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Title:	FOCUS VERSUS BREADTH: THE EFFECTS OF NEURAL GAIN ON INFORMATION PROCESSING
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Abstract:	We propose that brain-wide variations in neural gain control the degree to which information is processed in a broad, integrative manner, or conversely, in a narrowly focused manner. Neural gain, which is thought to be modulated throughout the brain by the locus coeruleus-norepinephrine system, can be thought of as a contrast control mechanism. When gain is high, the contrast between weakly and strongly activated neurons is increased, and thus, we expect processing to be more narrowly focused on the most strongly represented sources of information. In contrast, low gain may allow the integration of a broader range of information. We first investigate the whole-brain effects of neural gain using functional connectivity and graph-theoretic analyses of neuroimaging data, in conjunction with pupil diameter indices of norepinephrine function, as well as in response to a norepinephrine-enhancing drug. The results reveal signs of brain-wide fluctuations in gain that are tracked by pupillary indices, and suggest that high gain has a focusing, clustering effect on neural interactions throughout the brain. We then present three sets of experiments designed to investigate the behavioral effects of variations in gain. In the first experiment, we show that pupillary and neuroimaging indices of high gain are associated with learning that is more focused on particular types of stimulus features, in accordance with individual predisposition. In the second set of experiments, we show that high gain has a similar effect on perception and memory, making them more focused and less integrative, and that the effects of gain do not have to be tied to individual predisposition, but rather, they can be flexibly manipulated by means of subliminal priming or experimental task. In the third set of experiments, we show that the reduced integration that is associated with high gain comes with a benefit - weaker susceptibility to classical decision making biases. Finally, we end by integrating the results presented throughout the thesis into a coherent Bayesian account, and discuss how this account may serve as a basis for a cognitive theory of autism.
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