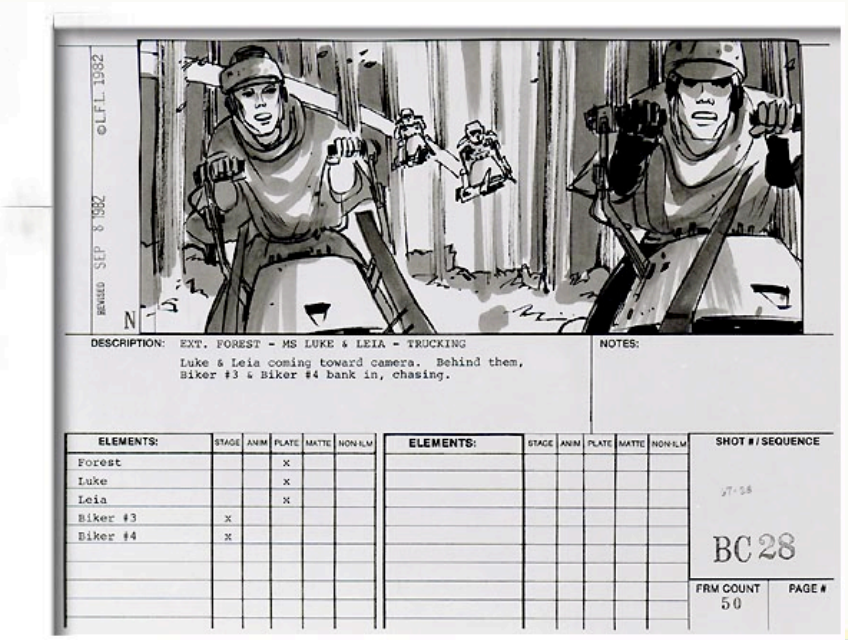
Creating an Animation Program

Alice

Step 1: Design

- Decide on the problem to be solved
- Design a solution
  - We will use a storyboard design technique, commonly used in the film industry



Example

- The scenario is:

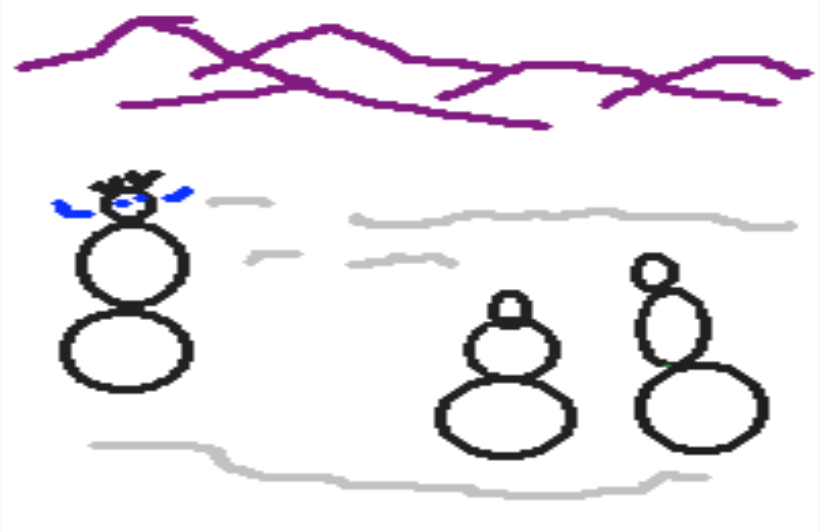
  Several snowpeople are outdoors, on a snow-covered landscape. A snowman is trying to meet a snowwoman who is talking with a group of her friends (other snowwomen.) He says “Ahem" and blinks his eyes, trying to get her attention.

- The problem is:

  How can we create this animation?

Create Initial World

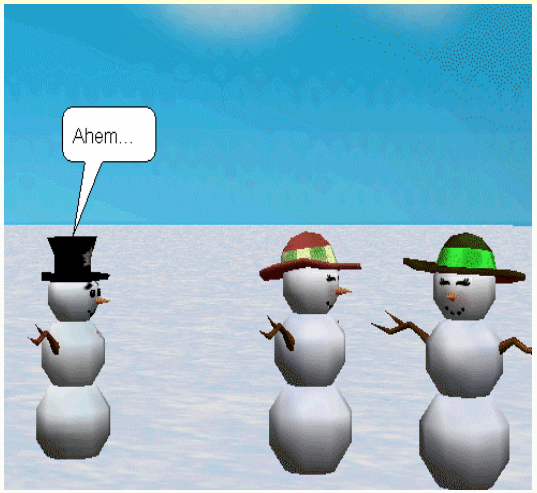
Storyboard
Option 1: Sketches



Storyboard
Option 2: Screen shots

Initial scene

Snowman tries to catch snowwoman's attention



Snowwoman looks around

Storyboard
Option 3: Text Form

- **A textual storyboard is like a "to-do" list.**
- **The Learning to Program in Alice textbook puts a textual storyboard in a box:**

Do the following actions in order
snowman turns to face snowwoman
snowman “blinks eyes” and calls out to the snowwoman.
snowwoman turns around.

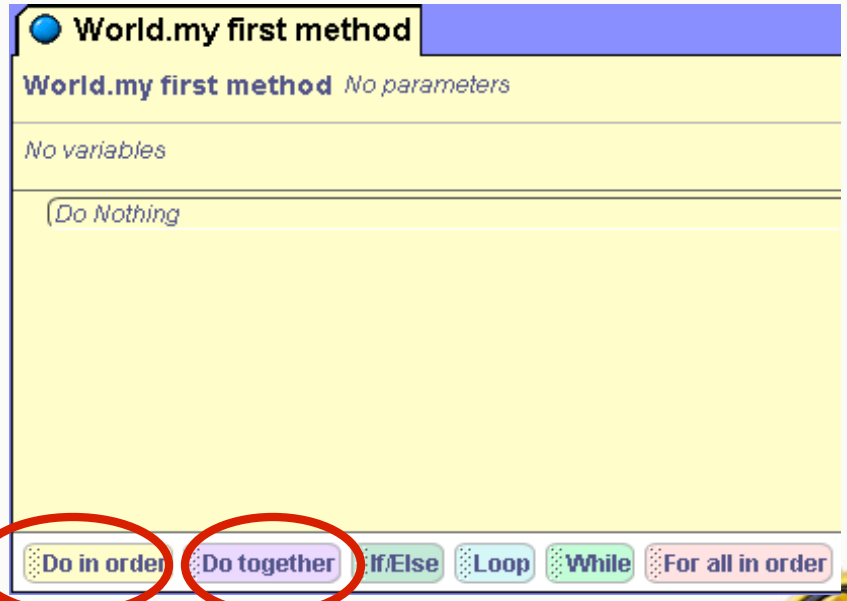
Step 2: Implementation

- To implement the storyboard, translate the actions in the storyboard to a program.
- **Program** (a.k.a. **script**)
  - a **list of instructions** to have the objects perform certain actions in the animation

Action Blocks in Alice

Sequential Action Block

– actions occur one after another



Simultaneous Action Block

-- actions occur at the same time

Demo

- Ch02Snowpeople

Concepts in this first program

- Program instructions may have arguments
  - Example: for the **move** instruction, the arguments we used in this example were
    - direction
    - distance
- *DoTogether* and *DoInOrder* blocks can be nested one inside the other

Testing

- An important step in creating a program is to run it – to be sure it does what you expect it to do.
- We recommend that you use an **incremental development** process:
  - write a few lines of code and then run it
  - write a few more lines and run it
  - write a few more lines and run it…
  - This process allows you to find any problems and fix them as you go along.

Comments

- While Alice instructions are easy to understand, a particular combination of the instructions may perform an action that is not immediately obvious.
- Comments are used to document the code – explain the purpose of a particular segment of the program to the human reader.

Demo

- Ch02SnowpeoplewithComments
- Comments in this example world illustrate
  - description of the action performed by the entire method
  - description of the purpose of a small segment of code

Putting together the pieces

- A major part of learning how to program is figuring out how to "put together the pieces" that compose a program.
  - Analogy:

    putting together the pieces of a puzzle
- The purpose of this session is to
  - define the fundamental pieces of a program
  - demonstrate how to put the pieces together

Four Fundamental Pieces

- Instruction
- Control Structure
- Function
- Expression

Instruction

- An instruction is a statement that executes (is carried out by the computer at runtime).
- In Object Oriented Programming, an instruction is defined as a method.
- In Chapter 2, we used instructions to make objects perform a certain action.
  - Examples:

    snowman turn to face snowwoman

    spiderRobot move up 0.5 meters

Control Structure

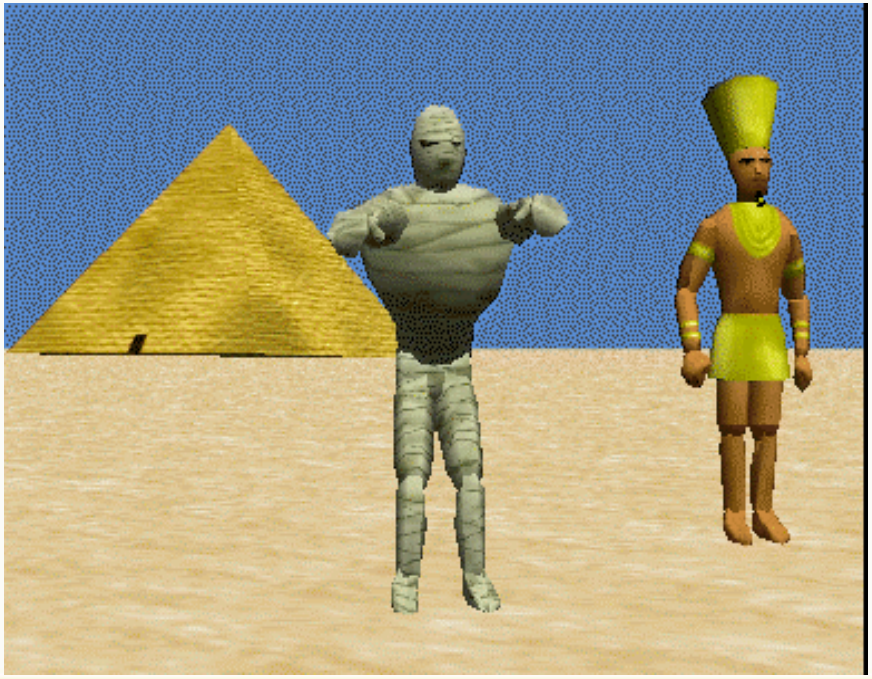
- A control structure is a statement that controls which instructions are executed and in what order.
  - In previous worlds, we used:
    - Do in order
    - Do together

Functions

- A function asks a question (to check a condition) or computes a value.
- In Alice, a function is used to determine
  - the properties of objects
    - **Is the snowwoman's face red?**
  - the relationship of one object to another
    - **What is the distance between the mummy and pyramid?**
  - a current condition
    - **What key (on the keyboard) was pressed?**
- Let's look at an example…

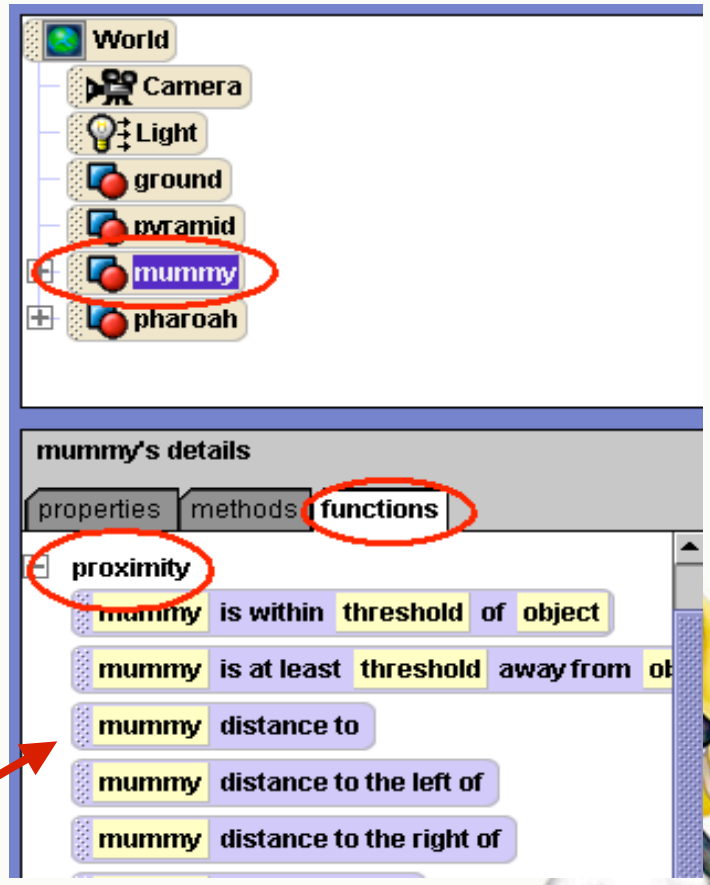
Problem Example

- A Hollywood movie set. The camera angle influences our perception of the scene. Is the mummy taller than the pharaoh? How far (meters) is the mummy from the pharaoh?



Built-in Functions

- Categories
  - proximity
  - size
  - spatial relation
  - point of view
  - other



This example illustrates some built-in proximity functions.

Values

- When a function is used to ask a question or perform a computation, an answer is returned.
- The answer is called a value.
- The type of value depends on the kind of function.
  - In our example, we want to ask the question:
    - What is the distance of the mummy to the pharaoh?
  - We expect to get a number value. It could be a whole number or a fractional value, such as
    - 3 meters or 1.2 meters

Demo

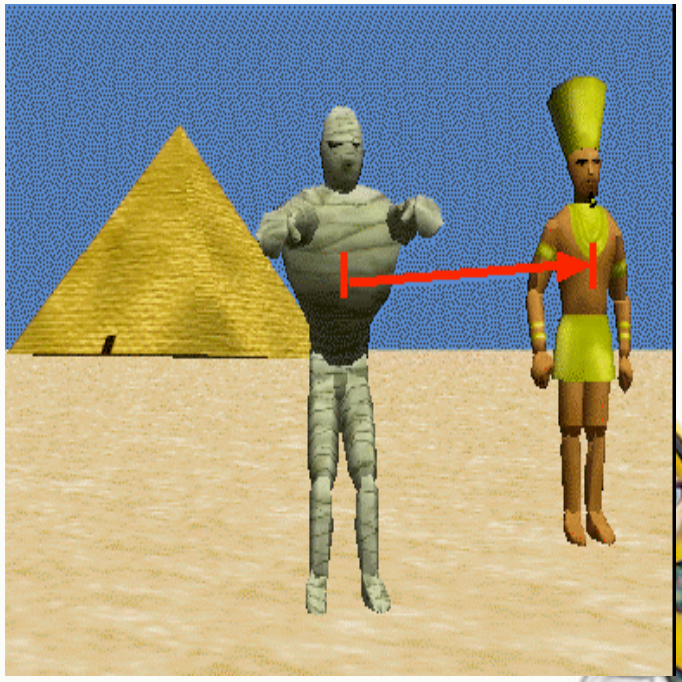
- Ch03Lec1mummyDistanceFunction
- Concepts illustrated in this example program:
  - The built-in *distance to* function determines the distance from the center of one object to the center of another object.
  - A function is not a "stand-alone" instruction; it is nested within another instruction.

Types of Values

- In our example, we used a function that has a number value. Other types of values include:
- Boolean
  - *true, false*
- String
  - "Oh, Yeah!"
- Object
  - snowman, helicopter
- Position in the world
  - (0, 0, 0) – the center of an Alice world

Problem: Collision

- When the program is run, the mummy collides with the pharaoh.
- The problem is the distance between two objects is measured center-to-center.
- One way to avoid a collision is to subtract a small number (1 or 2) from the distance.



Expressions

- An expression is a math or logic operation on numbers or other types of values
- Alice provides math operators for common math expressions:
  - addition +
  - subtraction –
  - multiplication *
  - division /

Demo

- Ch03Lec1mummyExpression
- Concept illustrated in this example:
  - Math expressions are created within an instruction.
  - Available math operators are +, -, *, /

Demo

- Ch03Lec1mummyExpressionV2
- Subtracting 2 meters from the distance is an arbitrary amount.
- To be more precise, we could subtract the width of the pharaoh.
- The resulting expression subtracts the value of one function from the value of another function.

Demo

- Ch03Lec1mummyExpressionV3
- To be even more precise, we could subtract half of the sum of the pharaoh's and mummy's width. That is,

  (width of the pharaoh + width of mummy)/2

- Now, the expression gives a very close estimate of the distance to move.

Assignment

- Read Chapter 2 sections 1 and 2
  - Scenarios and Storyboards
  - A First Program
- Read Tips & Techniques 2
  - Orientation and Movement Instructions
- Read Chapter 3 Section1, Functions and Expressions