Foraging and navigating in a virtual orchard: Which tree do you visit next?

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Real-world foraging tasks are multilayered: you search for the best apple on the tree and for the best tree in the orchard. How do you decide where to go to maximize your search returns? We ran foraging experiments in a 3D virtual orchard, where participants were asked to pick as many "good" apples as possible within a time limit. In Experiment 1, "good" apples were red and "bad" apples were yellow; in Experiment 2, good and bad apples were drawn from overlapping color distributions. In both cases, we were interested in how foragers would decide which tree to visit next. We compared two naïve foraging rules (always go to the nearest tree, or the one with the most red apples) to an optimal foraging model, which assumes that people maximize their rate of return by choosing the tree(s) with the best fruit to distance ratio. Furthermore, we asked whether observers only thought one step ahead, choosing the single tree that gave the best return? Or, alternatively, did they think ahead and look for multi-tree paths that gave the best overall return? We modeled these alternatives by computing the rate of return for every tree (or every path) and then investigated how well human performance matched the predictions of these models. Results from the two experiments were very similar: all versions of optimal foraging better predicted human behavior than the naïve "nearest tree" rules. Moreover, the "best 2-step path" model (AUC = 0.94) modestly outperforms the 1-step ("best tree") model (AUC = 0.92). The 3-step model's performance was not significantly different from the 2-step model. These results show that people use an optimal foraging strategy in a 3D environment and they "think ahead", choosing the best available path between multiple trees, rather than merely choosing the best single tree.

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