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Agency Attribution in Goal-Directed Actions: Active Sampling Improving Bayesian Model Comparison

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Perception of own actions is influenced by visual information and predictions from internal forward models [1]. Integrating these information sources depends critically on whether visual consequences are associated with one's own action (sense of agency) or with changes in the external world unrelated to the action [2] and the accuracy of integrated signals [3]. Attribution of percepts to consequences of own actions depends thus on the consistency between internally predicted and actual visual signals.

However, is the attribution of agency rather a binary decision ('I did, or did not cause the visual consequences of the action' [4]), or is this process based on a more gradual attribution of the degree of agency? Both alternatives result in different behaviors of causal inference models, which we try to distinguish by model comparison.

METHODS. We used a virtual-reality setup to manipulate the consistency between pointing movements and their visual consequences. We investigated the influence of this manipulation on self-action perception.

We compared two Bayesian causal inference models to the experimental data, one with a binary latent agency variable [2], and one with a continuous latent agency variable [4].

Here, subject-specific regions for stimulus conditions that maximally differentiate between the two models were identified online using Active Sampling methods [6] to evaluate relative model evidences with a small number of samples.

RESULTS/CONCLUSION. Both models correctly predict the data, and specifically empirical agency ratings showing high attribution of agency for small deviations between sensory and predicted feedback. Some participants show signatures of a binary internal representation of agency. In addition, relationships with other inference models [5] are discussed.

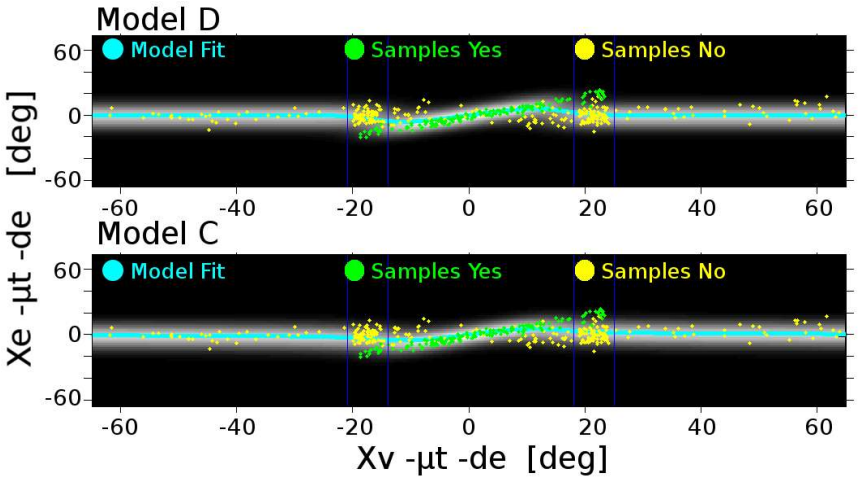

Figure 1: Estimation-error as a function of visual discrepance. Data and predictions of Models C and D.

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