The Beauty and Joy of Computing

Lecture #17
Higher Order Functions

Putting Watson to use for City Apps

The City of Surrey in British Columbia, Canada is the first city to use IBM's Watson technology as the basis for a new app, "My Surrey". The app has been described as 'Siri for local government' because of the ability for users to use natural language to find answers.
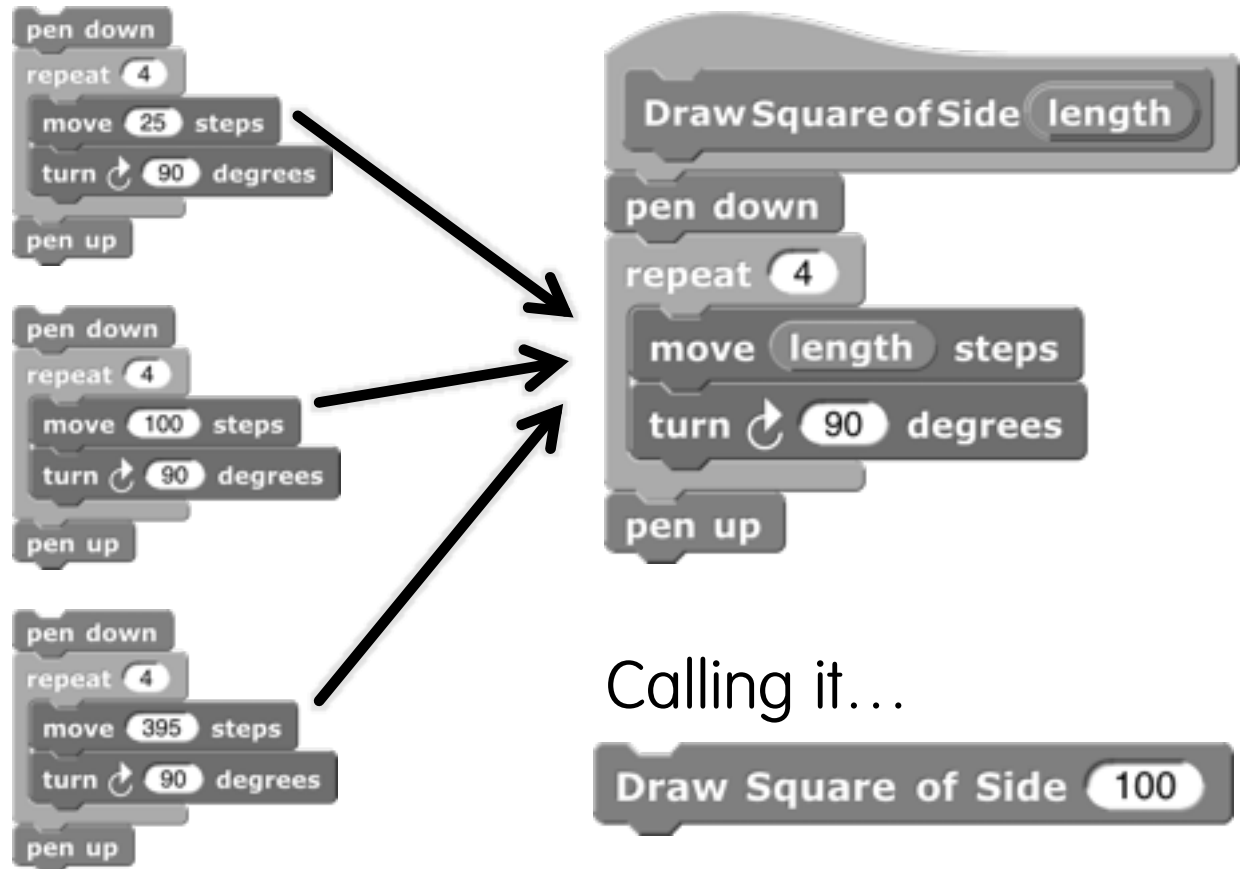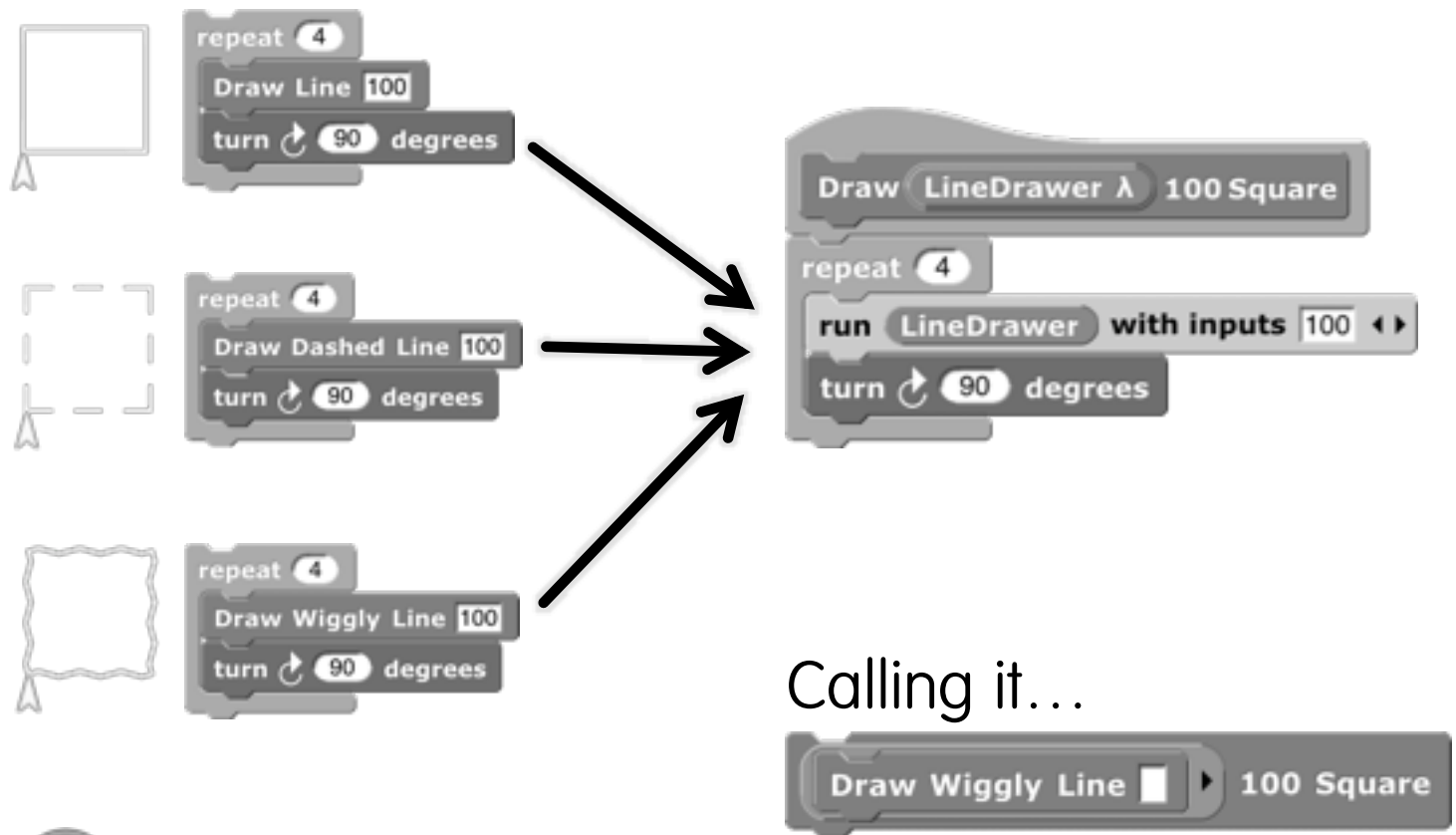
http://www.prweb.com/releases/2015/07/prweb12862131.htm

Higher Order Functions… Why? Basics…

Why Use Functions? (review)

Calling it…

Why Use Higher-Order Functions?

Calling it…

Why HOFs are like Pregnant Fish, Sharks

Data (e.g,. Sentences, Words, Booleans, Lists)

Functions

Normal Fish

Sharks

Data (e.g,. Sentences, Words, Booleans, Lists)

Data (e.g,. Sentences, Words, Booleans, Lists)

Data (e.g,. Sentences, Words, Booleans, Lists)

Functions

Pregnant Fish

Pregnant Sharks

Functions

Functions

Source: Brian Harvey, Wikipedia (Fbattail, Aka, Evdaimon)

**UC Berkeley "The Beauty and Joy of Computing": Higher-Order Functions (5**

HOFs you have seen before

Useful HOFs (you can build your own!)

- **map** `Reporter` **over** `List`
  - **Report a new list, every element** `E` **of** `List` **becoming** `Reporter(E)`

- **keep items s.t.** `Predicate` **from** `List`
  - **Report a new list, keeping only elements** `E` **of** `List` **if** `Predicate(E)`

- **combine with** `Reporter` **over** `List`
  - **Combine all the elements of** `List` **with** `Reporter(E)`
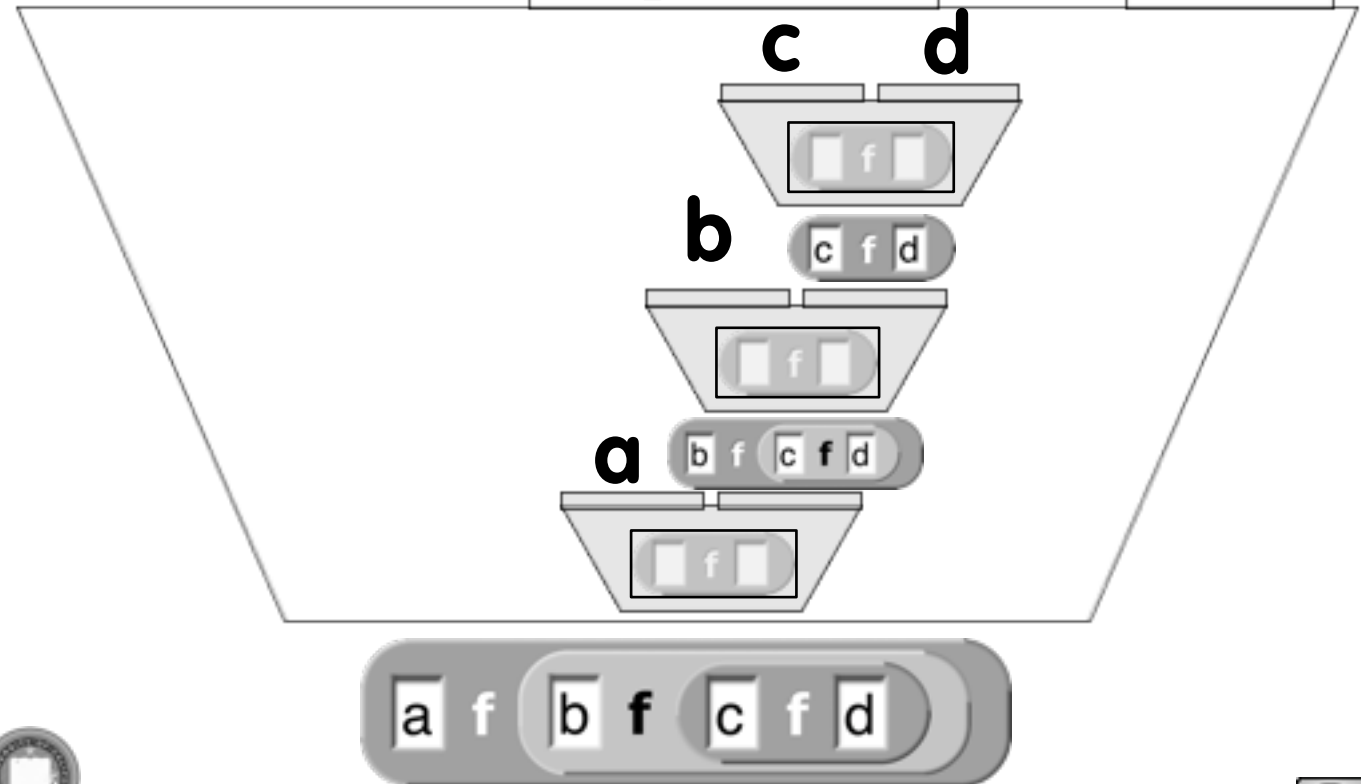 - **This is also known as "reduce"**
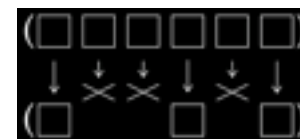
How combine works:

combine with **Reporter** over **List**
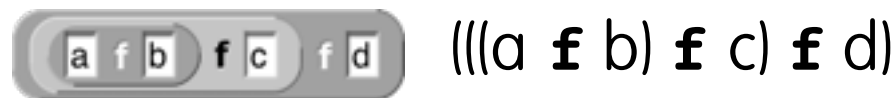
combine above the abstraction line

(a b c d)

combine using f

a **f** b **f** c **f** d
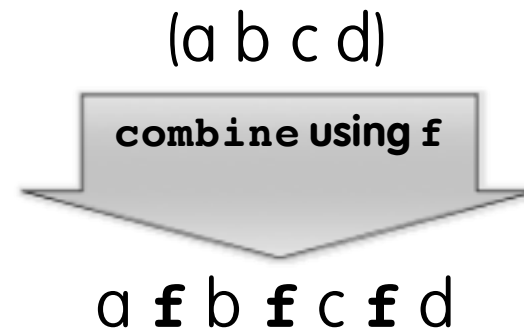
Your **f** should be **associative**, and work if it's

((a **f** b) **f** (c **f** d))
or…

(((a **f** b) **f** c) **f** d)
etc…

List

1	a
2	b
3	c
4	d

+ ▤ length: 4

Clicker Question

What is reported here?

a) abcd

b) acdb

c) bdac

d) dcba

e) (nothing)

L joinswap R

report join R L

combine with (joinswap) items of (list a b c d)

Acronym

Acronym Algorithm

input

1	the
2	Beauty
3	and
4	Joy
5	of
6	Computing

length: 6

(the Beauty and Joy of Computing)

keep only
uppercase words

(Beauty Joy Computing)

map first letter only

(B J C)

combine into one
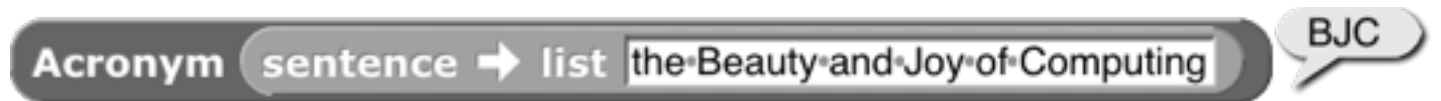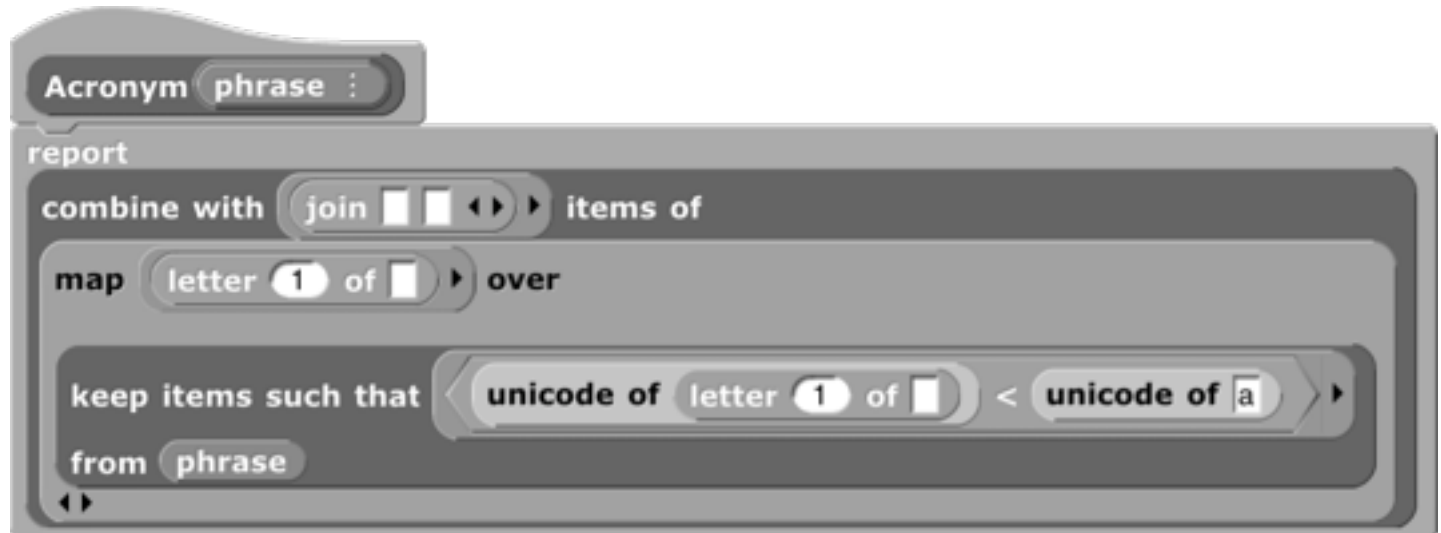word (join)

BJC

UC Berkeley "The Beauty and Joy of Computing": Higher-Order Functions (1

Acronym (uses `map, keep, combine`)

(Cal) Clicker Question

What is reported if I swap **keep** and **map** in Acronym and call it on `(the Beauty and Joy of Computing)`

a) bjc

b) BJC

c) CJB

d) (nothing)

e) Error

HOF Tools & Demo

HOF tools, sharks, pregnant fish, mymap