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Waters Grant Project

## Catalina Foothills School District Challenge Curriculum Objectives:

- Future problem-solving requires planning, discussion, decision-making, research, and critical thinking.
- The negative impact of change and chaos can be addressed through forecasting.
- Knowing our paradigms helps us to understand how we view the world and be open to alternative solutions.
- The causes and solutions to future problems are interdependent.

## Curriculum Objectives: Corresponding Systems Concepts:

- Future problem-solving requires planning, discussion, decision-making, research, and critical thinking. **Dialogue, team learning**
- The negative impact of change and chaos can be addressed through forecasting. **Behavior over time, structure generates behavior, leverage**
- Knowing our paradigms helps us to understand how we view the world and be open to alternative solutions. **Mental models**
- The causes and solutions to future problems are interdependent. **Interdependencies, feedback, structure generates behavior**

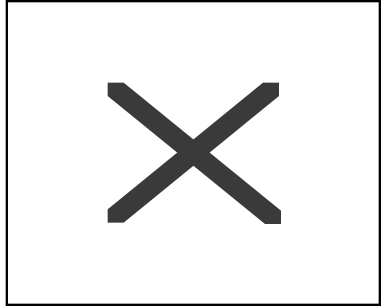
## Systems Thinking Tools

- Behavior-over-time graphs
- Causal loop diagrams
- Tragedy of the Commons  
Archetype
- Stock/Flow maps
- Iceberg

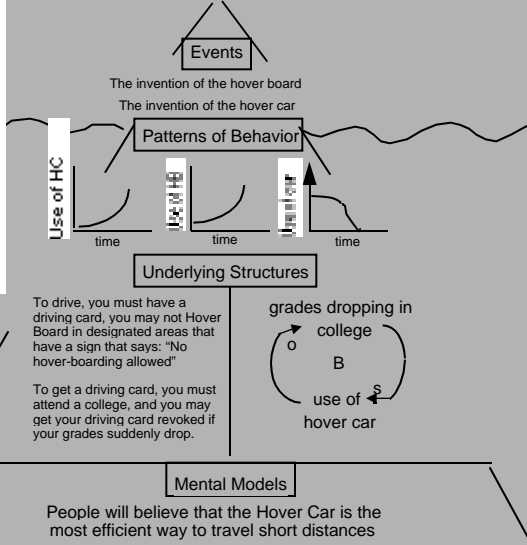
**The Future City project:** Each city is an internally congruent system comprised of at least 4 systems.



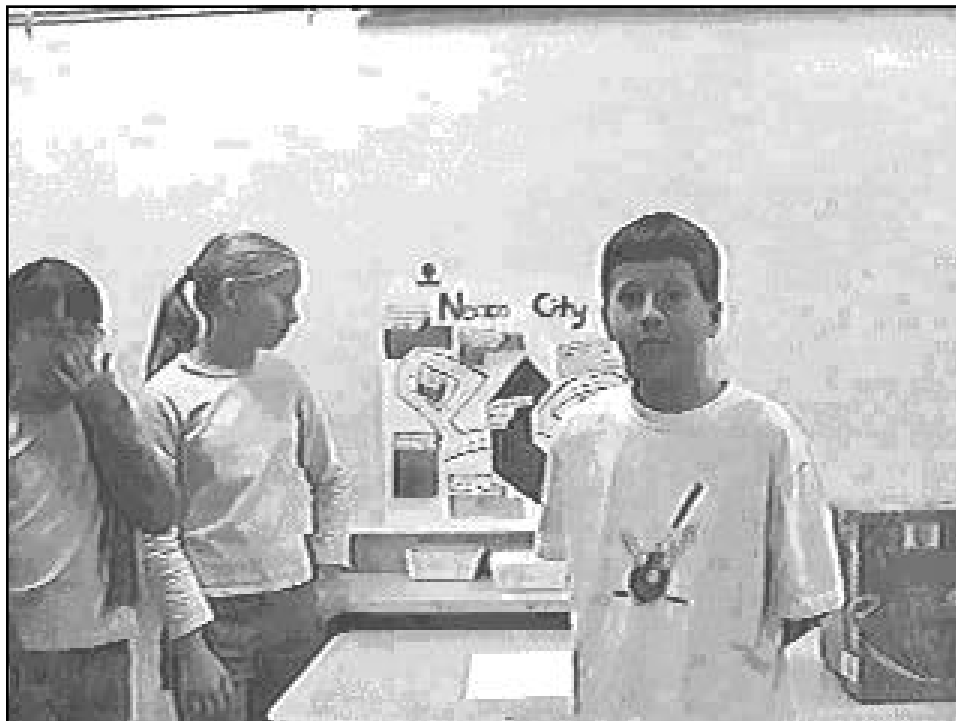
Each subsystem in the city is it's own internally consistent system.



## Future Transportation



Adapted by Waters Foundation, CFSD from Innovation Associates, Inc. February 1999



## Prior Knowledge

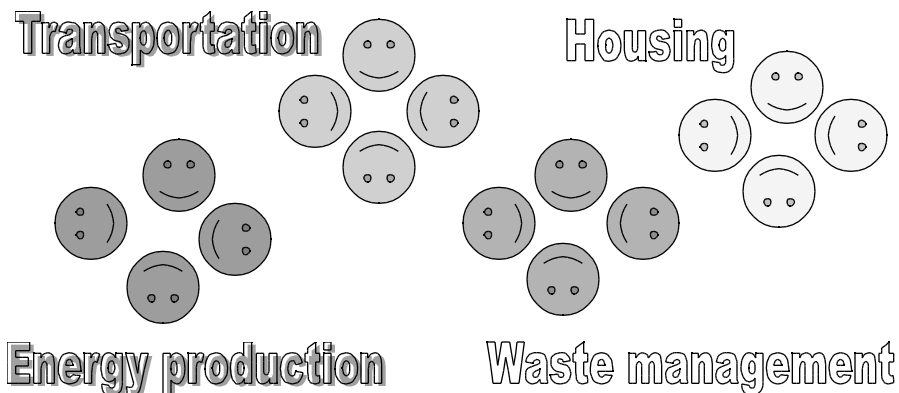
In fourth grade the students:

- **Constructed individual stock/flow maps of endangered species using STELLA**
- **Analyzed the use of electricity over time using the Iceberg, behavior-over-time graphs, and a causal loop diagram**
- **Identified resource limits and alternatives pertaining to the use of electricity through the use of the Tragedy of the Commons archetype**

## Unit Design

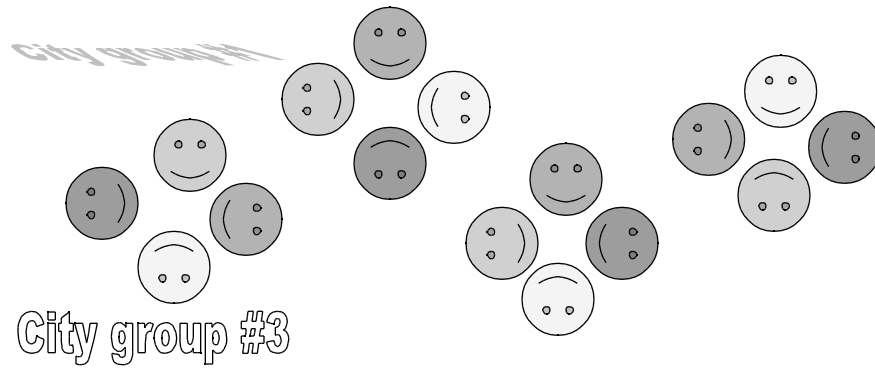
“Expert” groups use the “Iceberg” to:

- \* analyze the current reality of the system
- \* identify any “commons” involved
- \* choose goals for the system
- \* create possible alternative systems



City groups use the “Iceberg” to:

- \* present their “expert” findings and recommendations
- \* choose goals for the city system
- \* adjust and integrate individual systems to support the city system
- \* aid in the thinking behind the city pamphlet




# Revisiting the systems thinking tools...

- “Iceberg”
  - Behavior-over-time graphs
  - Mental models
  - Causal loop diagrams
  - Stock/flow maps
- Tragedy of the Commons archetype

## Current Reality for the SnackBar System

What events are occurring?



The students are hungry

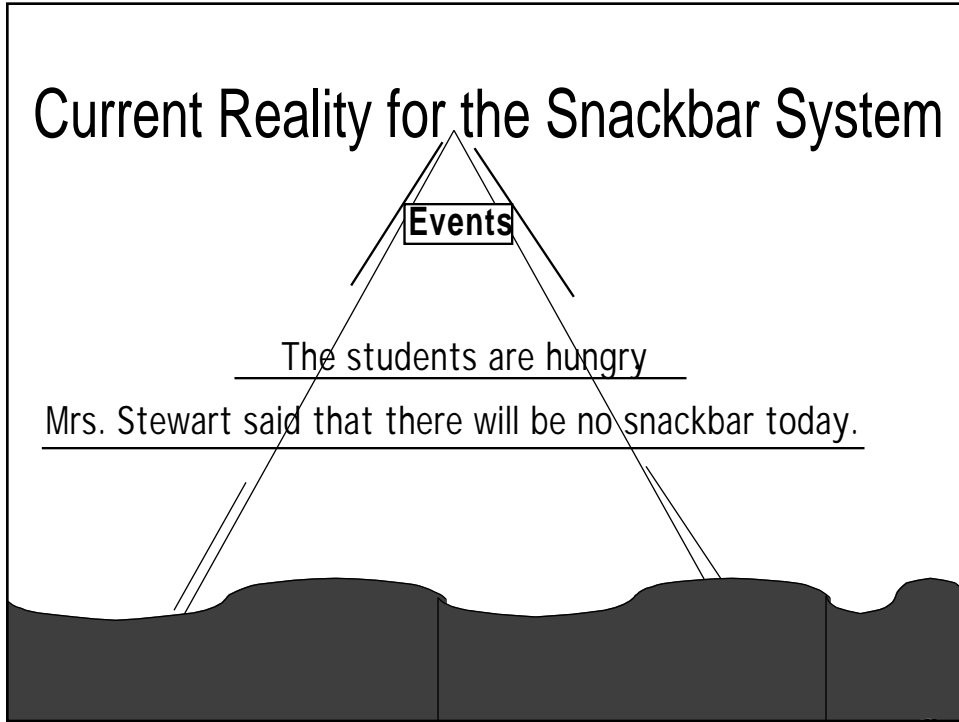
Mrs. Stewart said that there will be no snackbar today.

# Current Reality for the Snackbar System

Events

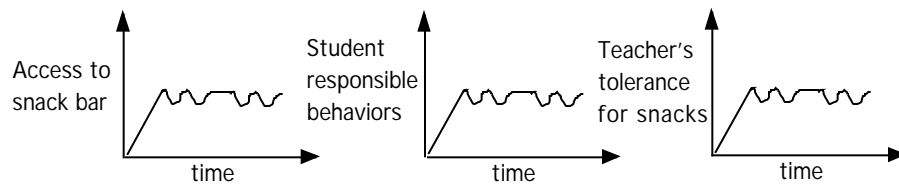
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What are the trends?

Patterns of Behavior



# Current Reality for the Snackbar System

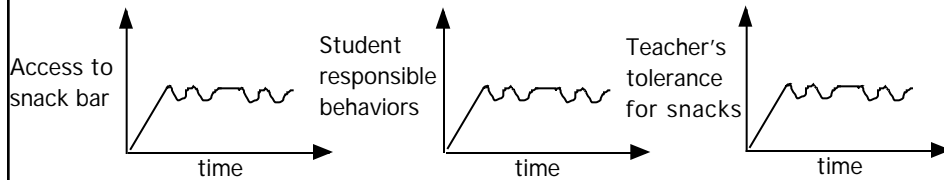
Events

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Patterns of Behavior

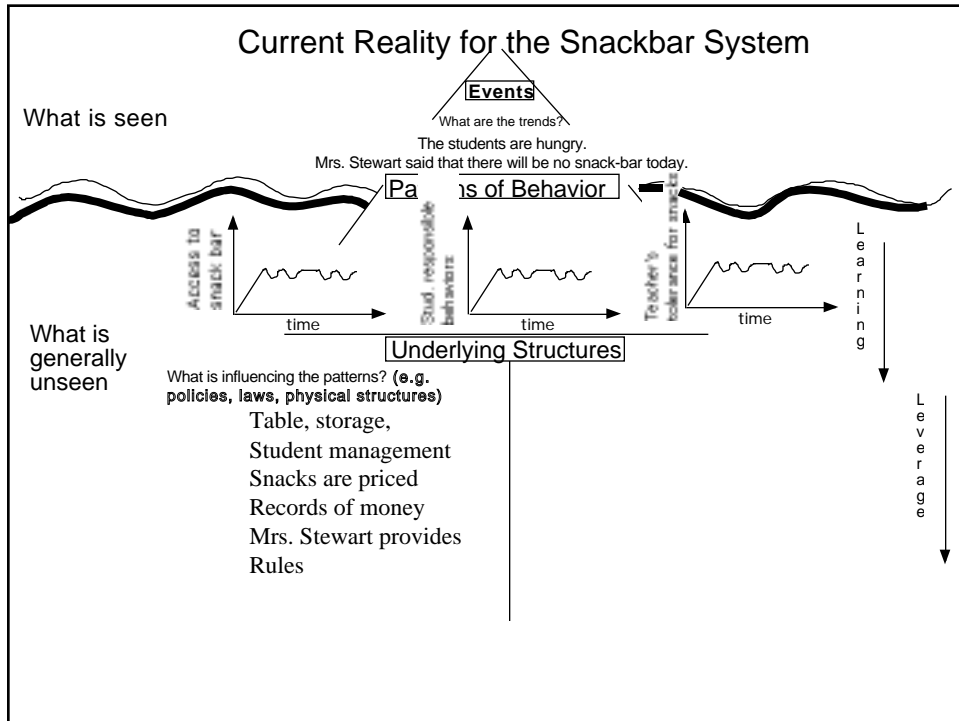
What are the trends?



What is influencing the patterns?  
(e.g. policies, laws, physical structures)

## Underlying Structures

Table, storage,  
Student management  
Snacks are priced  
Records of money  
Mrs. Stewart provides  
Rules

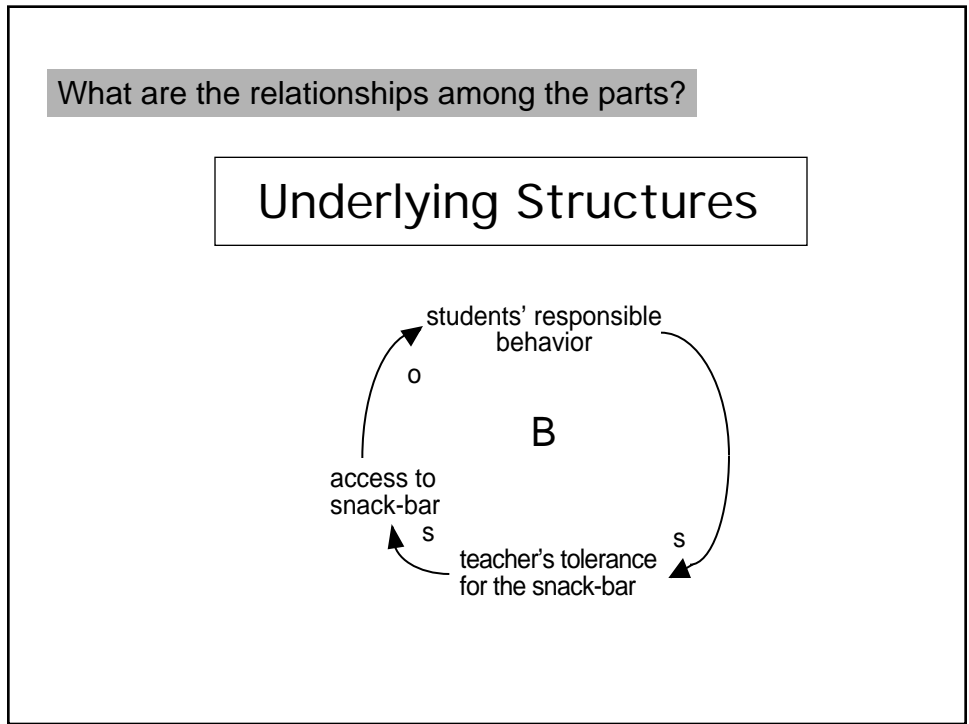
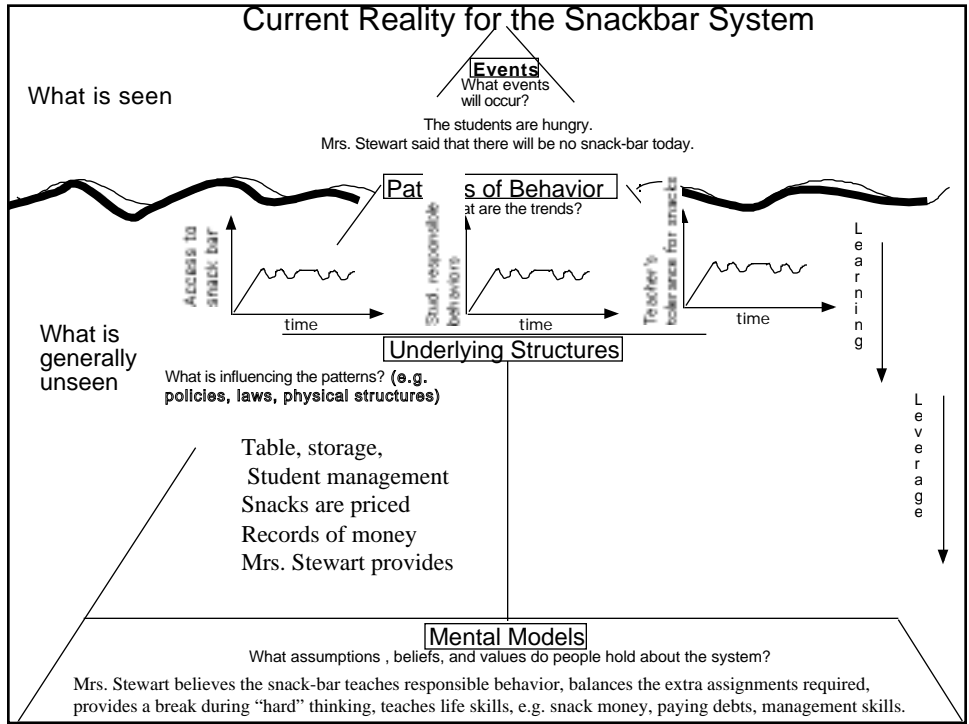


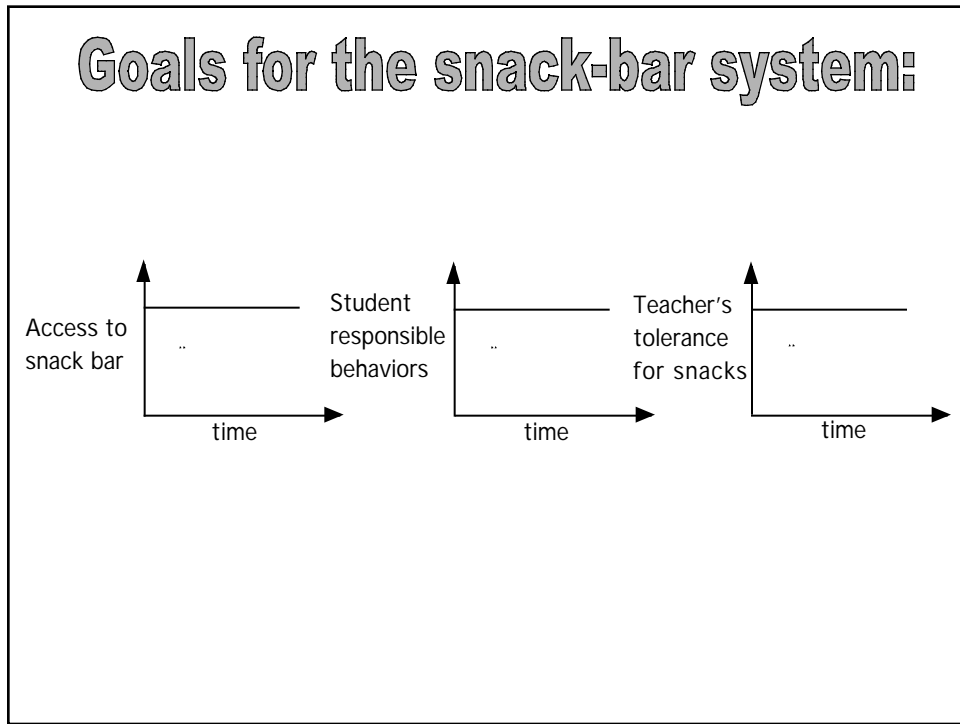
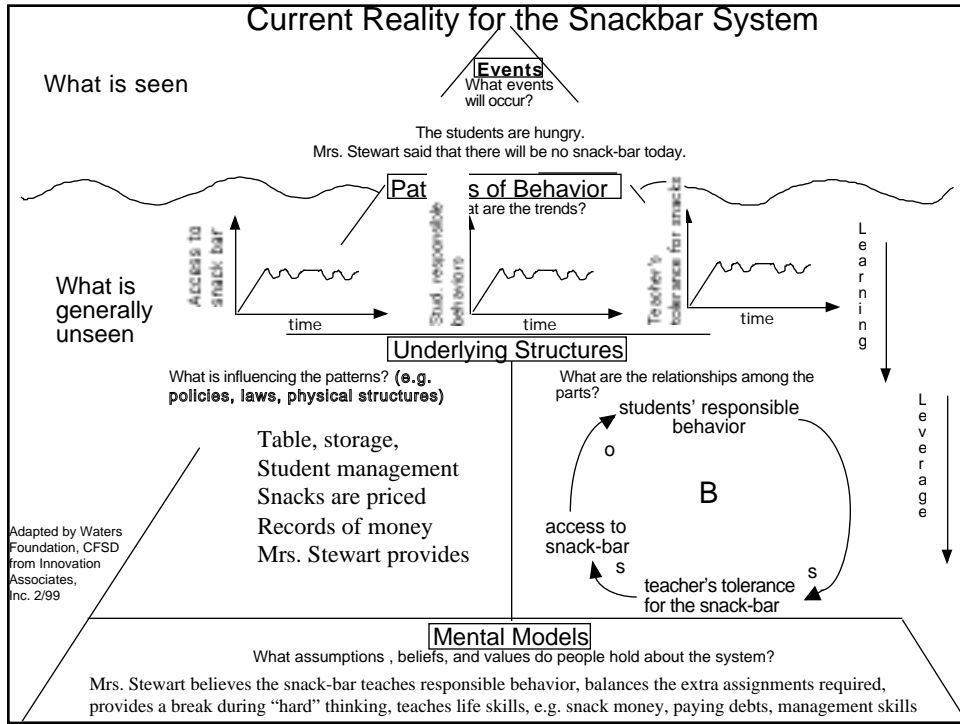
What assumptions, beliefs, and values do people hold about the system?

## Mental Models

Mrs. Stewart believes the snack-bar:

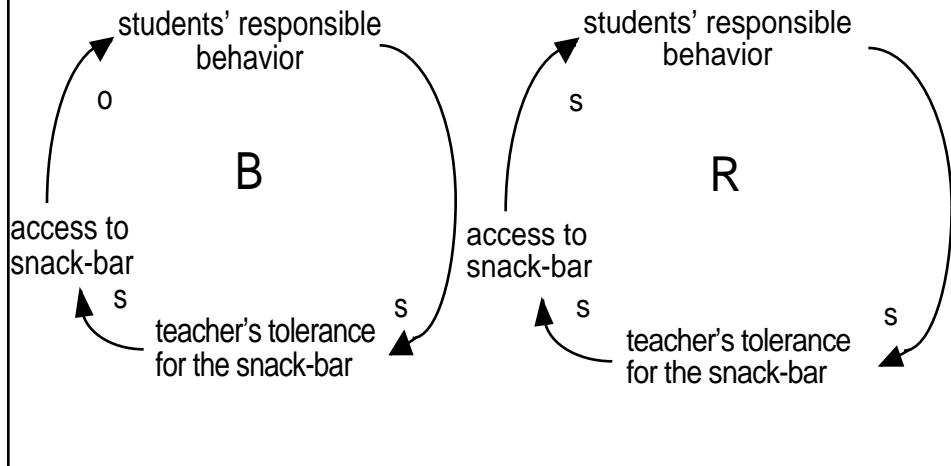
- teaches responsible behavior
- balances the extra assignments required
- provides a break during “hard” thinking
- teaches life skills, e.g. bring snack money, pay debts, management skills



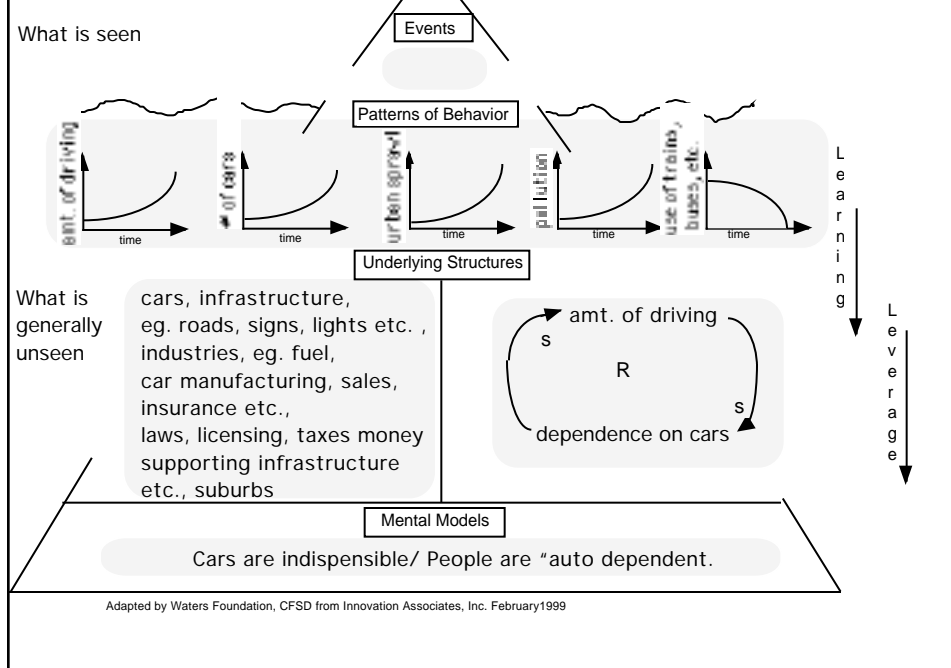


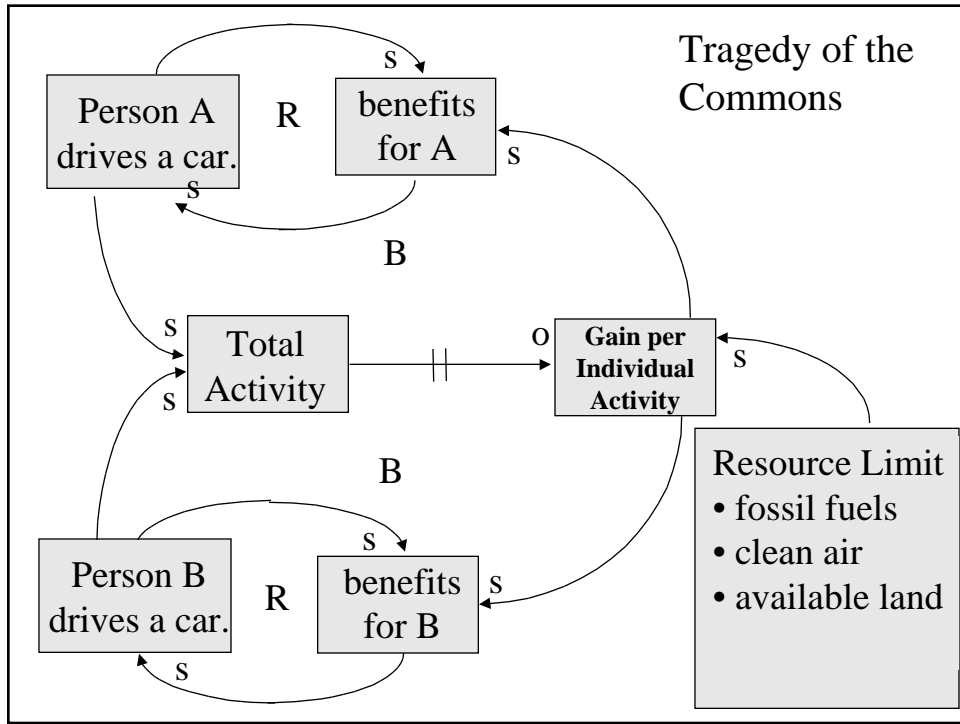
# Goals for the snack-bar system:

## Looking for leverage:



### Current Reality practice for the System of Transportation







## Pamphlet Write-up

**Type of system:** Including inventions

**Description of how the system operates:** Including a summary of the physical structures, policies, laws etc.

**Reasons for selection:** Including...

- belief/value statements that summarize the mental models underlying the system.
- goals for the system which address the desired patterns of behavior and the desired increase/decrease of the effects on a “commons.”

**Additional requirements:** The city system must be internally consistent, e.g. The mental models support the structures and trends. The structures support the inventions, etc.