THINK LIKE A FORAGER

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Learning goals

- Understand Patch Model
- Understand Diet Model
- Know the relation between these models and real life

Optimal Foraging Theory

- What types of food to eat?
- Where & how long to search for food?
- What type of search path to use?

Optimal Foraging Theory

- Any food item has both a **cost** (time & energy) & a **benefit** (net food value).

- The relative value of each of these determines how much 'profit' a particular item represents.

- **Efficient** foragers should select **most profitable** prey!

Optimal Foraging Theory

- Many behaviors can be understood as foraging.
- Consider humans and many ways we forage everyday.
- They share a number of similar concerns, constrains, and behaviors.

Discussion

- Suppose you go to a Shopping Mall with $2,500. There are many different stores. You can buy everything you like within the budget. What's your strategy to buy things?

- 2-3 people

Patch Model Example

- Big Garden

- Many flower species

Charnov's Marginal Value Theorem

- Bees have to move from one patch to another.
- Flower patches have different densities.
- Bees **cannot evaluate** the **quality of a patch** until they are in it. So Bees have to decide when to leave in search of a more profitable area.

Question

- When a bee should leave the current patch?
- Any volunteer?

Charnov's Marginal Value Theorem

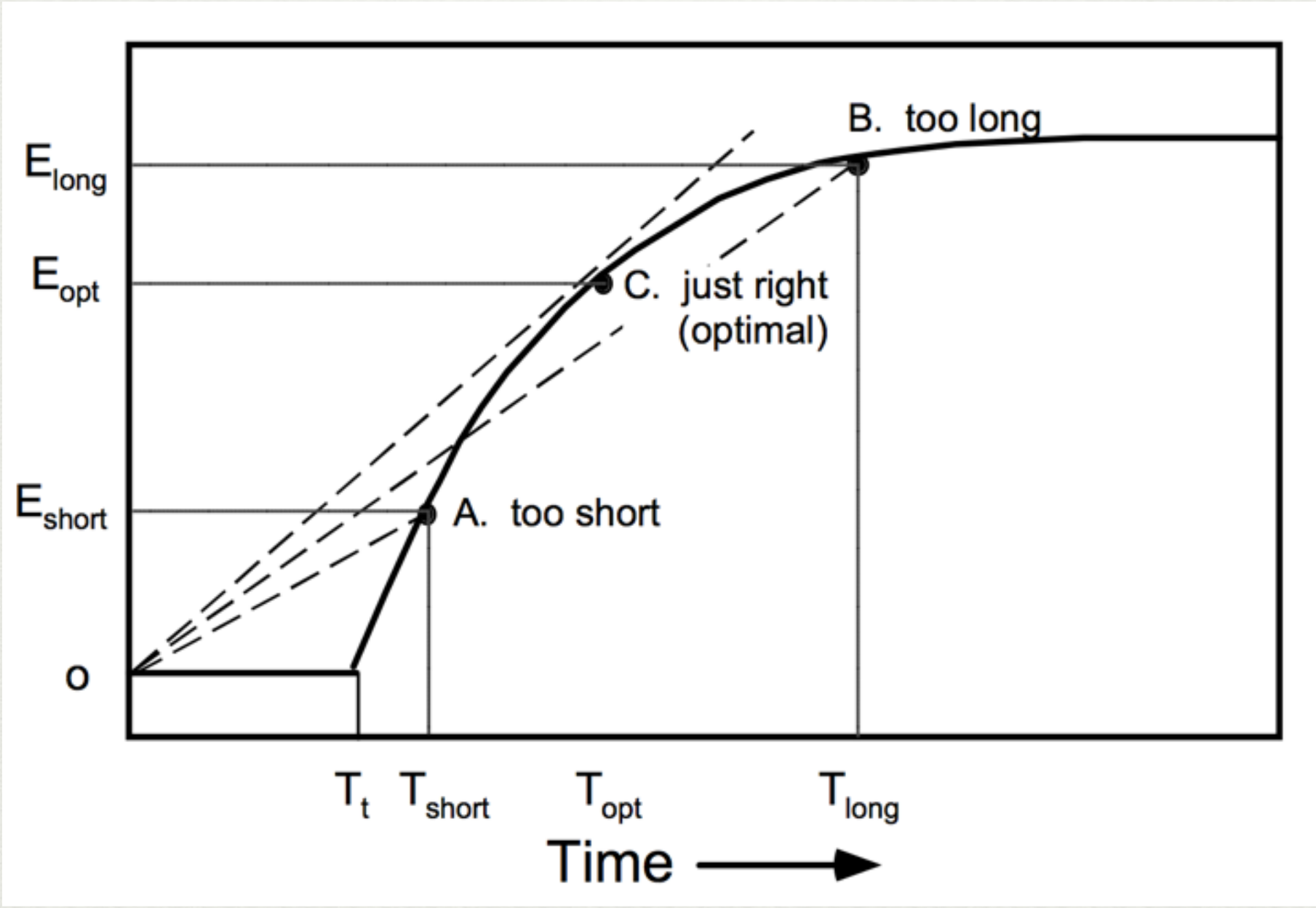
- The forager should leave a patch when the expected rate of foraging at another patch minus costs of moving to that patch becomes greater than the current rate of foraging.

- When they are equal to each other, that point is called **marginal value**.

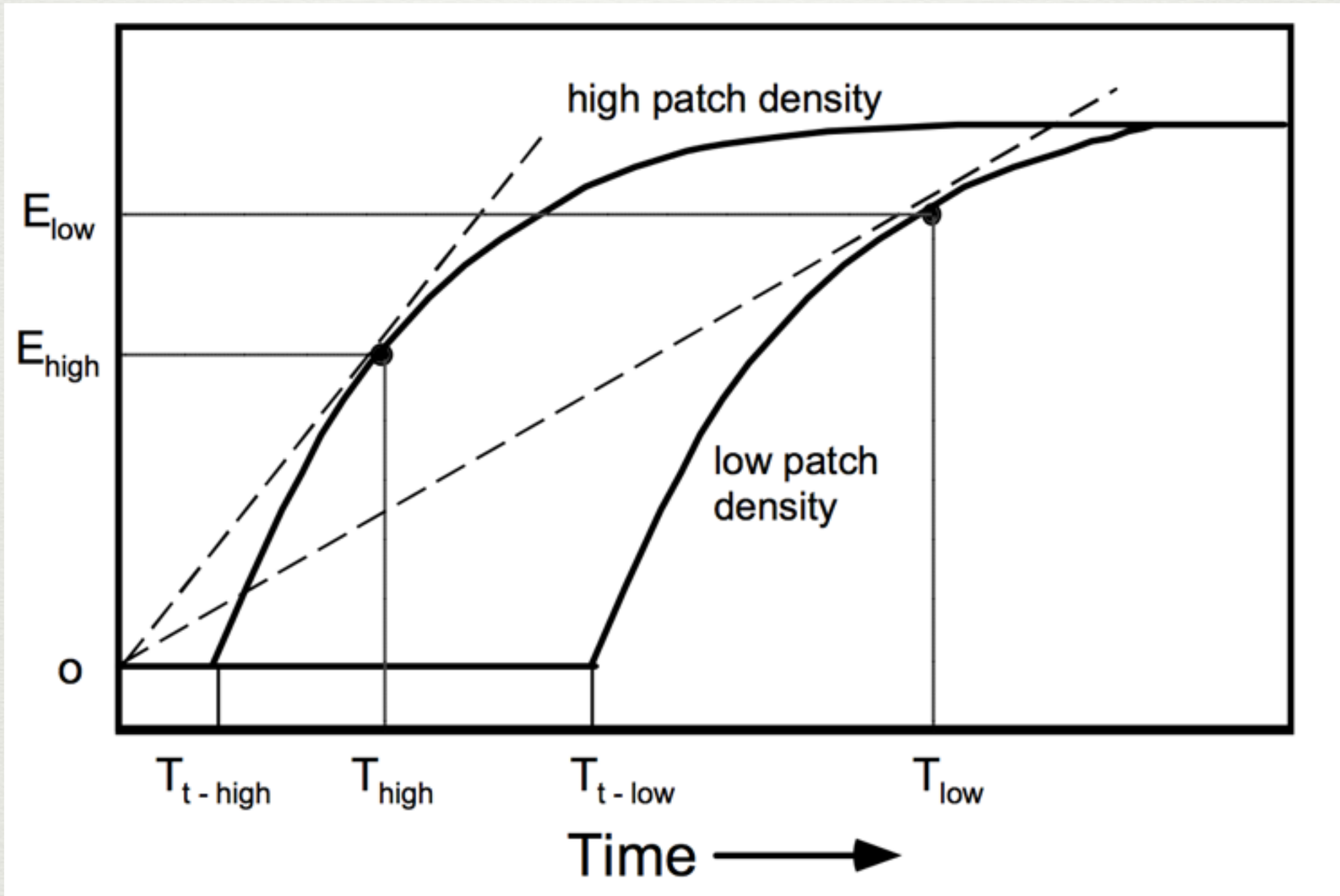
Charnov's Marginal Value Theorem

- t: time spent on one flower patch
- Tt: time spent from one patch to another
- Gain: amount of nectar gathered
- When to leave?

Charnov's Marginal Value Theorem



Charnov's Marginal Value Theorem



Between-Patch & Within-Patch Enrichment

- **Modify** the environment so as to **gain more**!

  A. minimize between-patch foraging costs

  B. improve within-patch foraging results

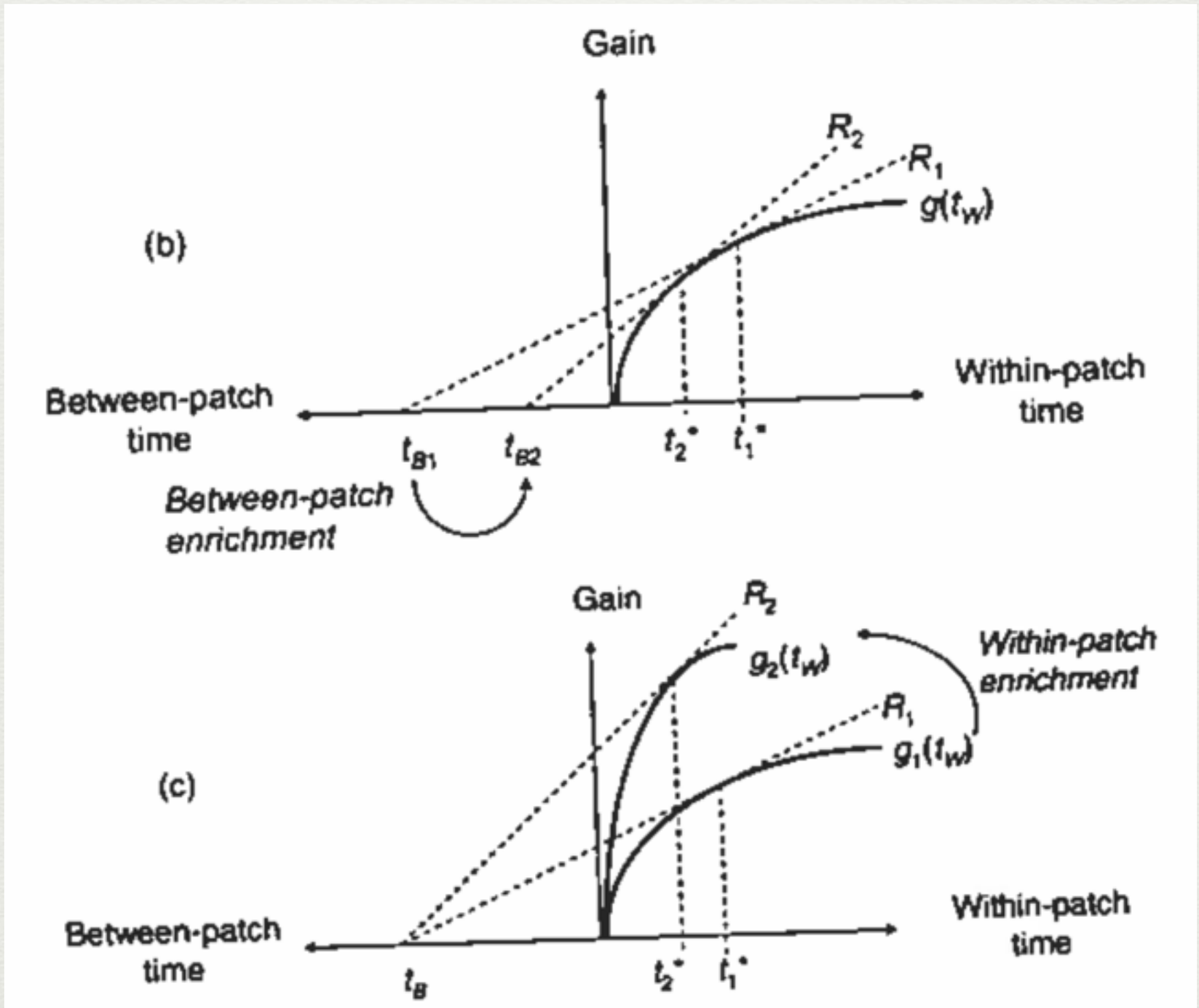
- Example

Discussion

- Use Charnov's Marginal Value Theorem to analyze how the optimal leave time will change for both enrichments

- 2-3 people

Between-Patch & Within-Patch Enrichment



Diet Model

- What kinds of prey should the predator pursue, and what kinds should be ignored?

Diet Model

- If a predator is too specialized, it will spend all of its time searching.
- If the predator is too generalized, then it will pursue too much unprofitable prey.

Discussion

- Imagine you have many food in your refrigerator: grain, eggs, meat, vegetables etc. You are very hungry. How will you choose?

- 2-3 people

Diet Model

- Selection algorithm
- Principle: add a food if it is more profitable (2.19)
- Steps:
  - Rank the prey types by their profitability
  - Add prey types by decreasing profitability
  - Make sure that you should only add another type that will bring more profit, otherwise just stay on the current type.

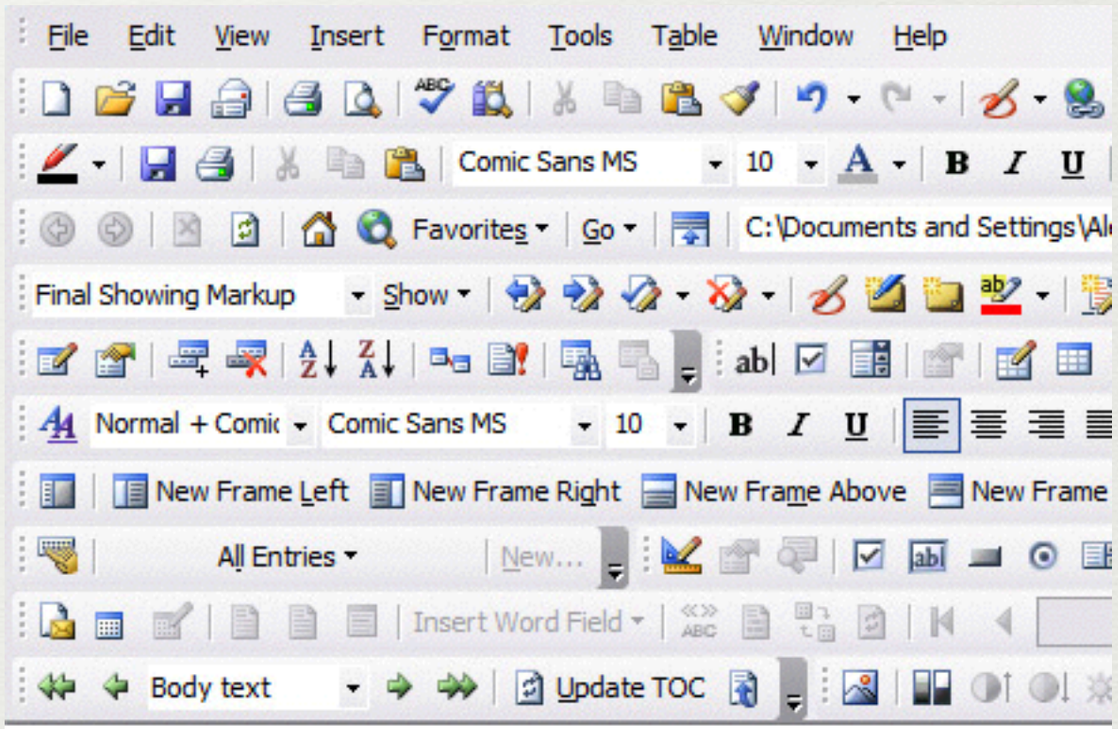
Beyond performance

Learning goals

- Overview of the design space for adaptive interfaces
- Understand the tradeoffs between performance and awareness.

Why to personalize GUI?

- Reduce visual complexity
- Improve interaction efficiency (performance)



How to personalize GUI?

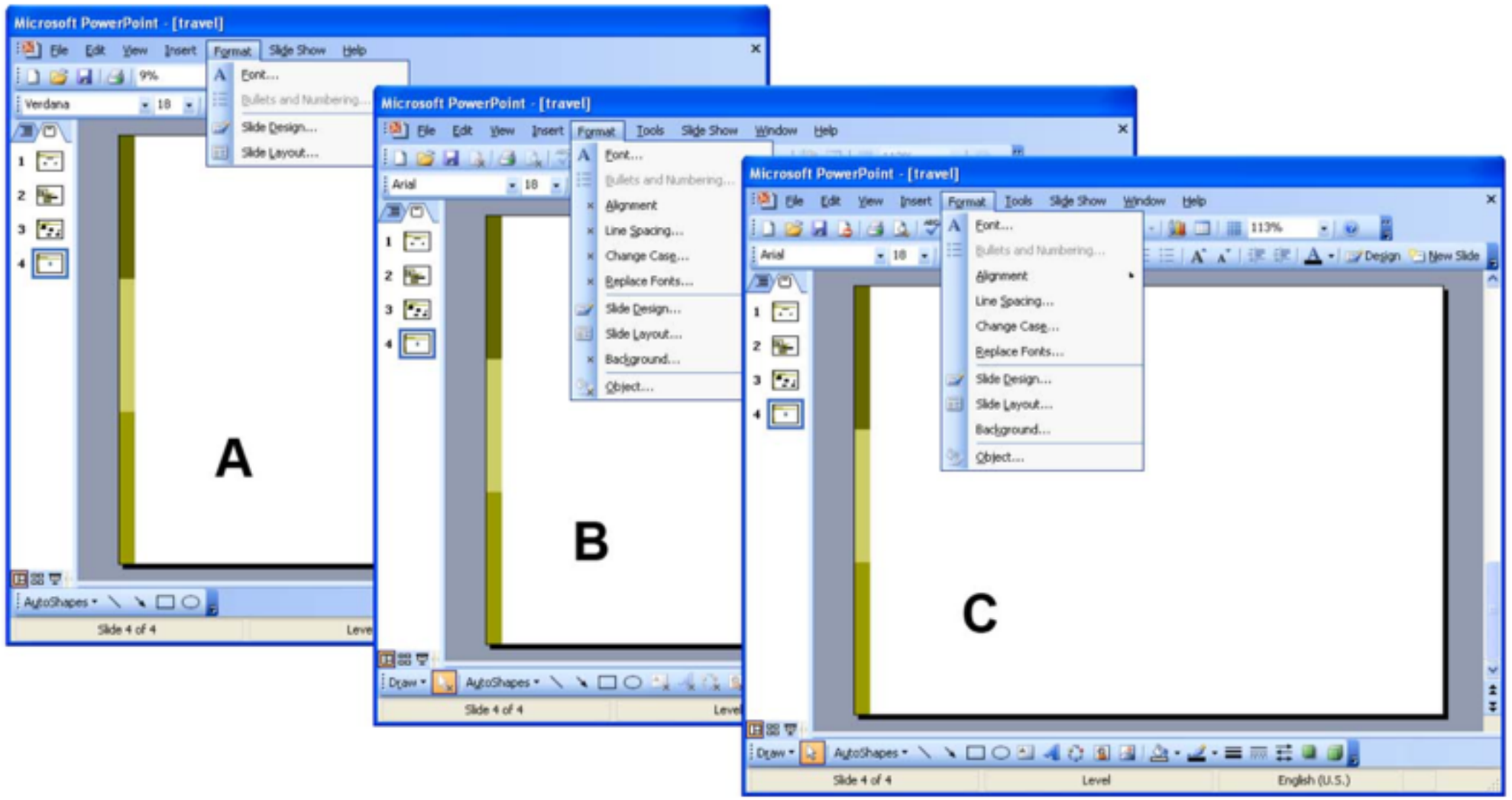


Figure 1. Sample screenshots from the interface layers used in Study 1: minimal interface layer (A), marked interface layer (B), and full interface layer (C).

What needs to consider?

- Controlled by system or user
- Fine-grained or coarse-grained
- Visibility of change
- Frequency of change

Discussion

- What are the advantages and disadvantages of controlled by system and controlled by user?

- 2-3 people

- Everything is fine, BUT?!

Discussion

- Everything has two sides. Personalized GUI can improve the current task performance, but what are the bad impacts?

- 3-4 people

Awareness

- Awareness of the full set of available features
- When you are interacting with GUI, you are highly possible to “learn” some other features by the way.

Feature Awareness in Personalized Interfaces

- Since fewer buttons etc. are provided, user can learn much less.

- Impact new task performance.

How to measure?

- Recognition rate of unused features
- New task performance

Thanks!