Motion Experiment - The Domino Effect

Purpose

To investigate how distance, time, and average speed are interrelated by maximizing the speed of falling dominoes. Also to practice basic graphing techniques.

Required Equipment

approximately 50 dominoes, stopwatch, meter stick

Discussion

When we measure the speed of an automobile, we measure the rate at which an easily seen physical thing moves over the ground. We can determine the number of kilometers (distance) traveled in one hour (time). When we measure the speed of sound, we must measure the rate at which this energy moves, even though we cannot see it. In this experiment, you will measure the rate of motion of a falling row of dominoes. In effect, you will measure both the rate of physical thing (the dominoes themselves), and the energy associated with it.

The independent variable we will choose, is how close the dominoes are to one another before they are knocked over. We can call this the domino spacing distance (see Figure 1). The dependent variable will be the speed that the dominoes fall over. In this experiment we will see how the spacing of the dominoes effects the speed with which they fall.

Procedure & Calculations

After each step of the procedure, fill in the Data Table provided on a separate sheet. Instructions on how to do the calculations are also there. Also, refer to Figure 1 as needed.

Step 1: Set up 50 dominoes in a straight row, with an equal spacing between each domino. Start with a small spacing between each domino, roughly 1 cm.

Step 2: After you are finished setting up your row of 50 dominoes, measure the total length of your row in cm.

Step 3: Compute the average spacing distance between dominoes. Divide the total length of your row (Step 2) by the number of dominoes (50).

Step 4: Measure the length of a domino.

Step 5: Compute the average spacing distance between dominoes in units of domino lengths. Divide the average spacing distance (Step 3) by the length of one domino (Step 4).

Step 6: Gently push over the first domino so that it knocks down the entire row. Time how long it takes from your initial push until the last domino hits the table.

Step 7: Compute the average toppling speed for your row of dominoes. Divide the total length of your row of dominoes (Step 2) by the time it takes for your dominoes to fall down (Step 6).

Step 8: Repeat steps 1 thru 7 five times, each time increasing the spacing each time. Try to get the five values of average spacings to evenly cover the possible spacings from the minimum of 0 cm to the maximum of 5 cm.

Graph

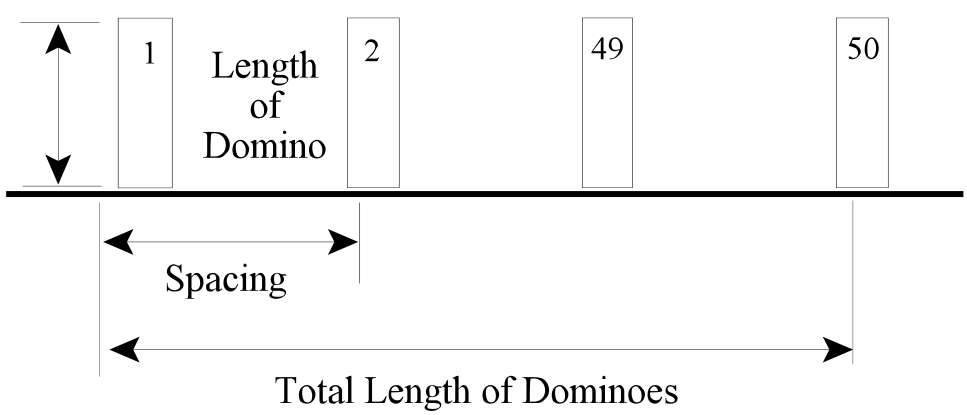
Graph the average speed (Step 7) on the y-axis versus the spacing between dominoes (Step 5) on the x-axis. Leave plenty of extra room on the y-axis for the data from the rest of the class. After your instructor has checked your data plot the data from the rest of the class from the list on the board. Use circular point protectors (and color if you like) for your data, and triangular point protectors for the data from the rest of the class.

Lab Write-Up

Your lab report should include the following:

1. A cover sheet with a title, your name, and the name of your lab partners.
2. A data table (provided) with the data filled in.
3. A graph as described above on the graph paper provided.
4. The conclusion questions answered in the spaces provided.

Figure 1



Conclusion Questions

1) What is the definition of constant speed?

2) Why was the term average speed used in this experiment, rather than the term constant speed?

_____________3) From your graph, what was the maximum toppling speed

_____________4) In general which spacing between dominoes (from the x-axis of your graph) resulted in the greatest toppling speed?

__________ 5) At the maximum toppling speed of the row of dominoes, how long a row of dominoes would be required to take 1 min to fall?

6) Are there any factors that might effect the outcome of this experiment (in other words, any that should be controlled)? Name one. DO NOT use the two variables that were used in the experiment itself.

7) EXTRA CREDIT: Explain why the curve on your graph has the shape that it does? You need to mention something(s) other than the domino spacing.

Data Table

	Trial 1	Trial 2	Trial 3	Trial 4	Trial 5
Step 2: Length of domino row (cm)					
Step 3: Average Spacing (cm)					
Step 4: Length of One Domino (cm)					
Step 5: Average Spacing (dominoes)					
Step 6: Time to fall (sec)					
Step 7: Average Speed of Fall (cm/sec)					

Class Data

Group 1		Group2		Group 3		Group4		Group 5		Group 6	
Spacing (cm)	Speed (cm/sec)	Spacing (cm)	Speed (cm/sec)	Spacing (cm)	Speed (cm/sec)	Spacing (cm)	Speed (cm/sec)	Spacing (cm)	Speed (cm/sec)	Spacing (cm)	Speed (cm/sec)

Graph - Spacing versus Speed