Is Yawing Contagious?
Permutation tests in Algebra 2

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CCSS S-IC.5

Use data from a randomized experiment to compare two treatments; use simulations to decide if differences between parameters are significant.

Examining the Mythbusters Claim

- Video
- Simulate!
- Applet simulation

Memory Test

- Means
- Technology options

Simulation tools

- Physical
  - cards
  - coins
  - 3x5 cards
- Applets
  - rossmanchance.com
  - StatKey (Locke5)
  - statcrunch.com
- Calculators
- Fathom
- *Statistical Reasoning in Sports*, Josh Tabor
- *Stats: Modeling the World 4e,* Bock (See "What If…?" features)

Is Yawing Contagious?
Did the Mythbusters Get It Right?

1. What is the claim the Mythbusters is testing?

2. Describe the two different treatment groups.

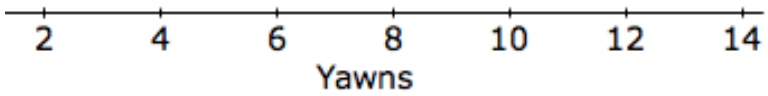
3. This is their data. Describe their conclusion.

Observed Results

	Seeded	Control	
Yawn	10	4	14
No Yawn	24	12	36
	34	16	50

4. Now run the simulation using your cards. How many Yawns were in your Seeded treatment group?

5. Run the simulation again. Collect at least 10 simulation results from your classmates. Place them on this dotplot.



6. Your teacher will provide with the simulation results with 1000 runs. What is the probability of a random process producing 10 or more Yawns?

7. Describe what this simulation tells you about the Mythbuster's conclusion.

Memory

Given 32 randomly selected numbers, volunteers are asked to memorize as many digits as they can in 30 seconds. Here are the results, separated by gender:

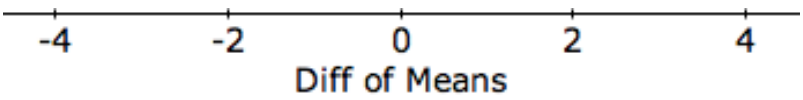
m	12, 16, 13, 14, 13, 15, 19, 13, 15, 22	mean(male) = 15.2
f	11, 14, 19, 19, 19, 15, 16, 9, 11, 11	mean(female) = 14.4

1. Make a graphical display that shows the differences in the gender memorization skills. Describe your graph.

2. Do you think that this result shows that males are better at memorization than females? Explain.

3. Use 3x5 cards (shuffled) to create two different groups of 10 scores. (or use technology to do this!). What is the difference of the two means for a random shuffle?

4. With your classmates, gather at least 30 randomly created mean differences. Graph them below.



5. Based on the results of the class simulation, do you think that the difference we observed is statistically significant? Explain.

Is Yawing Contagious?
Did the Mythbusters Get It Right?
Suggested Solutions

1. What is the claim the Mythbusters is testing?

   They are testing to see if another person yawning will make it more likely that a person will yawn.

2. Describe the two different treatment groups.

   One group of people were observed in a room with nothing done to them.
   The other group were given a treatment: Kari yawned as she led them to their waiting room.

3. This is their data. Describe their conclusion.

Observed Results

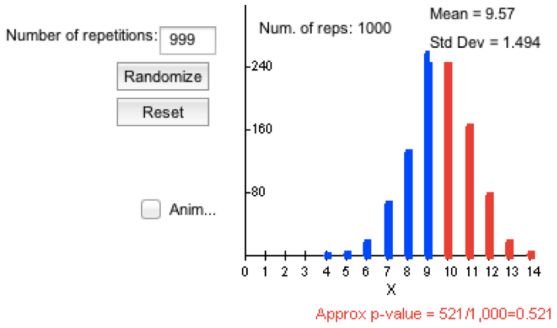
	Seeded	Control	
Yawn	10	4	14
No Yawn	24	12	36
	34	16	50

   Out of the 34 people in the treatment group, 10 yawned = 29%.
   In the control group, 4/16 people yawned = 25%.
   Mythbusters concluded that this 4% difference is a big enough difference to prove that yawning is contagious.

4. Now run the simulation using your cards. How many Yawns were in your Seeded treatment group?

5. Run the simulation again. Collect at least 10 simulation results from your classmates. Place them on this dotplot.

6. Your teacher will provide with the simulation results with 1000 runs. What is the probability of a random process producing 10 or more Yawns?



7. Describe what this simulation tells you about the Mythbuster's conclusion.

   Given that 10 or more yawns will happen about half the time just by random assignment, it is very clear that this difference is very likely to happen by chance. Thus we conclude that Mythbusters did not succeed in finding a statistically significant difference between treated yawns and the control yawns. They did not prove that yawning is contagious.

Memory
Suggested solutions

Given 32 randomly selected numbers, volunteers are asked to memorize as many digits as they can in 30 seconds. Here are the results, separated by gender:

m	12, 16, 13, 14, 13, 15, 19, 13, 15, 22	mean(male) = 15.2
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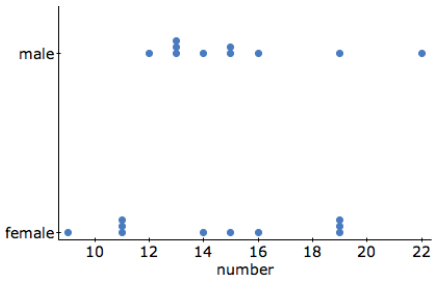
1. Make a graphical display that shows the differences in the gender memorization skills. Describe your graph.



Females appear to have slightly lower scores than males. The male scores are skewed to the right.

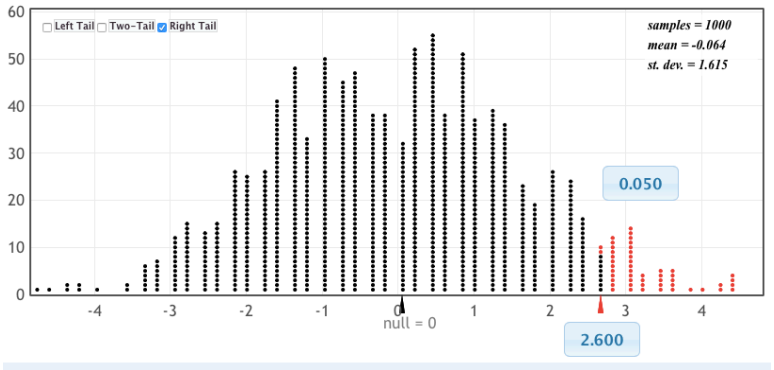
2. Do you think that this result shows that males are better at memorization than females? Explain.

While the male average is slightly higher, it is not a very big difference. An average difference of 0.8 could just be random variation.

3. Use 3x5 cards (shuffled) to create two different groups of 10 scores. (or use technology to do this!). What is the difference of the two means for a random shuffle?

4. With your classmates, gather at least 30 randomly created mean differences. Graph them below.

5. Based on the results of the class simulation, do you think that the difference we observed is statistically significant? Explain.



If the means were different by 2.6 or more, that would be very unusual and happen only 5% of the time. So a difference of 0.8 appears to the type of difference that could just happen by random chance.

37 93 85

97 13 72

42 31 28 21

98 83 25 94

92 30 12 69

63 99

20 40

60 54

61 55 24 11

70

62 88 45