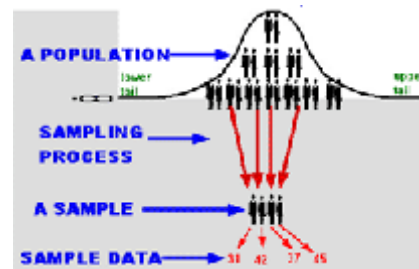


Detect Difference and Double Sample Lecture

Learning through Interactive Simulation

Quick Review



Example: Normal Sample Tool



Interactivity is crucial

Computer Simulation: Playing with interactivity

Process Learning:

Every Process proceeds in accordance with its structure.

Structure

NOT girders...

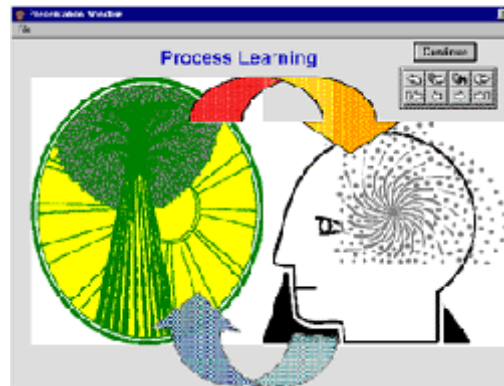
Grammatical Structure of Language

Structure of flow of stream

Mathematical Structure

Internal Processes adapt to...

By engaging in...



Examples

Language Learning

Learning a computer operating system

Learning a computer application

Through process learning we proceed in accordance with our learning structures

Language

Computer skills

Riding a bike

Old Media

Audience

Old media demand that you structure your processes to be passive

New Media

Example: Virtual Lab

Example: Double Sample Tool

Users are active

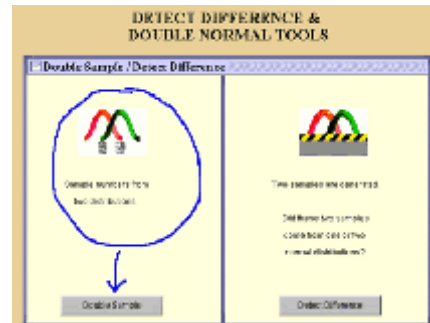
Users learn to structure their processes to fit structure of program

Users structure their internal processes to...

A new way of learning

Relationships between Populations and Samples

Double Sample Tool



Instructions

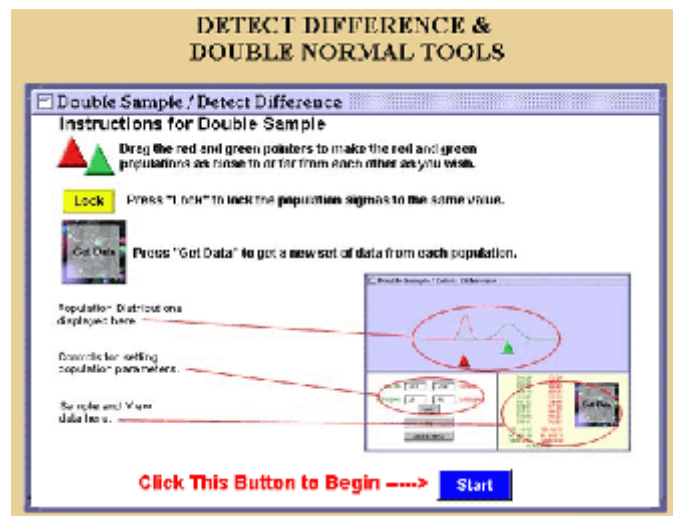
Lavender area

White Area

Yellow Area

Get Data Button

μ (m)



Sigma (s)

Lock

Some Statistics

M

S

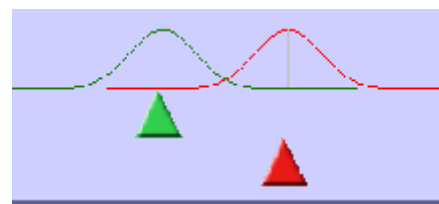
SEM

t

Playing with Data Simulations

Playing with mu (μ)

Distributions far apart



Data

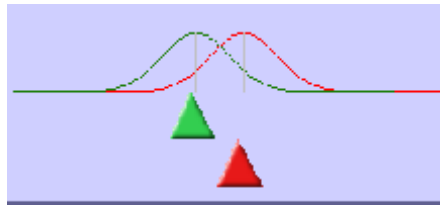
How much overlap?

Statistics

	Set Mu	100	187	Set Mu
		146.74		157.76
Set Sig		127.42		212.87
		77.94		165.83
		77.64		168.95
		71.85		180.39
		95.01		189.71
		74.99		182.24
		132.51		175.22
		108.66		187.67
		107.96		202.81
	SD:	25.53		SD: 15.95
	M:	102.07		M: 182.35
	SEM:	8.51		SEM: 5.31
	t=:	-7.9991		

M green vs M red

What about t?

Distributions close together

Set Mu Set M.
 Set Sigma Set Sigma

106.61	152.96
144.97	173.78
119.23	143.61
133.26	151.57
123.61	194.20
111.95	187.55
128.84	175.43
170.45	141.02
144.21	144.03
182.39	177.33
SD: 23.32	SD: 18.72
M: 136.55	M: 164.15
SEM: 7.77	SEM: 6.24
t: -2.7673	

Data and Statistics

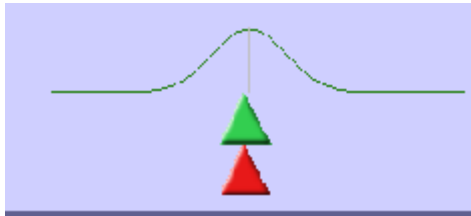
Means

What about t?

Distributions very close*(Do this section on your own, using Double Sample Tool)*

Means

What about t?

Extreme Case

Set Mu Set Mu
 Set Sigma Set Sigma

94.72	187.72
119.53	131.61
149.74	117.36
142.10	133.58
167.57	184.18
149.39	174.45
136.12	149.50
149.31	150.51
115.82	141.46
120.77	130.16
SD: 20.47	SD: 23.12
M: 134.51	M: 150.05
SEM: 6.82	SEM: 7.70
t= -1.5100	

Data and Statistics

Means

What about t?

Extreme Case reduces to one population

Two samples from one probability distribution

Generalizations

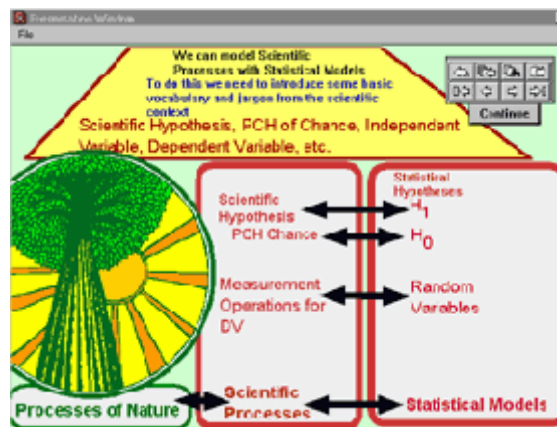
A Puzzle

The heart can be compared to a pump. When it contracts, it pumps blood through the blood vessels and pressure increases. This is systolic blood pressure. When the heart relaxes between beats, the pressure decreases. This is diastolic pressure. It is generally thought that a "normal" (i.e., healthy) blood pressure reading for an adult is 120/80. BP is measured in mm of mercury.

Here is a specific example of a very common research puzzle. Suppose a group of scientists is working on developing a new chemical formula for a pill to lower blood pressure. Suppose they have two groups of volunteer participants. (They plan to test this new chemical first on people with normal blood pressures.) They give one group (Control Group) a placebo pill and the other group (Experimental Group) a pill based on the newly developed chemical that might lower blood pressure. No one knows if it lowers blood pressure or not; that's why the scientists are doing research--to find out.

At the end of the study they have two samples of numbers, one sample from each group. They have to figure out from these two sets of numbers if this chemical is worth pursuing, or whether they would be better off pursuing another line of research.

Constructing a Model of the Puzzle



Mysteries of the Universe

Measurement Operations

Statistical Models

Normal Distribution as model of DV measurement operations

Treatments and Treatment Effects

Treatment Effect Size

Construct a Model

Effect size = -10 mm of Hg

Effect size = -5

Effect size = -2

Homogeneity of Variance

Summary

Simulating the Experiment

Effect size = 0

Simulating an INEFFECTIVE treatment

Record your observations for five simulations with Double Sample Tool

Do the two data sets overlap a lot in each of the 5 simulations?

Means

Does which of the two means is higher change from one simulation to the next?

0 Effects size means that ...

Simulate Effect Size = -10

Click the **Get Data** button several times

How much do the data overlap?

What about the Means?

What about t?

Simulate Effect Size = -5

Click the **Get Data** button several times

How much do the data overlap?

What about the Means?

What about t?

Simulate Effect Size = -2

Click the **Get Data** button several times

How much do the data overlap?

What about the Means?

What about t?

Effect Size NOT = 0 means that...

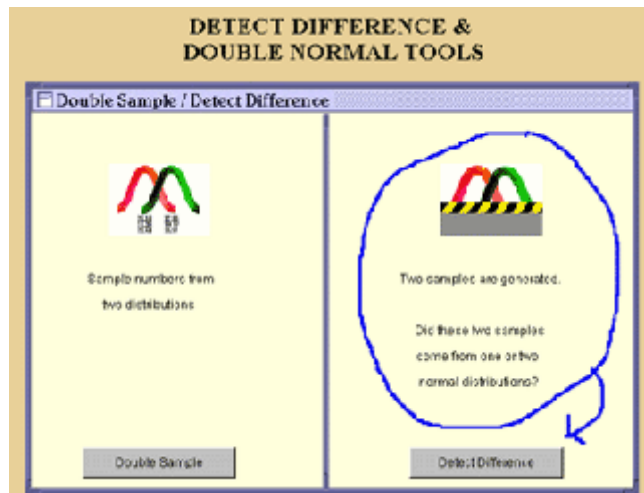
Treatment Populations

Wrap up Double Sample Tool

Your experience

Summary

Getting to the Detect Difference Game



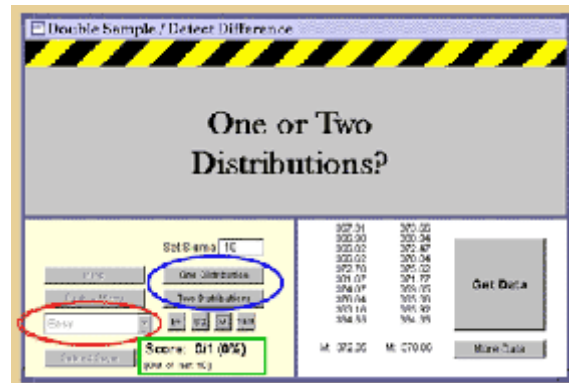
Simulating a Scientific Puzzle

The Detect Difference Game

Instructions

Set level of difficulty

Get Data



Make a scientific decision

Press either One or Two Distributions

Score

Statistical Resources

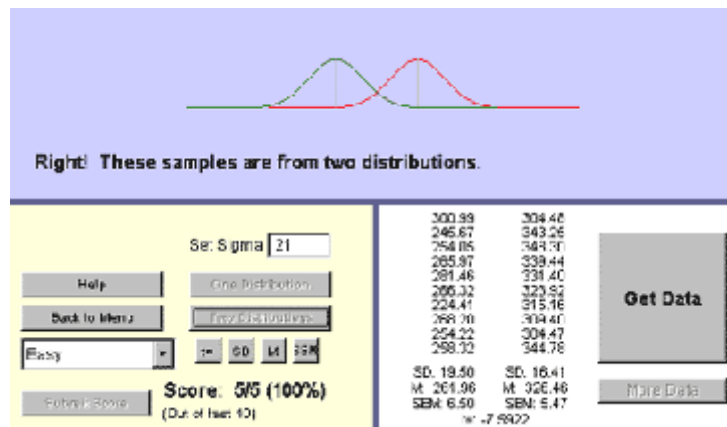
M

S (or SD) (or Standard Deviation)

SEM

t

Feedback



Philosophical Aside

Models are only models; they don't exist

Levels of Difficulty

How do I get a decent grade?

Think about the data and statistics carefully

Replicate: The Get More Data button

Playing with Sigma in Double Sample Tool

Compact (narrow) distributions

Sample Standard deviation

Sample Means and Populations Sigma's

Spread out (wide) distributions

Sample Standard deviation

Sample Means and Populations Sigma's

Interesting Generalizations