## CALIFORNIA STATE SCIENCE FAIR 2006 PROJECT SUMMARY

## Name(s)

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Project Number J0305

## Project Title

## Perception of Randomness

## Objectives/Goals

Abstract
How does human perception of randomness compare to real randomness? Can people accurately simulate a string of random coin flips, or will they alternate between heads and tails too often? How does this change with age?

## Methods/Materials

Forty-one 5th-graders, 70 8th-graders, and 72 adults (age >=21) pretended they were flipping a coin 35 times and wrote the results as a string of heads and tails. A calculator simulation created 10,030 random strings of length 35 and counted the number of runs (consecutive heads or tails) in each. The runs in the subjects' strings were counted. The means and medians of the subjects and each of the three age groups were compared to the simulation. The mean of each group was compared to that of each other group using Student's T-test, and their variances were compared using the F-test.

## Results

Each of the age groups, and the pooled subjects, had higher means and medians (more runs) than the simulation. T-tests showed no significant differences between the means of the three age groups. When variances were compared, 5th-graders had the highest variance (their results were more spread out), 8th-graders had lower variance, and adults had the lowest. All the F-tests comparing these variances showed statistical significance at $\mathrm{p}<=0.05$, and the difference between 5th-graders and adults was significant at $\mathrm{p}<=0.005$.

## Conclusions/Discussion

Children and adults alike have the mistaken belief that a coin alternates from heads to tails and back again more often than it actually does. Adults display lower variance, perhaps because of having acquired a more standardized (and incorrect) notion of randomness. The 5th- and 8th-graders had similar means to the adults, but their higher variances suggested less standardized and therefore more realistic perceptions of randomness. Variance decreases with increasing age, suggesting a uniform and incorrect perception of randomness that becomes more ingrained with time.

## Summary Statement

People imagining a coin flip sequence alternate between heads and tails too often, and variance decreases with increasing age, suggesting a uniform and incorrect perception of randomness that becomes more ingrained with time.

## Help Received

Dad helped pass out questionaires to adults

