Personal or Computer Agency?

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When students first start exploring chance, there are always a few who insist that they can control the outcomes of the spinner (Cha 1 on the Chance construct map). And, there are always a few who wonder whether or not the samples generated with Tinkerplots are due to chance or to some unseen but biased programming. To explore these notions, I adapt the curriculum guide in Unit 5 re Melissa's Spinners so that some students use hand held spinners to generate samples of 10 spins of the equally partitioned red and blue spinners while other students use Tinkerplots Sampler to generate the data. Prior to the collection of the data, the class talks about the potential effects on the data of a person spinning differently each of 10 times, and the potential effects of combining the data from different experiments (different samples of ten spins). Some students have suggested an analogy to the effects of measurement error on the center of the measurements: Any biases tend to be counterbalanced, much in the manner of gaps and laps when measuring with a ruler. This balance notion predicts little effect of individual differences on the outcomes. Other students tend to hold stronger conceptions of personal agency and are not convinced by the analogy. Some students suggest that if people do approximately the same thing each time that they spin, each outcome will be uncertain but that if enough spins are combined, it will be "about 50-50."

I display each student's bar graph of the number of red and blue outcomes on the wall of the classroom, organized in the manner suggested by Unit 5 guide. As we examine the data, we see that the outcomes of the "controllers" look a lot like those of the non-controllers, and that the computer results are as variable as those obtained with the hand held spinners. Relatively rare outcomes, such as 1 red and 9 blue, occur even with students who don't control the outcomes! Students also notice that the controlling students do not have any significant impact on the accumulated trials, which tend toward the relative frequencies expected by the equal areas of red and blue on the spinner. I use the accumulation of the trials to bring up the assumptions we are making when we combine outcomes: each trial spin, most visibly for the hand-held devices, is not exactly alike, but they are the equivalent in that red or blue is equally likely, even if one time we spin clockwise, another time counterclockwise, or we combine the spins of different students, each of whom does not spin in exactly the same manner. This is the concept of trial (Cha 2). The variability of the results obtained with the computer suggests that it also mimics this process of uncertain outcome for any particular trial, as well as the predictable proportions of outcomes, if we accumulate sufficient repetitions of the spinning process. This image of repeated process is vital to maintain as it goes to the heart of what a sample is—a portion of the repeated process.