

# Data Structures



STEPHEN F. AUSTIN  
STATE UNIVERSITY

NACOGDOCHES, TEXAS

# Communication – D2L / Discord

## ➤ Course Files

- Schedule, policies, links, assignments, etc.
- Grade book and assignment submissions

## ➤ Discussion: Q&A

- Ask and answer questions – Prof. and T.A. will monitor & contribute
- *ALL* questions on course material should go here

## ➤ Office Hours: spread throughout the week

- Can also reach out to make individual appointments

# Complexity and Abstraction

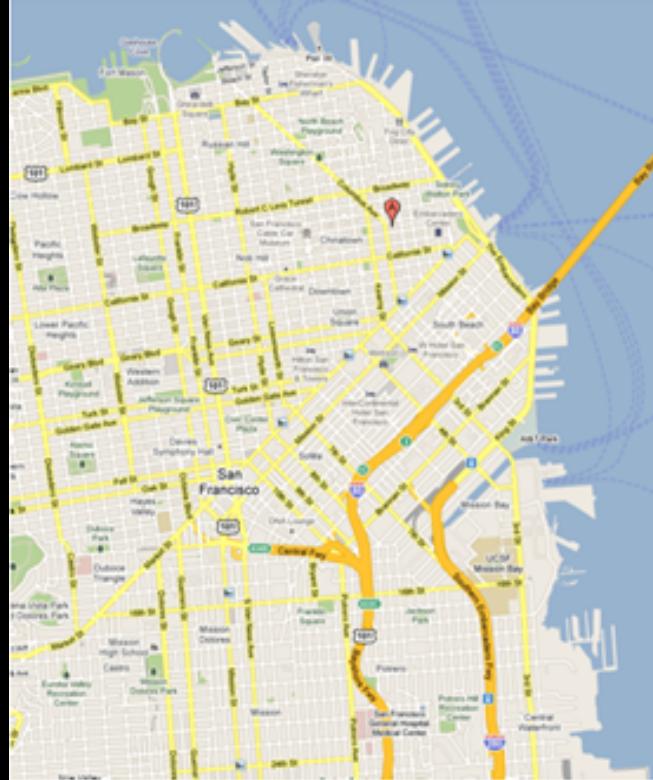
- ❑ Programming is straightforward, as long as your programs are small
  - *Complexity* is our enemy
  - *Abstraction* is the key to conquering complexity
- ❑ **Abstraction** allows us to build general-purpose artifacts
  - **Detail Removal:** Hide unnecessary details from users and designers
  - **Generalization:** Avoid unnecessary repetitive work
- ❑ Learning to reason using the most appropriate abstraction is a key goal of computational thinking

# Abstraction: Detail Removal

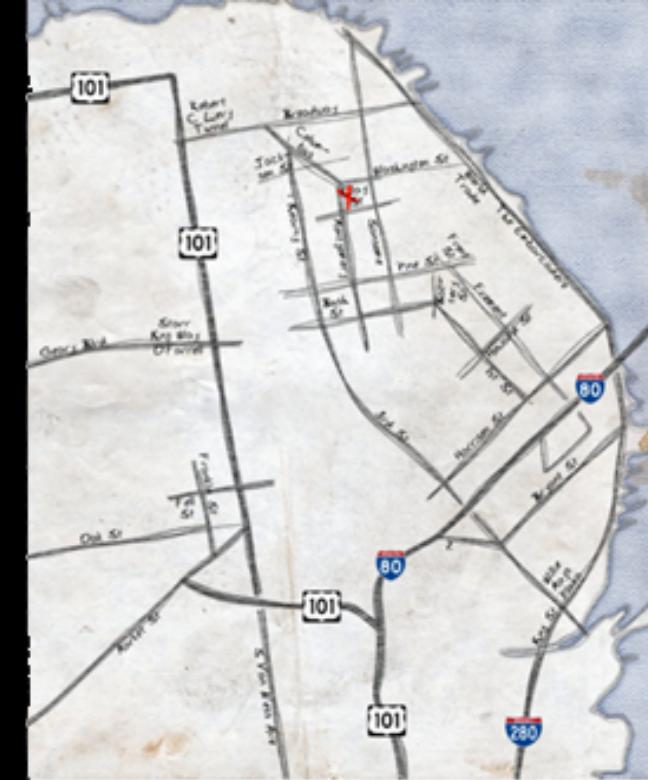
- ❖ “The act or process of leaving out of consideration one or more properties of a complex object so as to attend to others.”



Henri Matisse “Naked Blue IV”



Maps for directions



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# Abstraction: Detail Removal

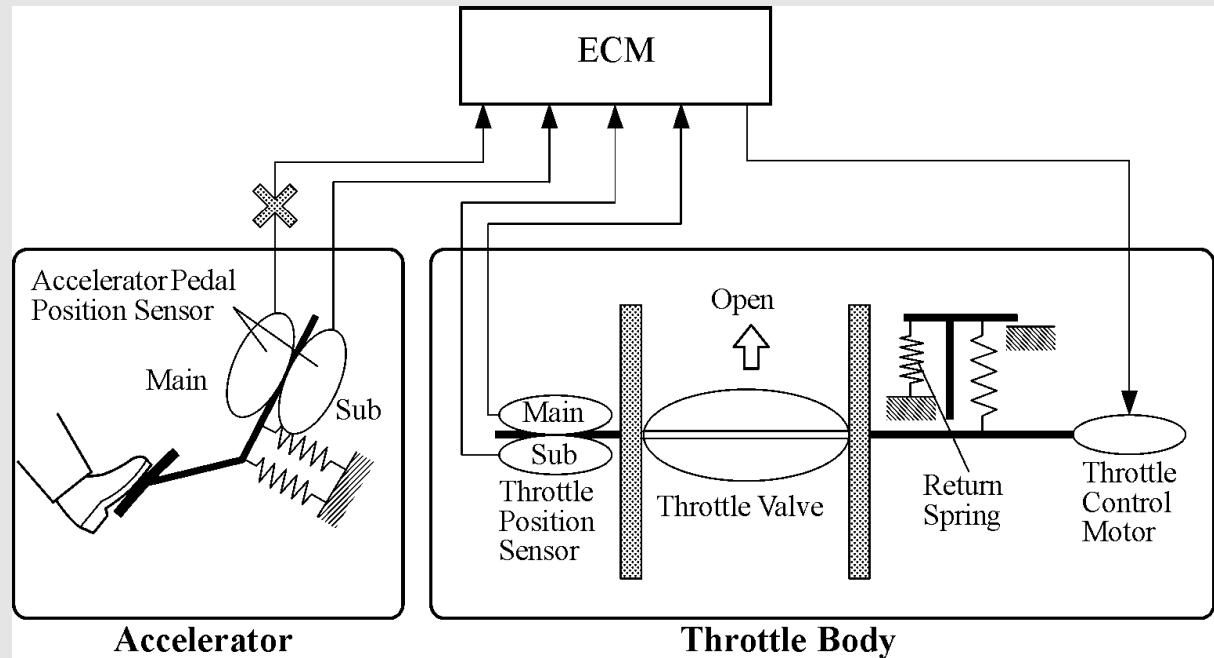
## □ Detail removal example:

- Modern user interface: Right pedal is “accelerate”, left is “decelerate”
- Even as underlying technology has changed, this abstraction has not!
  - Computer controlled fuel injection
  - Anti-lock brakes (ABS)
  - Electric cars



# Abstraction: Detail Removal

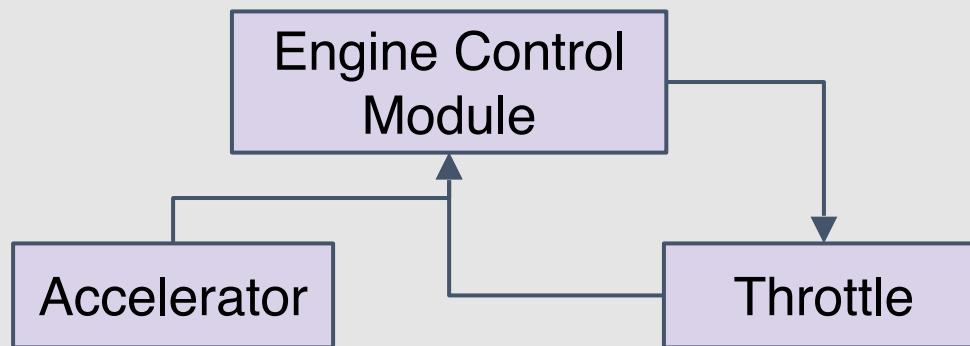
- Detail removal example:
  - Hide unnecessary details from other designers
    - e.g. Engine Control Module (ECM) designer doesn't care about the return spring inside the Throttle!



# Abstraction: Detail Removal

## □ Detail removal example:

- Hide unnecessary details from other designers
  - *e.g.* Engine Control Module (ECM) designer doesn't care about the return spring inside the Throttle!
- Nice to be able to think of a system as a hierarchy of well defined "chunks" with precise functionality
  - In CS, we say that we have a **separation of concerns**



# Abstraction: Generalization

- “The process of formulating general concepts by abstracting common properties of instances.”
  
- Extensible shower rods
- Adjustable hats and belts
- Single recipe for <fruit> cheesecake
- Feeding animals on a farm
  - To feed <animal>, put <animal> food in <animal> dish
  
- Your brain generalizes every day, without you even consciously realizing it!

# Audience Responses

- Other examples of detail removal:
- Other examples of generalization: