

## UNB Brunswickan

### **Perspectives: Grains of Sand in the River of Time**

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Most of us believe that any one individual has little or no effect on the long-term outcome of human history - excepting those rare people like Alexander the Great and Nelson Mandela. A revolutionary new branch of mathematics called '[chaos theory](#)' tells us that this idea is wrong. Believe it or not, even the flicker of a baby's eyelash has an enormous long-term impact on the world's future!

The idea is simple but deep, like a river. It seems appropriate therefore to begin with an analogy of a grain of sand, and a river.

Consider a river, say about ten meters wide and two meters deep, with many curves, and littered with various size rocks and boulders creating lots of turbulence. From moment to moment the river will change dramatically, as rivers do, with [whirlpools appearing and disappearing](#), waves cresting and subsiding, eddies swirling and dying, and so on and so forth, the river never looking exactly the same way twice.

Now say that a friend throws a single grain of sand into the middle of the river a mile upstream from our position, and that the river travels a mile in twenty minutes. The question is this: will the turbulence in the river as it passes by our observation point (twenty minutes later) be significantly affected by that grain of sand? Will the configuration of the waves, whirlpools, and eddies be any different from what they would've been had the grain of sand not been thrown?

Up until very recently mathematics would have said that the initial splash of the grain of sand would be absorbed and dissipated, and that the river turbulence twenty minutes later a mile down stream would be exactly the same as it would have been had the grain of sand not been thrown. Most of us would probably have gone even further, and said that even the splash of a good sized boulder would be completely absorbed well within a mile. It seemed so sensible to believe that relatively small inputs could be largely ignored.

Chaos theory tells us that this reasonable view is absolutely wrong. We now know that the effect of the extremely tiny tipples and eddies produced by the splash of a single grain of sand are not absorbed, are not dissipated, but are instead multiplied, magnified, and propagated throughout the river, so that the configuration of the waves, whirlpools, and eddies will have been entirely and irrevocably changed a mile later.

You don't need to know the mathematics. Just remember that in real systems (especially fluid systems with turbulence) tiny changes end up producing great changes. Consider

now the application of this new understanding, in the simplest of ways, to the actions of individual human beings: it immediately follows that the smallest body movements of human beings have, over time, an enormous impact on global weather systems!

For example, say you waved at a friend across the street today, causing small eddies and whirlpools to form behind your hand and arm as it swept through the air. By exactly the same principle described earlier, this small turbulence will be slowly propagated throughout the atmosphere, and eventually around the entire planet, so that in a year's time the entire global weather system will have been affected and be completely different from what it would have been had you not waved to your friend a year earlier. Our every wave, every breath, every flicker of an eyelash propagates through the atmosphere to eventually affect the weather of the entire planet.

In this very simple way then, we can see that each of us is of profound importance to our world and its future, for our smallest actions affect the weather, and the weather affects plane crashes and car crashes, the outcome of elections, battles and wars, when we eat, sleep, and make love, and therefore eventually human history itself.

We may be no more than grains of sand in the river of time, but oh what affect on that river we have!

  

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