

FREEDOM IS AN EMERGENT

"Freedom is not a state; it is an act. It is not some enchanted garden perched high on a distant plateau where we can finally sit down and rest.

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"Freedom is the continuous action we all must take, and each generation must do its part to create an even more fair, more just society."

—John Lewis, 1940-2020

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John Lewis understood systems.

Here are his words, with changes in brackets using the concepts that you'll see developed here:

"Freedom is not a state; it is an [emergent]. It is not some enchanted garden perched high on a distant plateau where we can finally sit down and rest.

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"Freedom [emerges from the] continuous action we all must take, and each generation must do its part to create an even more fair, more just society."

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What does politics have to do with emergence, and what is emergence anyway? That's what this essay is about.

Here is my deeper agenda: There is an important missing conversation that needs to be happening between social scientists and systems scientists.

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This essay is a contribution to that conversation. I will show that there is a single structural pattern that describes a large variety of group cohesion behaviors, some human, some not.

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Also I will suggest that, because of their structural similarity, many of the common aspects of these phenomena can be understood outside of the narrow confines of their academic specialties.

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One can learn a lot about the overall behavior of systems by looking at the ways their parts interconnect, even before one studies the details of what's inside the parts.

Why pursue this approach now?

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1 of 3: It's urgent.

Today's big problems, for example, poverty, climate change, and pandemics, are behaviors of large interconnected systems. We experience these systems, not in their details, but in the effects they manifest, for example social disorder and global warming.

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These manifested effects are emergents. (The noun "emergent" is a shortening of "emergent phenomenon".)

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"Emergence" is one of those terms on whose definition experts don't precisely agree, but they can agree that "I know it when I see it".

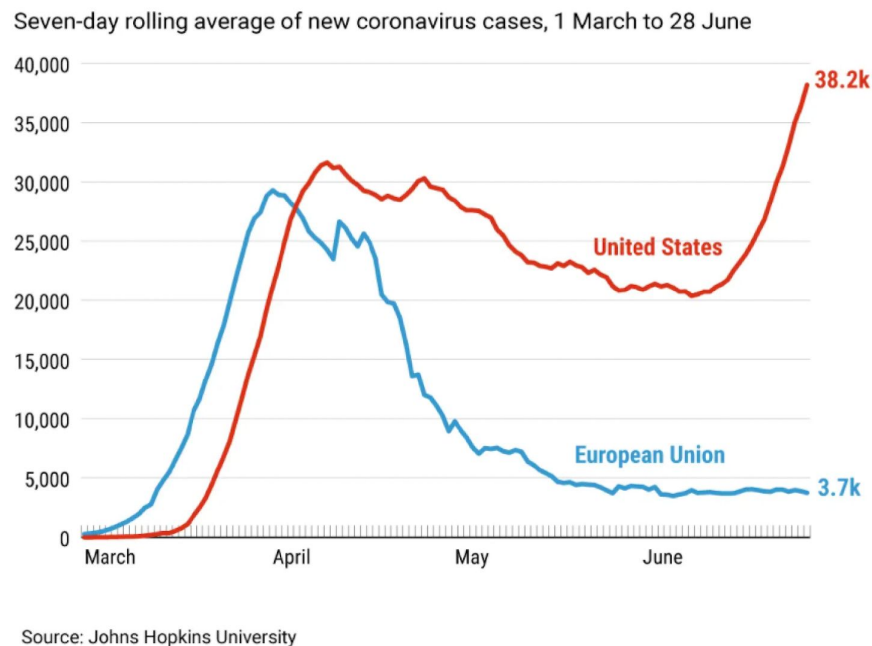
<https://en.wikipedia.org/wiki/Emergence>

I think we can do better.

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2 of 3: This approach is relevant.

For example: The American response to COVID-19, differs markedly from the EU response. Why? Government policy, an emergent, is responsible for the difference.



**Fig. 1. The Responses to COVID-19
of the US and EU are Different**

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3 of 3: This approach suggests a powerful method of analysis. You will see a high-level model structure that applies to (in my view) all phenomena of our experience and that permits scientific inquiry via modeling and simulation.

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This essay is about emergence. It is Part One of two parts.

Part Two will be about the application of the pattern developed here to the social sciences. I expect to be publishing it in pieces; here is the first piece:

https://twitter.com/conways_law/status/1285990003244503044

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Part One Table of Contents.

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EMERGENCE IS EVERYWHERE

During the Cold War I often heard this:

“I have no problem with the people of the Soviet Union, it’s their government I don’t like.”

Here is an understanding of distinct behavior at “two levels of description”: people and government.

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The introduction of the concept of *two levels of description* is a liberating characteristic of our view of the world.

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Aggregating phenomena into multiple levels *of description* (not *of reality*) is our brains’ invention for making sense of an otherwise incomprehensible world.

(Here is Richard Feynman talking about “this tremendous mess”:
<https://www.youtube.com/watch?v=FjHJ7FmVOM4>)

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Please understand that I’m not saying that the world is divided up in a particular way; the world is beyond our comprehension.

I’m saying that creating different levels of *description* is how we make sense of the world.

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So, given this confession of vulnerability, we are free to come up with stories that work for us.

Science is one of the best processes we have going for generating stories that work for us.

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The story told by the present essay is embodied in one graphic that captures the two-level concept in a form applicable to many subject areas.

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Fig. 2 is this graphic, applied here to the people/government distinction we started with. Text in blue can change depending on the subject area being discussed. Text in black is generic and will apply across all subject areas we'll be seeing below.

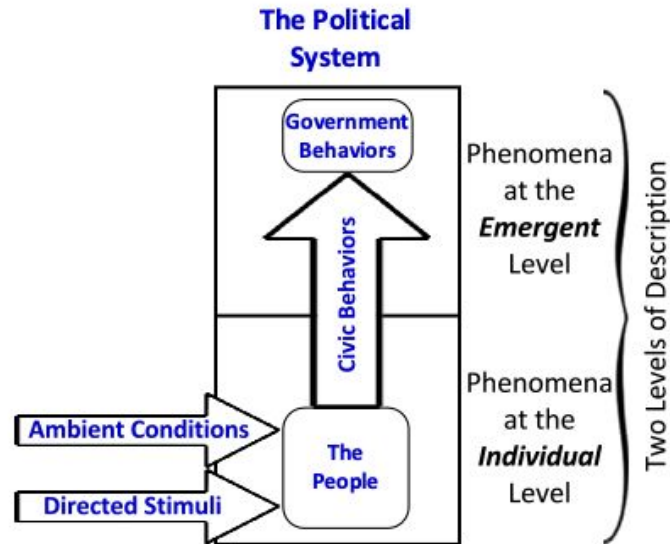


Fig. 2. Politics is an Emergence Process

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THE EMERGENCE PROCESS DESIGN PATTERN

Fig. 3, a relabeling of Fig. 2, shows the generic *Emergence Process* design pattern.

“Ambient Conditions” and “External Stimuli” (not always present) are already generic names. Fig. 3 gives generic names to the other blue text.

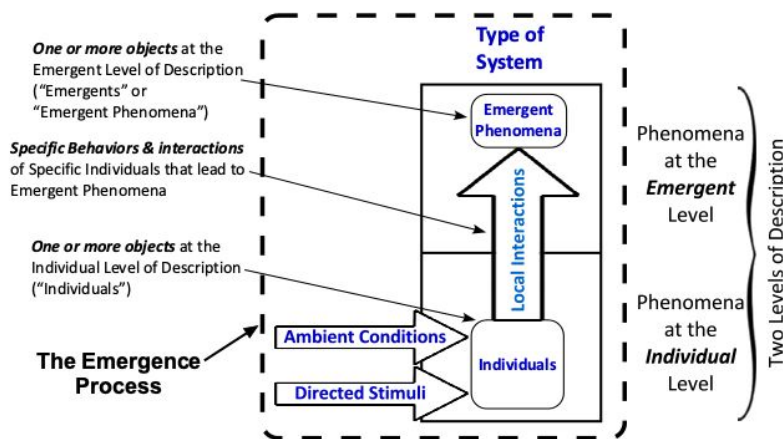


Fig. 3. The Emergence Process Design Pattern

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The vertical arrow labeled “Local Interactions” is the crux of this pattern that ties the two levels together. You will be seeing this applied in different contexts repeatedly below.

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The existence of Local Interactions seems to be a necessary condition for emergence.

Others have described emergence using Local Interactions; the two-levels-of-description pattern is the essence of the approach presented here.

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DEFINITION OF AN EMERGENT (PHENOMENON)

An emergent phenomenon is a phenomenon *at the emergent level of description* that arises from specific combinations of Local Interactions *that occur at the individual level of description*.

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I am using the not-fully-accepted noun “emergent” as synonymous with “emergent phenomenon”.

Note that phenomena at the two levels of description might, or might not, appear to be in the same category of phenomena.

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MILITARY UNIT COHESION IS AN EMERGENT

A well-trained infantry is a living example of emergence.

<https://www.armyupress.army.mil/Journals/NCO-Journal/Archives/2019/October/Team-Building-and-Unit-Cohesion/>

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Our story begins in classical Greece.

“Men wear their helmets and their breastplates for their own needs, but they carry shields for the men of the entire line.”

--Plutarch, Moralia

<https://qa.perl.org/phalanx/history.html>

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The hoplite citizen infantries of classical Greece developed the hoplite phalanx formation, whose front line had a coherent barrier of overlapping circular shields, each of a diameter of approximately one meter.

<https://en.wikipedia.org/wiki/Hoplite>

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What made this coherence possible was a rigid two-part attachment of the shield to the forearm and hand of the soldier. When the men were pressed against each other the shields formed a rigid serpentine wall. Note the nesting of shields in Fig. 4.



Fig. 4. A Hoplite Phalanx

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The primary duty of each man on the line was to keep the line from breaking.

A common element with other emergent systems is that *each man had only to maintain integrity with his immediate neighbors*. See Fig. 5.

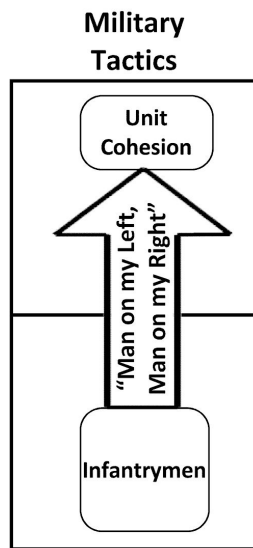


Fig. 5. Unit Cohesion is an Emergent Phenomenon

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You're going to see such Local Interactions in every system with emergent behaviors.

What makes this approach profitable is that you don't have to understand the simultaneous operation of the whole system; you need only study certain *repeated* Local Interactions.

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In the case of the hoplite phalanx the key local interaction is the shield-to-shield overlap maintained by the understanding of each man on the line. In Fig. 5 I label it “Man on my Left, Man on my Right”. The emergent effect is a nearly-unbreakable defensive line.

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FLOCKING OF STARLINGS IS AN EMERGENT

Fig. 6 shows the pattern for flocking of starlings. This NPR article cites research showing that each bird navigates relative to 6 or 7 near neighbors:

<https://www.npr.org/sections/13.7/2017/01/04/506400719/video-swooping-starlings-in-murmuration>

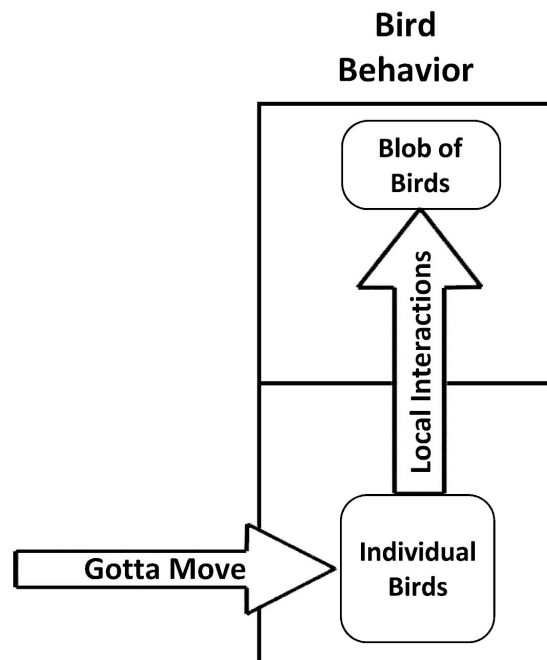


Fig. 6. Murmurations of Starlings are Emergent Phenomena

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OTHER COMMON EXAMPLES OF EMERGENCE

A. Science

Science advances one funeral at a time.

--Max Planck

This is no mere quip. It holds a big idea: scientific knowledge is a thing unto itself, but it lives in the minds of a lot of people.

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Scientists can have trouble changing their basic ideas, but when the people get replaced the science can change.

Scientific knowledge is a distributed thing that lives in the minds of a lot of people, but it's neither the people nor their minds. What is it?

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The two-level pattern allows an answer without struggle.

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Fig. 7 is the application of Fig. 3 to science. Scientific knowledge is an emergent phenomenon arising from the activity of a bunch of people we call “scientists”. Science is the name we give to the whole two-level process.

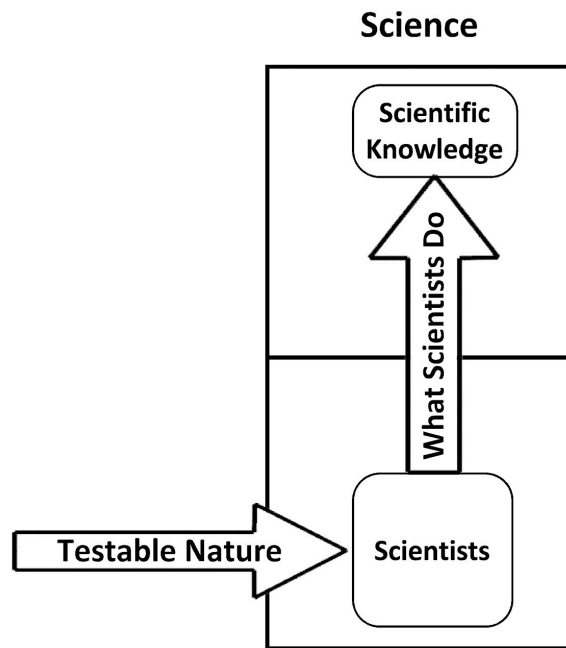


Fig. 7. Science is an Emergence Process

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Now, just because you can't touch it, scientific knowledge is no less of a "thing" than the people who create it.

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In my view, everything we think of as a "thing" is an emergent in some system. That reflects, again in my view, that the two-level model is simply a representation of how our brains make sense.

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B. An epidemic

In Fig. 8 an epidemic is an emergent phenomenon.

(An earlier essay on this approach,

http://melconway.com/CBH/Missing_Quadrant.pdf

describes public behavioral health as an emergent phenomenon.)

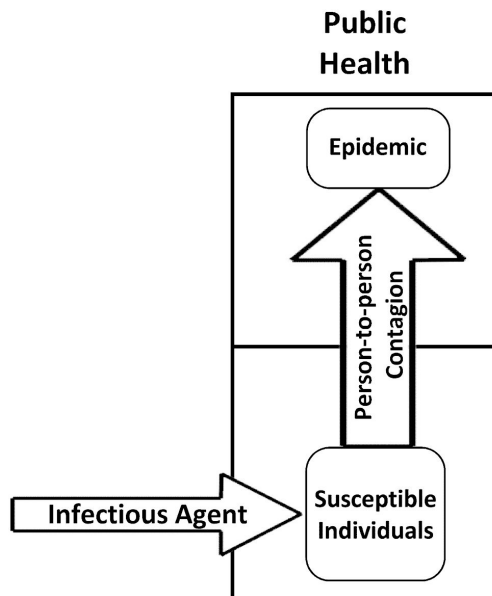


Fig. 8. Public Health is an Emergence Process

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C. Water and Milk

Figures 9 and 10 describe the ice and liquid phases of water as emergent phenomena, with the H_2O molecules (not shown) as the individuals.



Fig. 9. Phase Transition at the Liquid-Solid Boundary

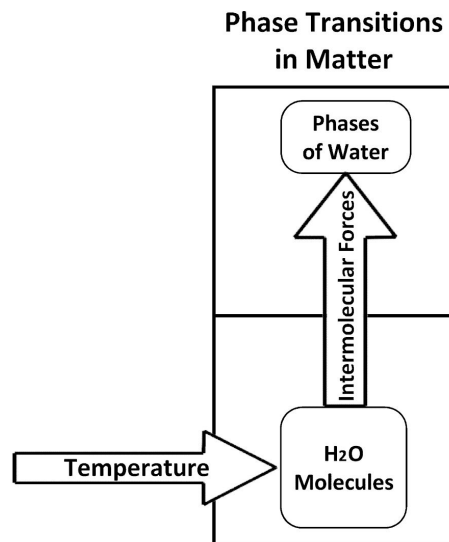


Fig. 10. Phases of Matter are Emergent Phenomena

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The pattern for curdling of milk looks similar, except that the ambient condition that causes the change is not temperature but pH. See Fig. 11.

<https://en.wikipedia.org/wiki/Curdling>

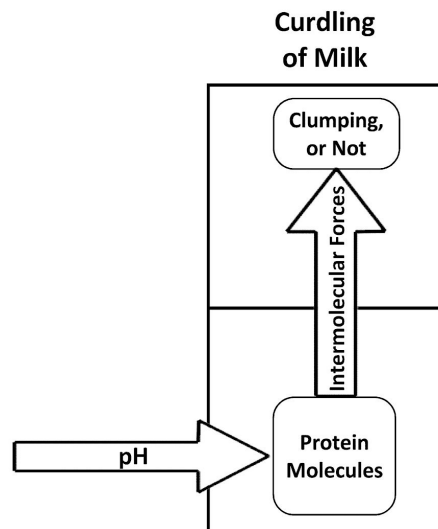


Fig. 11. Curdling of Milk is an Emergent Phenomenon

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D. The spatial dynamics of infection

Fig. 12 is a map from the CDC website that shows the total cumulative cases of COVID-19 for each county in the continental US on June 23, 2020. At the beginning of the year there would have been only one color in this map.

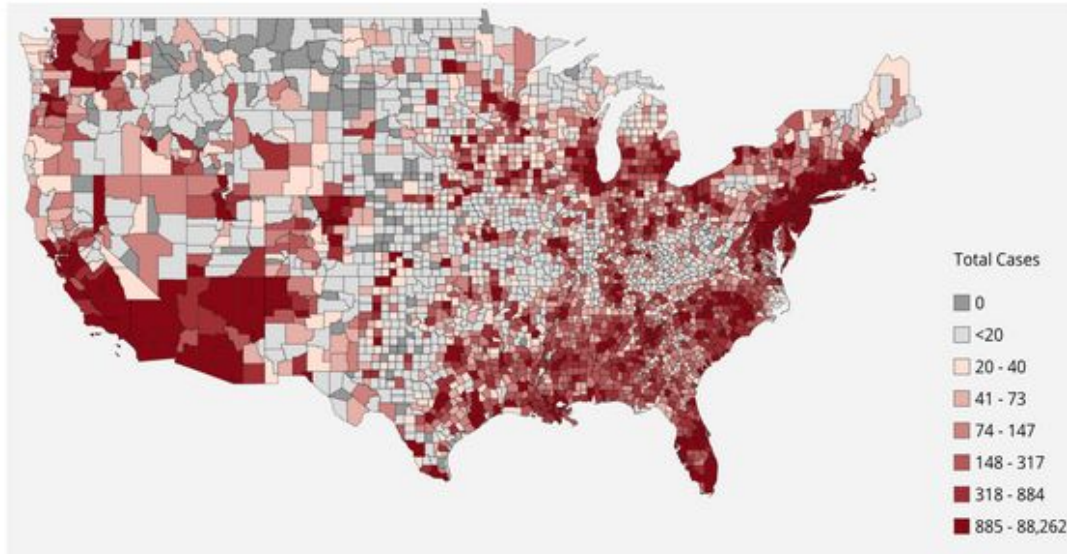


Fig. 12. Total COVID-19 Cases by County in the Continental US

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Someone who follows the news might imagine an animation of the daily progress of this map beginning around March 1 that would show the dark areas spreading from the coasts toward the interior.

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What is this dark thing we're watching move across the country? If this were an America-shaped Petri dish we would say it's a bacteria colony;

we would be looking at an emergence process with bacteria as the individuals and a bacteria colony as the emergent.

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So let's call it a "COVID colony". Fig. 13 shows it as part of a dynamic emergence process.

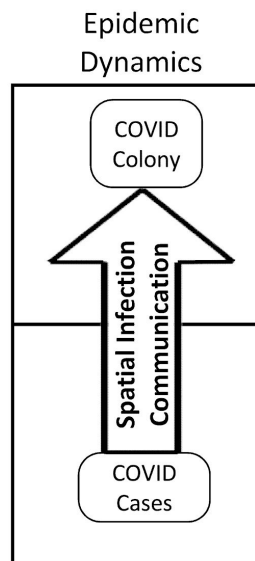


Fig. 13. A Colony Has a Life of its Own over Time

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"What!" you say, "We're not being inhabited by a colony." Yes we are. This emergent is just as much of a "thing" as a COVID case, which, when you think about it, is an abstraction dependent on an ICD-10 definition. <https://www.who.int/classifications/icd/COVID-19-coding-icd10.pdf?ua=1>

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What's important, and what I'm missing in the public conversation, is that the *evolution of the colony* is what we need to understand in order to model the future of living with this virus.

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My inability to find data in the CDC and WHO websites that help me understand this evolution tells me that the public-health mindset has pursued growth/shrinkage *at a point* over time, but not movement *across space* over time.

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This film clip from the cold war suggests that our propagandists seem to have had a better handle on the concept than our public-health experts.

<https://www.gettyimages.com/detail/video/animated-map-w-dark-spr-eading-communism-moving-from-ussr-news-footage/510447759>

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HOW IS FREEDOM AN EMERGENT?

Here is John Lewis's modified quotation again.

"Freedom is not a state; it is an [emergent]. It is not some enchanted garden perched high on a distant plateau where we can finally sit down and rest.

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"Freedom [emerges from the] continuous action we all must take, and each generation must do its part to create an even more fair, more just society."

Fig. 14 illustrates this.

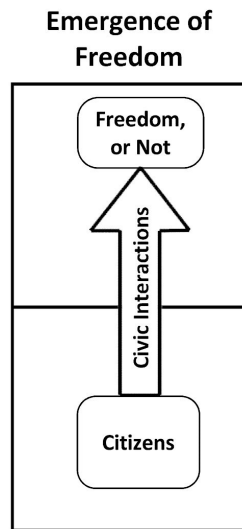


Fig. 14. Freedom (or Not) Is an Emergent Phenomenon

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EMERGENTS CAN BE MESSY

My view is that everything in our experience is an emergent. Usually, saying "everything is an X" makes X meaningless. In this case however, there is a structure that comes along with X that makes it worth examining in some cases.

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In what follows I'm going to look in places normally ignored by this kind of analysis: history and politics.

(See @Peter_Turchin for a parallel approach.)

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A. Emergents can be parts or attributes of other emergents

One of our first examples has been unit cohesion, with the Greek hoplite phalanx front line as the example. But the phalanx itself is an emergent; the front line is part of that, and cohesion is an attribute of the front line.

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B. Emergents can have life cycles

Greek hoplites were citizens who came together and formed military units when necessary to defend their society. Then these units all but disappeared until the next call. See Fig. 15.

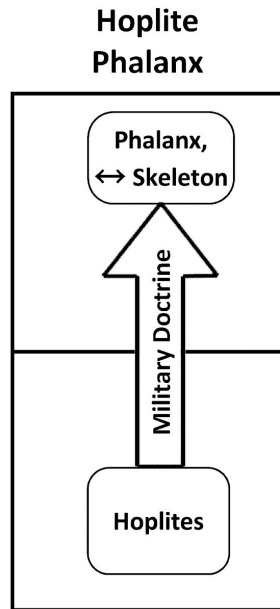


Fig. 15. The Hoplite Phalanx Had a Life Cycle

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We have an interesting parallel to Greek hoplites possibly in formation right now: the “Wall of Moms”.

<https://thewallofmoms.com/>

<https://www.washingtonpost.com/nation/2020/07/22/portland-moms-protests/>

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C. Emergents can undergo transformation

In Fig. 14 the emergent is “Freedom or Not”. Let’s relabel the “Not” as “Tyranny”. That suggests another cycle, and presents an opportunity for the use of this approach in historical analysis. See Fig. 16.

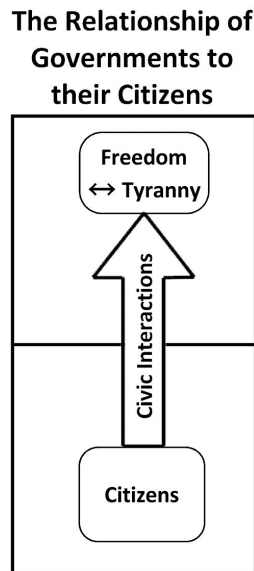


Fig. 16. The Freedom-Tyranny Transformation Cycle

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D. Is intervention into transformation of emergents possible?

If the present approach has a message, it is to look to the Local Interactions if you want to intervene in an emergence process. Two questions arise:

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1 of 2: If there is a natural cycle, where are the feedback loops in the Local Interactions? I won't address that here, except with this. Most observers who have studied the cycles take them as given and extrapolate from that.

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If, as I will suggest below, we need to think about designing for sustainability and robustness, we will need to learn specifically about how Local Interactions work.

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2 of 2: We are learning that it's a lot easier to break freedom than build it. Building I believe, involves intervening at the Local Interactions level, probably in multiple emergence processes over multiple generations.

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As for breaking, @chrisinsilico has shown us how that is being done in a few years, after several decades of political inattention.

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The transition from democracy to tyranny, particularly in Europe in the 1930s, has been well studied. Exceptionally useful in "On Tyranny" is @TimothyDSnyder's enumeration of 20 individual interventions at the Local Interactions level.

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We do need a theory that describes the sensitivity of the “Freedom ↔ Tyranny” emergent to the details of Local Interactions. Developing this will be a long and difficult process. Snyder’s list is an excellent starting point.

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QUESTIONS AND OPPORTUNITIES

We now have a common language for discussing systems with emergence, human or not. It is my hope that this common language provides a platform for a fruitful conversation between systems scientists and social scientists.

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In the first Twitter thread of Part Two I have begun exploring this Conjecture:

Civic coherence is an emergent arising from signaling within interpersonal negative feedback loops whose effects are to align the individuals’ behaviors.

https://twitter.com/conways_law/status/1285990003244503044

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This hypothesis suggests that loss of coherence might be associated with disruption of feedback loops. See this, for example:

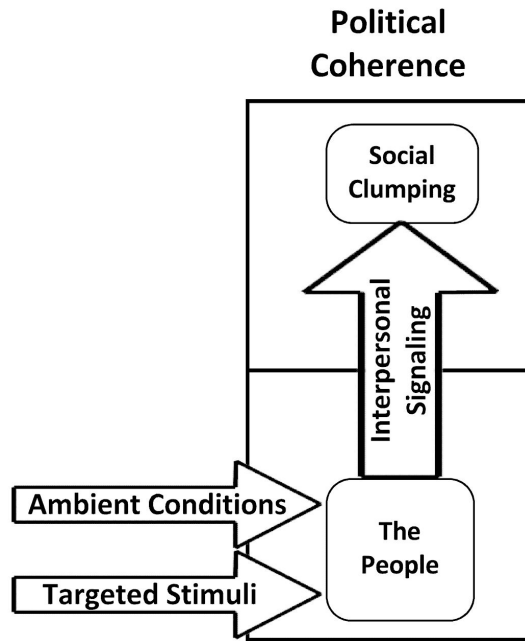
https://twitter.com/conways_law/status/1256235632545927176

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We have an opportunity to ask whether the way we define ourselves structurally and procedurally as a “democracy” has instability built into it. If so, we have found feedback loops with multi-generational characteristic times. What should we do about that?

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I have been using the general term “social clumping” for people and animals in general to use interpersonal signaling to align individual behaviors in order to form emergents. Fig. 17 shows its pattern.



**Fig. 17. Social Clumping is an Emergent
Arising from Interpersonal Signaling**

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Now that we have a pattern, we have new questions.

1. What are the major pathways over which interpersonal signaling occurs that significantly affect political integration/disintegration?

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2. How do we draw causal connections between the psychologies of individuals and interpersonal signaling?

3. How do we draw the whole causal chain from Ambient Conditions and Targeted Stimuli, through interpersonal signaling, to social clumping?

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Note that an even partial understanding of this chain has already been destructively applied by our adversaries, and is well described by @chrisinsilico in “Mindf*ck”.

Here is an open opportunity for a collaboration between systems and social scientists.

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