What makes patch foraging difficult?

Readings for today

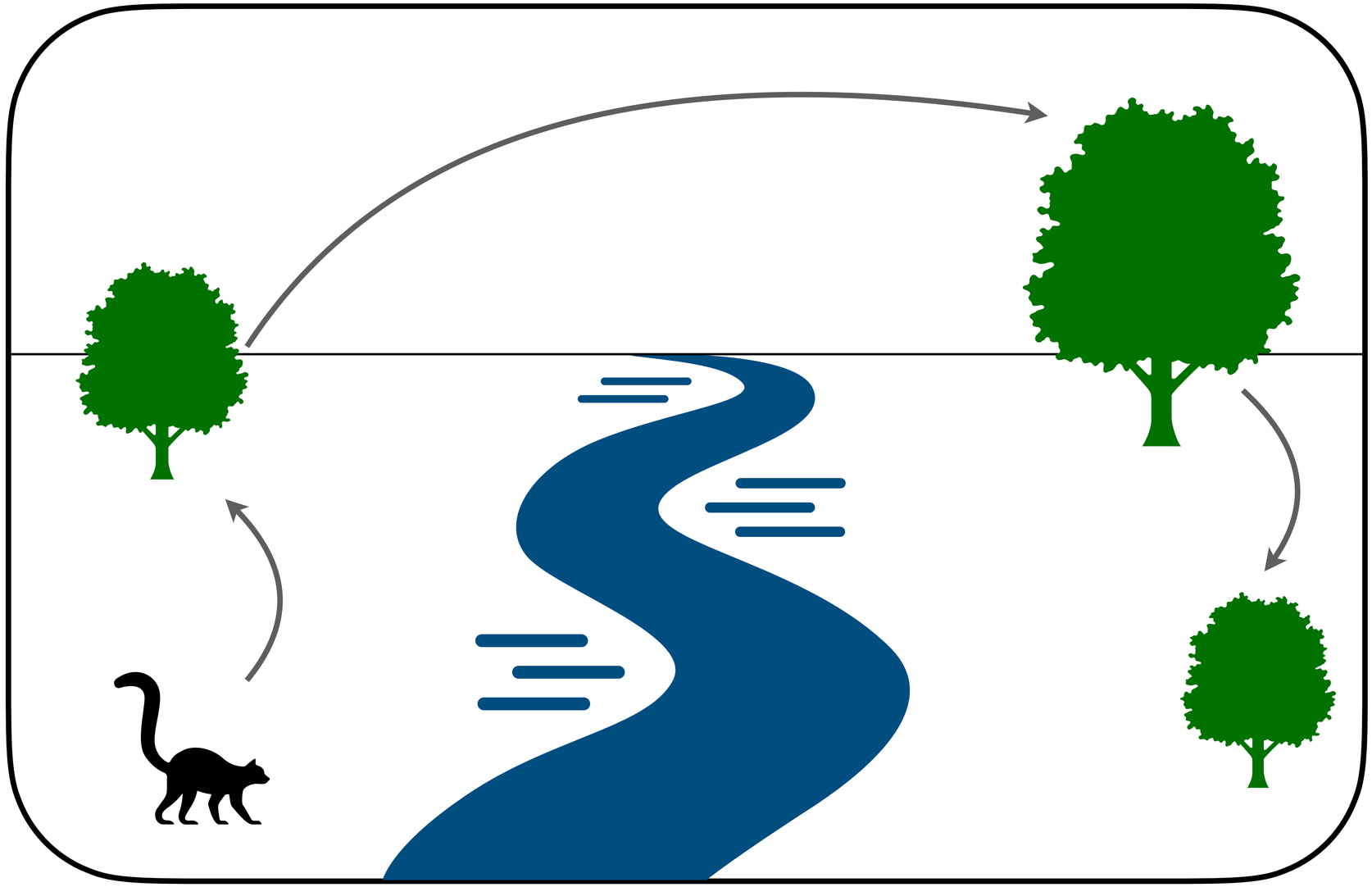
- Barack, D. L. (2024). What is foraging?. Biology & Philosophy, 39(1), 3.

Topics

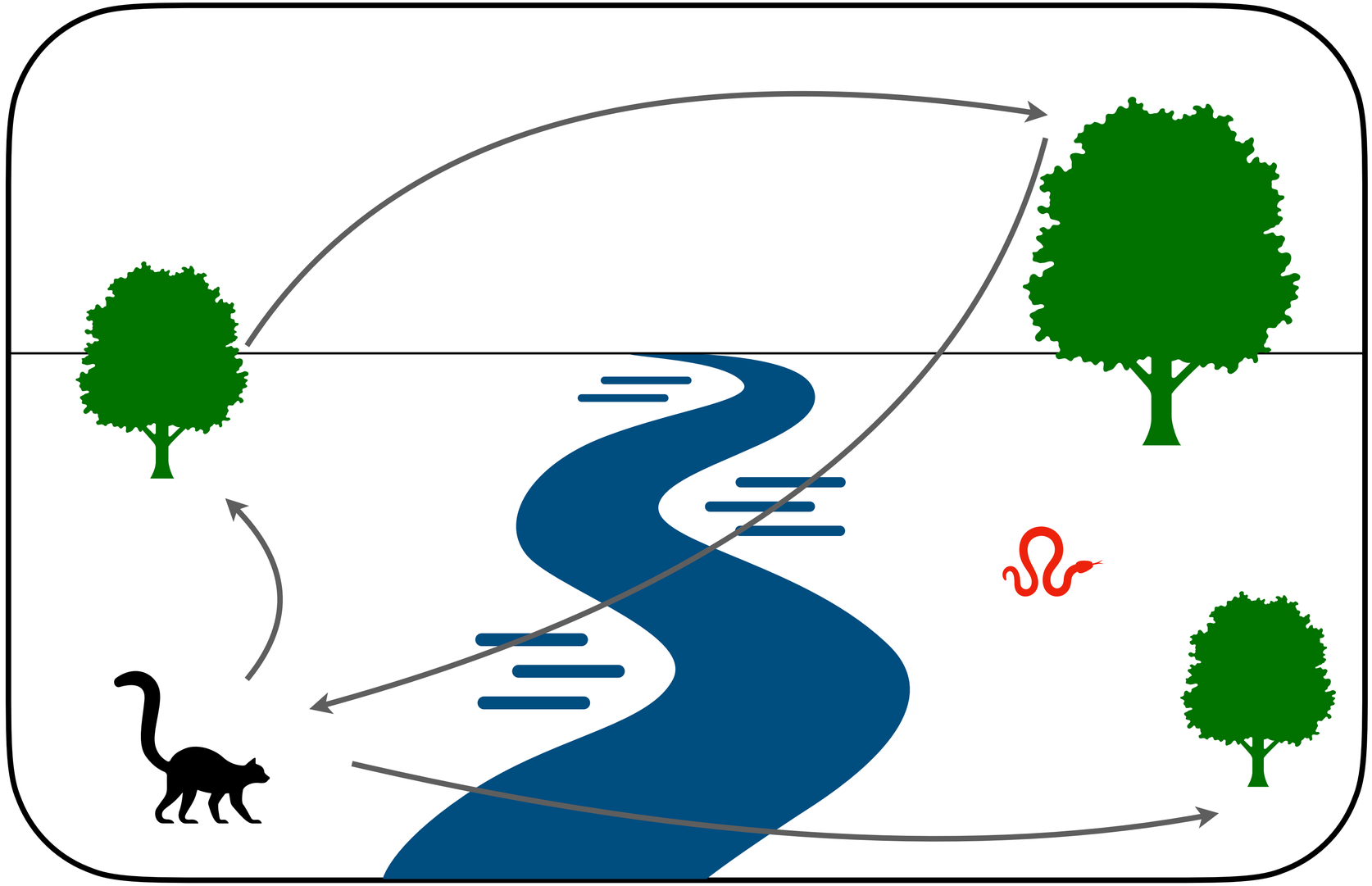
- The foraging problem

The patch foraging problem

The foraging problem



The foraging problem



Foraging

Definition: “Foraging is the serial search under constraints for general resources in accept-or-reject, exclusive, persistent decision contexts.” - Barack, 2024

General Idea: Foraging is a central competence of mobile organisms, applied broadly across biology and increasingly in cognitive science to search for various resources, including food, information, and memories.

Resources

- **Tangible**: Physical resources whose value increased with each unit obtained (e.g., food, water, money).

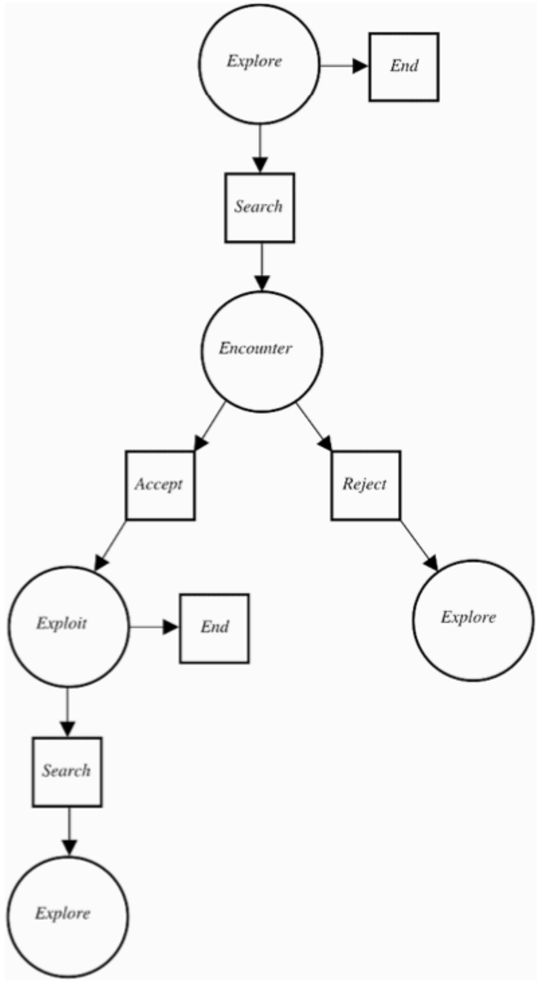
} Patches

Costs

- **Resource costs**: Expenditures of calories, money, etc. that are incurred by the chosen activity.

(Barack, 2024; Charnov 1976)

Foraging as a directed acyclic graph



Cyclical graph model:

The process of foraging can be represented as a cyclical graph using Markov decision processes (MDP) and directed cyclic graphs. This model captures the cyclical nature of foraging decisions, which involve repeated exploration, encounters, and decisions.

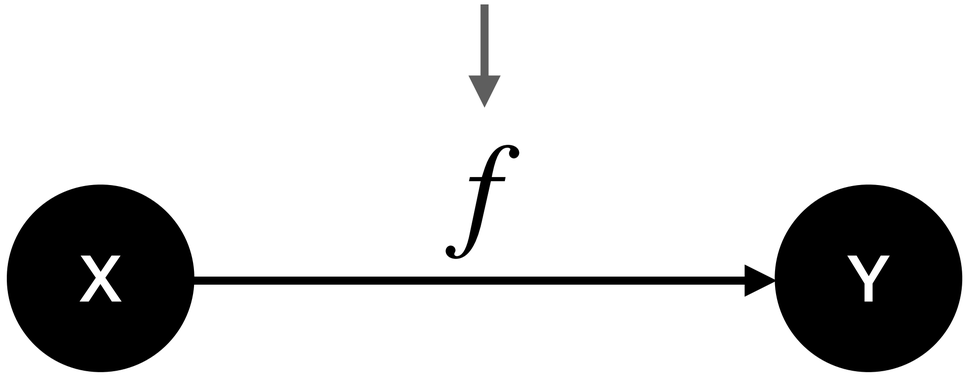
(Barack 2024)

Graphs

Functional form:

$$f(X) = Y$$

Graphical form:



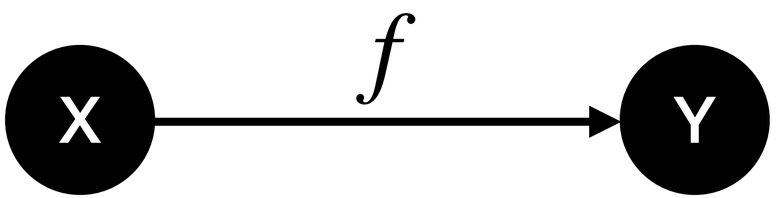
Nodes: The objects (variables)

Edges: The connections (relations)

Types of graphs

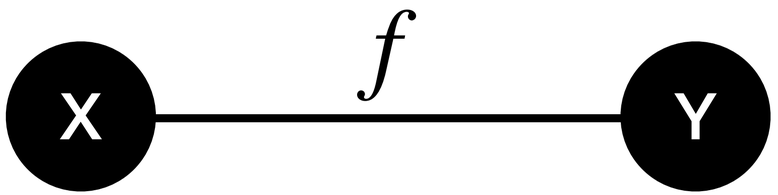
Directed graphs:

- “causal”
- regression

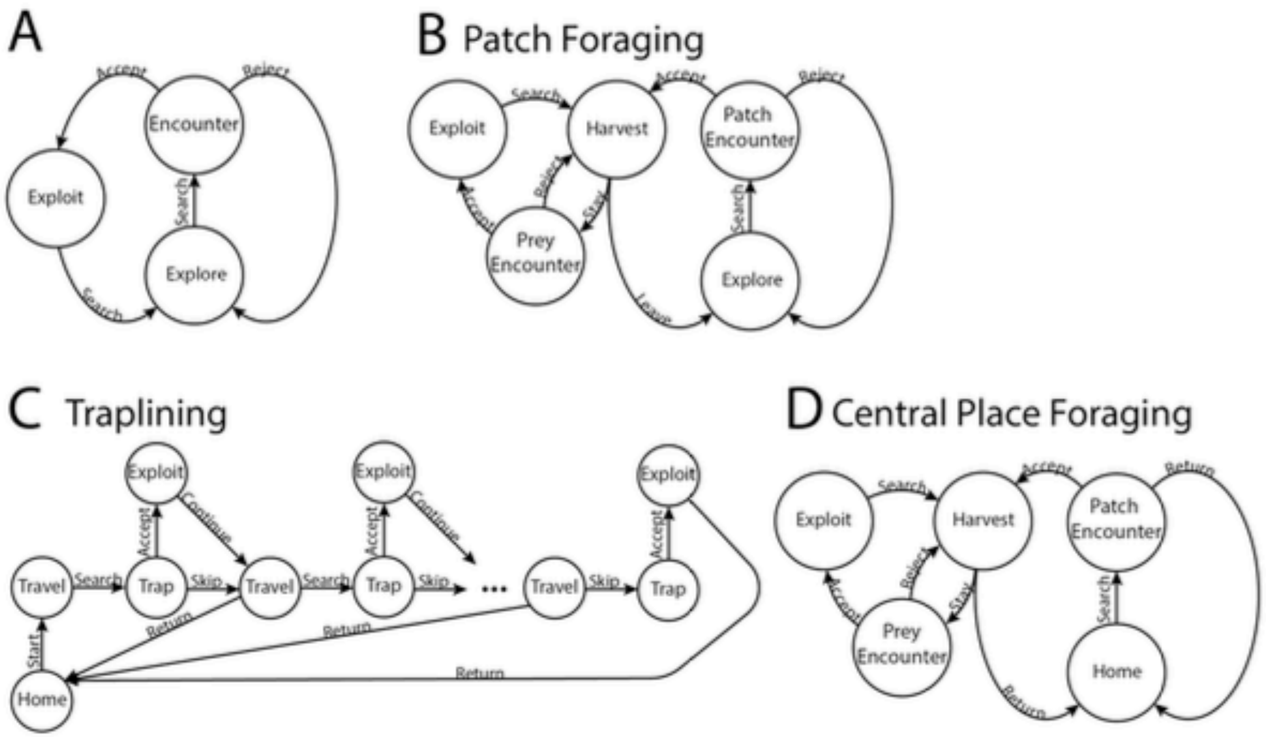


Undirected graphs:

- association
- correlation



Types of foraging



Patch foraging:

Searching the environment for resources that are clustered into groups or "patches." Once a patch is located, the forager must decide whether to stay and exploit the resources in the patch or leave and search for a new one.

Traplining:

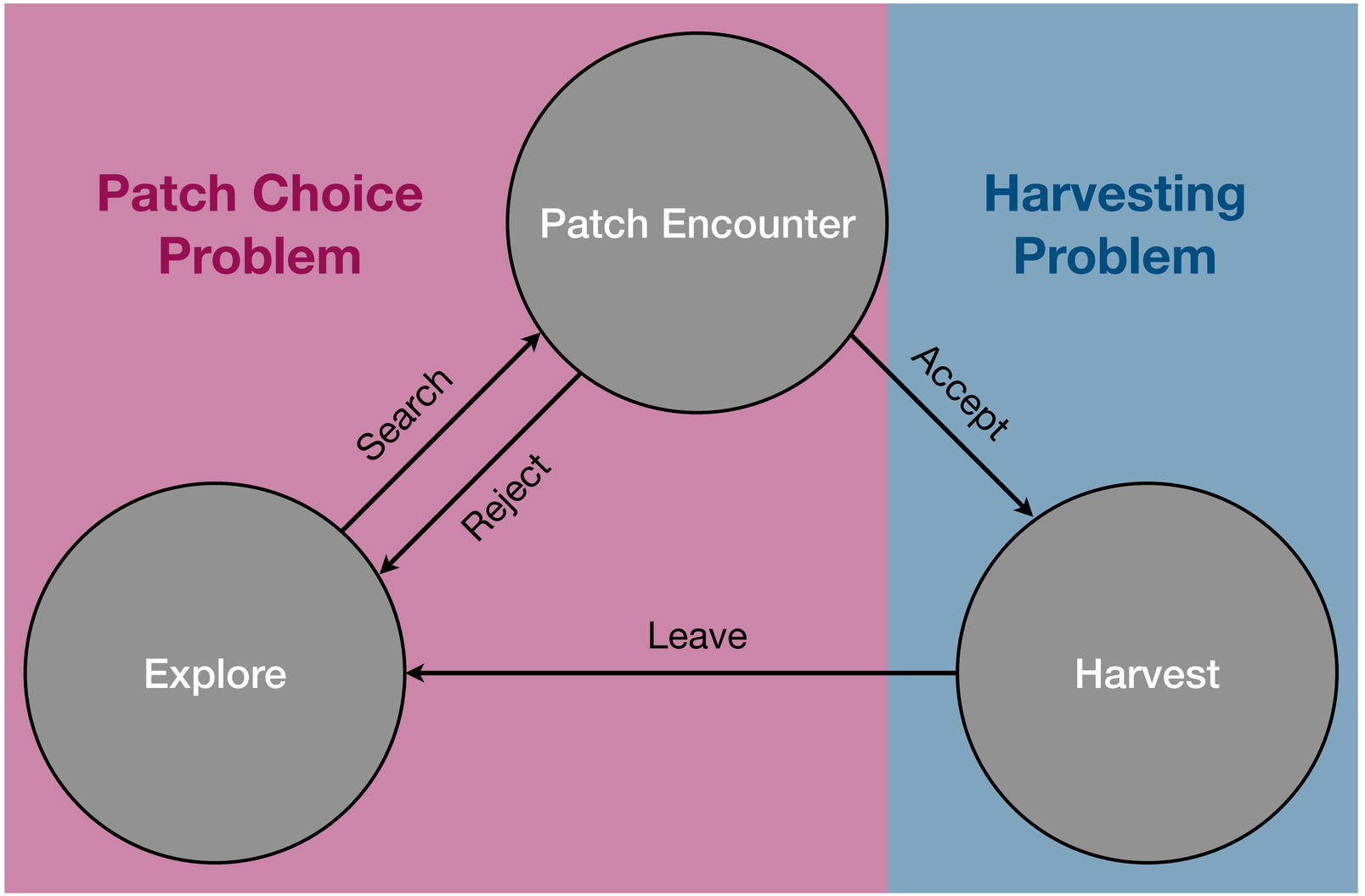
Follow a set route or sequence of known locations where resources can be found. The exact location of the prey within each site may be unknown, but the forager visits each location in turn to find prey.

Central place foraging:

When a forager begins from a central location, such as a nest or home, travels to resource patches, collects resources, and then returns to the central location.

(Barack 2024)

The patch foraging problem



(Barack 2024)

Take home message

- Foraging is a distinct, cyclical process involving serial search and decision-making under specific constraints, such as exclusive, accept-or-reject choices.

Let’s get forage!

Task: Collect as many stones in 60 seconds as possible from 5 patches at varying distances

Rules:

- Pick a single forager from your group.
- Plan the foragers route as a group.
- Forager can only *walk* as a moderate “toe-to-heel” pace. *No running.*
- Forager can only pick up one stone at a time with tongs provided. No more than one stone at a time.
- Forager has to return to the start for the points to count.

Hint: Think of balancing time spent harvesting against time moving between patches.

Map

(Not to scale)