



# CALIFORNIA STATE SCIENCE FAIR 2006 PROJECT SUMMARY

<b>Name(s)</b> Connor J. Kreeft	<b>Project Number</b> <b>J1219</b>
<b>Project Title</b> <b>Are the Cards Stacked Against You? The Randomness of Card Shuffling: Manual vs. Automatic</b>	
<p style="text-align: center;"><b>Abstract</b></p> <p><b>Objectives/Goals</b> The purpose is to determine whether the manual riffle method of shuffling a deck of cards produces a more random deck than an automatic card shuffling machine. I hypothesize the manual riffle shuffle method will produce a more random deck. I do not believe the automatic card shuffler will produce a thorough, professionally shuffled deck after the third shuffle as stated in the instruction manual.</p> <p><b>Methods/Materials</b> New decks of standard playing cards were opened and numbered in order from 1 to 52. One deck of cards was shuffled by the manual riffle method. The numerical order of the cards was recorded, beginning with the top of the deck. The process of shuffling and recording was repeated for a total of eight riffle shuffles. The experiment was then conducted using the Deluxe Card Shuffler, instead of the manual riffle method. The entire experiment was run eight times. The data was analyzed with respect to the frequency of rising sequences of cards at each shuffle.</p> <p><b>Results</b> The frequency of rising sequences in each shuffle was much higher when the automatic card shuffler was used. After the third shuffle, the number of rising sequences ranged from 6 to 14, and 14 was the most common. After five shuffles, the number ranged from 2 to 8, and 8 was the most common. After seven shuffles, the number ranged from 1 to 7, and 5 was most common. The manual riffle method was clearly better at randomizing the deck. After the third riffle shuffle, the number of rising sequences ranged fairly evenly from 3 to 13. After five riffle shuffles, the number ranged from zero to 7, and zero was the most common, followed by 2. After seven riffle shuffles, the number ranged from zero to 3, and zero was the most common, followed by 1.</p> <p><b>Conclusions/Discussion</b> The manual riffle method of shuffling was more effective at randomizing the deck of cards than the automatic card shuffling machine. The manual riffle method consistently produced a more random deck by the fifth shuffle. In contrast, the automatic card shuffler did a very poor job of randomizing the deck, even after eight shuffles. The data clearly disproves the claim in the instructions of the Discovery Home Casino Deluxe Card Shuffler that using the card shuffler two to three times will produce a "thorough, professional shuffling."</p>	
<b>Summary Statement</b> My project tests whether the manual riffle method of shuffling a deck of cards is more effective at randomizing the deck than an automatic card shuffling machine.	
<b>Help Received</b> Mother helped type report and did all manual riffle shuffling.	