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**Infotaxis or how to search without gradient** EMMANUEL VILLERMAUX, IRPHE, Marseille, MASSIMO VERGASSOLA, Institut Pasteur, Paris, BORIS SHRAIMAN, KITP, Santa Barbara — Chemotactic bacteria rely on local concentration gradients to guide them towards the source of a nutrient. Such local cues pointing towards the location of the source are not always available at macroscopic scales because mixing in a flowing medium breaks up regions of high concentration into random and disconnected patches. Thus animals sensing odors in air or water detect them only intermittently as patches of odor sweep by, carried by winds and currents. A macroscopic searcher must devise a strategy of movement based upon sporadic cues and partial information. We propose a search algorithm, which we call “infotaxis” (Vergassola et al. *Nature* **445**, 2007), designed to work under such conditions. Any search process can be thought of as acquisition of information on source location and in infotaxis the latter plays a role similar to concentration in chemotaxis. The infotaxis strategy locally maximizes the expected rate of information gain. Its efficiency is demonstrated using a model of odor plume propagation as well as experimental data on real mixing flows. Infotactic trajectories feature zigzagging and casting paths similar to those observed in flights of moths. The proposed search algorithm is also relevant to the design of olfactory robots, but the general idea of infotaxis can be applied more broadly in the context of searching with sparse information.

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