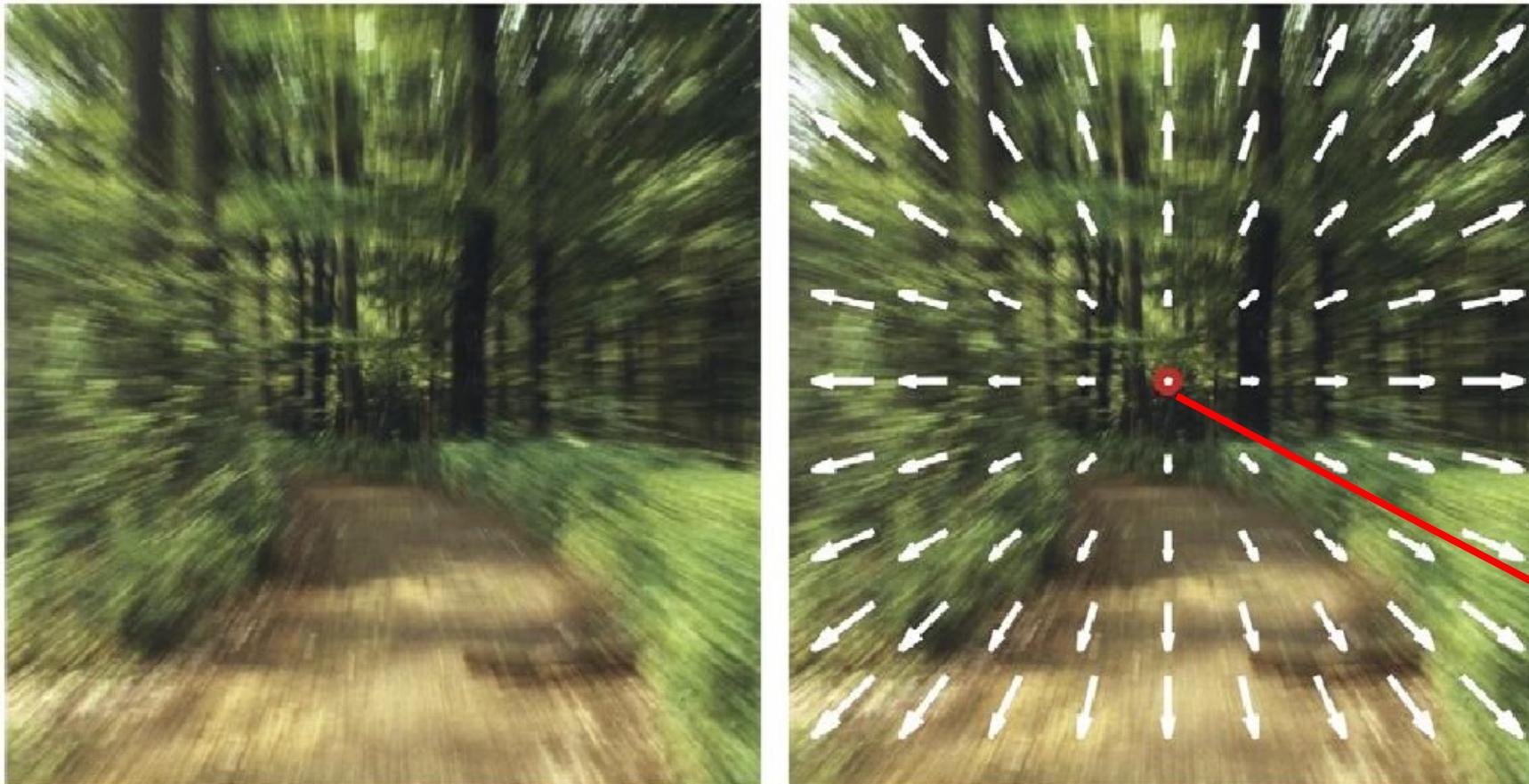




前进和后退自身运动判断中的 中心偏差的非对称性

报告人：洪宝
导师：李黎(上海纽约大学)
2025.06.07

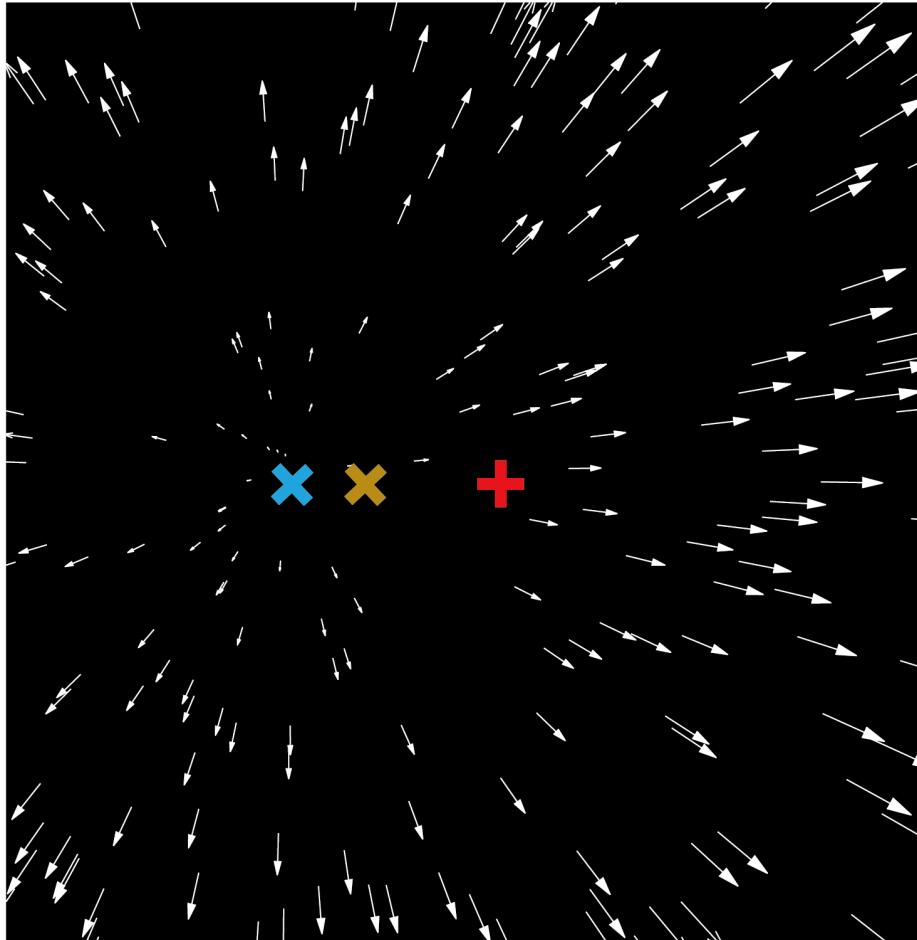
利用光流感知自身运动方向



(Bremmer, 2008)

人类可以从光流 (Gibson, 1950) 中准确感知自我运动的方向 (Warren et al ,1988 ; Li et al , 2002)

自身运动判断中的中心偏差



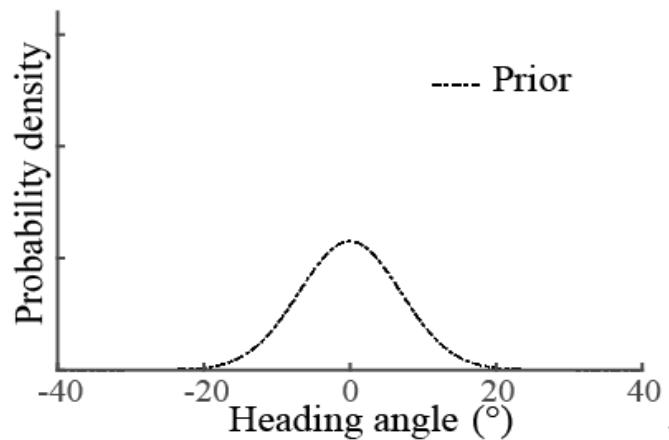
- ◆ Center of display
- ◆ Actual heading (FoE)
- ◆ Perceived heading

Warren & Hannon, (1988). *Nature*
Sun et al., (2020). *Journal of vision*

中心偏差的贝叶斯解释

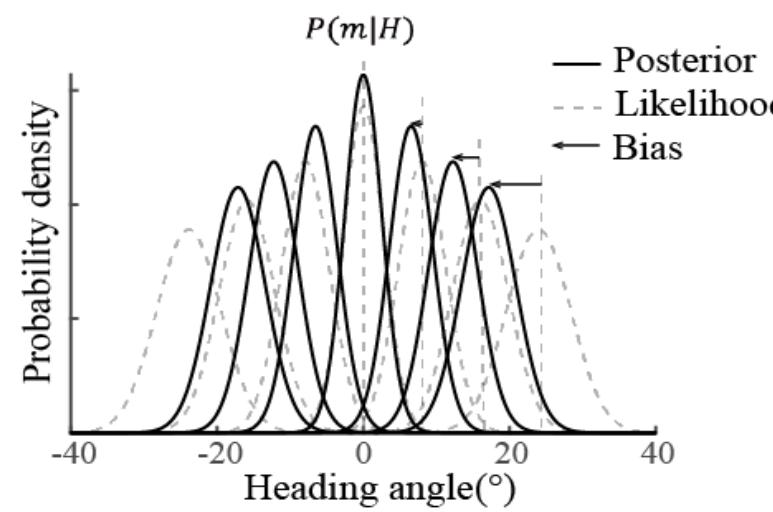
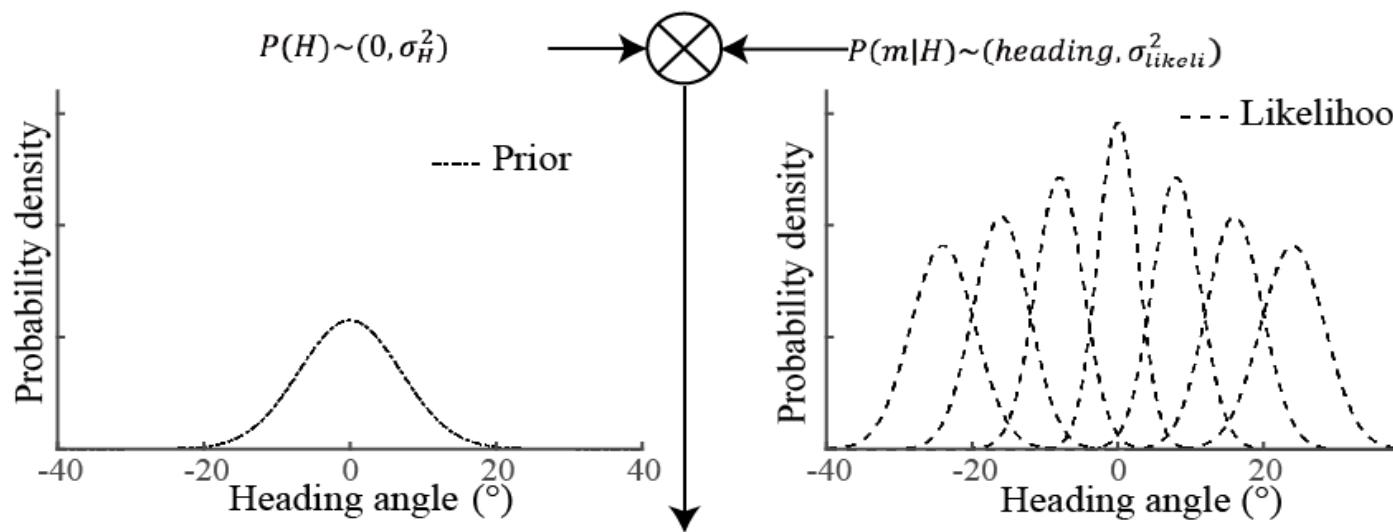
- $P(H|m) \propto P(m|H)P(H)$

$$P(H) \sim (0, \sigma_H^2)$$

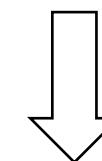


中心偏差的贝叶斯解释

- $P(H|m) \propto P(m|H)P(H)$

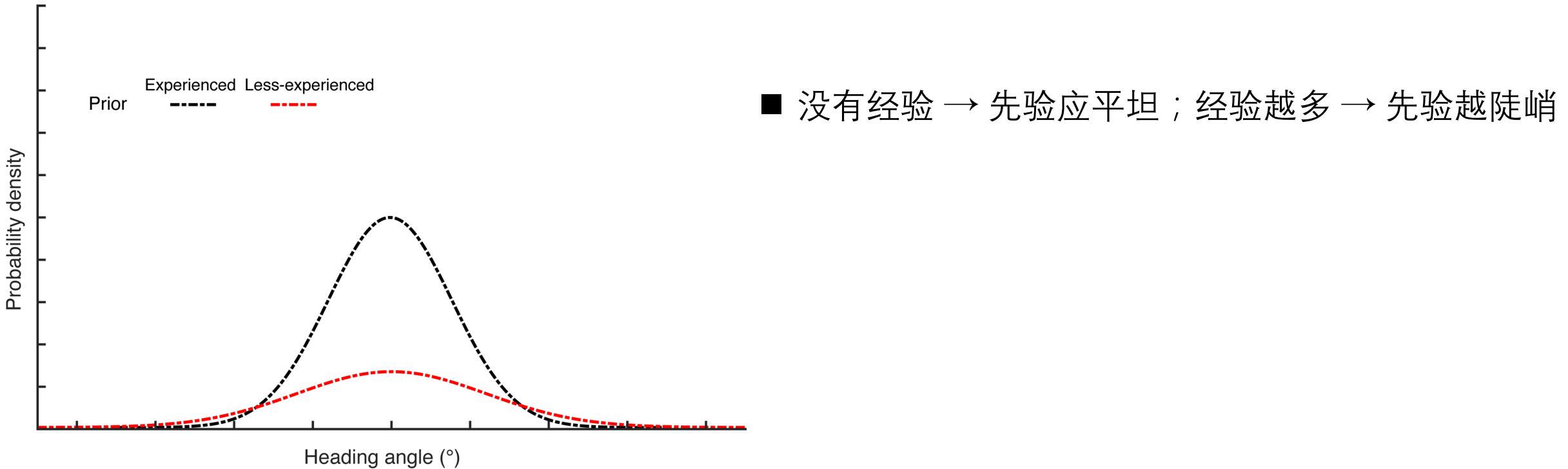


中心偏差的来源是长期经验？



是否经验的丰富程度会影响先验信念的强度，进而影响中心偏差？

经验塑造先验强度并影响中心偏差





前进运动是人类最常见的自我运动形式

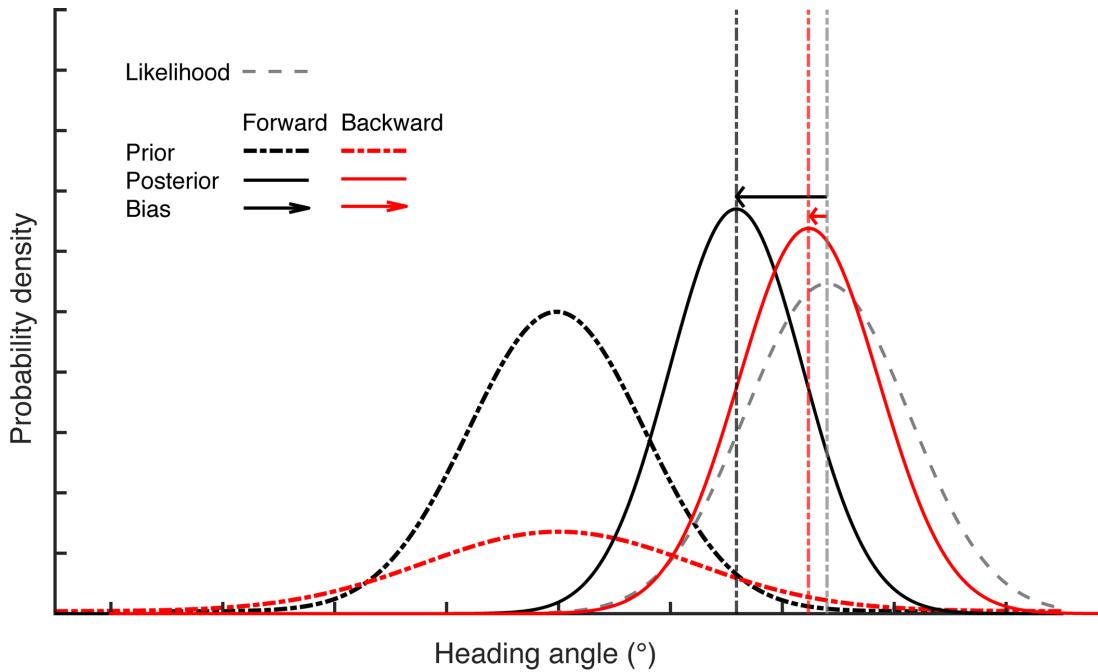




前进运动是人类最常见的自我运动形式



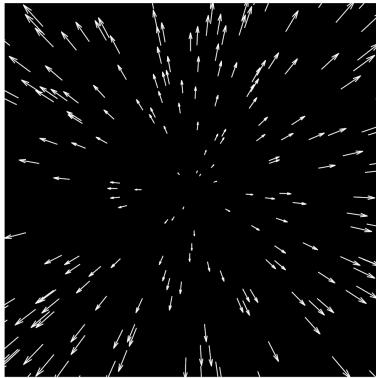
经验塑造先验强度并影响中心偏差



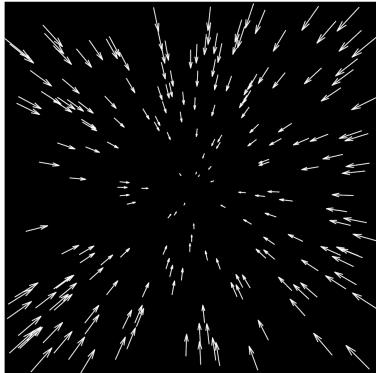
- 没有经验 → 先验应平坦；经验越多 → 先验越陡峭
- 预测：
 - 前进条件 → 更大的中心偏差 & 更陡峭的先验
 - 后退条件 → 更小的中心偏差 & 先验更平坦

实验1：任务和设计

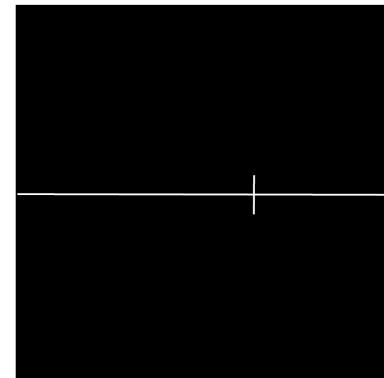
Forward



Backward



Optic flow
500 ms



Judgment

刺激: 500-ms 点云光流 (速度: 3m/s, 深度范围: 0.565 – 2 m)

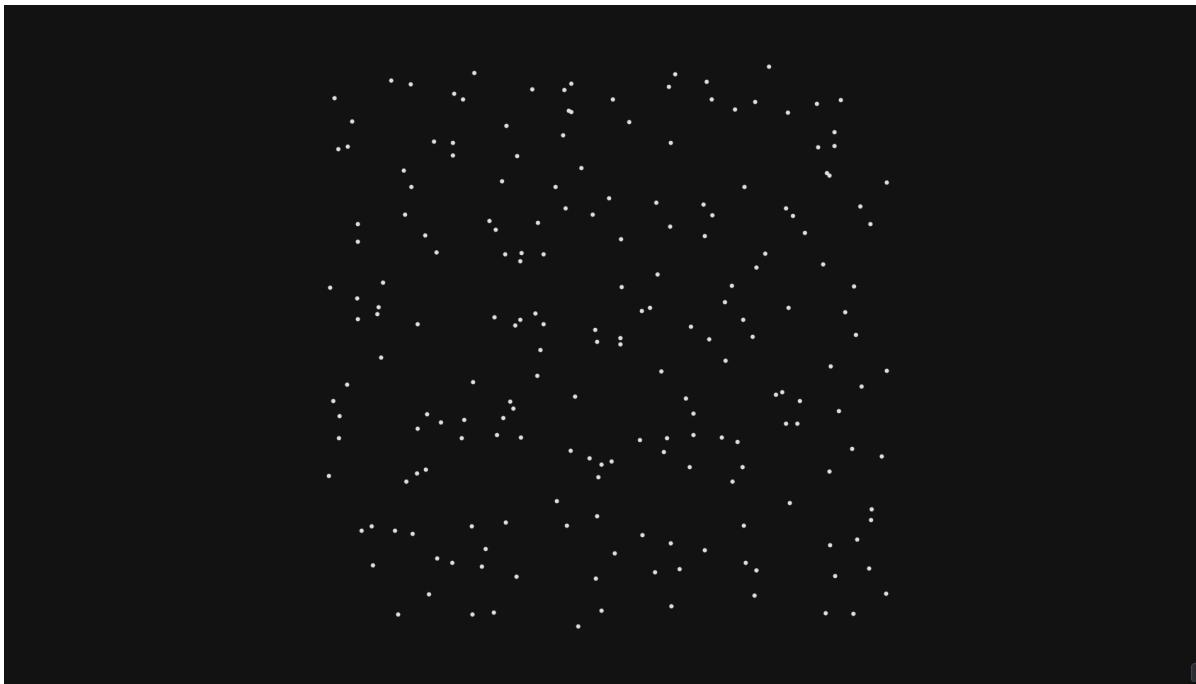
条件: 向前/向后自我运动 (区块设计, 被试内随机)

自我运动方向: -24° : 4 ° : 24°

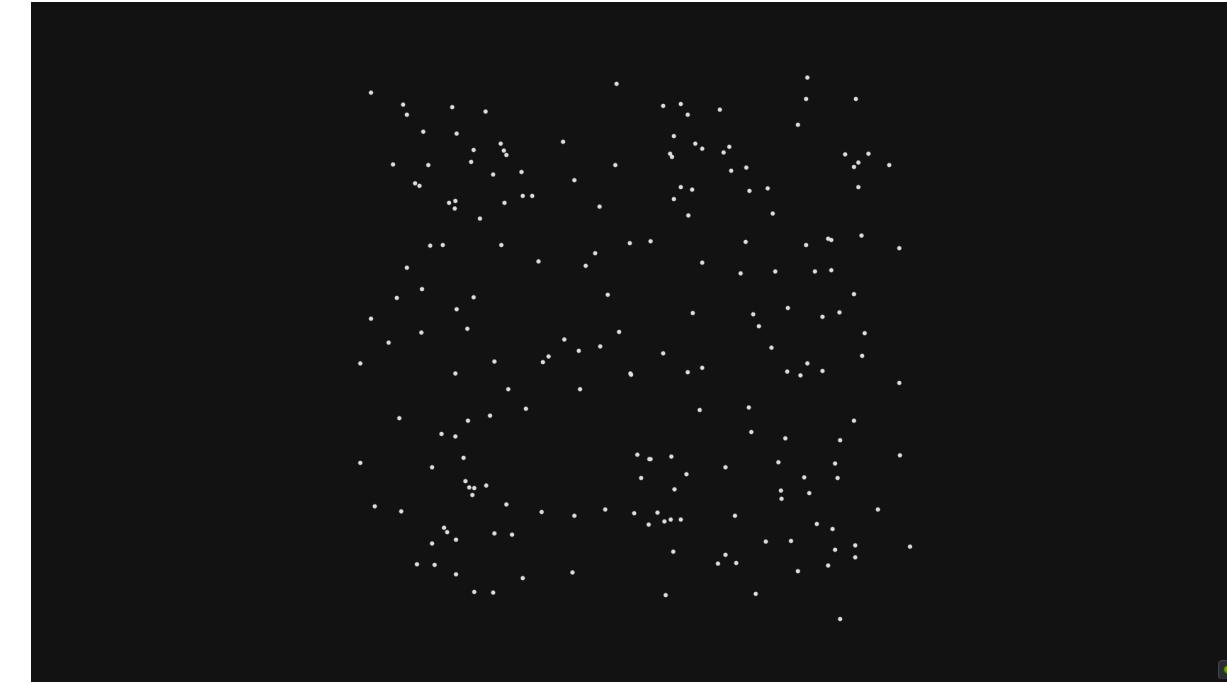
被试: N= 30 (F/M = 20/10)

实验刺激

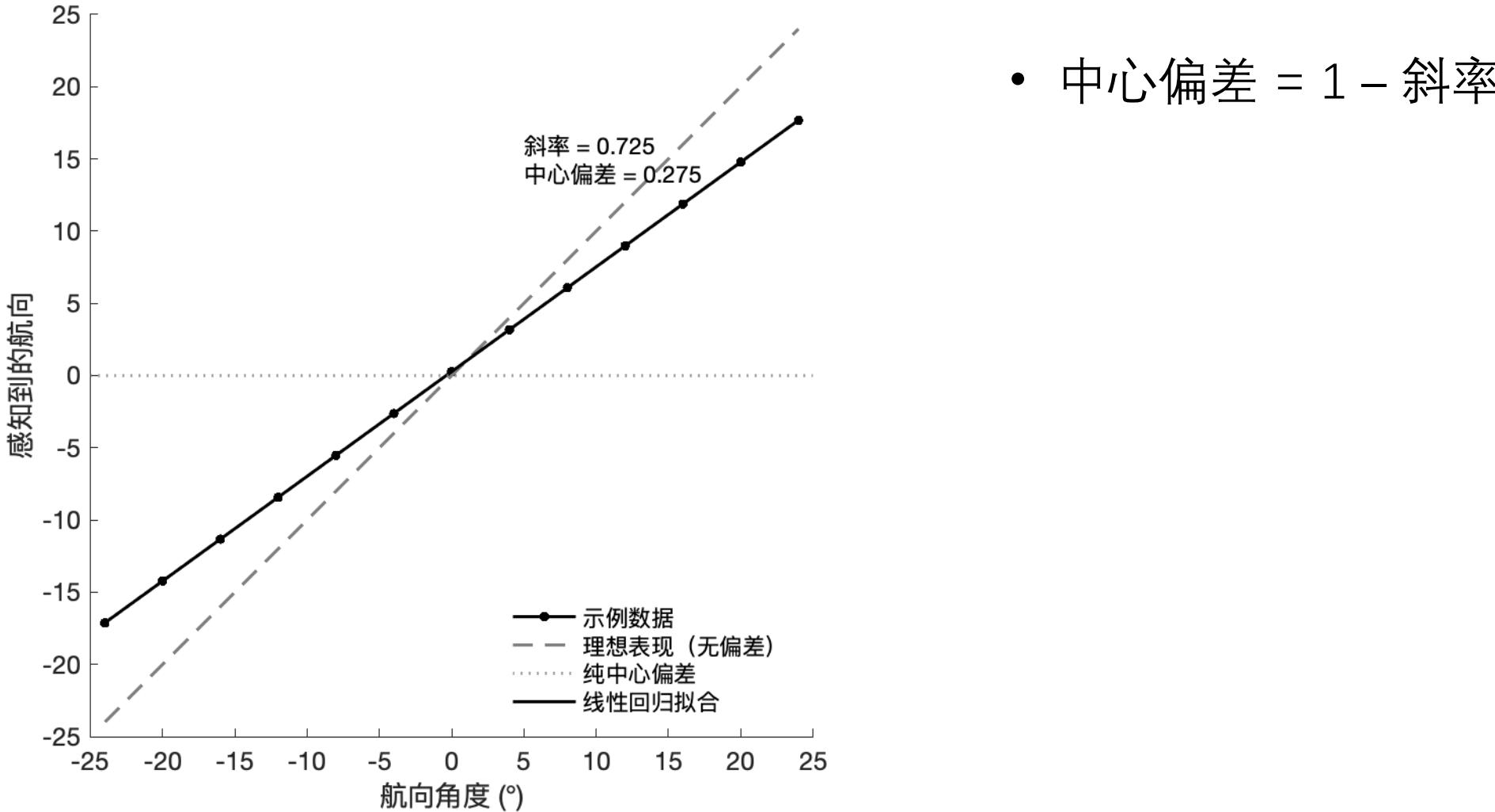
向前运动



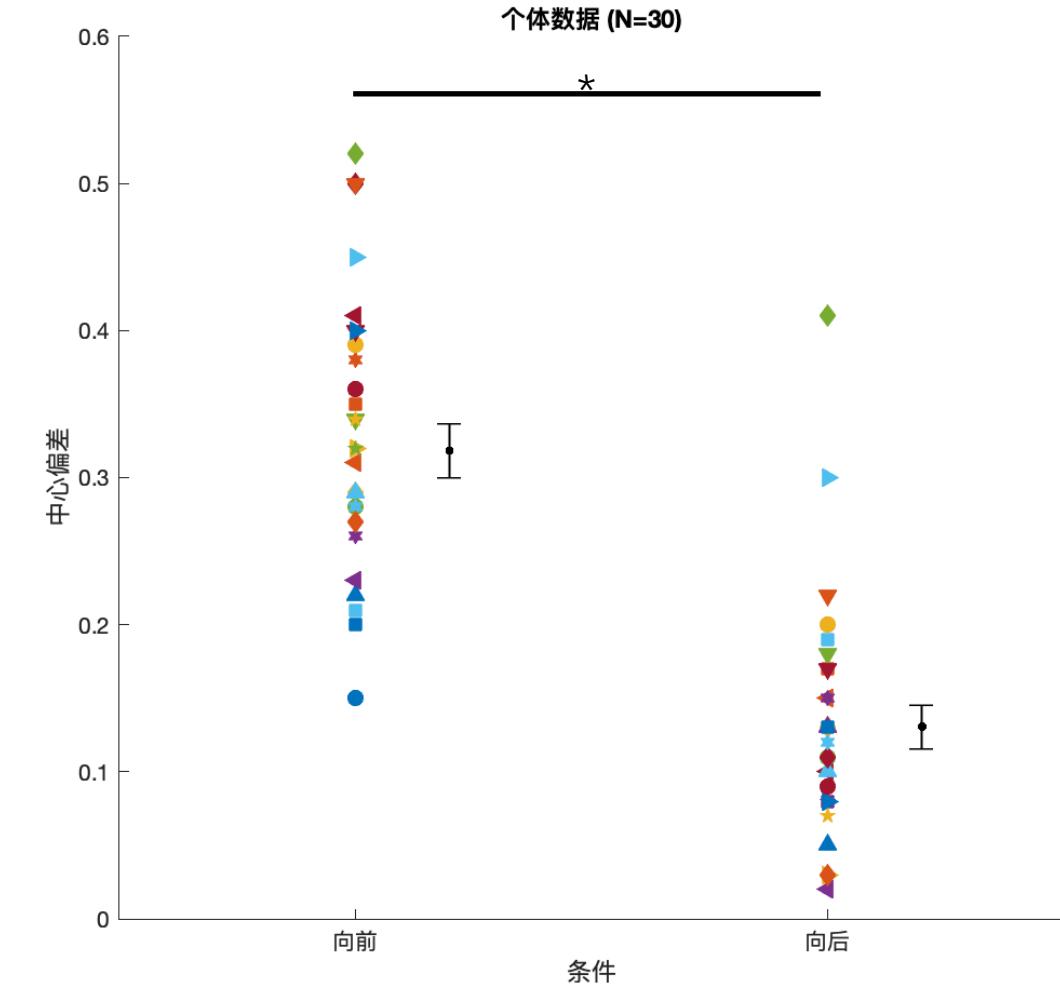
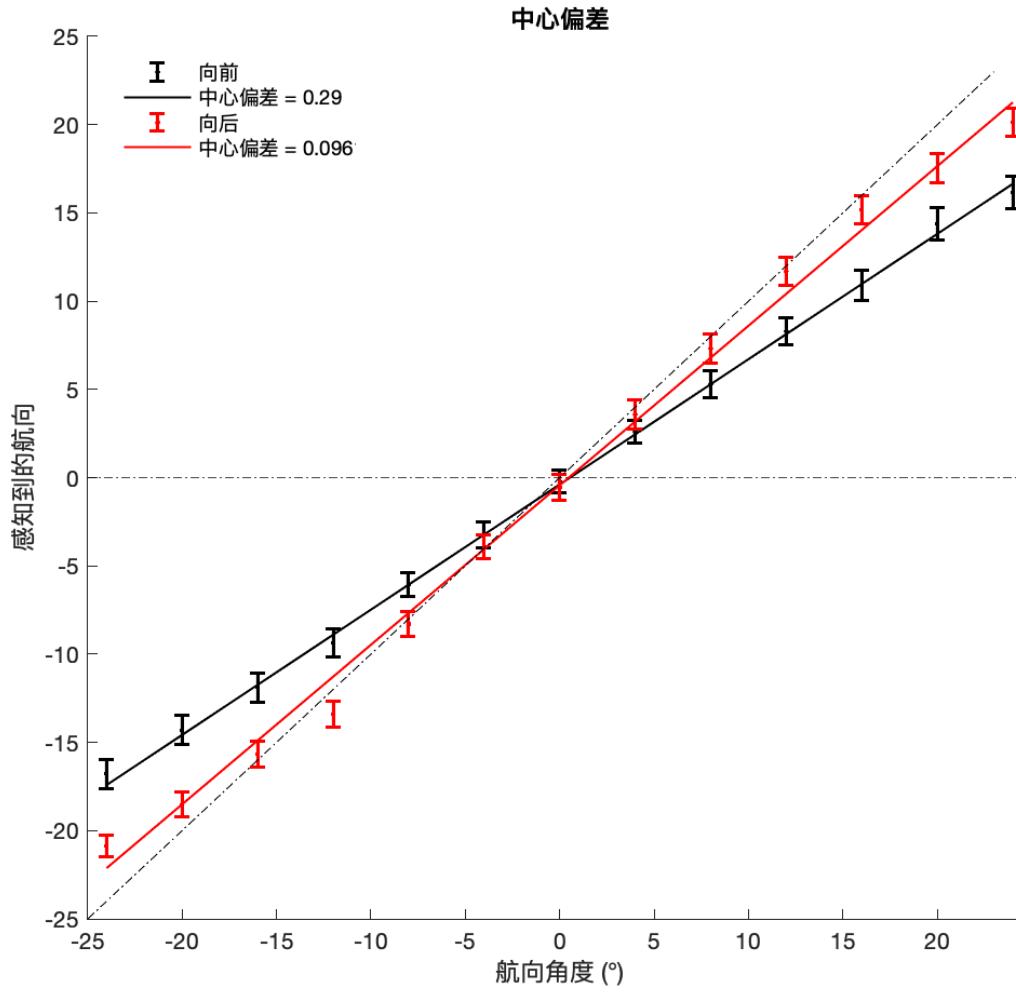
向后运动



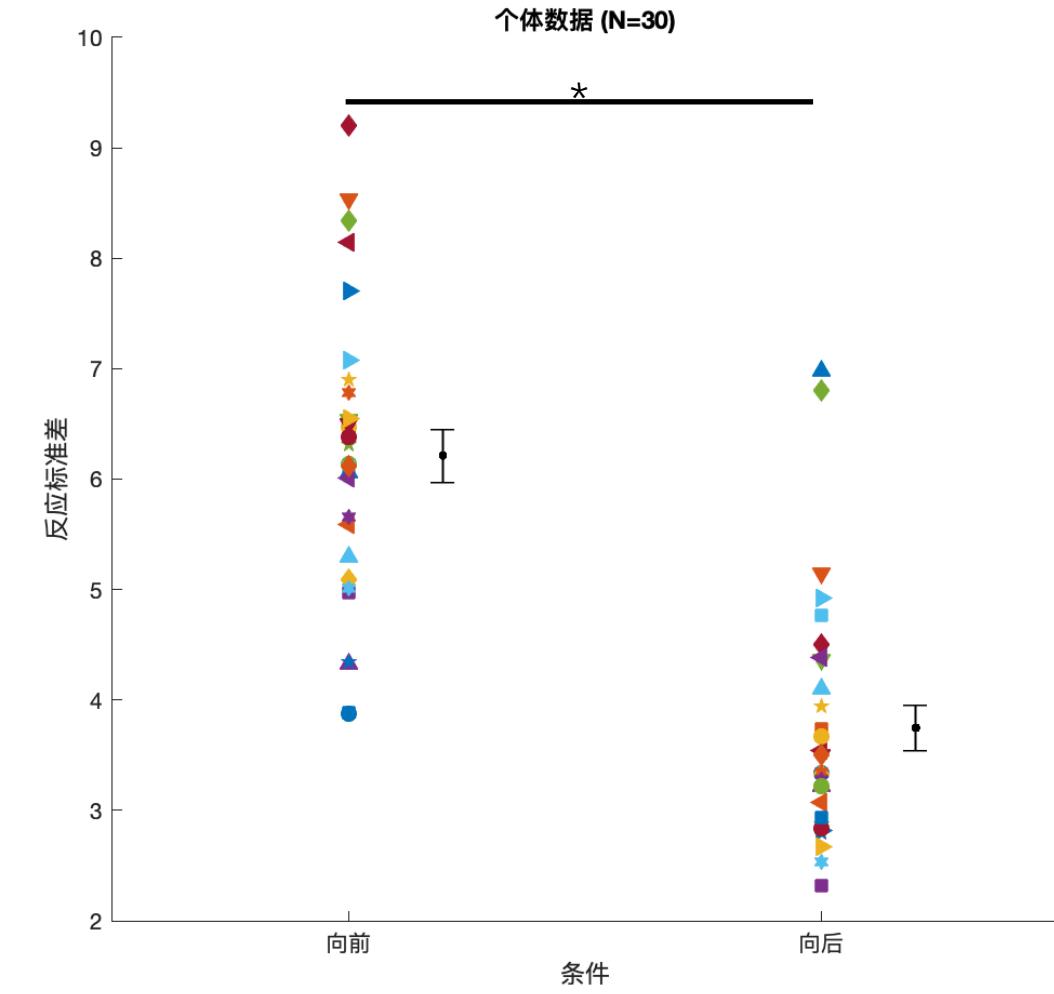
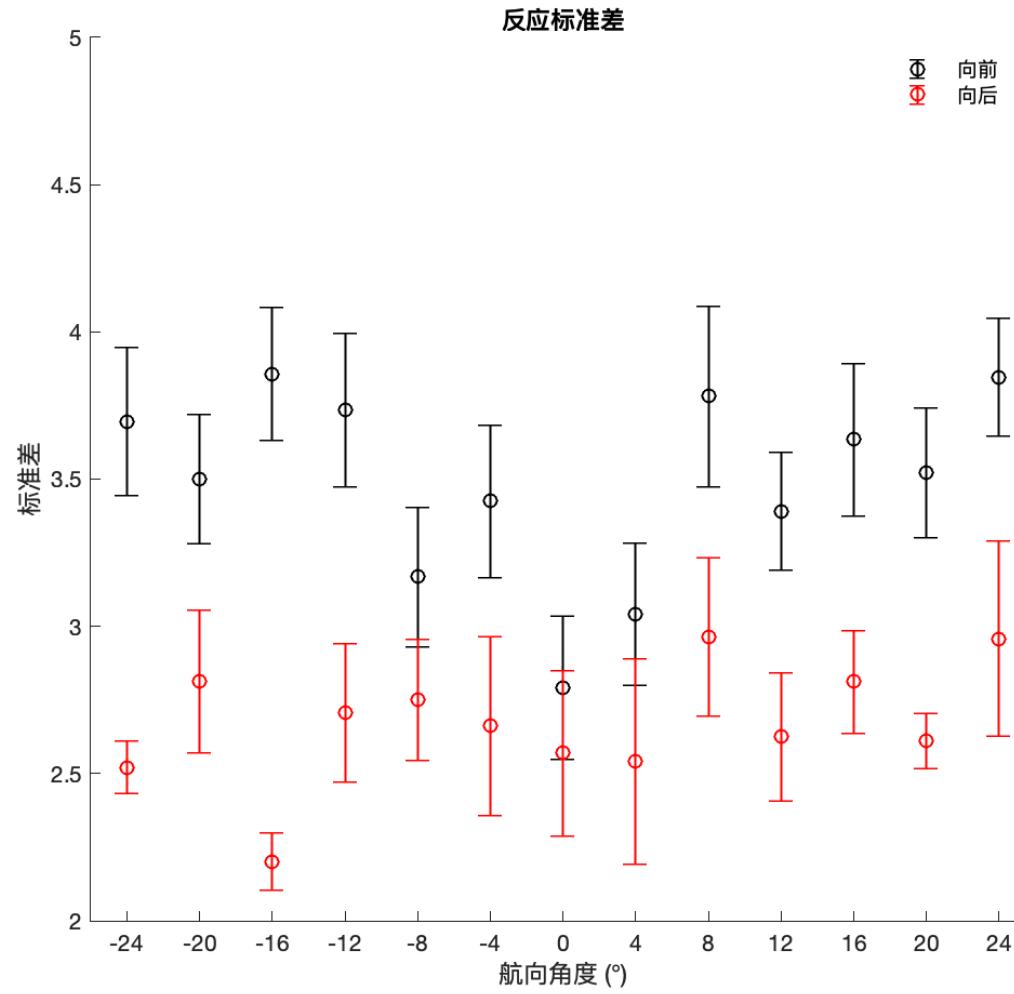
中心偏差的计算



结果：中心偏差

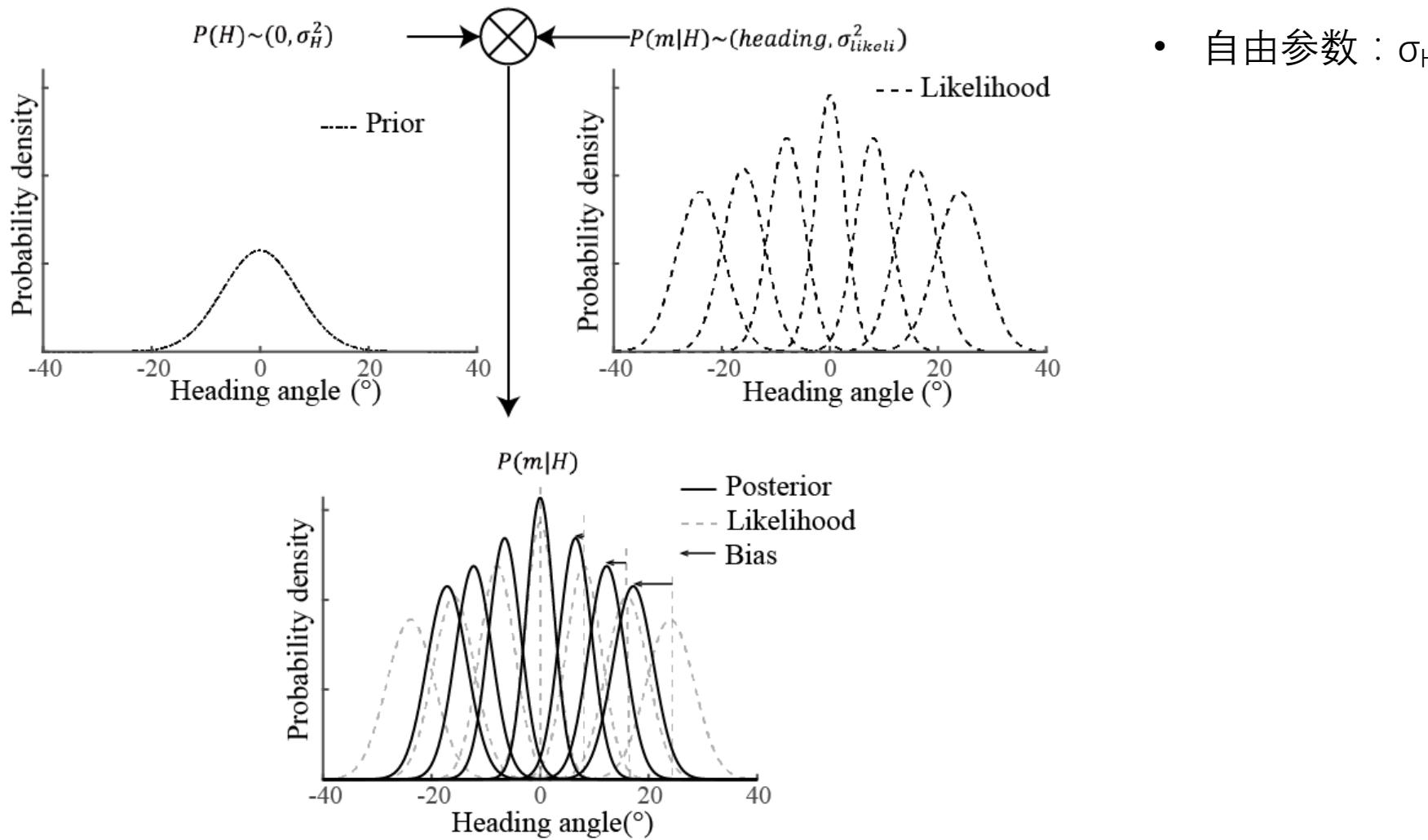


结果：反应标准差

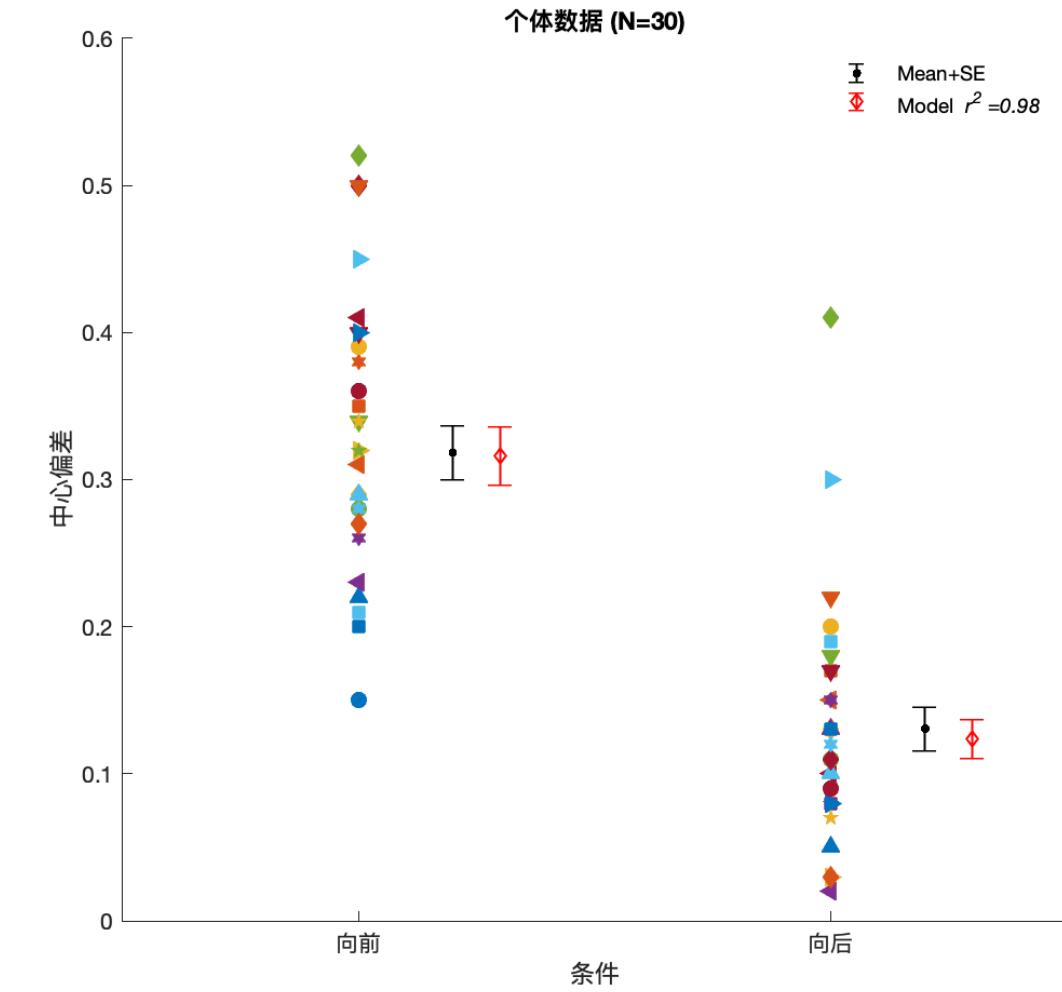
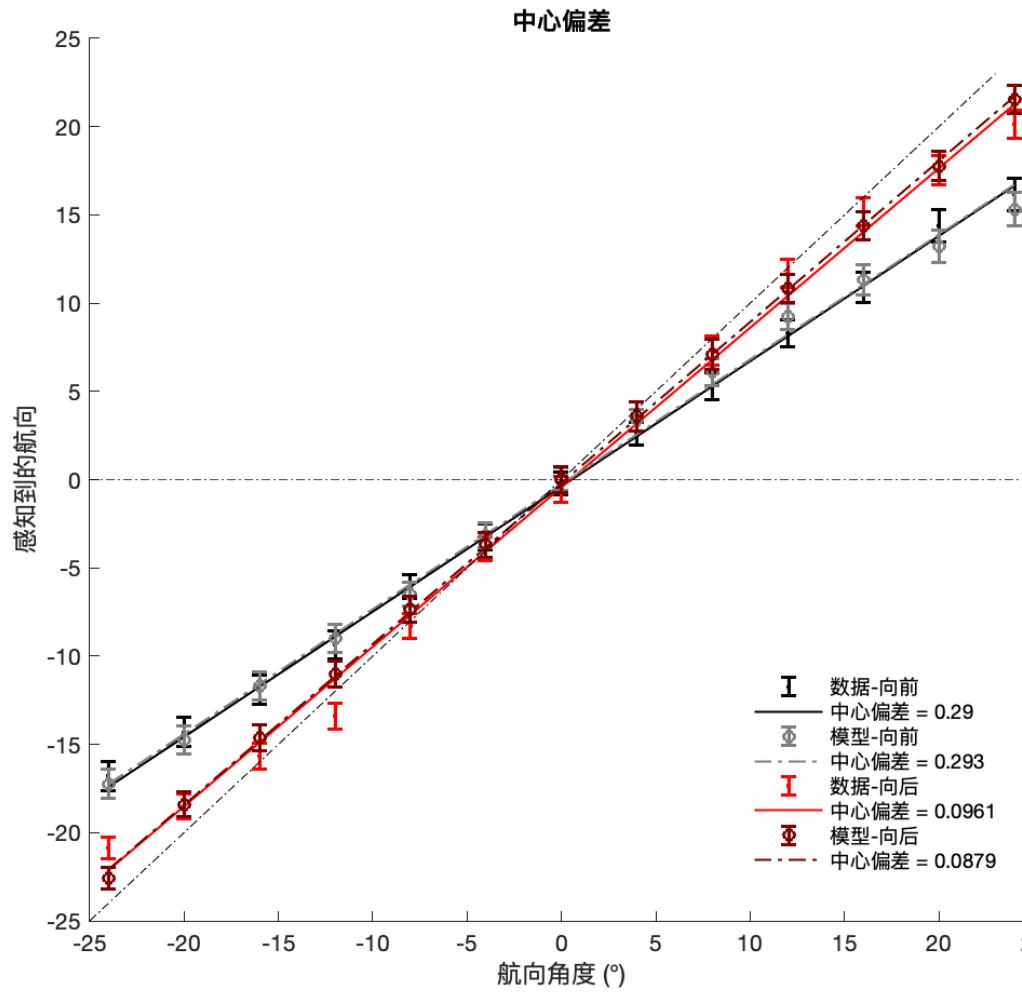


模型拟合和先验恢复

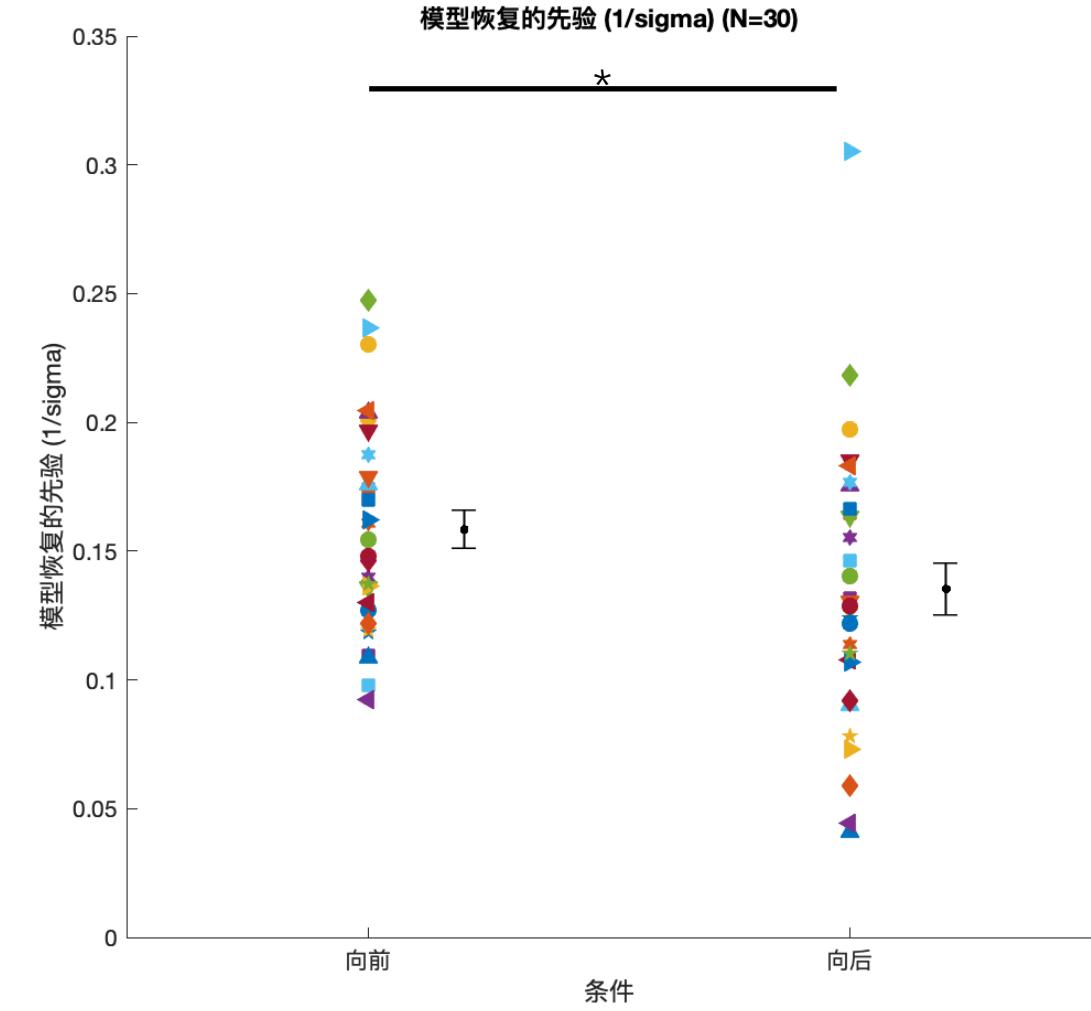
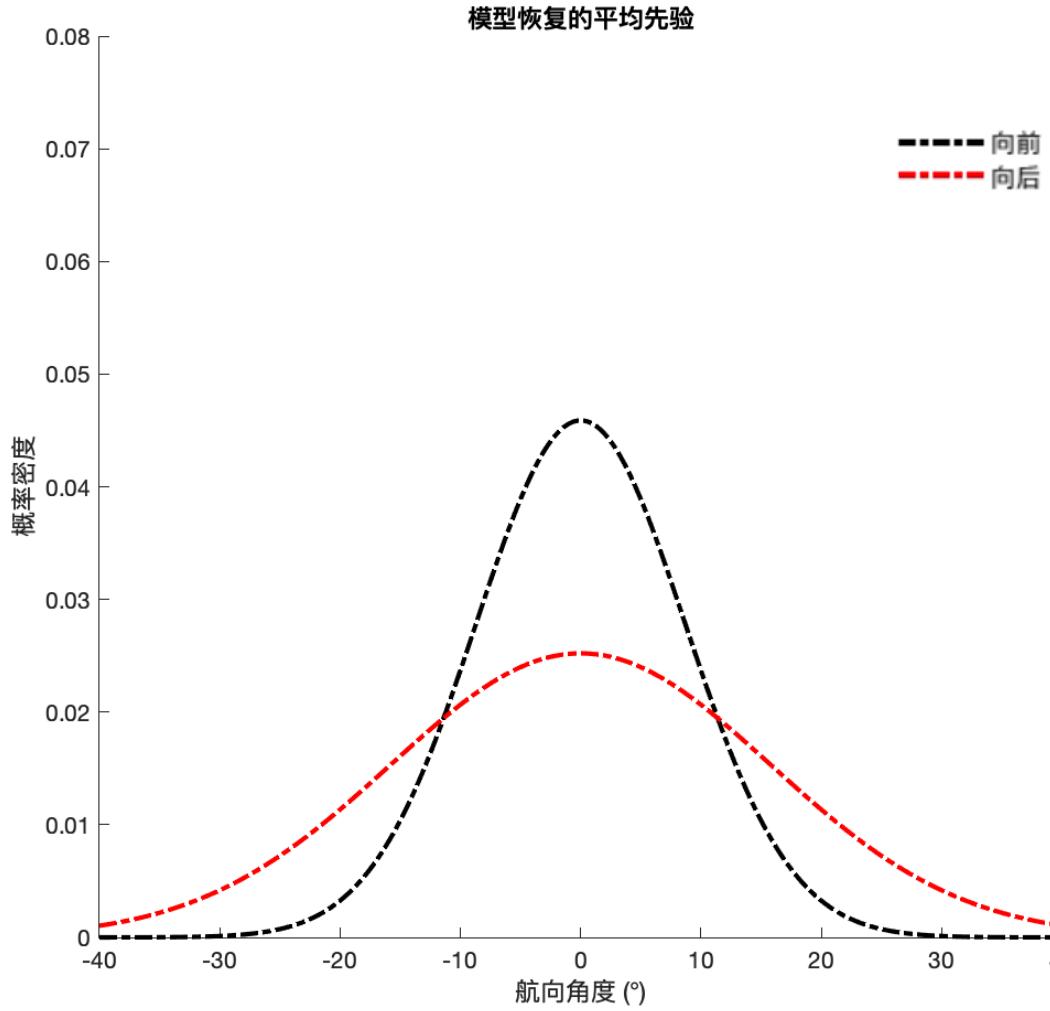
- $P(H|m) \propto P(m|H)P(H)$



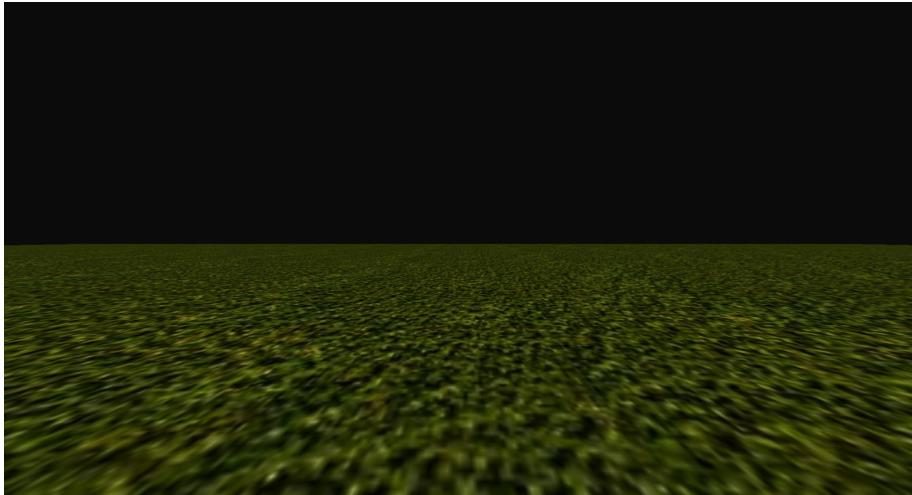
模型预测：中心偏差



模型预测：恢复的先验



实验2：任务和设计



刺激: 500-ms 地平面光流 (速度: 3m/s, 深度范围:
0.565 – 50 m)

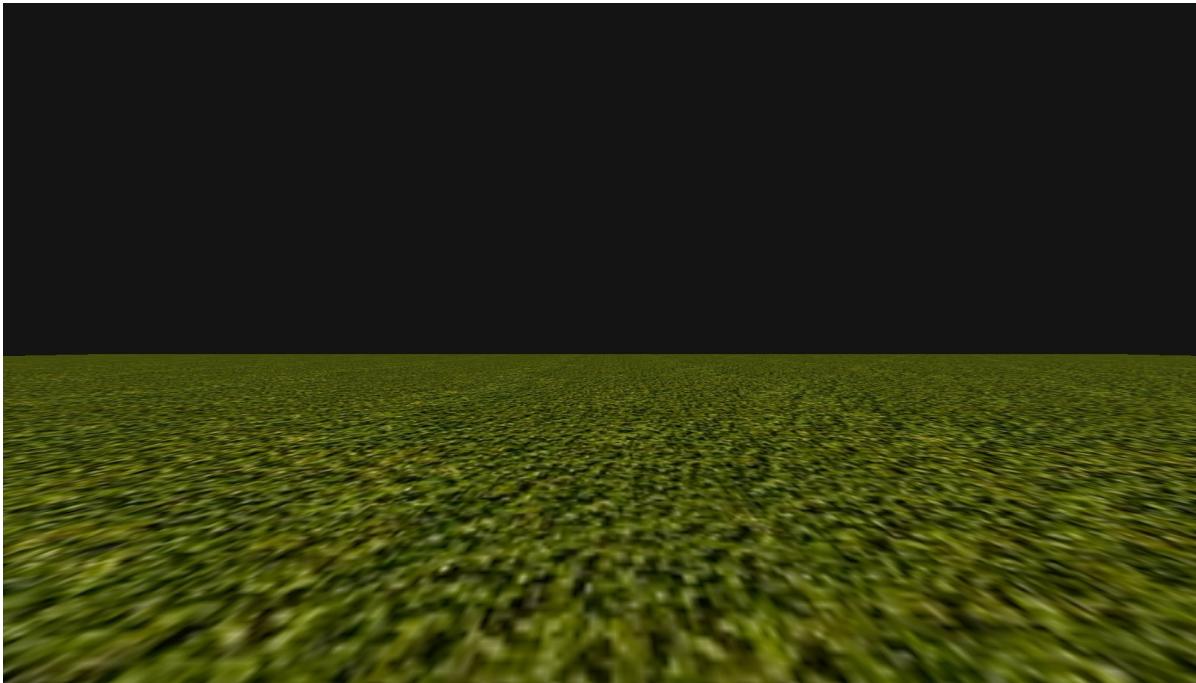
条件: 向前/向后自我运动 (区块设计, 被试内随机)

自我运动方向: -24° : 4 ° : 24°

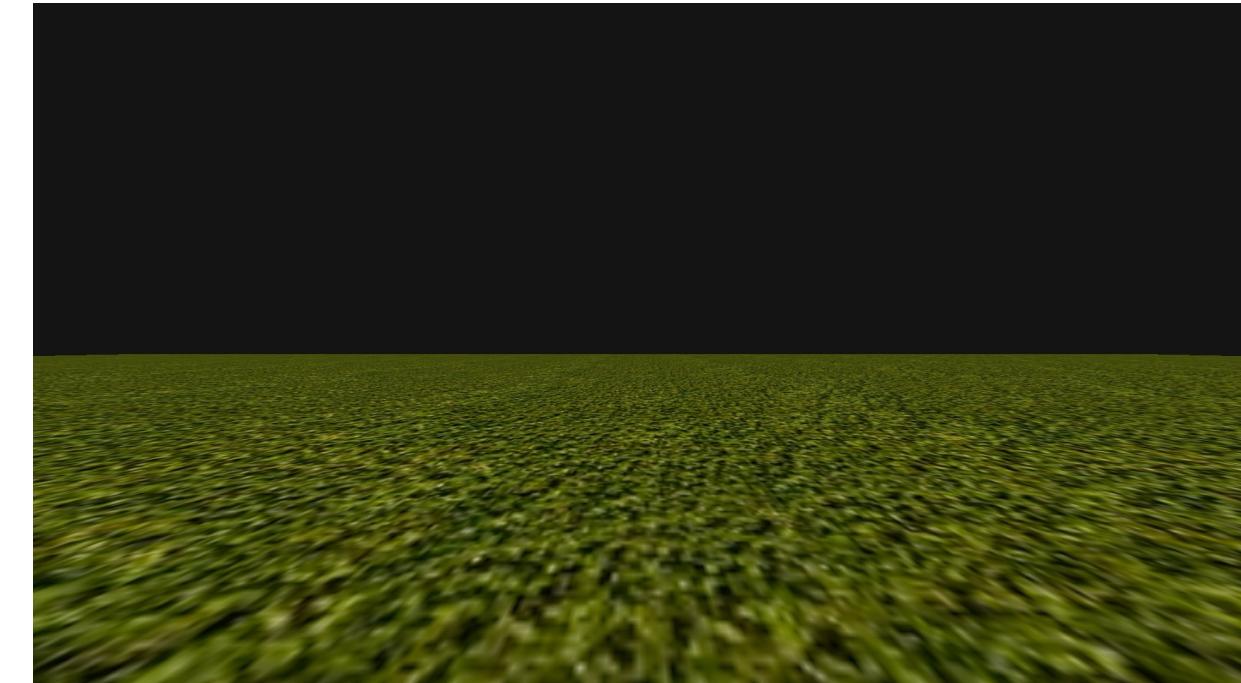
被试: N= 30 (F/M = 20/10)

实验刺激

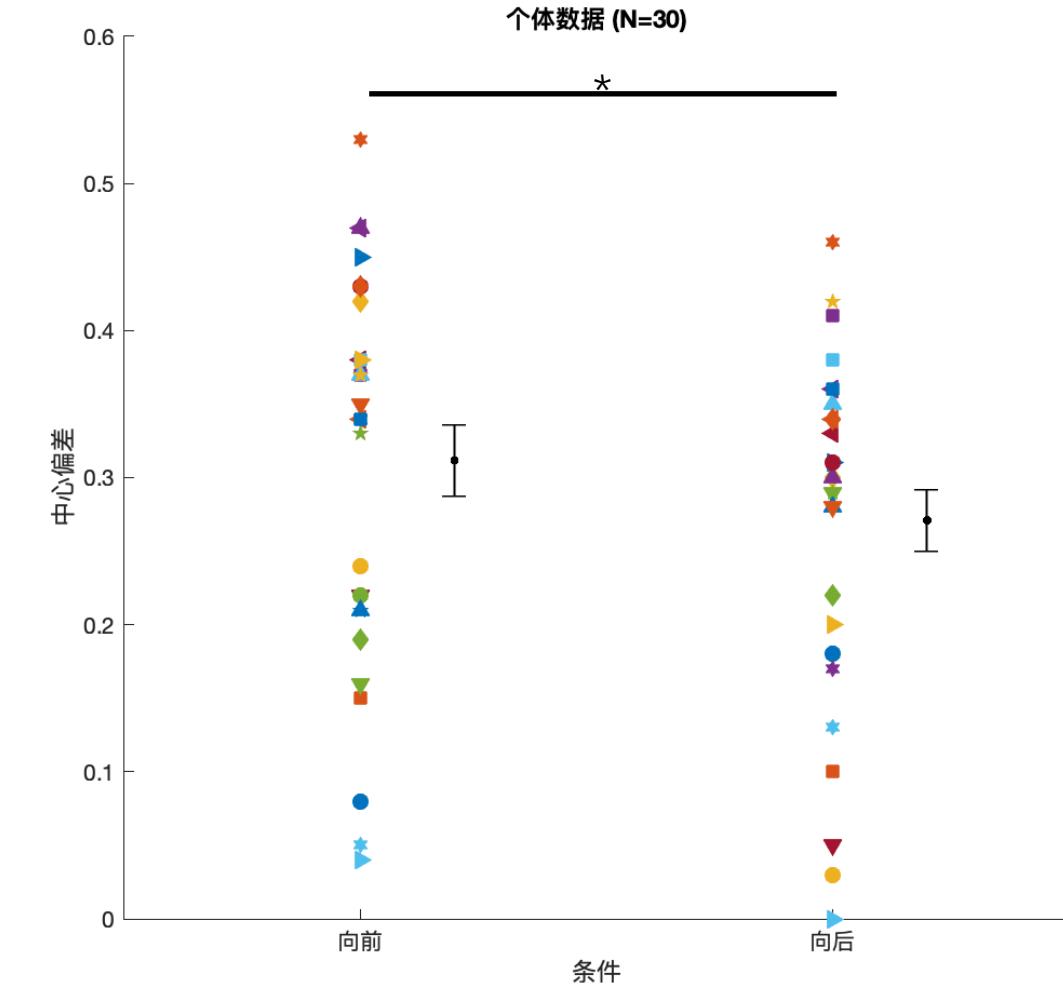
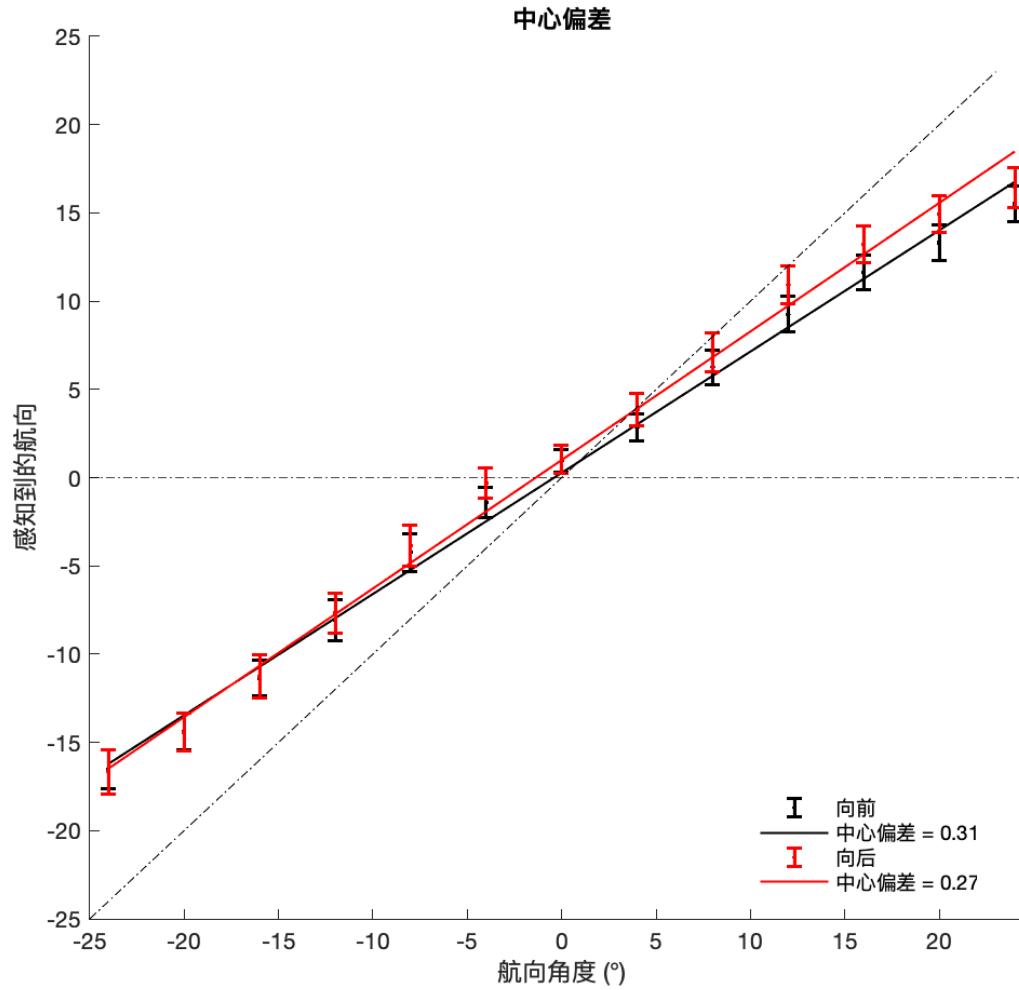
向前运动



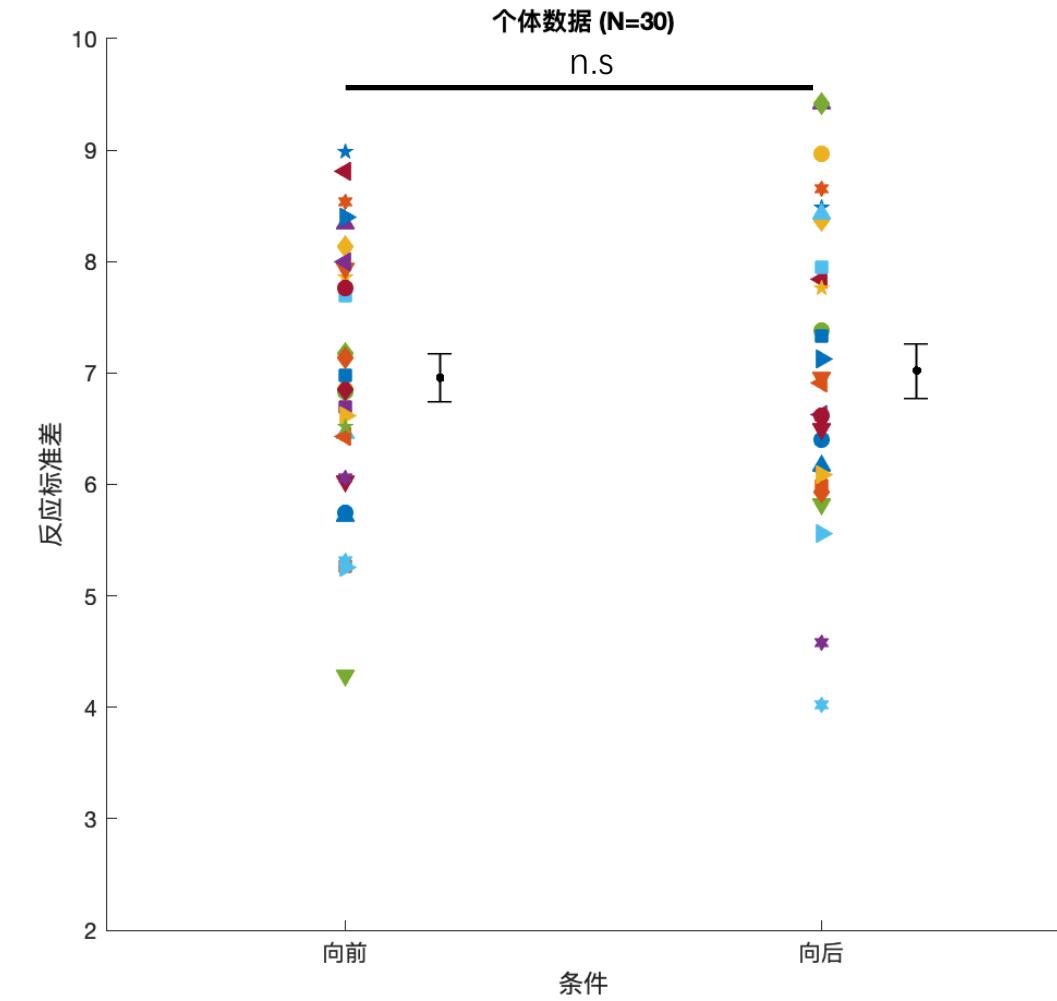
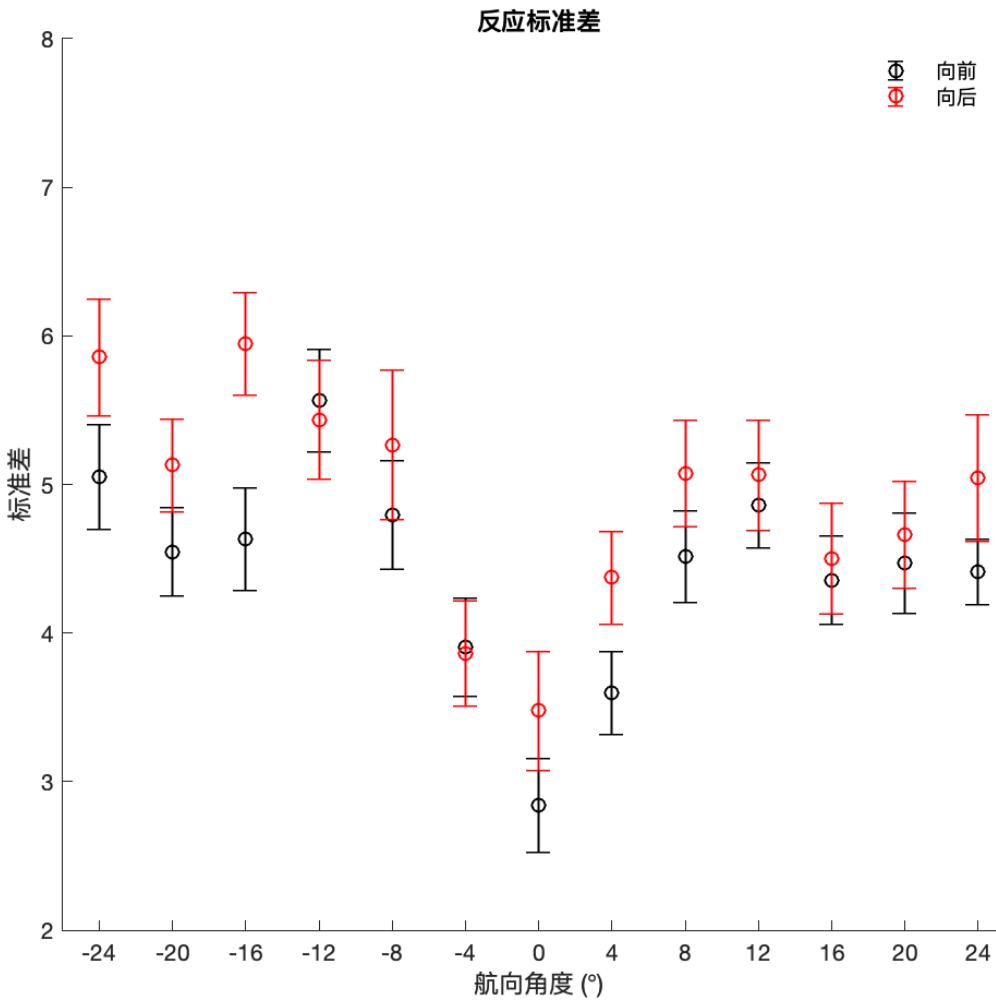
向后运动



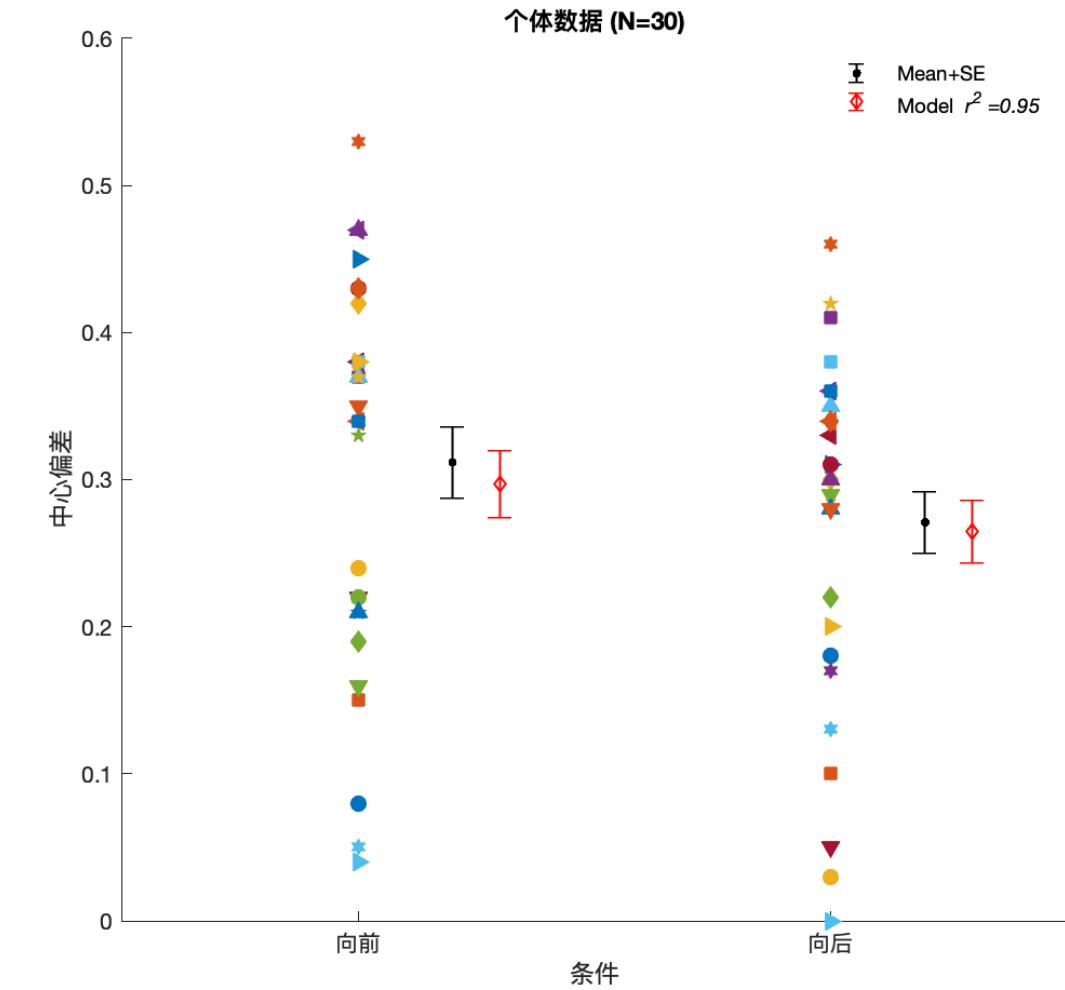
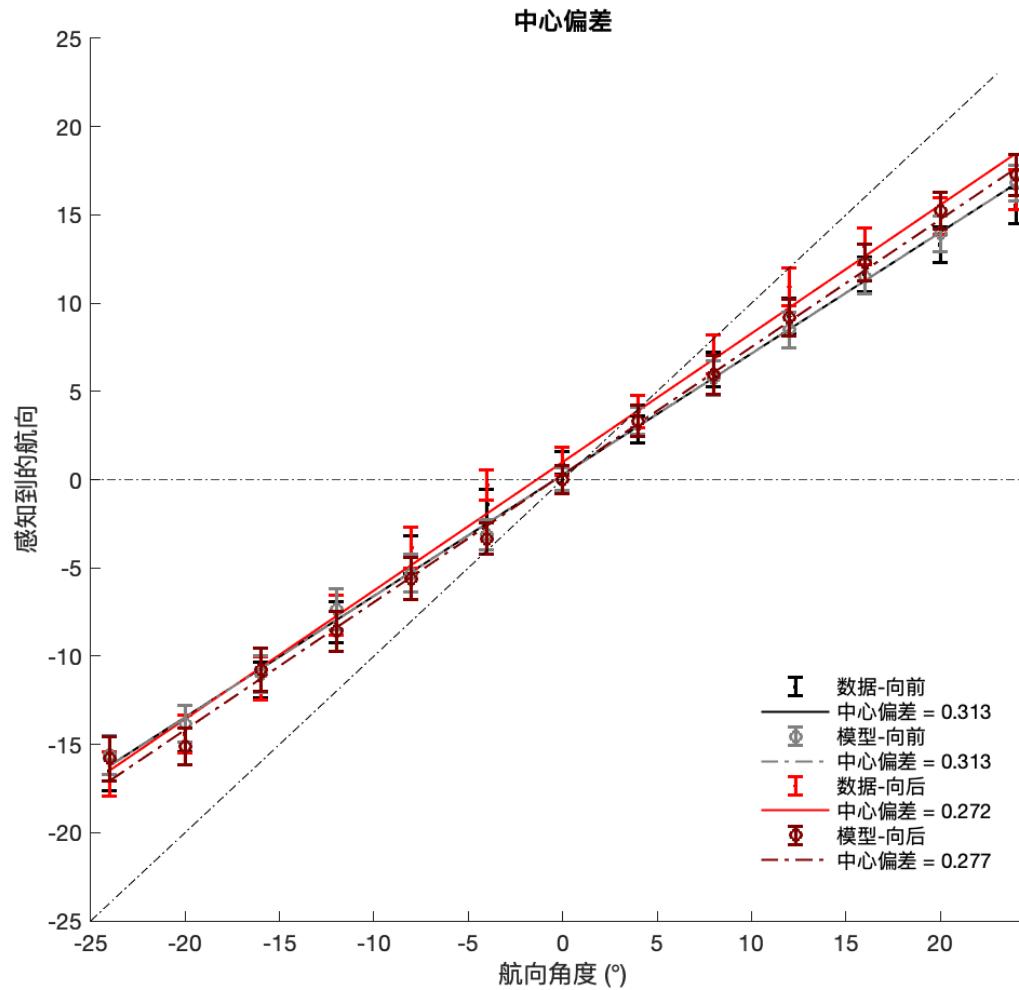
结果：中心偏差



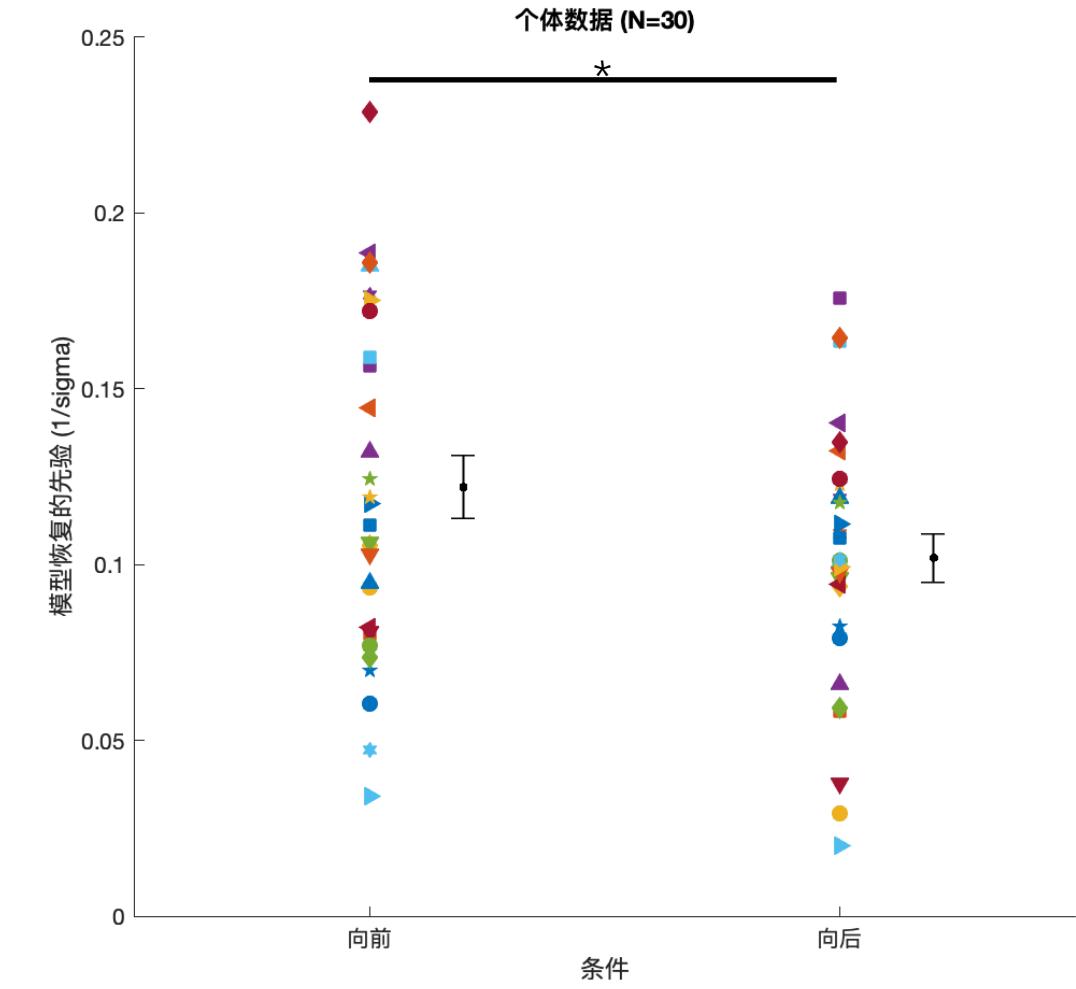
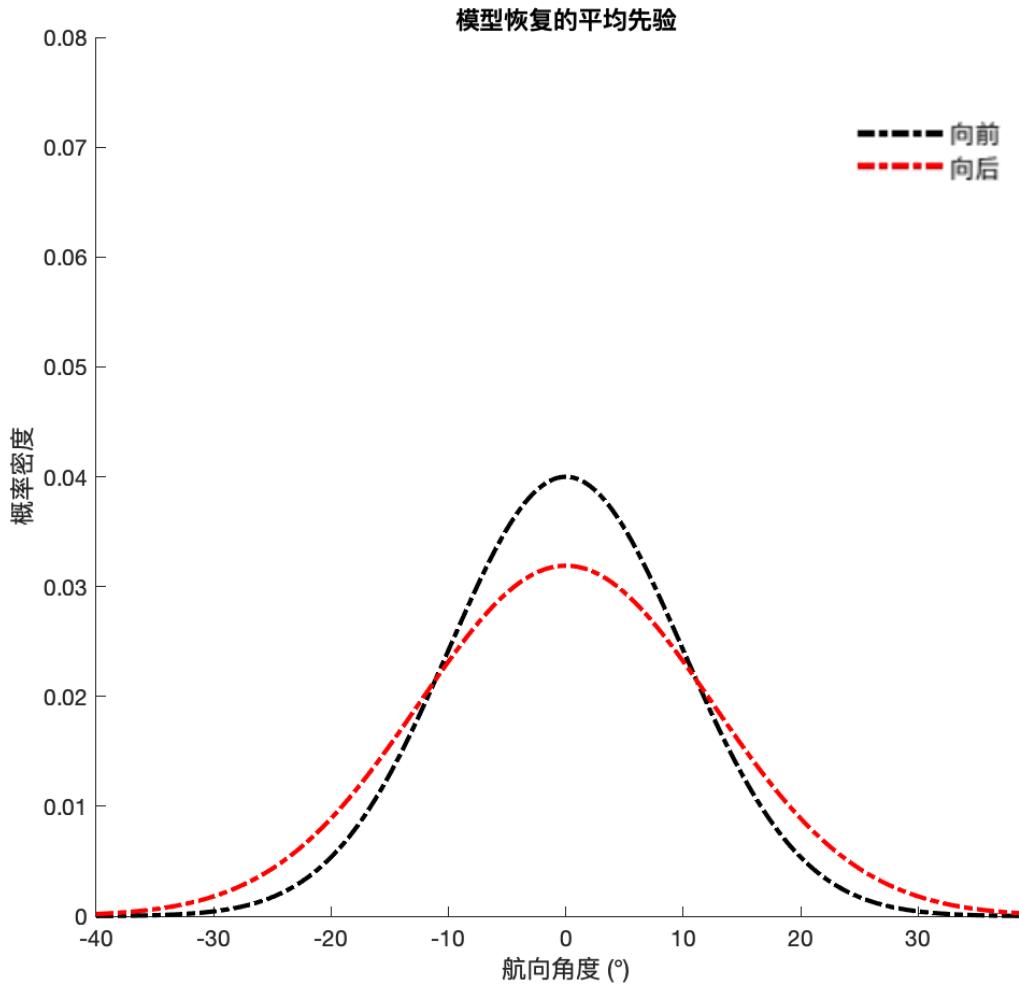
结果：反应标准差



模型预测：中心偏差



模型预测：恢复的先验





总结

- 人类在判断自身运动方向时，存在一个非对称的中心偏差；
- 这种非对称性表现为前进条件下中心偏差更强；
- 使用贝叶斯模型分析表明，这种偏差可以由不同的先验分布所解释；
- 生态经验可能在方向知觉中先验的形成中发挥重要作用。



致谢

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