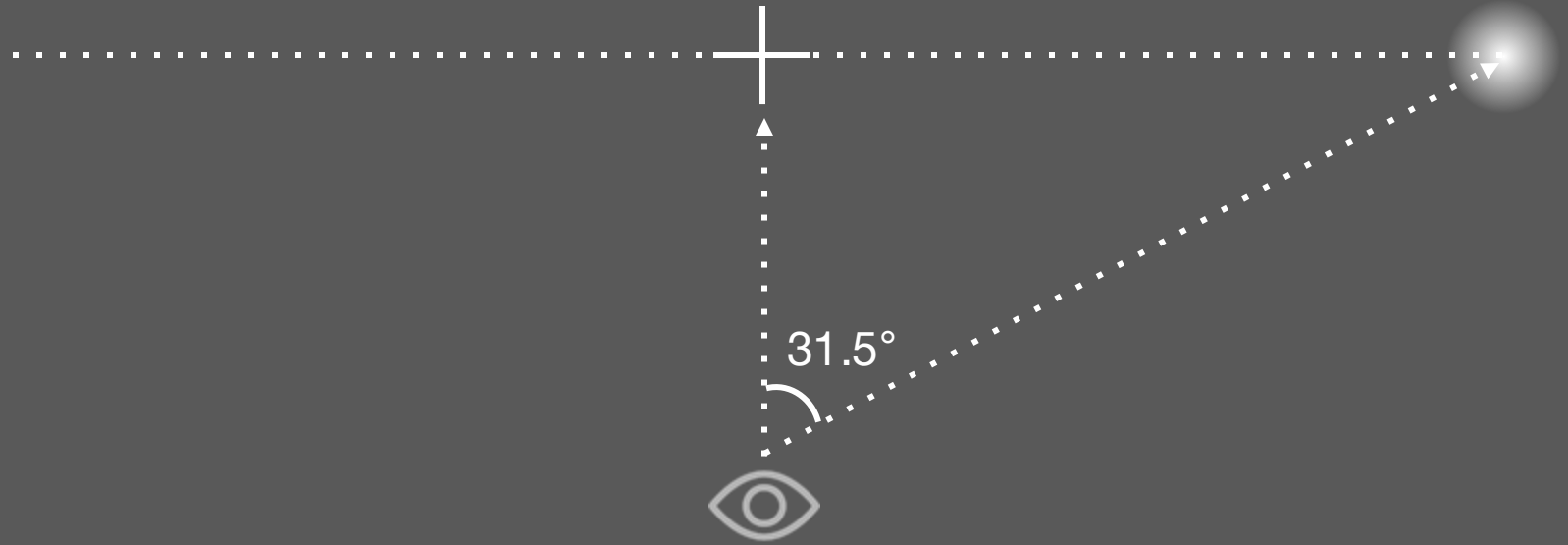
  - The self-consistency of a perceptual decision

*(Caziot & Mamassian, 2021)*

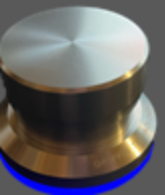
- Incentivized, continuous confidence response

*(Fassold, Locke, & Landy, 2023; Li et al., 2021; Yoo, et al., 2018)*

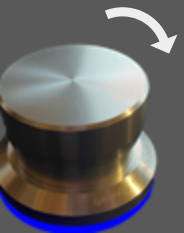
# Methods


31.5°

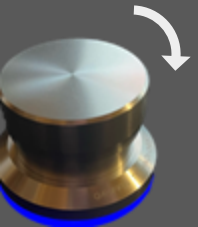
Potential reward: 1



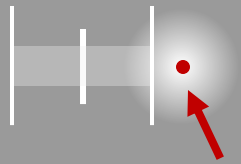
Potential reward: 0.70



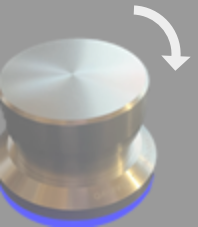
Potential reward: 0.59



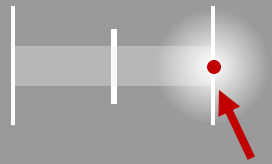
Potential reward: 0.59



Target center
(Invisible to participants)



Potential reward: 0.33



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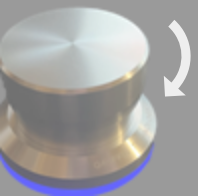

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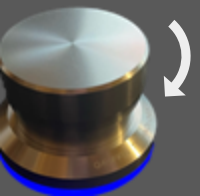
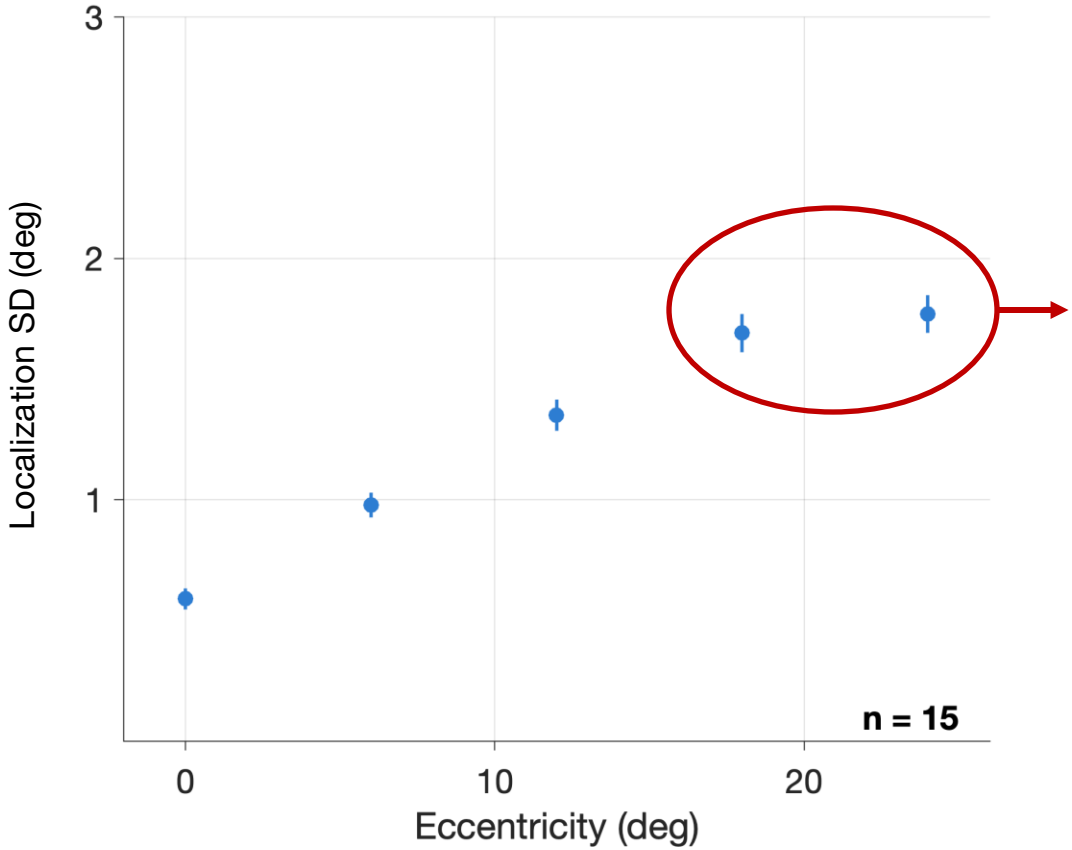


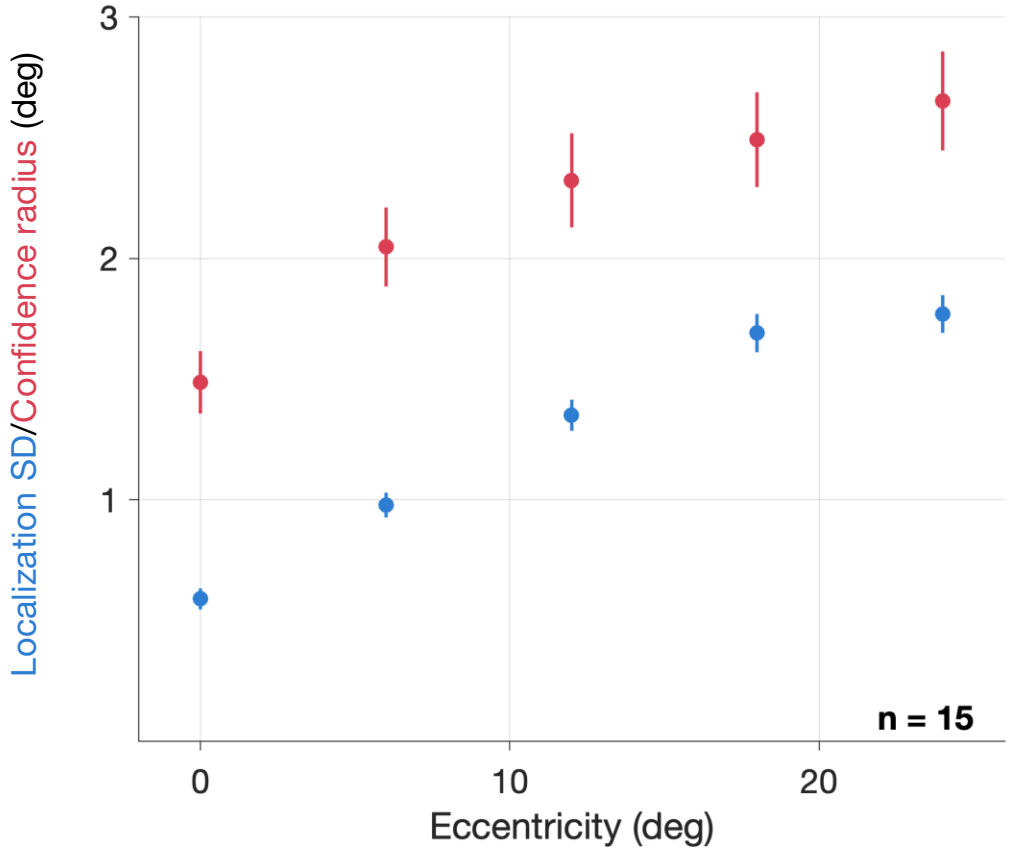
# Behavioral results

# Localization



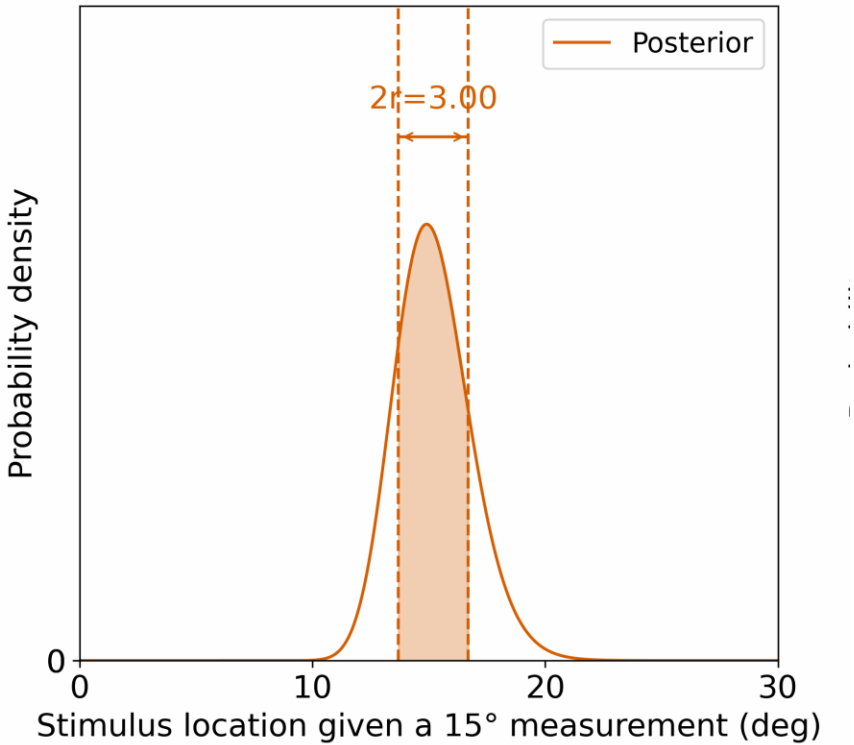

For the plateau of localization variability in far periphery, see *Fortenbaugh et al., 2012; Temme, Maino, & Noell, 1985*

# Localization and confidence radius



# Confidence models

# Optimal observer model



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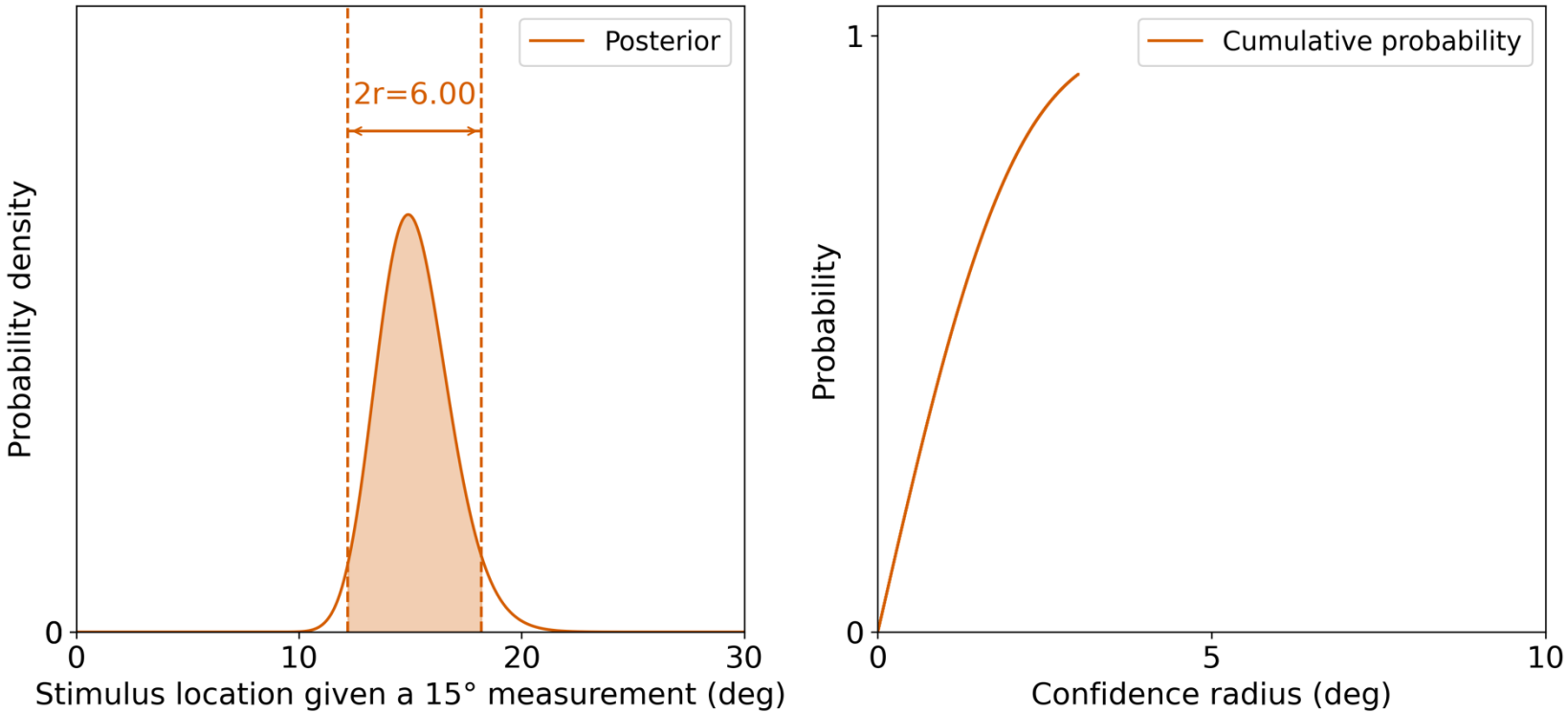

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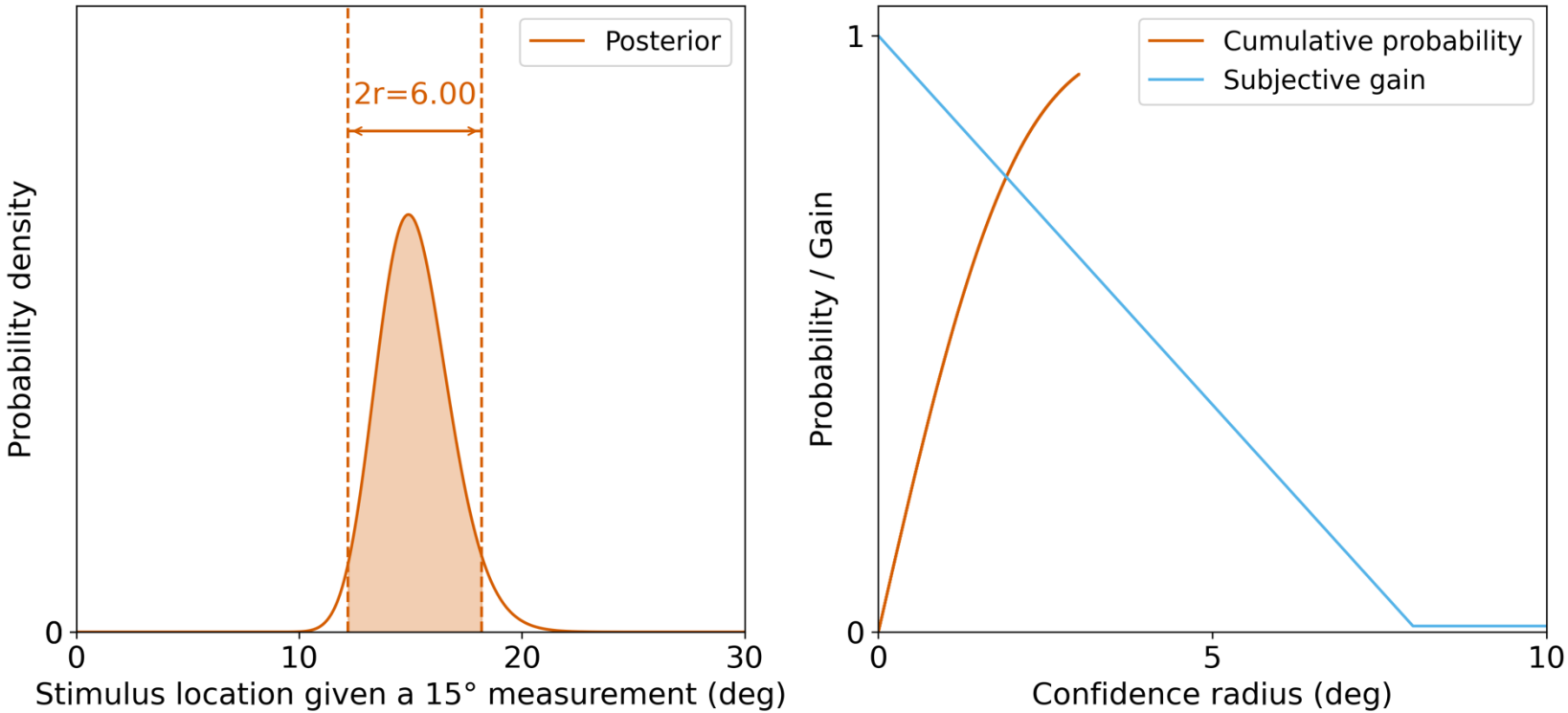

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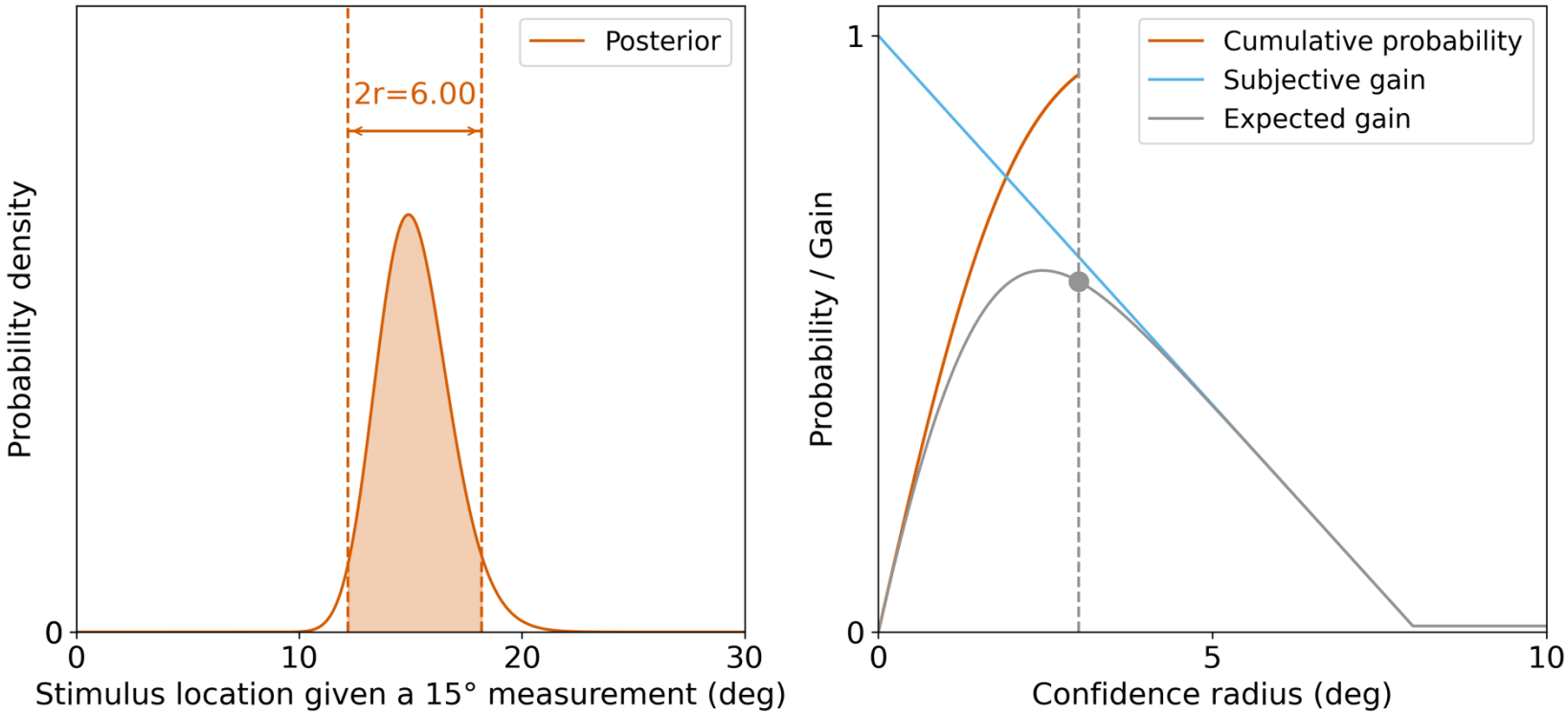

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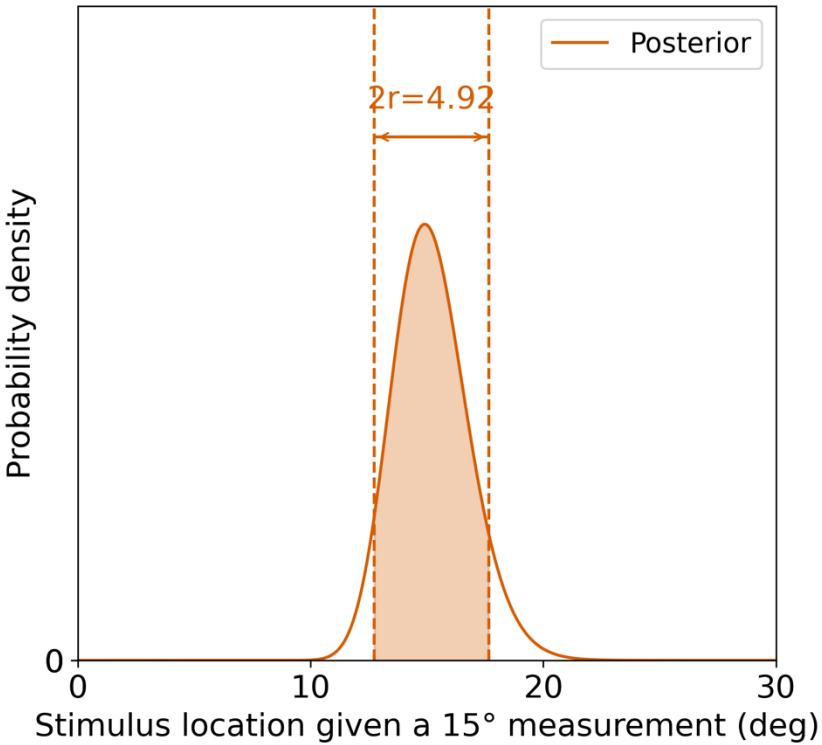


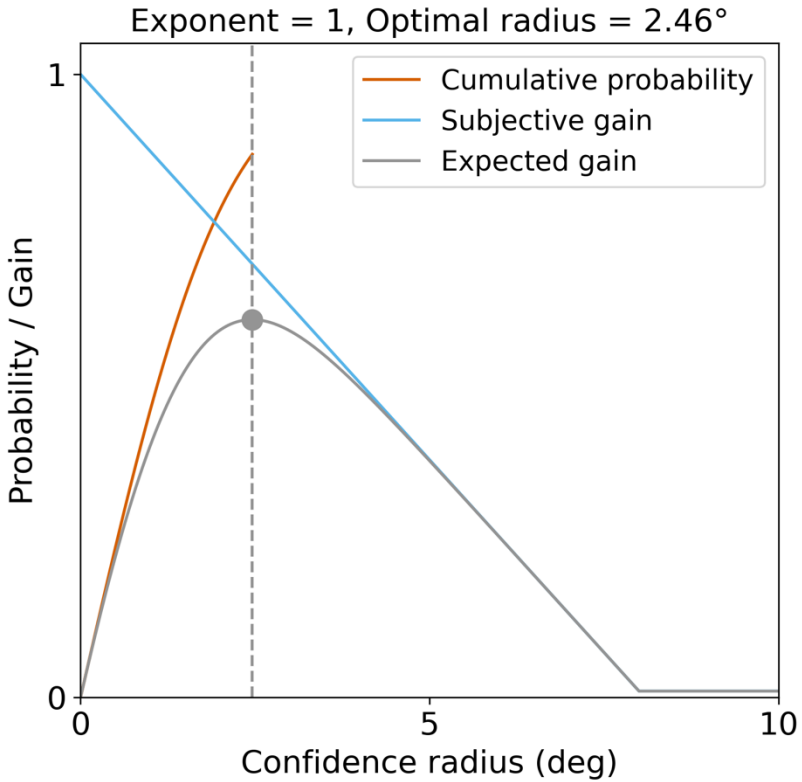

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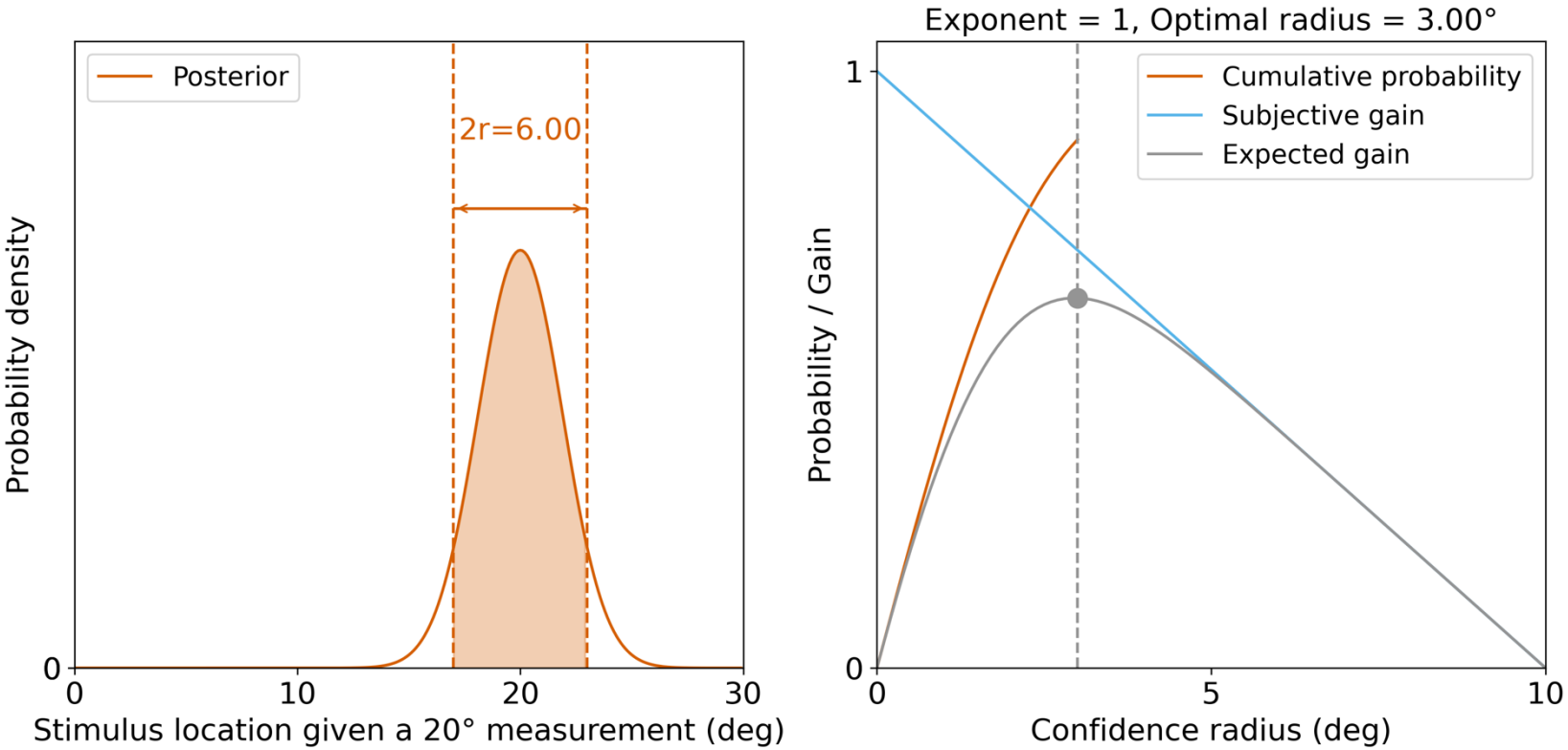

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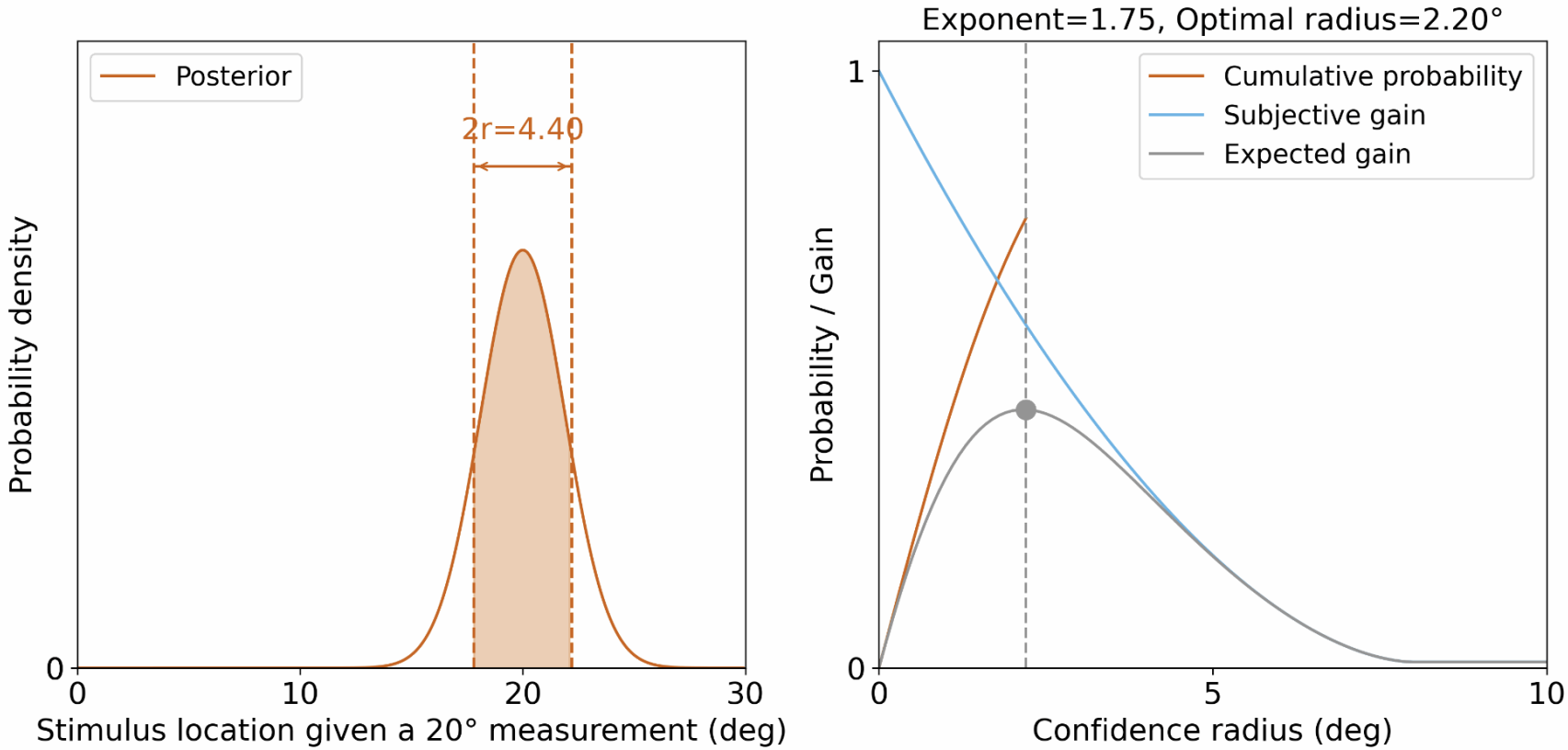

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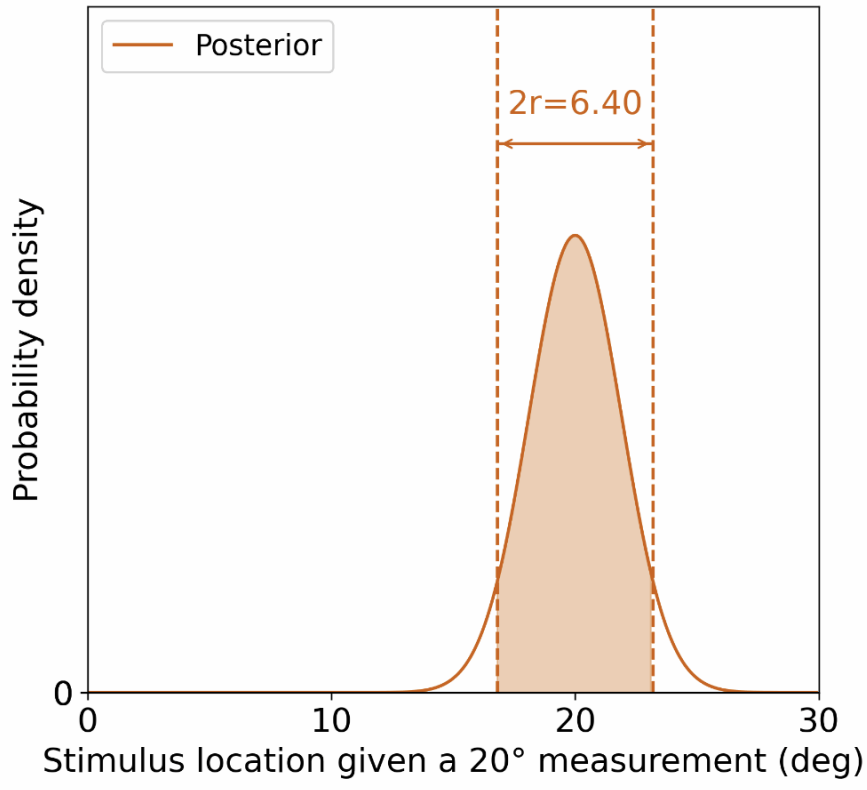
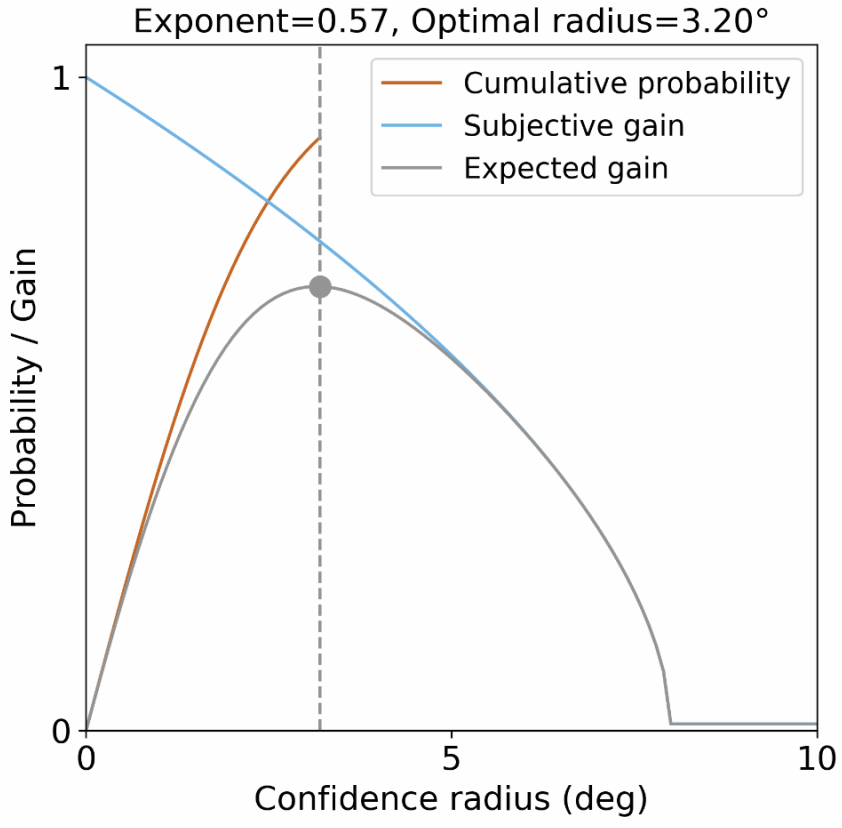


# Confidence models

| | Use posterior | Use gain function |
|---|---|---|
| Optimal | ✔ | ✔ |

# Confidence models

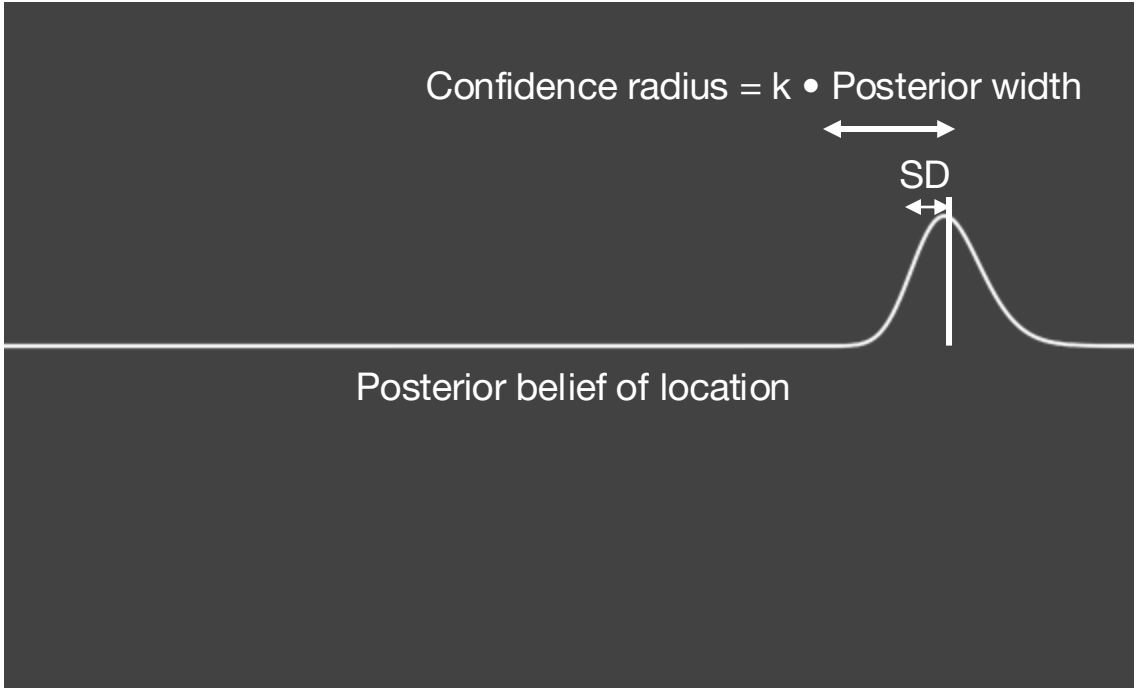
| | Use posterior | Use gain function |
|---|---|---|
| Optimal | ✓ | ✓ |
| Scaled posterior width | ✓ | ✗ |
| Scaled log posterior width | ✓ | ✗ |

# Confidence models

Optimal

Scaled posterior width

Scaled log posterior width

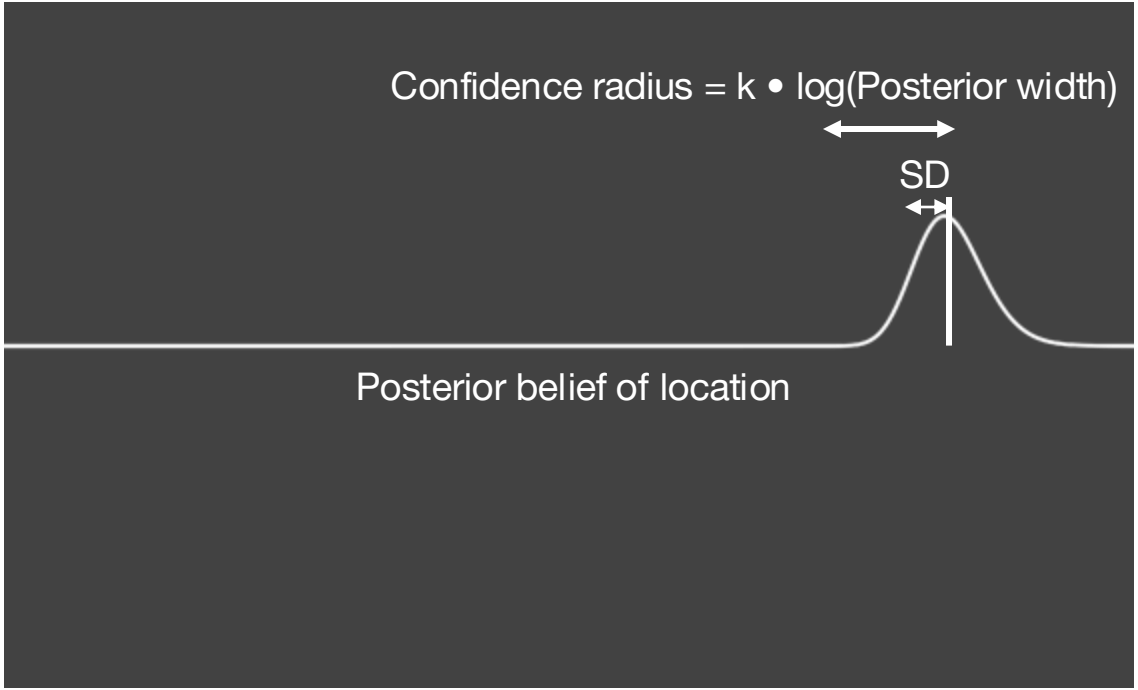


# Confidence models

Optimal

Scaled posterior width

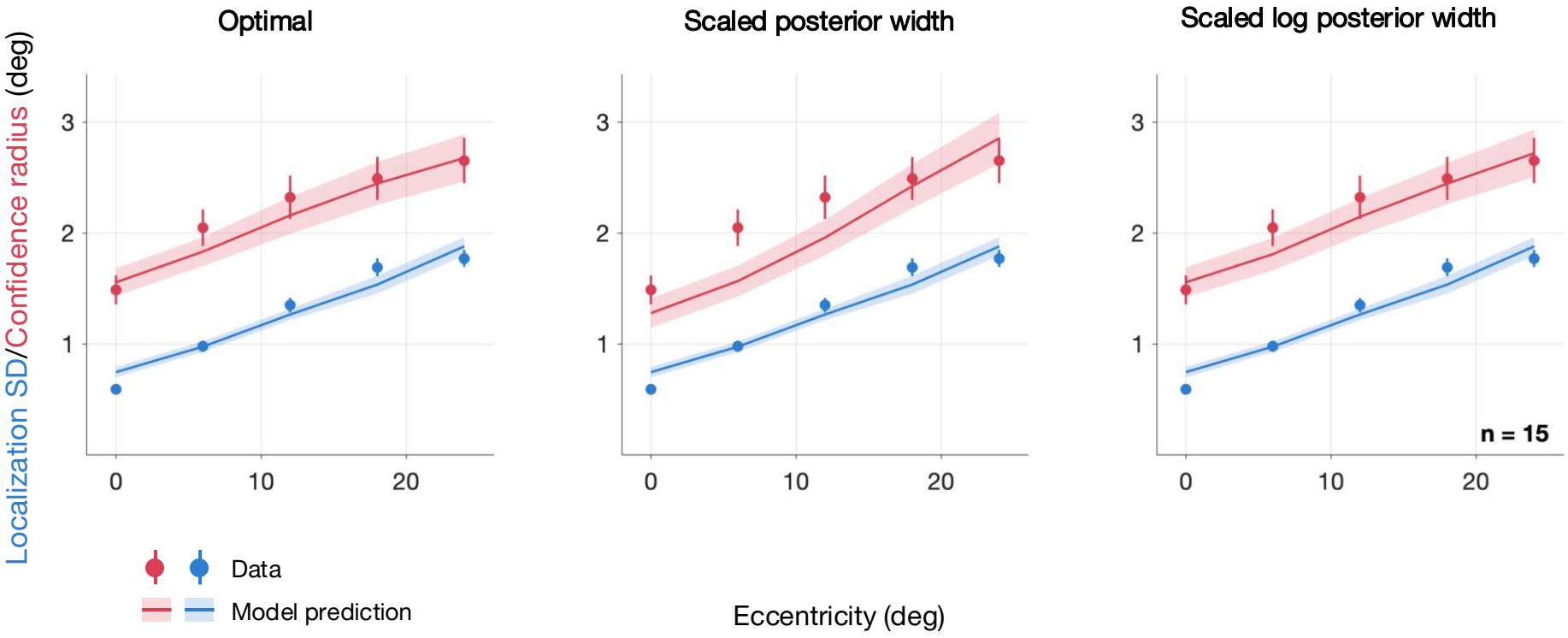
Scaled log posterior width



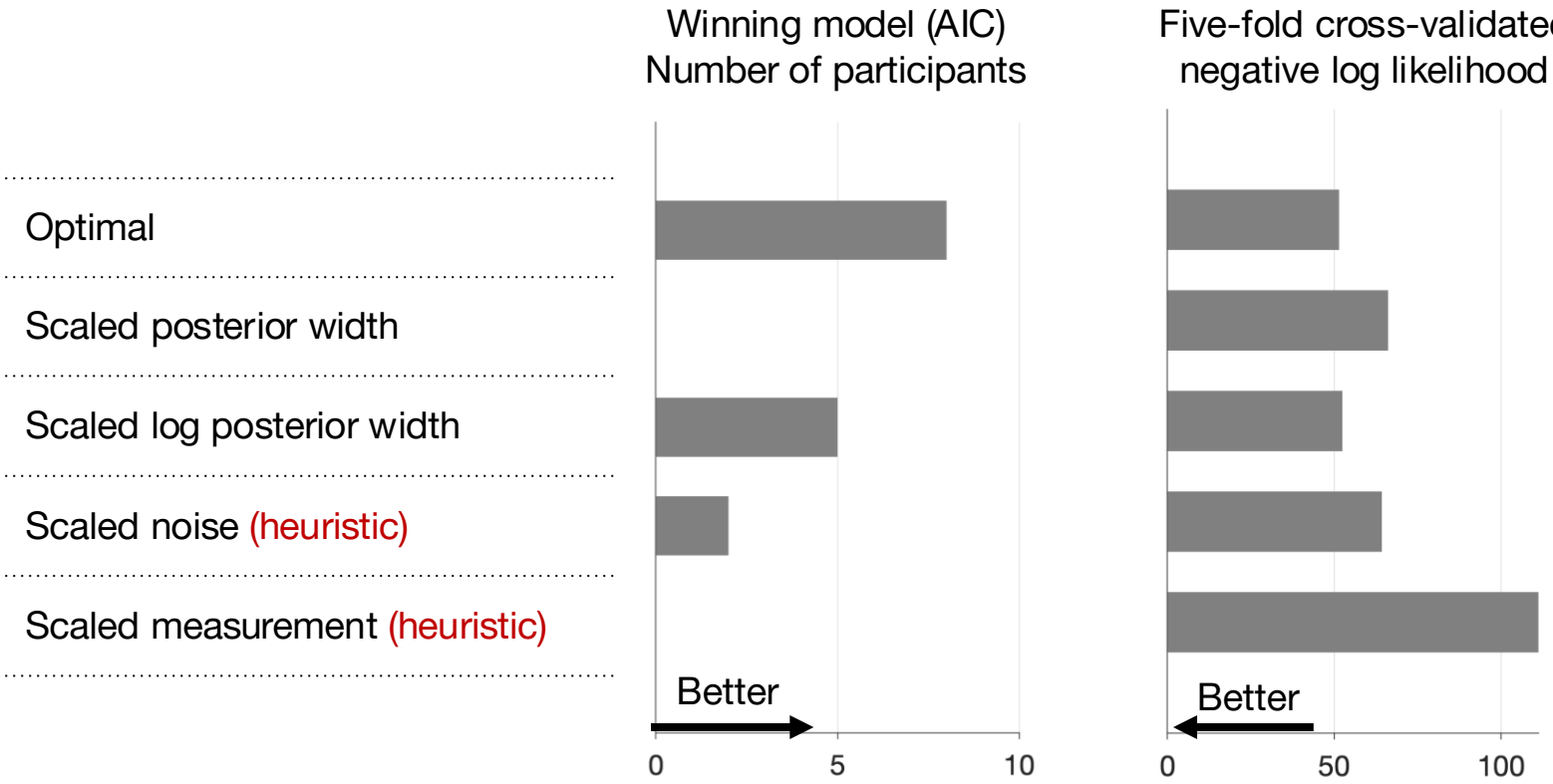

*(van den Berg, Yoo, & Ma, 2017)*

# Modeling results

# Model predictions



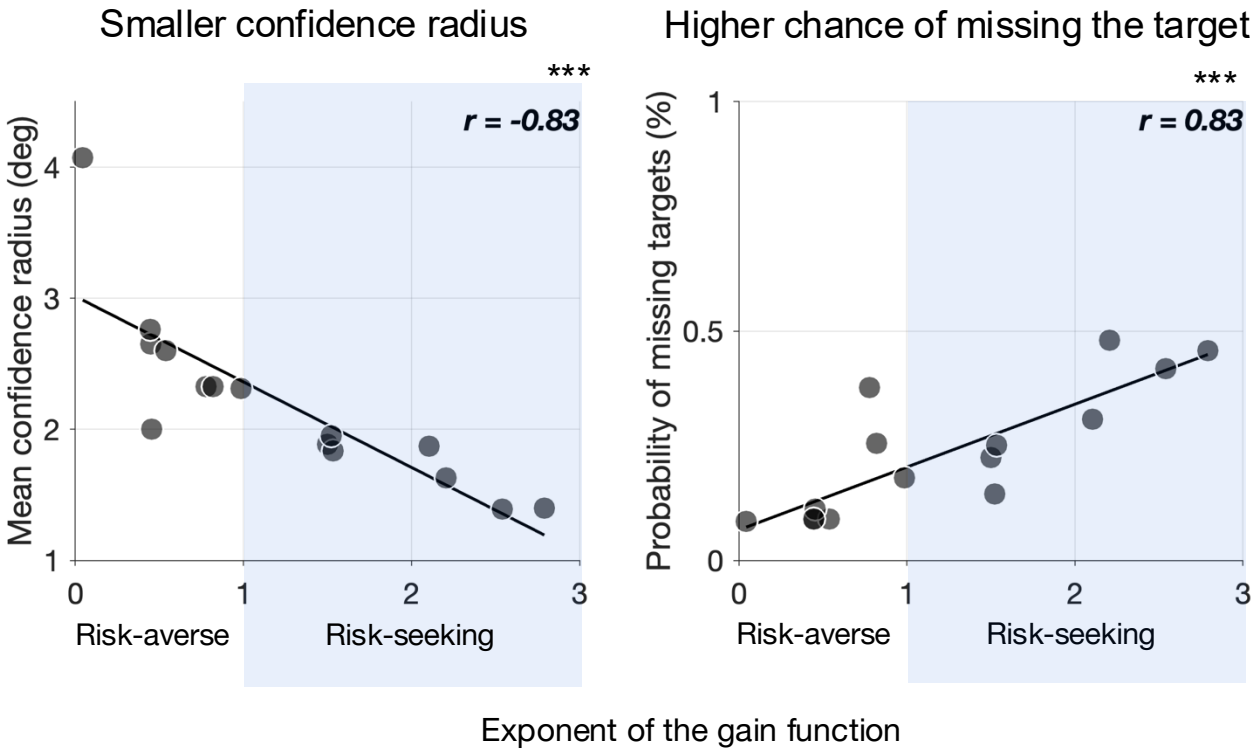
# Model comparison



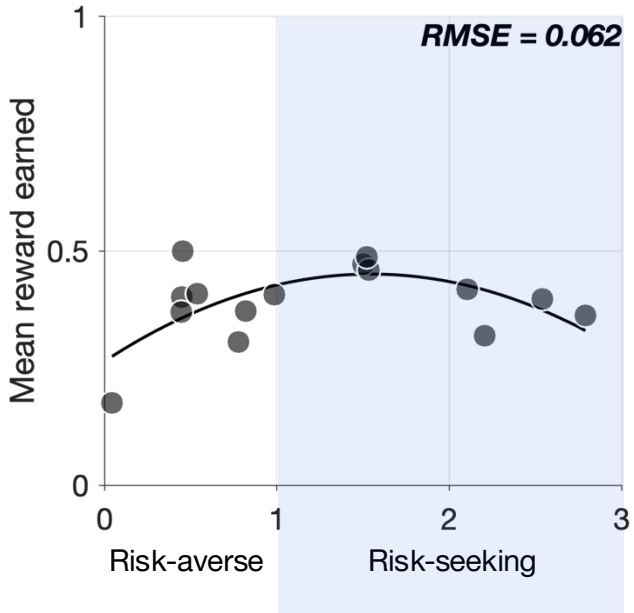
# Winning confidence models

| | Confidence radius | Free parameter |
|---|---|---|
| Optimal | argmax(Expected gain) | Exponent of the gain function |
| | | |
| Scaled log posterior width | k • log(Posterior width) | Scaling factor k |

# A larger exponent (more risk-seeking) correlated with...



# Extreme values of the exponent are associated with less reward



# Conclusions

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- The optimal-observer model predicts data as well as a descriptive logarithmic-mapping model, both of which outperform heuristic models.
- Visual confidence accurately tracks increased sensory noise in the periphery.
- Our findings add to the scant evidence supporting the Bayesian-confidence hypothesis, suggesting that people can approach optimal confidence judgments when sufficiently incentivized.

Interactive model demo available at osf.io/5cgbt/ OR

# Thank you!

Landy lab