WHEN STYLE MATTERS: VISUAL EXPLORATION IS LOW DIMENSIONAL AND PREDICTED BY INTRINSIC DYNAMICS.

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Background: Visual exploration is a complex behavior, for many years considered a purely bottom-up process. However, the anatomy of our visual system suggests a role of top-down connections in driving visual exploration, which would account for individual differences in eye-movements. We hypotesize that these differences depend on intrinsic brain dynamics.

Aims: We planned to carry out a series of experiments to pursue the following main aims:
- To examine whether eye movements during free exploration depend on intrinsic dynamics (Exp. 1);
- To test the relation between eye movements, visuospatial memory and brain dynamics at rest (Exp. 2);
- To validate Exp.1 results and study the relation between eye-movements dynamics and online EEG dynamics (Exp. 3).

The following Method and Results sections refer to Exp. 1.

Method: We recorded eye-movements of N=120 participants during free-viewing of 185 real-world scenes, and while watching a blank screen. Subsequently, participants were administered a set of cognitive tests measuring short-term, working and visuospatial memory, and impulsivity. We reduced the dimensionality of eye movement data by means of a Principal Component Analysis (PCA), and we tested the existence of identifiable visual exploration styles, and their relation to intrinsic dynamics and to cognitive features.

Preliminary results: The PCA showed that three components accounted for 60% of the variance of eye-movement data across participants, with the first PC identifying two viewing styles: Static and Dynamic viewers. Static viewers were characterized by fewer and longer fixations, while dynamic viewers showed more numerous and longer fixations.

These viewing styles were not significantly influenced by sensory salience nor semantic content of the scenes, instead they were predicted by the power-law distribution of eye movements steps, a measure that reflects intrinsic neural constraints. Accordingly, individual viewing styles were detected even when watching a blank screen and correlated with cognitive impulsivity.

Conclusions: In conclusion, this study suggests that visual exploration of natural scenes is significantly driven by intrinsic dynamics.

Keywords: Eye movements; viewing styles; Intrinsic brain dynamics

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