

# TURTLE MUSIC

New Mexico Adventures in Supercomputing Challenge

Final Report

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## **SYNCHRONICITY**

### **INTRODUCTION:**

Synchronicity happens when events in space and time that seem unrelated, happen at the same time. When activities are synchronized, they seem to happen in cycles. First they begin randomly, and then seem to adjust their rates to each other, and then peak in synchronicity. Then they fall out of synch and die. Sometimes these cycles go on for a long period of time and sometimes for a short time. Our project is about synchronicity that takes place in everyday living and how it happens. We did this project because we were curious about synchronicity and wanted to explore its many mysteries. Through our research, we realized that synchronicity happens automatically in real life and it's very complex.

### **EXECUTIVE SUMMARY:**

Synchronicity is the relation that exists when things happen at the same time. It happens all the time and people don't have a real understanding of why it happens. It can be found in the activities of many things like cars in traffic. Why do these cars seem to go and stop in synch? What would happen if each car on a freeway were to pay attention only to its own rhythm and was to ignore the rhythm of all the other cars? This would cause chaos and accidents because each car would be going and stopping whenever it felt like it. Do things always have to in synch? Why do some go in and out of synchronicity and how long do they stay synchronized? People who go to concerts seem to clap in and out of synchronicity at different times. How long do they stay synchronized in their clapping? Would the atmosphere in a concert hall be the same if people didn't synchronize their

applause? These are some of the questions that led us into investigating this mystery in our project.

### **DESCRIPTION:**

We became curious about the synchronicity of clapping when our class attended a concert last fall at the Lensic Theater, in Santa Fe, New Mexico, where we go to school. The performer was so awesome that after every song, the kids began to clap. At first, they would clap randomly, and then after a while, we realized that they began to synchronize their clapping with others until the whole theater was in sync. We wrote a Star logo program to model this synchronicity.

### **PROBLEM DEFINITION:**

When attending a performance, most people in the audience like to show appreciation for a good performance by clapping. During such performances a person usually hears the initial thunder, which often turns into synchronized clapping. At the beginning, the clapping is totally uncoordinated, but slowly builds up to become a sudden synchronized clapping after which everybody claps simultaneously and periodically. This synchronization can disappear and reappear several times during the applause.

Synchronized clapping is just one example of a phenomenon of social self-organization. In nature synchronization can also be found in the flashing of the Southeast Asian fireflies, which seem to flash in a rhythm, cicadas plucking spikes on their legs during the summer to find mates. In this project, we wanted to find out the impact that the duration of clapping has on the audience. We wanted to find out if the size of an audience would affect the length of time it took to clap in synch.

Our hypothesis was that the larger the group, the longer it would take to synchronize clapping. In order to test our hypothesis, we did two things:

First we went around classrooms at our school and asked student to clap. We recorded how long it took them to synchronize their clapping. Second, we wrote a Star logo model of what we did in order to simulate what was happening in these classrooms.

### **RESULTS:**

After performing our experiment 3 times with each group, we averaged our findings and made a graph to show our findings.

Average group size	Time it took to synchronize in seconds.
20	2.2
15	2.2
10	2.2
5	2.2

### **MATH MODEL:**

**Ic = Initial clapper**

**Fc = Following Clappers (those who adjust their clap-rate to the initial clapper).**

$$Ic(Ic+1)=(Fc1+Fc2+Fc3+Fc4)/4$$

**Our math model is based on a theory that people follow a single leader to adjust their clap rate to this initial clapper. In the math equation above, (1c) stands for a person who sets a rate of clapping. The people on each side of the (1c), (Fc1, Fc2, Fc3, and Fc4) set their own clap rates to the clapping rate of the (1c) until all of them are in synch.**

**In the first synchronized group, the process begins again with the 5 initial clappers who are in synch. The person on each side of these clappers, begin setting their clap rate to the rate of these 5 clappers, and this leads to a larger group of clappers. This cycle repeats itself over and over until everyone in the group is clapping in sync. If you have 20 people in the group, this process repeats itself 4 times. (4x5+=20).**

## **STARLOGO MODEL:**

```
turtles-own [time]

to goop
if pc = blue [settime 5]
if pc = blue [setc pink]
wait 1
setc yellow
wait 1
setc red
wait 1
setc purple]
if pc = orange [settime 3]
if pc = orange [setc black]
wait 1
setc gray
wait 1
setc brown]
if pc = gray [settime 2]
if pc = gray [setc white]
wait 1
setc turquoise]
if pc = cyan [settime 1]
if pc = cyan [setc sky]
if pc = blue [setc black]
if pc = orange [setc black]
if pc = gray [setc black]
if pc = cyan [setc black]
if pc = blue [setc blue]
if pc = orange [setc orange]
if pc = gray [setc gray]
if pc = cyan [setc cyan]
if pc = cyan [setc black]
if pc = gray [setc black]
if pc = blue [setc black]
if pc = orange [setc black]
end
```

## **CONCLUSIONS:**

From our experiment and model, we came up with the conclusion that crowd size does not affect the time it takes to synchronize clapping.

## **DISCUSSION:**

After reading about synchronicity and doing our experiment, we realized how little people have in the past paid attention to synchronicity and its science. We found that a few people are beginning to study the phenomenon of fireflies, cicadas, and even applause. Synchronicity involves a lot of physics that has to do with events happening in time and space. People could study synchronicity to predict natural events such as the

bark beetle attacking pinion trees. With such studies, people might be able to prevent the devastation of the trees that have been attacked by these beetles. People can also try to find out why some systems have to be synchronized, how they synchronize and why they do so. What would happen if systems went out of synch?

### **ACKNOWLEDGEMENTS:**

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### **BIBLIOGRAPHY:**

<http://www.comdig.de/ComDig00-08/#4>