The Art of Telling Your Design Story

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The Design Process

- Design is a messy, iterative process
- Early descriptions tend to be less precise
- Later descriptions add more precision and formality

A Design Storytelling Strategy

Tell interesting stories

Establish scope, depth and tone

Decide how detailed the story should be

Choose appropriate forms—tell it, draw it, describe it

Emphasize what's important

Clarify, compress, and expand as needed

Scope, Depth, and Tone

Scope—how much territory you cover

Depth—how many details you present

Tone—formal, casual, educational, inspirational…

Story:
A First Look at an Initial Design

List Key Story Points

List what you want to cover—whether big, small or overlapping—and what you don't

Key Points for "Build a Message" Collaboration
- Use a sequence diagram—keep simple
- Note complicated guessing logic
- Message content is structured
- Don't show threading details (yet)
- Point out parts that are adaptable

A Storytelling Example

Goal: Describe a CRC modeling session

Scope: Initial design for a key use case

Depth: High-level paths of interactions between key objects

Tone: Rough, brief

Results: Collaboration sketch with message names. Lists of issues and ideas

Early Collaboration Model Stories

Concentrates on control, coordination, important services, and information

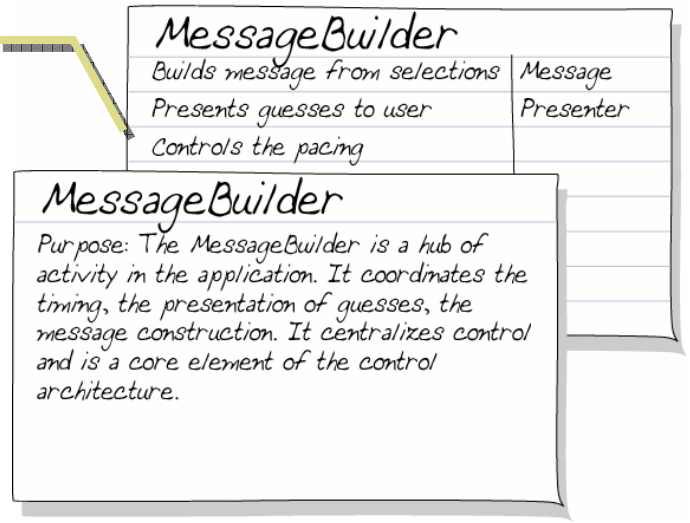
Focus on your inventions

Stops explanation when you can demonstrate that a focused set of design elements fulfill their purpose

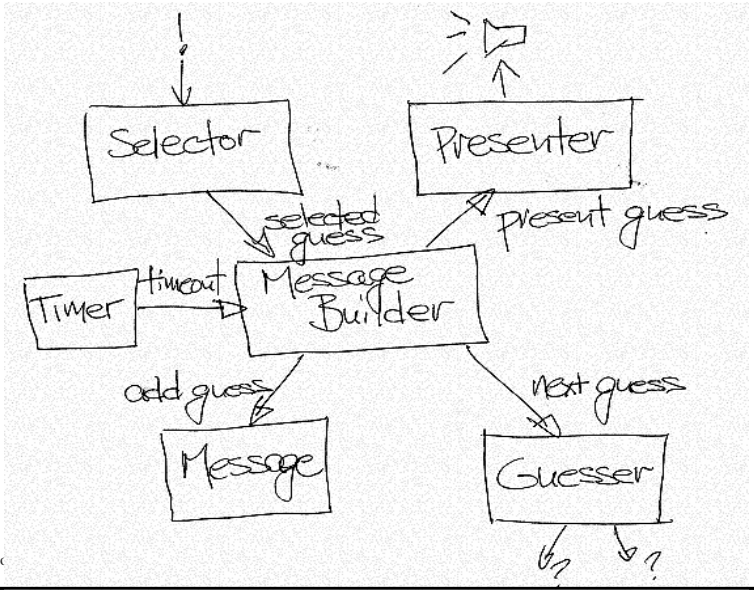
CRC Cards

*C*andidate, *R*esponsibilities, *C*ollaborators

CRC cards are an informal way to record early design ideas about candidates



Start with rough sketches…




It's OK to:

…then get more precise

Show a sequence of messages between these objects

- Label message arrows with names of requests
- Can be "less" than a full signature
- Shows arguments and return values when it is important to understand key information flow

Story: Exploring Alternatives

A Storytelling Example

Goal: Explain how a design evolved

Scope: Control design for a key use case

Depth: High-level paths of interactions between key objects

Tone: Explanatory, moderate amount of detail

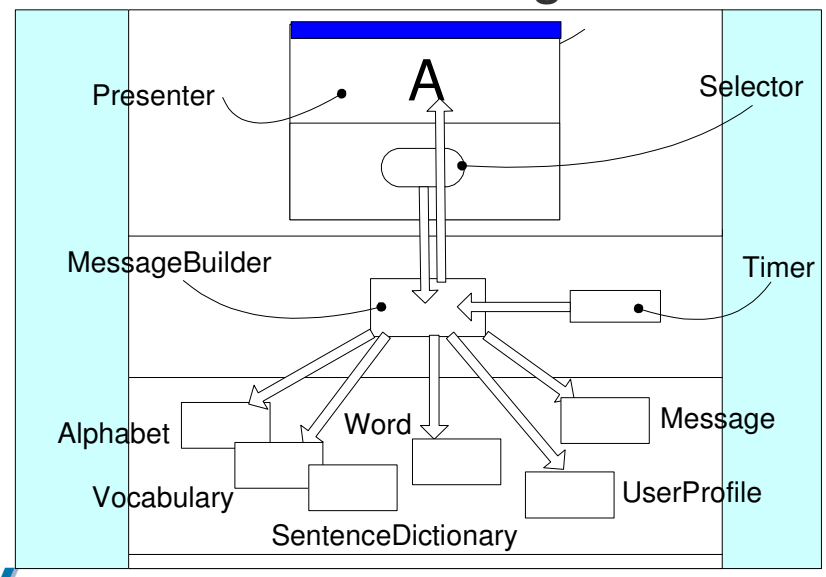
Results: Sketches of design, analysis of problem, and recommended solution

"Build A Message" Use Case

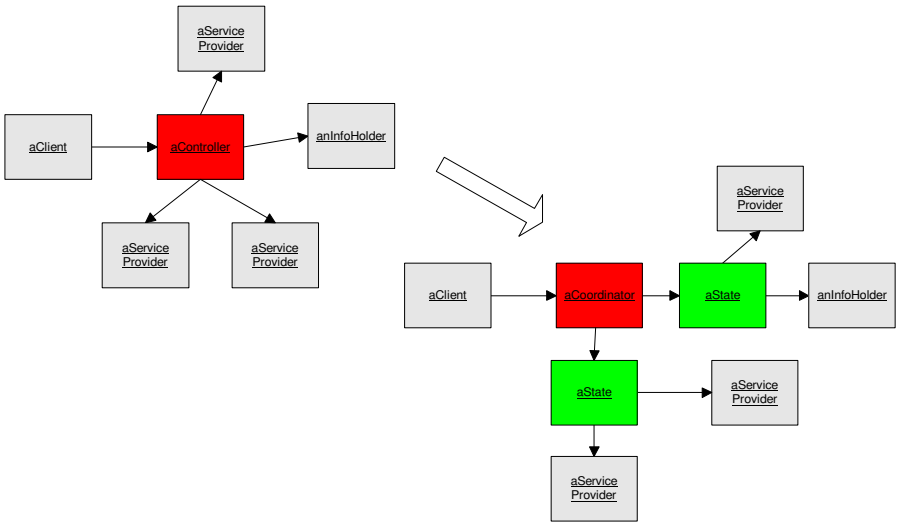
Speak for Me enables a severely disabled user to communicate

Actor Actions	System Responsibilities
"Click" to start software speaking	Start building a message
Repeat until . . .	
Optionally, "click" to select letter	Determine what to speak (letter, word, sentence, or space) Speak letter Add letter to word
Optionally, "click" to select word	Speak space Add word to end of sentence Start new word
Optionally, "click" to select sentence	Speak sentence Add sentence to end of message Start new sentence
... a command is issued	
	Process command (separate use cases)

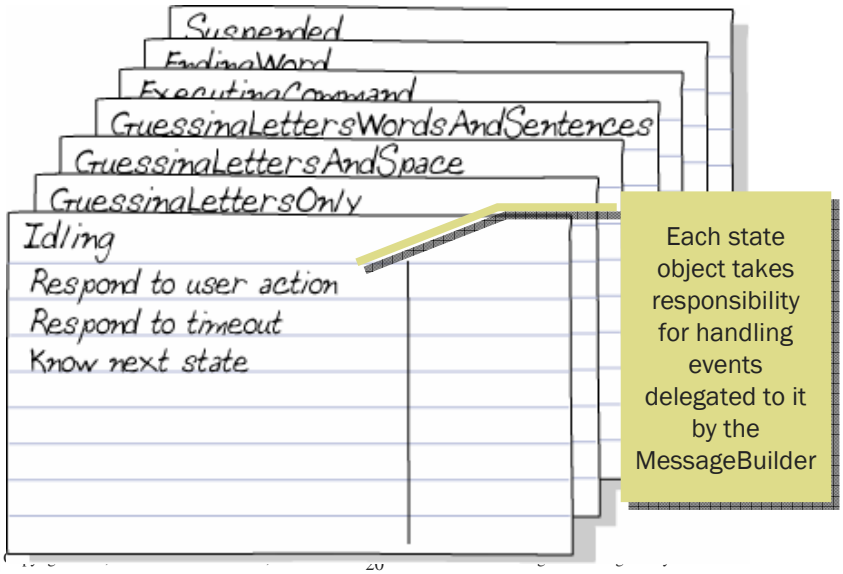
Build a Message



Controller = Coordinator + State



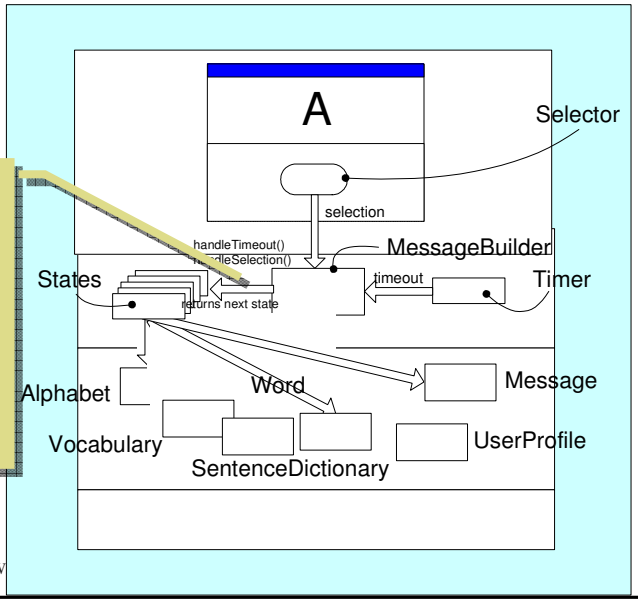
Applying the State Pattern to Simplify MessageBuilder



Each state object takes responsibility for handling events delegated to it by the MessageBuilder

Applying the State Pattern Simplifies the Controller

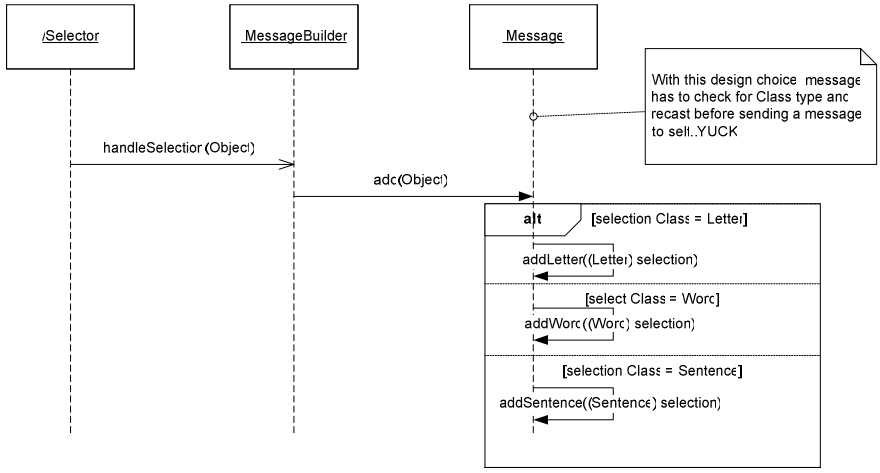
Complexity is still located in a "control center". Can we simplify the control center by giving other objects more responsibility?



Delegating Control

- Factors decision-making into helper objects
- Replaces complex control with simpler coordination and delegation
- Distributes focused logic into classes that implement singular, smaller roles
- More classes and objects

Delegating Message Construction
to Message

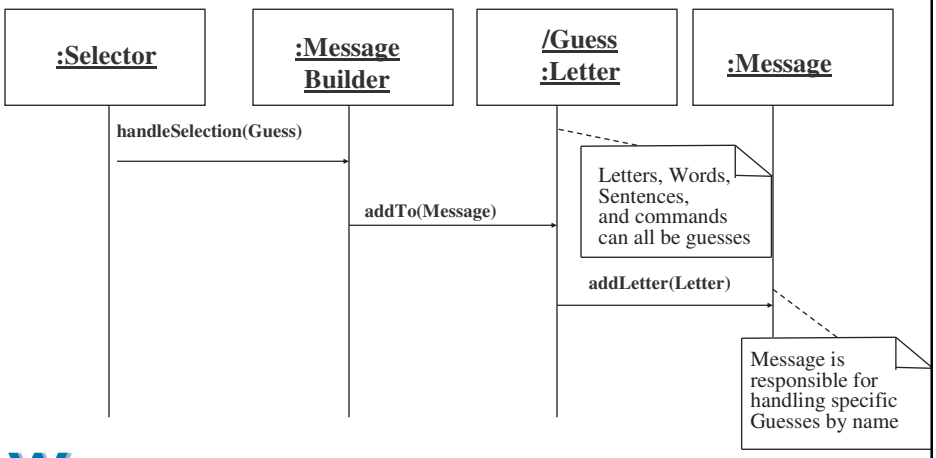


The Guess: now a more intelligent information holder

In our initial design Letters, Words and Sentences simply held the item that the user could select and knew their spoken representation

If each of these objects were responsible for adding themselves to a Message, type-based decisions could be eliminated!

Delegating Message Construction
to Guess



The Double Dispatch Pattern

Problem: How to select an action based on the type of two objects appearing in combination

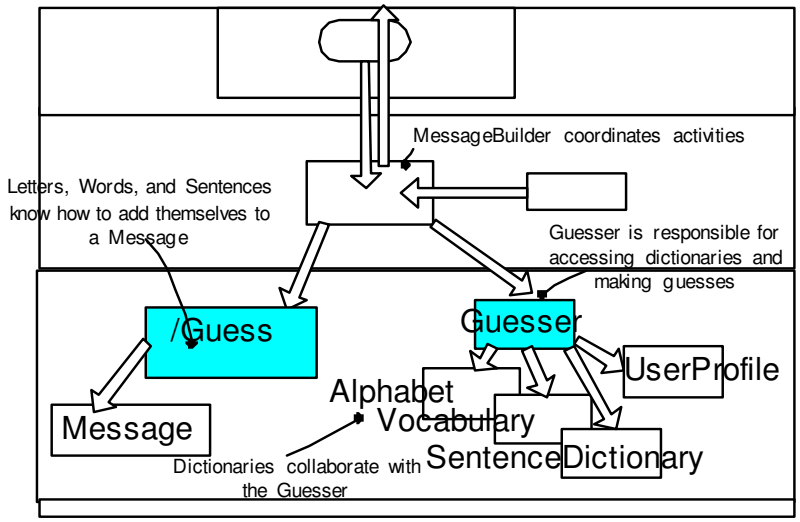
Context: Sometimes you need to make a decision based on the class of one of the parameters in a message.

Forces: Cases or switch statements are often used in procedural languages to decide what action to take. If you hardwire in class references, you have to update your code that decides each time a new class is added. If you use polymorphism, you can eliminate decisions.

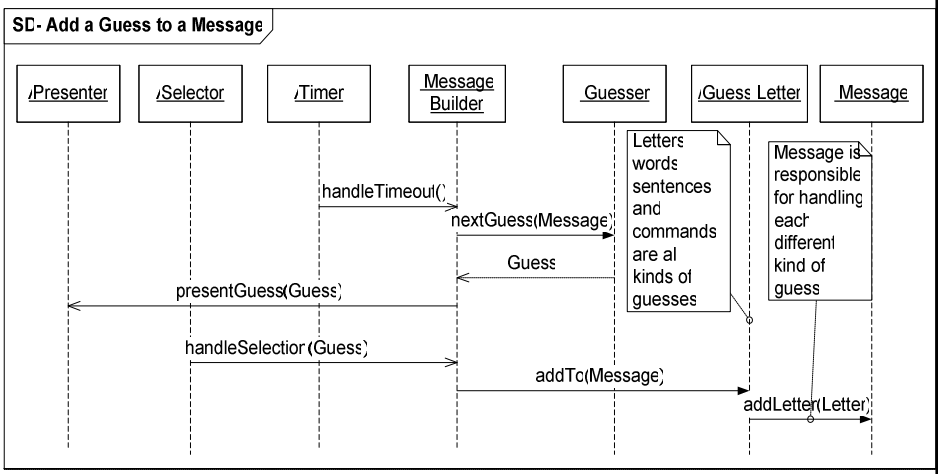
Solution: Instead of checking on a class of a parameter, add new methods having the same name to each class of a parameter objects. Pass along a reference to the calling object, then have the receiver call back and execute the "right" method.

Consequences: This eliminates any conditional checks. Code is more maintainable because it is easier to extend by adding methods rather than modifying existing ones.

To Delegating the Responsibilities



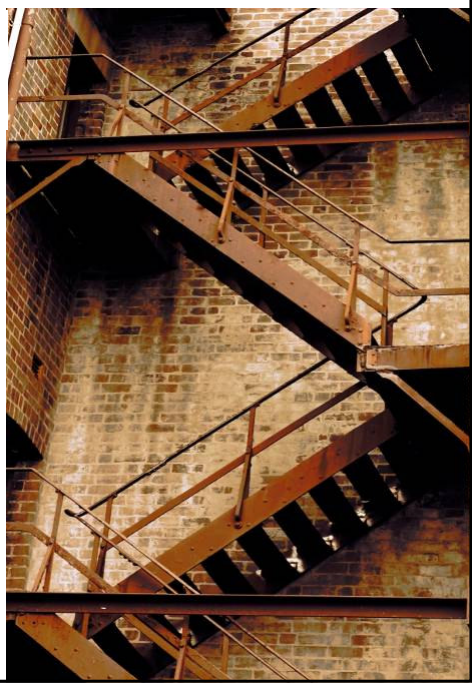
Delegating Message Construction to Guess—our preferred design



/before role name :before class name

Use Multiple Descriptions

- Text to explain interfaces, assumptions, qualities, ..
- Element roles and responsibilities for a conceptual overview
- Specific connections and protocol details
- UML sequence diagrams to show key interaction sequences



Use Progressive Realization

Landscape architects create views that move someone to where they want in gradual, interesting steps

With describing a high-level view of your design

- Stick to the main points.
- Present central objects and what is important
- Then tell more…

Increasing Emphasis

Things gain prominence by their position and appearance. To increase an item's emphasis:

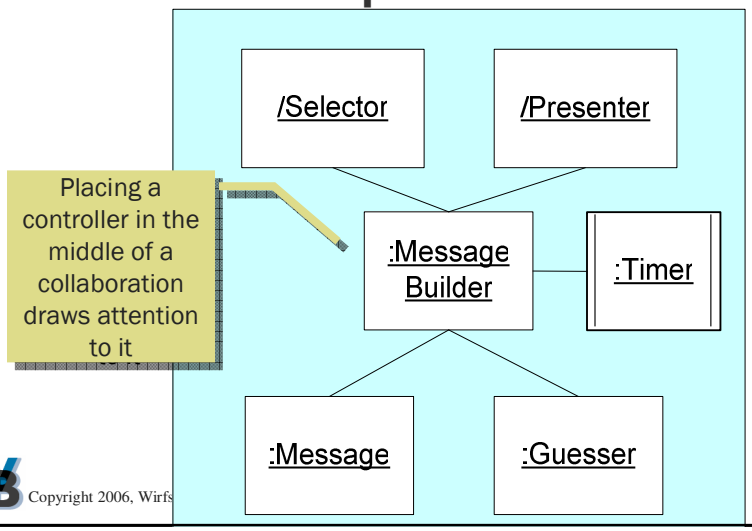
- Put it first

Highlight it

Surround it with space

- Put it in a bulleted list
- Mention it in multiple places
- Give it more room
- Repeat or restate it in different forms

Central location, size, and boldness add emphasis



Speaking to A Crowd

Interests and backgrounds differ

- Some may already know a lot
- Some may be looking for specific facts
- Some may want the punchline
- Others may need fundamentals first

Choose what to emphasize. Cater to the majority; give others pointers along the way

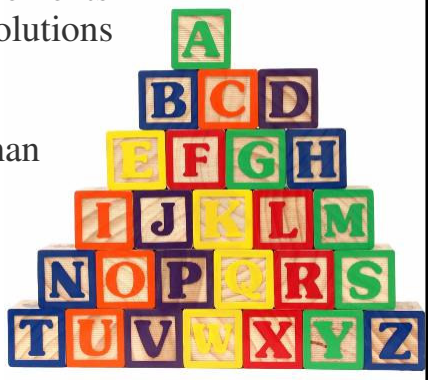
What's More Fundamental

Things you cannot change

Problem descriptions and requirements are more fundamental than solutions

The typical case

Things are more fundamental than relations between them



Dealing with an Impatient Audience

Those seeking specific facts won't sit still:

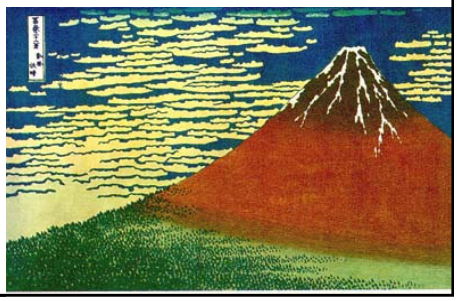
- Include a Frequently Asked Questions section
- Don't always present fundamentals first
- Present important things that deserve emphasis

Hold their Attention

Descriptions are more clearly understood if important parts are told first

Be aware of monotony setting in. Counteract it:

- Explicitly call out details
- Point out that the next five diagrams are similar
- Illustrate different perspectives



Mt. Fuji by Hokusai Katsushika

Describing Variations

Describing When Things Change vs. What Can Change

What does this mean?

- –(a) road slippery when wet
- –(b) dangerous curve
- –(c) reduce speed
- –(d) drunk driver ahead

Describe Only What The Person Making the Variation Needs to Know

If the support you have provided is high, then someone making a variation may not require deep knowledge.

- Perhaps you created a number of pre-built components or classes. To implement a variation, a developer chooses an existing component and plugs it into a collaboration by invoking a single "setter" method.
- They only need a simple set of instructions.

A Basic Recipe for Installing a New Device Driver:

Choose from one of ....

Configure into system by doing ....

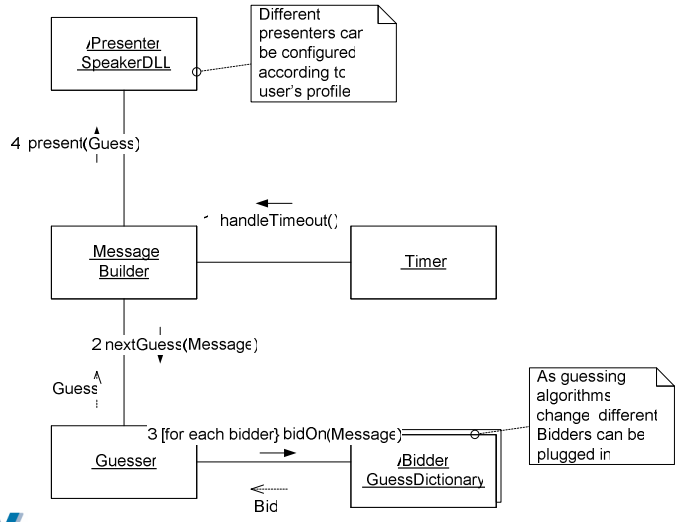
Restart and test by calling.....

Showing How to Adapt a Design

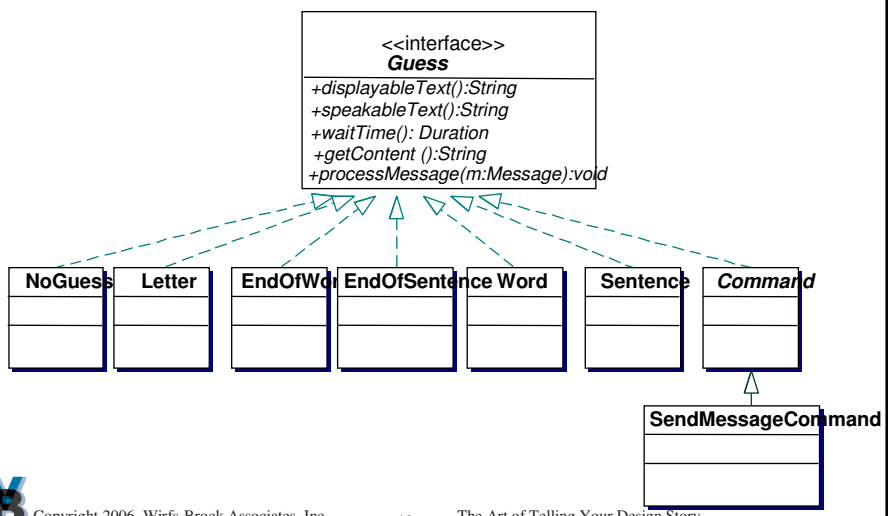
Explain three things:

- the current design
- what aspects are adaptable
- how to make these adaptations

What Can Be Configured



What Can Be Guessed



Recipe for Adding a Guess

To Add a New Kind of Guess

1. Define a class that implements the Guess interface.
   This type of object must know contents, formatted for both display and speech, know how long to wait before continuing with another guess, and be able to add itself to a message.
   Specifically, it must implement these methods:

```
public String displayableText()
public String speakableText()
public String getContent()
public Duration waitTime()
void processMessage(Message m)
```

2. Define a class that implements the Bidder interface.
   This type of object will contain all of the corresponding Guess objects and determine which is most relevant to the current message and how relevant they are. Specifically, it must implement:

```
Bid bidOn(Message m)
```

The Basic Elements of A Recipe*

Recipe Name: Usually starts with "How to"

Intent The reason to use this recipe

Design Description Which classes and interfaces are involved and need to be understood, what roles do they play and what collaborations are involved. What responsibilities are adapted via the variation... backed up by supporting UML diagrams and other descriptions.

Related Recipes: Alternative ways to accomplish a similar variation; or related sub-recipes. A complex recipe may be broken down into several sub-recipes.

Steps 1. First create a class that implements the xyz interface...

2. In it define a method named...

3. And another method named...

Discussion: Mention problems that might crop up, how to test that a variation is correctly installed, or what should not be attempted using this approach.

*** from *The UML Profile for Framework Architectures***
by Marcus Fontoura, Wolfgang Pree and Bernhard Rumpe

Strunk and White's Elements of Style

Do not overwrite. 10 pictures are not worth 10k words

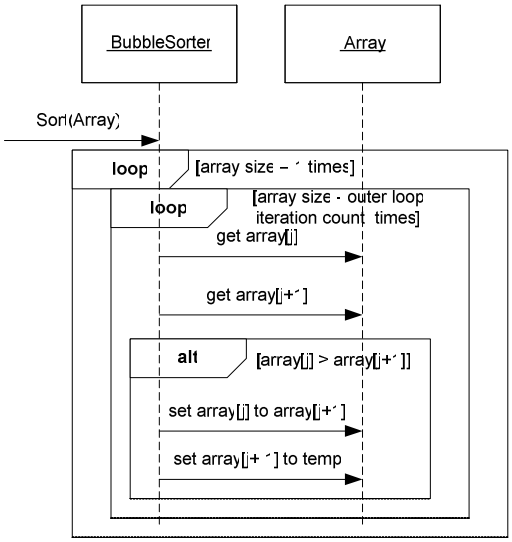
- If collaborations are similar, show a typical case first, then note how remaining ones differ.
- Draw representative interactions

Strunk and White's Elements of Style

Omit needless words.

- Visual equivalents of "needless words"on a collaboration or sequence diagram:
  - Gratuitous return values
  - Internal algorithmic details
  - Details of caching and lazy initialization
  - Object creation and destruction

Bubble Sort: A UML Sequence Diagram



Bubble Sort Explained

The algorithm for a bubble sort consists of two nested loops. The inner loop traverses the array, comparing adjacent entries and swapping them if appropriate, while the outer loop causes the inner loop to make repeated passes. After the first pass, the largest element is guaranteed to be at the end of the array, after the second pass, the second largest element is in position, and so on. That is why the upper bound in the inner loop decreases with each pass; we don't have to revisit the end of the array.

Bubble Sort: A Visual Illustration

Consider the array 42,56,13,23

Let's start sorting……

42,56,13,23 no swap

42,**56,13**,23 swap

42,13,**56,23** swap – end of 1st pass outer loop

42,13,23,56 swap

13,**42,23**,56 swap – end of 2nd pass outer loop

13,23,42,56 no swap – end of 3rd pass

Bubble Sort: Some Code

```
class BubbleSorter{
 void sort(int a[])
{ for (int i = a.length; --i>=0; )
  { boolean swapped = false;
   for (int j = 0; j<i; j++ ) {
       if (a[j] > a[j+1]) {
         int T = a[j];
         a[j] = a[j+1];
         a[j+1] = T;
         swapped = true; }
  if (!swapped) return; } } }
```

Where UML Diagrams Fall Short

The best way to see isn't always with a standard diagram

Use words, pseudo-code, code, BNF grammar, decision tables, state tables, or pictures that emphasize certain features

Sequence diagrams sometimes fall short:

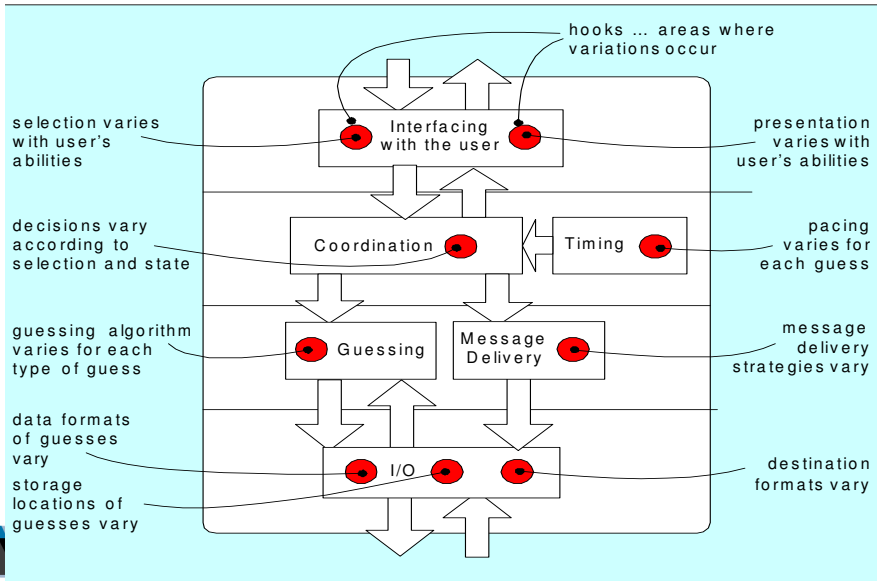
- They do not show side-effects
- It's hard to emphasize special areas
- It's hard to interpret algorithms
- Control flow and iteration can be difficult to see

Strunk and White's Elements of Style

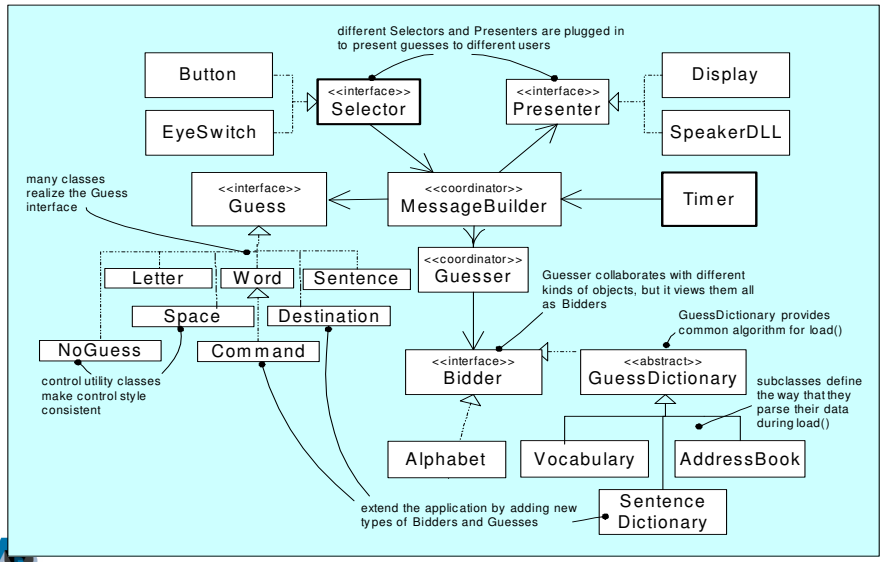
Revise and rewrite. If someone doesn't "get it", it could be your problem

- A designer drew two views showing the same collaboration. One view omitted the interface details, the other included them. Some developers wanted to know what interfaces to use. Others who only wanted to how their parts of the system were activated didn't want to see these details. Both views were needed to get her design across.

Consider Your Audience



The Same View In UML



Strunk and White's Elements of Style

Do not overstate. Don't tell more than what you believe at any given point

- The same diagram can be drawn with different degrees of precision
  - If you only know general paths of collaboration—don't show specific messages
  - If you know specific messages, but not the arguments—don't invent arguments just to fill in the blanks

Strunk and White's Elements of Style

Do not affect a breezy manner. Don't leave things understated, undrawn, or unexplained

- CRC cards are too breezy if you want to explain an interaction sequence
- Don't arbitrarily limit your diagrams to a single page, or to ten or less objects. Stick with your design description goals. Get it down, then figure out how to show it

Strunk and White's Elements of Style

Be clear. Choose the right form of expression

- To emphasize message ordering, use a sequence diagram. If timing is critical, add timing marks
- Add running commentary to explain

A picture doesn't tell all

Acts as a key to supporting documentation

Can be understood at a glance

Is explicit

Provokes discussion

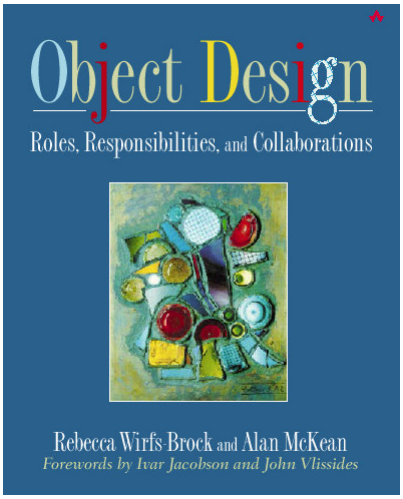
Design Representation Options

Goal	Simple Representation	Options
Describe responsibilities and collaborators	CRC cards	Transfer information to a document/use a table
Show collaboration relationships between objects	Simple Collaboration Diagram	Add visibility links to make explicit who collaborates with whom
Illustrate an Interaction Sequence	Collaboration Diagram	To be more formal, draw a sequence diagram To explain how objects are affected, add a running commentary To explain interactions between subsystems treat them as "big objects" and include in diagram

Design Representation Options

Goal	Simple Representation	Options
Explain complex algorithms	A visual animation or storyboard	Pseudo-code Draw an interaction diagram and annotate
Describe detailed interactions	Either a collaboration or sequence diagram	Add timing marks, guards, branches, loops, recursive calls, and notes to the diagram
Describe how to reconfigure a collaboration	Define responsibilities of "configurable objects" Draw a typical interaction sequence. Identify where configurable alternates can be "plugged" in	Write a recipe describing a step-by-step procedure for configuring a collaboration Include examples or sample code

Resources



Read more about describing collaborations in:

Object Design: Roles, Responsibilities and Collaborations, Rebecca Wirfs-Brock and Alan McKean, Addison-Wesley, 2003

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