

Unconducting the Self-Synchronizing Orchestra S'abstraire de la direction de l'orchestre auto-synchronisé

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Résumé de l'article

La synchronisation est définie comme étant la science étudiant l'influence mutuelle de plusieurs systèmes oscillants. Bien que le terme soit souvent utilisé, à tort, comme synonyme d'unification, il s'agit d'un concept beaucoup plus riche dans son sens organique véritable. Dans plusieurs domaines de recherche scientifique, on assiste à une émergence de projets consacrés à la synchronisation. Cet article traite de plusieurs nouvelles formes d'interactions entre humains, dans lesquelles les préceptes de la synchronisation constituent une structure utile à leur analyse et à leur compréhension. La musique orchestrale en fait partie. Étant donné l'évolution de la nature et de nos modes de communication, nous développons de nouvelles façons d'interagir, qui nous demandent d'adapter nos façons de composer et d'interpréter la musique de manière à nous sentir plus en harmonie avec notre nouvelle manière d'être. La synchronisation fournit les bases scientifiques permettant de décrire l'influence de différents mécanismes non hiérarchiques et non causaux qui agissent sur le plan cellulaire, sur le plan humain et sur celui des écosystèmes.

Unconducting the Self-Synchronizing Orchestra

Andrew Culver

À propos

We live in a time when it is possible to express almost anything in almost any way. A right to, and affordable means of, packaging self-expression is readily available to over half of humanity, and not far off for the rest of us.

Simultaneously, our thought distribution technologies are evolving faster than our thoughts. Every good idea is already everywhere.

But there is also a lot of noise.

The quality of what we express is not now in the content of the message of the few, but in the fidelity of its expression by the many.

How do we practise this collective expressive excellence?

Near-instantaneous communications

I spend a lot of my time these days working to remove the collaboration and communication barriers brought on by contemporary collaboration and communication technologies.

When discrete software systems were first devised about 40 years ago, and then again when networked systems were being devised about 20 years ago, a number of fundamental concepts were misappropriated from previous technologies, including:

- The InBox (an interface between the desk of a clerk and the cart of a mail carrier),
- Mail (a mechanism for paper-based, non-instantaneous communication),
- The message (a discrete communications unit).

What makes all these inappropriate is that they exist at the wrong order of magnitude of the time scale. The old world time scale of hours, days, and weeks sets up these expectations:

1. A message is carefully crafted for a specific set of recipients.
2. Because it takes days or weeks to deliver, the message takes on the form of a report and/or an order.
3. Because it is a report or order, it exists within, and reinforces, a hierarchical inter-human framework.

If it takes longer to deliver a message than to craft it, these concepts are generally appropriate, or merely unavoidable; hence their commonality to all pre-instantaneous forms of communication (from the business letter, to the decisions of the court, to the command and control of the army).

If the reverse is true, these metaphors fall apart.

When human communication travels faster than the speed of thought—that is, when the communication is being received before it has been fully compiled—as in instant messaging or music-making or love-making—the idea that communication must by necessity be construed as a set of ‘messages’ being ‘delivered’ by a ‘mail system’ embodying a ‘report’ or ‘command’ is awkward, if not perverse. As in film and digital audio, there comes a delivery frequency above which we no longer perceive discrete message units. With acceleration, the ‘packet’ becomes the ‘stream’ and then simply the ‘feeling’. Like light, near-instantaneous communications mean messages can be described as both discrete packets and a continuous wave. But because their frequency is so fast, they are perceived, again like light, as a continuity.

Beyond a certain point, the collapsing time scale changes the nature of communication, of the communicators, and thus of the relationships between them. Hierarchy gives way to anarchy.

Network Person

Organization Man is what we used to be, while Network Person is what we now are:

Organization Man	Network Person
Hierarchic—command and control	Anarchic—self-responsibility
Works for a boss	Works for a Project
Work is private and exclusive	Work is shared and inclusive
Driven by procedures	Driven by deadlines
Wants ownership	Wants use
Knowledge is power; Shares knowledge as little as possible	Contacts create strength; shares knowledge as freely as possible
Avoids decisions; seeks cover under hierarchy, bureaucracy and convention	Makes decisions frequently, guided by knowledge bases, community practices, and a quick, collaborative culture.
1-way messages convey an order	2-way messages encapsulate a contract

The new organization is a group of individuals taking individual self-responsibility for a common mission. There are no hierarchies, only shared systems, processes, and objectives.

Synchronization

“Nature is not based on isolated individual systems. It is rich in connections, interactions and communications of different kinds that are complex beyond belief. With this, synchronization is the most fundamental phenomenon associated with oscillations. It is a direct and widely spread consequence of the interaction of different systems with each other.”¹

“Synchronization is an adjustment of the time scales of oscillations due to interaction between the oscillating processes.”²

Synchronization is the subject of a great deal of research these days.³ It has applications in physics, chemistry, engineering, electronics, robotics, cybernetics, medical devices, computer sciences, the list goes on. The story so far can be summarized thus:

1. The universe is a universe of systems.
2. Systems tend to oscillate, either periodically or chaotically (or some combination of these).
3. Independent oscillating systems nonetheless influence each other under exceedingly common circumstances.
4. Synchronization occurs if two factors are present: a weak (but not too weak) coupling strength, and a moderate degree of frequency mismatch between the oscillating systems (if the frequency difference is too great, coupling cannot occur).

Coupling strength is the heart of the matter. If it is too low, no interaction between the systems takes place, and there is no synchronization; if too strong, no synchronization occurs at all, since the formerly independent systems are composed into a unified system.

This last point is critical: when coupling strength is too strong, it obliterates the independence of the contributing systems, which cease to exist separately, and synchronization is no longer operative. “Synchronization is a complex dynamical process, not a state.”⁴

In music, we frequently use the term synchronization to describe this too strong degree of system unification (for example, of digital clocks in digital recording systems), and thus we are not in accord with the science. And this may lead us to fail to notice the inherent beauty and musicality of the term, which describes independent systems under mutual influence.

1. Balanov *et al.*, 2009, p. 1.

2. *Ibid.*, p. 10.

3. Google Scholar finds 15,500 articles and patents with the word “synchronization” in their title over the last 5 years. “allintitle: synchronization – Google Scholar,” *Google Scholar*, http://scholar.google.com/scholar?as_q=synchronization&num=10&as_epq=&as_oq=&as_eq=&as_occt=title&as_sauthors=&as_publication=&as_ylo=2007&as_yhi=&as_sdt=1.&as_sdtp=on&as_sdtf=&as_sdfs=5&btnG=Search+Scholar&hl=en&as_vis=1 (consulted 4 February 2012)

4. Pikovsky, Rosenblum, and Kurths, 2001, p. 17.

Listening is being alive to the coupling between self and surrounding systems.

Performance means weakly forcing the coupling between self and surrounding systems (human and mechanical).

Synchronicity

One more principle enters the big picture here. In his introduction to Richard Wilhelm's translation of the *I Ching*,⁵ Carl Jung wrote of:

... a certain curious principle that I have termed synchronicity, a concept that formulates a point of view diametrically opposed to that of causality. Since the latter is merely a statistical truth and not absolute, it is a sort of working hypothesis of how events evolve one out of another, whereas synchronicity takes the coincidence of events in space and time as meaning something more than mere chance, namely, a peculiar interdependence of objective events among themselves as well as with the subjective (psychic) states of the observer or observers.

We can understand synchronicity without knowing exactly how it works. Synchronization shows us that it is easy to understand the behaviour of synchronized systems without understanding the nature of the coupling mechanism.

Synchronicity means that there is always a relationship between independent systems merely because they happen in the same time and space. These relationships can be observed; and as the observer is himself a bundle of systems in operation, it follows that the observer contributes to the complex of relationships, and that coupling can occur if the conditions are right.

Synchronicity therefore can be understood as a synchronization of certain processes of the human mind with oscillatory systems operating outside of it yet close by in time and space. The coupling strength is typically very weak, but everyone experiences these unexpected influences occasionally (coincidence, déjà vu), and some people follow special practices specifically to make use of them (meditation, chance operations).

Whole systems thinking

The Rocky Mountain Institute (RMI) is a 'think-and-do' tank based in Snowmass, Colorado, that has for 30 years been at the forefront of advanced energy systems research. Their mission is "to drive the efficient and restorative use of resources," and the outcome they envision is "a world thriving, verdant, and secure, for all, for ever."⁶

5. Wilhelm, 1950, p. XXIV.

6. "Vision and Mission," *Rocky Mountain Institute*, <http://www.rmi.org/rmi/Whole-Systems+Design> (21 October 2011)

One of RMI's guiding principles is whole-systems design:

Designers and decision-makers too often define problems narrowly, without identifying their causes or connections. This merely shifts or multiplies problems. Whole-systems design—the opposite of that dis-integrated approach—typically reveals lasting, elegantly frugal solutions with multiple benefits, which enable us to transcend ideological battles and unite all parties around shared goals.⁷

The discussion of whole-systems design on the RMI website begins with the observation that “our lives are embedded in systems: families, communities, industries, economies, ecosystems.”⁸ And since a musical performance transpires over some part of our lives, it must also be embedded in these same systems. Or, via bi-directional synchronization: these same systems are embedded in a musical performance.

Whole-systems design requires of us an embracing consciousness of the interconnectedness of all these “simultaneous and only partially overlapping”⁹ systems. It benefits from any mechanism that reveals the bigger, and still bigger, and ultimately biggest, picture. And even if this enlarged and enlarging view passes over areas we have not previously considered and that we know little about, we need not worry: synchronization tells us that we can infer knowledge of adjacent systems both theoretically, and pragmatically (through human interconnecting: asking questions).

Whole-systems thinking goes even further: it opens the door to thinking about what we don't know we don't know.

Integrative processes

The designing and building of buildings is going through a revolution these days; or some would say, a rapid evolution. Under the monikers of green building and sustainable development, the global property industry is trying change to address numerous threats: climate change, rapidly depleting resources, rising financial and geopolitical energy costs, water scarcity, environmental degradation, and human productivity and health. My colleagues and I at iLiv¹⁰ (along with many others throughout the world) are agents of this change.

Because of these multiple threats, green building and sustainable development are becoming a new baseline. The technologies to reach these new objectives largely exist today, or are rapidly coming onto the market. However, it turns out that these new objectives cannot be met through conventional professional interactions, relationships, work processes, and methods of communication. Who we work with, and when, and for how long, and what we talk about: all these need to be radically different if we are to shelter humanity within the confines of our one and only planet.

7. “Whole-Systems Design,” *Rocky Mountain Institute*, <http://www.rmi.org/rmi/Whole-Systems+Design> (21 October 2011)

8. *Ibid.*

9. Fuller, 1978, p. 60.

10. iLiv is a Canadian Internet and software corporation. It hosts a service called All-In, which is an integrative process collaboration and communication application based on concepts derived from best practices in composition and performance for uncondacted orchestras.

This new working process has a name:

The Integrative Process actively seeks to design, construct and operate buildings that are Earth-regenerating and cost-effective over both the short and the long terms, by engaging all project team members in an intentional process of discovering mutually beneficial interrelationships and synergies between systems and components, in a way that synchronizes technical and living systems, so that high levels of building performance, human performance, and environmental benefits are achieved.

Think how different this is from the aspirations and objectives conventionally ascribed to the building professional, how different it is from the notion, for example, that architecture is art, and the architect is an artist.

Think also about how strongly it maps to the ideas previously discussed in this article.

Utilities supporting anarchy

The quality of what we express is not now in the content of the message of the few, but in the fidelity of its expression by the many. How do we practice our collective expressive excellence?

In the musical domain, specifically, composition and performance for orchestras, this amounts to finding ways to shift the centre of expression from the few (the composer and the conductor) to the many (the musicians and the audience).

We start by removing unnecessarily strong coupling mechanisms:

1. Shared parts
2. Conductor
3. Meter
4. Tempo
5. Sectional seating
6. Proscenium staging
7. Sectional forms (ABA, movements, acts, etc.)

We continue by introducing weak coupling mechanisms:

1. Time brackets¹¹
2. Non-specific durations
3. Non-expressive organizing technologies (stopwatches, digital clocks)
4. Multiple layers of simultaneous but only partially overlapping compositions

All the while providing enough specificity to assure a rich complement of oscillating systems:

11. Time bracket notation was devised by John Cage and is the principle feature of his numbered pieces. A time bracket provides the player with an ordered list of one or more pitches within a pair of time periods: the player must begin sounding the first (or only) pitch within the first/left time period, and cease sounding the last (or only) pitch within the second/right time period.

1. Numerous musicians
2. Large time span
3. Precise event counts
4. Precise event sequences
5. Precise pitches

All of these parameters are present in my composition *Ocean 1-133*.¹²

The musicians who play this music (and other musics that share similar parameters, most notably, the large scale numbered pieces of John Cage¹³) learn, especially if engaged in multiple performances, that some kind of organizing principle that normally is not at play has entered the room. There's an interconnectedness that is new, and that works in a feedback loop to positively reinforce itself.

I propose that this strange phenomenon works through synchronization. For example, the conductor in conventional orchestral music typically imposes rather than influences variables such as tempo. The mere fact of the existence of a score (as well as the fact of the score's intentions as expressed through unified meter, structure, form, and so on) serves to reduce musician independence. The result is that the conductor-to-musician relationship has such a high coupling strength that it risks amounting to unification rather than synchronization.

On the other hand, time bracket notation works to weakly couple each independent musician's sounds in relation to all the other sounds and musicians.

The parts of *Ocean 1-133* (there is no score) map out an integrative process, born of whole systems thinking, that intentionally invites weakly forced coupling between a large number of independently oscillating systems, namely, all the musicians and listeners in the room.

Conclusion

Synchronization is the science of the mutual influence of oscillating systems. Although the term is commonly misused as a synonym for unification (showing a mechanical bias), it is a far richer concept in its true (organic) sense.

There is a burgeoning body of research on synchronization in fields such as biology, ecology, psychology, neuroscience, telecommunications, computer science; the list goes on; but in this article I have noted some important new forms of human interaction, in various fields, where the precepts of synchronization provide a novel and useful framework for analysis and understanding.

12. *Ocean 1—133* was commissioned by the Cunningham Dance Foundation, the kunstenFESTIVALdesArts and the Holland Festival for the work *Ocean*, conceived by John Cage and Merce Cunningham, with choreography by Merce Cunningham, electronic music by David Tudor, orchestral music by Andrew Culver, and design and lighting by Marsha Skinner. It was premiered by the Merce Cunningham Dance Company and the Nederlands Balletorkest at the Cirque Royale in Brussels on May 18, 1994.

13. *Twenty-Six, Twenty-Eight and Twenty-Nine* (1991); *103* (1991); *108* (1991); *Fifty-Eight* (1992), *Sixty-Eight* (1992), *Seventy-Four* (1992), *Eighty* (1992).

Instant communications change the nature of what is communicated, as packets of incomplete messages burst into consciousness before meaning has been shaped, or had time to emerge. Architects, engineers, builders, and building operations professionals struggle to gain and hold a holistic understanding of how their building works internally as well as in relationship to occupants, Earth and the surrounding community. Hierarchy stifles the ability of teams to innovate, rapidly adapt, and attract creative participants. Causality fails to model much of what we experience, or drive what we can achieve.

These pains cannot be addressed through the use of the same thinking that causes them. You can't overcome your avalanche of email messages by writing longer, better emails. You can't reduce the complexity of a building, and integrate its systems and the people working on them, by building a more complex building model. You can't command your team to be more innovative, or manage change more strictly and expect to be more agile. You can't increase control to gain flexibility. You must decrease control, reducing the coupling strength between systems (including people) to a point where influence is active but not bound.

Music, the subject near and dear to all our hearts, is one of the fields of human interaction where synchronization provides insight. As the nature and means of our communications evolve, we become experienced in new patterns of interaction, which require of us new methods of composition and performance that feel more like the way we have become, rather than the distinctly different way our grandparents were. It is not just (or even significantly) a case of technological novelty: we are experiencing new forms of partnership that alter the nature of our relationships.

The call, then, is to evolve musical relationship processes that, having learned from other human endeavours going through similar relationship pattern change, map well to the way humans are right now. Synchronization provides a science-based description of non-causal, non-hierarchical influence mechanisms that work.

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