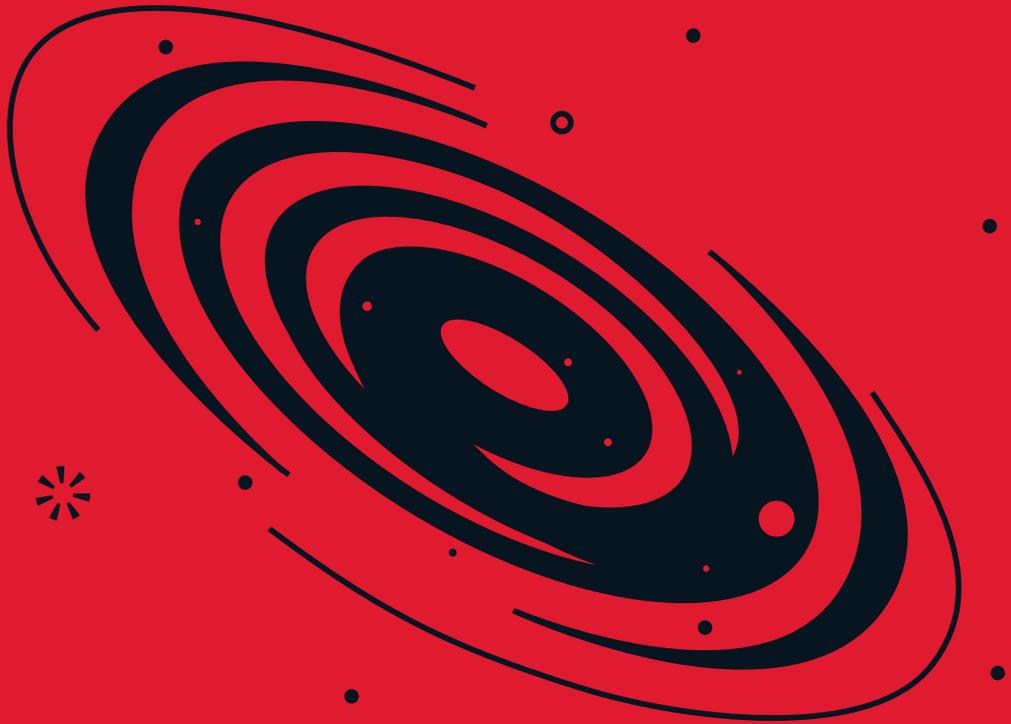


The Great Mental Models

Vol.2



Chapter 17: Cooperation

“Cooperation...is its own evolutionary force that contributes to an organism’s immediate survival but also creates the possibility for adaptive responses to future challenges.”

— Rafe Sagarin

Cooperation

Cooperation, or symbiosis, in biology rests on the idea that an organism that cannot perform an important function alone fills this particular gap by using the physical body of another organism, who also benefits from the interaction. It's often a way for species to increase their competitive prowess by giving them an advantage over their competitors. "All organisms are constrained in their adaptability at some point, and symbiotic relationships allow them to extend their inherent adaptive capacity to exploit new resources and environments or adapt to their own environment as it changes."¹

We commonly think of biological cooperation as a win-win arrangement for the parties involved. You have a need. Someone fills it in. In exchange, you fill one of their needs. You don't require cooperation to survive, but with it the quality of your life improves. A shark doesn't need little fish to clean its teeth in order to live that day, but overall the quality of the shark's life is enhanced because clean teeth mean healthy teeth, which will give it more years to feed on prey. Cooperation significantly expands what's possible, by creating emergent properties that have more power than the individual components.

The origin of mitochondria is an excellent example of cooperation in biology. Mitochondria are the energy-producing organelles of cells. They are now an indispensable component of cells, but they do not exist in cells as a product of natural selection. We are here because at some point a mitochondrion and another cell cooperated.

According to one theory, mitochondria originally existed in nature as free prokaryotic cells (simple cells) and that one such mitochondrion was then acquired by an anaerobic, already eukaryotic cell (complex cell) for the purposes of converting toxic oxygen radicals into harmless

¹ Sagarin, Rafe. *Learning from the Octopus*. New York: Basic Books, 2012.

water for the host. Another theory states that both the mitochondria and the host cell were prokaryotes and that the eukaryotic cell that now powers the vast majority of living organisms was then created as a result of the cooperation.²

Either way, the ancestor of mitochondria was a bacterium that got incorporated into a cell, from which a mutually beneficial relationship developed. Mitochondria produce adenosine triphosphate, or ATP, which can be thought of as the energy currency of the cell. Most chemical reactions in the cell need a lot of energy. These reactions are possible because the mitochondria are on board to create a rich energy source.³

Because of the success of this new cell, the mitochondria began “living” in the host cell, and over time became a part of the host cell and reproduced in this manner. These events took place over 1 billion years ago. Without this cooperation between two types of cells, complex organisms would not have been able to evolve.

The symbiosis between cows and the bacteria that live in their digestive systems is also interesting. These bacteria digest the cellulose found in hay and grass for the cow, while the cow offers nutrient-rich environments for the bacteria. It’s a win for both organisms. Combined with their multi-layered stomach and short appendix, this relationship means cows can eat tough plant foods. Humans cannot digest cellulose in part because they do not have cellulose-digesting bacteria in their digestive systems!

A final, fascinating example is the interaction of the Hawaiian squid and a bacterium, *Vibrio fischeri*. The bacteria emit light and live in the light-producing organ of the squid. This is a relatively safe environment for the bacteria, as anything that wants to consume them has to get

2 Roger, Andrew J., Sergio A. Munoz-Gomez, and Ryoma Kamikawa. “The Origin and Diversification of Mitochondria.” *Current Biology* 27, R1177–R1192, November 6, 2017.

3 Ibid.

through the squid. The squid, in turn, uses the light produced by these bacteria to camouflage itself from predators in oceans.

Cooperation...is its own evolutionary force that contributes to an organism's immediate survival but also creates the possibility for adaptive responses to future challenges.⁴ — Rafe Sagarin

Progress takes the fast track

In some cases, the cooperation can be so valuable to the organisms involved that they evolve to become part of each other permanently. As in the mitochondria example above, the benefits realized by those organisms cooperating provide a foundation for further development. When you can depend on the cooperation and the needs it addresses, you can leverage the freed energy to support growth and innovation.

A human example of this is the development of the railroad and the telegraph. As inventions they were completely separate, but the cooperative relationship that developed between the two allowed them to take over the world. As Alfred D. Chandler writes: “The railroad and the telegraph marched across the continent in unison.”⁵ The telegraph provided train companies with a mechanism for communicating the progress of trains on the line—if they were late or early—so people could be ready to unload perishable goods and otherwise adjust their schedules. This extreme efficiency was key to the railroads being profitable. In return, the rail lines provided telegraph companies with an infrastructure on which to construct their system—from the poles and wires linking cities to the stations that often housed telegraph offices.

⁴ Sagarin, *ibid.*

⁵ Chandler, Jr., Alfred D. *The Visible Hand: The Managerial Revolution in American Business*. Cambridge: Harvard University Press, 1977.

The cooperation was so successful that very quickly neither industry could conceive of doing business without the other. Their businesses became linked due to the mutual benefit each provided, and the benefits that further accrued from their symbiotic relationship. The interactions between the two technologies “intensified the speed and volume of the flow of goods, passengers, and messages.”⁶ They helped each other to be better, and similar to cooperation among biological organisms, “what matters is that partnerships develop according to how effectively tasks are accomplished.”⁷ The attachment between the railroad and telegraph was so strong that it could be depended on completely, allowing each industry to free up resources that would otherwise be spent on duplicating the other’s technology and infrastructure.

The lesson here is, how often do you look for opportunities for collaboration? We often talk of the competition—what they are doing, what direction they are headed—so we can keep up where we need to and not get blindsided or lose too much market share. But how many of us devote resources to looking for “the cooperation”—companies or industries with whom we can partner for mutual benefit?

Exceptional harmony

Writing about lichens, which are essentially a new organism produced through the symbiotic relationship between algae and fungi, Rafe Sagarin says of symbiosis that it “creates emergent properties that you wouldn’t predict from just looking at the two organisms on their own.”⁸

There is possibly no better example of the power of cooperation to transform existing structures and create new capabilities than the relationships required to achieve success as a symphony orchestra. The

⁶ Ibid.

⁷ Vermeij, Geerat J. *Nature: An Economic History*. Princeton: Princeton University Press, 2009.

⁸ Sagarin, *ibid.*

interaction between the musicians, and them with the conductor involves a huge amount of trust and commitment to produce something that is greater than the sum of its parts.

Alexander Shelley, conductor of the National Arts Centre Orchestra in Ottawa, Canada, describes the interaction of its members as such: “In the best-case scenario, they start to behave like a flock of birds. When you see a flock of birds moving around, you’re not quite sure who’s leading it or what’s happening.”⁹ This speaks to the unusual collaboration that happens in symphony orchestras. It’s not a leader with a bunch of followers. It is not a rigid hierarchy of responsibility. Shelley says, “When it’s functioning correctly, it’s a symbiosis between me and the eighty musicians on stage.”¹⁰

Why does an orchestra pursue its goals in this way? Because this is what all the participants believe is required to truly make the music. Perfect cooperation is the difference between good and inspirational. Shelley describes an orchestra by saying, “When things are working well, a conductor and orchestra are in this state of absolute coordination where the music is speaking the way it needs to speak.”

Other conductors have made similar points. Conductor Valery Gergiev says, “I just go straight to the most important thing—what is the color, what is the character of this music, what is the principal voice? And that means we are working immediately on...the relationship between all the parts, which is a huge coordination between all of us.”¹¹

Conductor Mariss Jansons defines that moment of success for an orchestra as “when a good performance becomes a great one, a coming togeth-

9 Parrish, Shane, ed. “The Knowledge Project: Alexander Shelley” The Knowledge Project (podcast). Farnam Street, 2016.

10 Ibid.

11 Service, Tom. *Music as Alchemy*. London: Faber and Faber, 2012.

er of the piece, the performers, and the audience that creates a positive feedback loop of continuous enrichment and enchantment.”¹²

Therefore, trust is an essential component of successful symphony orchestras. Each musician hears the instruments closest to them best, and in some halls cannot rely on their ears at all if they have to collaborate with an instrument in a different section. To cooperate fully as a group, they have to trust each other, and they have to understand how their individual part contributes to what the rest of the orchestra is doing. In *Music as Alchemy*, Tom Service describes the musicians in the Berlin Philharmonic Orchestra as “a group of players who value themselves enormously as individual musicians, but who together create an instantly identifiable single sonic body in their performances.”¹³ It’s the complete cooperation that allows the emergence of the musical experience.

An orchestra has to come together on many levels in order to make music. To achieve the trust required to anticipate the needs of the performance the cooperation must be absolute. Each member has to be all in.

An orchestra is an all-or-nothing situation. If one member is messing up and playing terribly, they can ruin the whole performance. Their playing jars with everyone else and throws them off. It requires total cooperation.

A remarkable example of this cooperation and trust is the Montreal Women’s Symphony Orchestra. Started in 1940, they were “the only complete all women’s symphony orchestra in North America at that time—conducted by a woman, managed by women, and composed of women.”¹⁴ This orchestra was born at a time when it was rare for women to play in orchestras, and if they did were confined to certain instruments that were considered “ladylike,” such as the harp. Anything happening in the public sphere, even music, was still very much considered the purview of

¹² Ibid.

¹³ Ibid.

¹⁴ Rachwal, Maria Noriega. *From Kitchen to Carnegie Hall*. Toronto: Second Story Press, 2015.

men. Of course, not everyone agreed, and two women, Madge Bowen and Ethel Stark, decided that there was enough untapped female talent in the city of Montreal to put together an all-female symphony orchestra.

The only requirement to join the orchestra at the beginning was commitment and passion. Thus, the orchestra was comprised of women from many walks of life— professional musicians and amateurs, housewives, socialites, working class, and upper class. There were Jewish women, Christians, French, English, and white and black women, including Violet Grant, the first black Canadian to be a permanent member of a symphony. Their emphasis, under the guidance of their conductor Ethel Stark, was on teamwork and inclusiveness, so that “despite their differences, they came together for one purpose: to make music.”¹⁵

The diversity of the group required a staggering amount of cooperation in order to make the orchestra succeed. They had to deal with social tensions that are still unresolved in contemporary society. Before the instruments could cooperate to make music, the cooperation of the members was required to create the orchestra. Class divisions had to be set aside during rehearsal time in order for their dedication to the music to achieve fruition.

Cooperation often comes about in a biological context due the latent understanding that no one can do everything. No species or individual is perfectly adapted to deal with the entire spectrum of possible environmental conditions. This applies equally well to an orchestra. There is no music without all the instruments, and these instruments cannot work together without people who are willing to trust each other to respond correctly to the demands of performance.

The Montreal Women’s Symphony Orchestra devoted themselves to their music, demonstrating, as Maria Noriega Rachwal describes in her

¹⁵ Ibid.

biography of the group, “the power of music to transcend boundaries.”¹⁶ Their dedication and talent were recognized after years of practice in basements and drafty industrial buildings, squeezing the music in between factory work and child-rearing, when the group became the first Canadian orchestra to be invited to play at Carnegie Hall in New York. The performance was exceptional; the music flowed out to rave reviews. Building on this success, the orchestra toured all over the world, as well as performing on television and radio. Never well-paid, the Montreal Women’s Symphony Orchestra eventually had to shut down after being denied funding that was made available to other Canadian symphony orchestras.¹⁷ So it is truly their commitment to music and each other that led them to the successes they had. In terms of cooperation, theirs was absolute. The women in the orchestra were all in.

Conclusion

Cooperation teaches us to seek out and frame interactions based on not only what we can get, but also what we can give. If there was any one model that explains humanity, then this is it. Cooperation unleashed the potential of the human species. Working and collaborating with others gives us options and opportunities that are unavailable when we insist on going it alone. Furthermore, when you don’t have time to evolve in response to changes in the environment, cooperation can significantly improve your chances of survival by pursuing relationships that bring mutual benefit.

Cooperation led to the powerful brains we have, capable of art and abstract thinking. Our complex societies are built on our ability to work with each other, believe in the same ideas, and share the same goals. Cooperation is the fuel that powers our day, from raising our children, to the jobs we perform, and the social

¹⁶ Ibid.

¹⁷ Ibid.

structures that give us everything from leisure time to meaning and purpose. When we cooperate, we lighten our individual loads and sometimes create something brand new.

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