"Struck by Lightning" Supplementary Materials

Group Exercise about P-Values

Your group should have three cards, each of a different suit (Clubs / Diamonds / Hearts). Working cooperatively with your group, consider the following questions:

1. Suppose someone claimed they had psychic powers, and that any time you put a card face-down on the desk, they could GUESS which of the three suits it was. According to current scientific practice, how many correct guesses in a row would they need before you believed that they had this power? (Explain your answer using precise mathematics.)

NOTE: Once you have finished question #1, confirm your answer with the instructor before starting the next question.

2. Have each member of your group try the following guessing game (with no cheating), the number of times determined in question #1, keeping track of all the results:

(a) Someone else shuffles the three cards, and then carefully places one of them face-down on the table.

(b) The group member stares at the face-down card.

(c) The group member guesses which suit it is.

(d) Someone else checks to see if they were correct.

3. Repeat question #2, replacing step (b) by:

(b′) The group member runs their fingers over the face-down card.

4. Repeat question #2, replacing step (b) by:

(b″) The group member deeply inhales the air over the face-down card.

5. Repeat question #2, replacing step (b) by:

(b‴) The group member lifts up and feels the face-down card (but without ever seeing the card's front).

6. Make a list of which group members (if any), using which of the above four methods, did manage to guess correctly the appropriate number of times in a row (as determined in question #1).

7. Do you believe that your results <u>prove</u> that the students using the methods listed in question #6 do indeed have psychic powers? Why or why not? (If you have <u>no</u> students and methods listed in question #6, then answer this question <u>pretending</u> that you did.)

8. In what ways are the students and methods listed in question #6 analogous to medical studies about new pharmaceutical drugs? Explain.

9. What trick does this experiment suggest that pharmaceutical companies could employ, if they were desperate to get a new drug approved?

10. What steps could be taken to prevent pharamceutical companies from employing this trick?

11. What further experiments could be done, to further clarify the results listed in question #6? (Provide details.) What do you think the results would be?

12. How is the previous question related to cases where a certain medical "fact" is established by one study, but then later contradicted by another study?

Bonus Question (if time): Suppose someone claims they can <u>usually</u> (not always) guess the correct suit. They take the test described in question #2, 10 times in a row, and guess correctly 9 times (and wrong one time). What is the p-value corresponding to this experiment? What would you conclude from this experiment?