Alice

Mathematical Expressions,
Conditional Statements, Control
Structures

Coverage

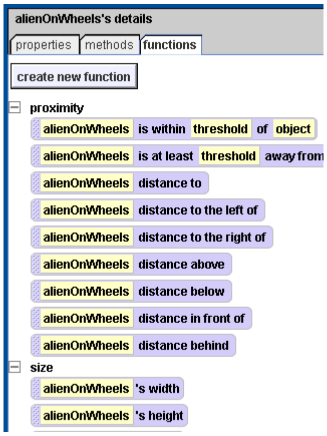
- Arithmetic Expressions
- Built-in Functions
- Conditional Execution
  - If/Then Statements
- Control Structures
  - Loops

Functions

- Alice provides a set of built-in **functions**
  - Similar to methods but like a mathematical function
  - Takes some input and computes some output
    - E.g. SquareRoot(25)
    - We say the function **returns** the value 5 and has an **input parameter** of 25
  - Built-in functions give us information about properties of objects and relationship to other objects (e.g. distance, position in world, width)

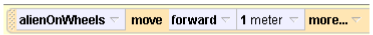
Functions

- Click on the functions tab after selecting an object


alienOnWheels's details
properties
methods
functions
create new function
proximity
alienOnWheels is within threshold of object
alienOnWheels is at least threshold away from
alienOnWheels distance to
alienOnWheels distance to the left of
alienOnWheels distance to the right of
alienOnWheels distance above
alienOnWheels distance below
alienOnWheels distance in front of
alienOnWheels distance behind
size
alienOnWheels 's width
alienOnWheels 's height

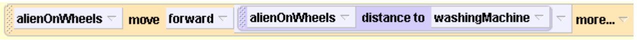
Arithmetic Function Example

- Make the alien on wheels move to another object
- If we use are not careful it will move right through the object
- We can experiment to find a good number



```
alienOnWheels move forward 1 meter more...
```

- More generally, we could change the distance it moves to the function that computes the distance between the two objects
  - Drag the distance function over the “1 meter” box



```
alienOnWheels move forward alienOnWheels distance to washingMachine more...
```

Arithmetic Function Example

- Now the alien moves to the middle of the object; how to fix this?

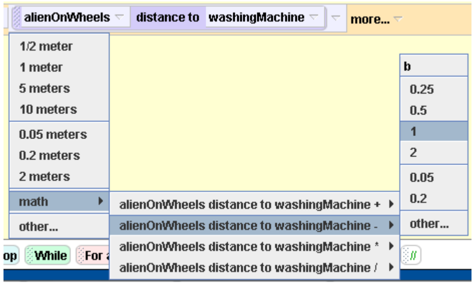
Arithmetic Function Example

- Should move a distance:

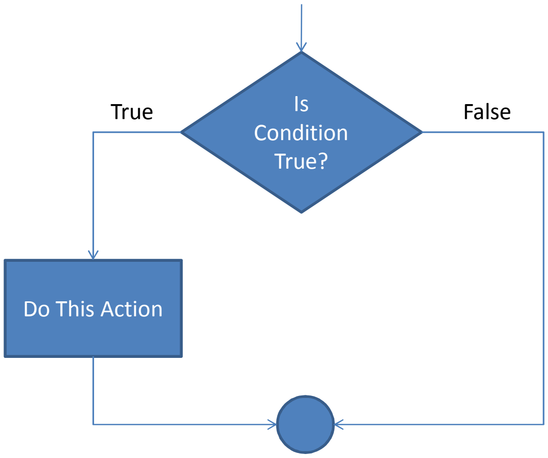
  (distance to object) – (Object width)/2 –

  (alien width)/2

  We can perform the math by clicking on the down arrow


alienOnWheels
distance to
washingMachine
more...
1/2 meter
1 meter
5 meters
10 meters
0.05 meters
0.2 meters
2 meters
math
other...
alienOnWheels distance to washingMachine +
alienOnWheels distance to washingMachine -
alienOnWheels distance to washingMachine *
alienOnWheels distance to washingMachine /
b
0.25
0.5
1
2
0.05
0.2
other...
op
While
For a
//

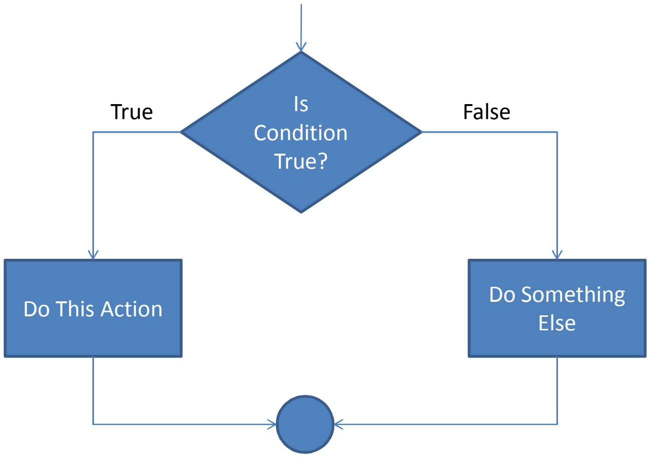
If-Then



To create, drag “If/Else” from bottom to the code window

Single Path If Statement

If-Then-Else



If / Else Statement

If/Else Example

- If the alien is smaller than the object
  - Move around it
- Else
  - Move right through it

- Can resize the object to check both cases

Relational Operators

- Relational operators are functions of the **world** object

A == B	A is equal to B
A != B	A is not equal to B
A > B	A greater than B
A < B	A less than B
A >= B	A gte B
A <= B	A lte B

If/Else Example

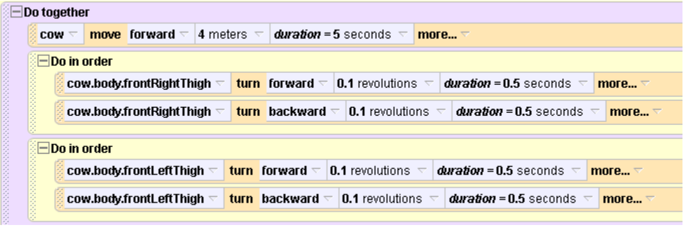
- If the alien’s height < 2 then
  - Move around it
- Else
  - Move right through it

- Change the number 2 to test both cases

Repetition

- Sometimes you want to repeat some code multiple times
- Example: Make a flying cow
  - Should wiggle front legs together as it flies, like a dolphin kick
  - Remember how to do this?

Flying Cow



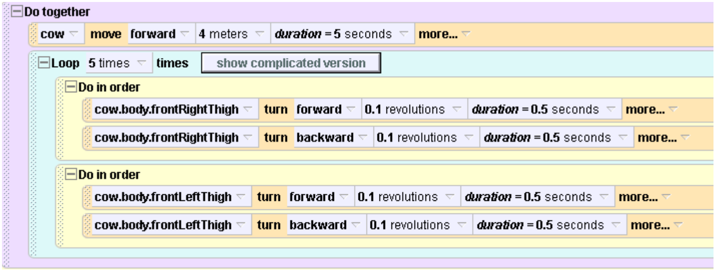
```
Do together
    cow  move  forward  4 meters  duration = 5 seconds  more...
    Do in order
        cow.body.frontRightThigh  turn  forward  0.1 revolutions  duration = 0.5 seconds  more...
        cow.body.frontRightThigh  turn  backward  0.1 revolutions  duration = 0.5 seconds  more...
    Do in order
        cow.body.frontLeftThigh  turn  forward  0.1 revolutions  duration = 0.5 seconds  more...
        cow.body.frontLeftThigh  turn  backward  0.1 revolutions  duration = 0.5 seconds  more...
```

- Problem: We would like the cow to wiggle her legs a total of 5 times, but it is a pain to copy the turn code 4 more times

Repetition

- We can use a loop to repeat any block as many times as we like
- Use LOOP to repeat something some known number of times
- Use WHILE to repeat something while some condition is true
  - Once the condition becomes false, the loop will stop

Version 1

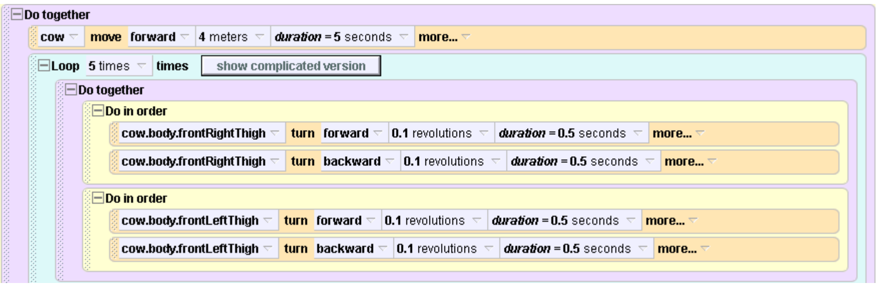


```
Do together
    cow  move forward  4 meters  duration = 5 seconds  more...
    Loop 5 times  times  [show complicated version]
        Do in order
            cow.body.frontRightThigh  turn forward  0.1 revolutions  duration = 0.5 seconds  more...
            cow.body.frontRightThigh  turn backward  0.1 revolutions  duration = 0.5 seconds  more...
        Do in order
            cow.body.frontLeftThigh  turn forward  0.1 revolutions  duration = 0.5 seconds  more...
            cow.body.frontLeftThigh  turn backward  0.1 revolutions  duration = 0.5 seconds  more...
```

Off a bit, why? Consider that we want the legs to move together like a dolphin kick, not running

Version 2

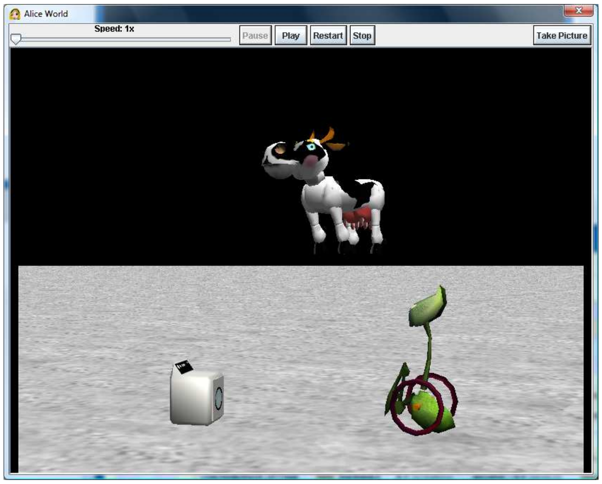
- The leg turning is done at the same time; requires another "Do Together" block



```
Do together
    cow  move  forward  4 meters  duration = 5 seconds  more...
    Loop  5 times  times  show complicated version
        Do together
            Do in order
                cow.body.frontRightThigh  turn  forward  0.1 revolutions  duration = 0.5 seconds  more...
                cow.body.frontRightThigh  turn  backward  0.1 revolutions  duration = 0.5 seconds  more...
            Do in order
                cow.body.frontLeftThigh  turn  forward  0.1 revolutions  duration = 0.5 seconds  more...
                cow.body.frontLeftThigh  turn  backward  0.1 revolutions  duration = 0.5 seconds  more...
```

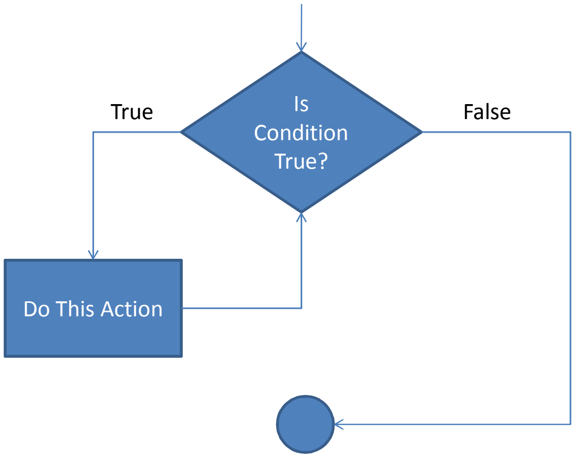
To try: Change Number of times to Infinity

Flying Cow



Reminder: Can also move camera around in the scene

While Loop

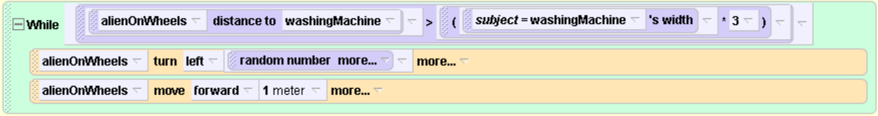


While Loop Example

- Make the alien try to randomly get close to the object
  - While (alien’s distance to the object > some value)
    - Turn some random amount
    - Go forward 1 meter
  - Say “Found it!”

Random Roll

- While Loop code
  - Many other versions possible



```
While alienOnWheels distance to washingMachine > ( subject = washingMachine 's width * 3 )
    alienOnWheels turn left random number more... more...
    alienOnWheels move forward 1 meter more...
```

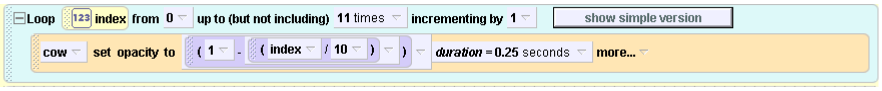
More Complex Loop

- If we click on the “Complex” loop then it shows additional loop options
- Most notably there is a loop “index”
  - This is a variable that holds a number for the current iteration of the loop
  - Sometimes we may want to do processing based on the index

```
Loop index from NUM1 to NUM2
     Loop body
```

More Complex Loop Example

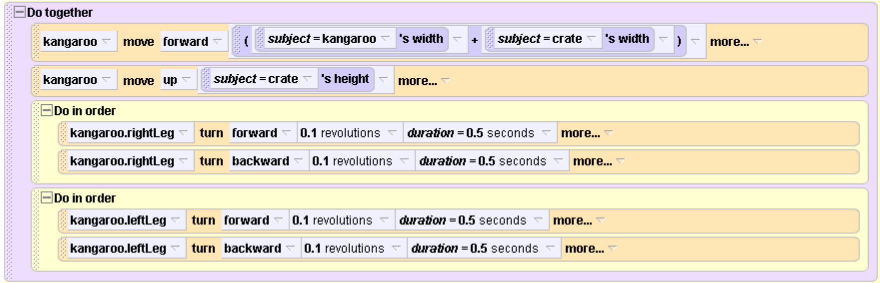
- The opacity property sets how transparent an object is
  - 0 = invisible
  - 1 = fully solid
- Use the complicated loop to make the cow
  - Fade from invisible to visible
  - Fade from visible to invisible



```
Loop 123 index from 0 up to (but not including) 11 times incrementing by 1   show simple version
    cow set opacity to ( 1 - ( index / 10 ) ) duration = 0.25 seconds more...
```

Class Exercise

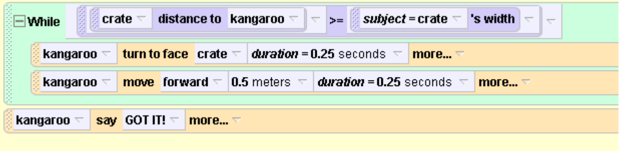
- Make a kangaroo jump onto a crate. The legs should make a hopping motion. Use the height/width of the objects to guide the forward and upward movements.



```
Do together
    kangaroo move forward ( subject = kangaroo 's width + subject = crate 's width ) more...
    kangaroo move up subject = crate 's height more...
    Do in order
        kangaroo.rightLeg turn forward 0.1 revolutions duration = 0.5 seconds more...
        kangaroo.rightLeg turn backward 0.1 revolutions duration = 0.5 seconds more...
    Do in order
        kangaroo.leftLeg turn forward 0.1 revolutions duration = 0.5 seconds more...
        kangaroo.leftLeg turn backward 0.1 revolutions duration = 0.5 seconds more...
```

Class Exercise 2

- Create a new event
  - Let the mouse move any object
- Create a loop so the kangaroo turns toward the crate and moves toward it ½ meter until it is close to the crate, then it stops and says “GOT IT”
  - Use the mouse to move the crate around; the kangaroo should chase it



```
While  crate  distance to  kangaroo  >=  subject = crate  's width
    kangaroo  turn to face  crate  duration = 0.25 seconds  more...
    kangaroo  move  forward  0.5 meters  duration = 0.25 seconds  more...
kangaroo  say  GOT IT!  more...
```