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Foraging in satellite imagery: When is it time to move to the next map?

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Optimal foraging theory predicts that foragers should leave a patch when the expected value from staying falls below the expected value from leaving, and this strategy has been observed across various simple foraging tasks (Charnov, 1976; Oaten, 1977; McNamara, 1982). However, it can be difficult to apply foraging models to more complex tasks like search in real-world scenes, where scene context and target features can be used strategically. We investigated quitting times in a map search task that preserves the complexity of scene search but makes it easier to apply standard foraging models. In our online experiments, Amazon Mechanical Turk participants searched for small targets (gas stations) in large satellite images using one of three magnifying interfaces (there were no significant differences between interfaces). Participants were paid based on the number of gas stations they found. We ran two versions of the experiment: in Exp. 1, maps had 0-10 targets and participants completed as many trials as they wished; in Exp. 2, all participants searched the same set of 24 maps containing 1-9 targets. We modeled quitting times with a Bayesian model that incorporates prior beliefs about the number of targets in each map and average search performance, and updates these beliefs as it searches the map. Leaving times were measured in number of search actions (clicks) on the map. Participants had fairly consistent leaving time strategies, quitting the current map when their expected rate fell to 0.019 targets/click (Exp. 1) or 0.015 targets/click (Exp. 2). This is lower than predicted for a rate-maximizing forager, meaning that people searched longer than they should have in each map. There are many possible reasons for this behavior; for example, people may have been trying to maximize total payment or their hourly wage across multiple tasks on the Mechanical Turk website.