

Why Information Grows



BITS IN ATOMS

CYRSTALLIZED IMAGINATION

THE QUANTIZATION OF KNOWHOW

THE COMPLEXITY OF THE ECONOMY

THE EVOLUTION OF PHYSICAL ORDER

Bits in Atoms

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THE SECRET TO TIME TRAVEL

- In our universe, there is no past, and no future, but only a present that is being calculated at every instant.
- Our planet is to information what a black hole is to matter and what a star is to energy. Our planet is where information lives, grows, and hides in an otherwise mostly barren universe.
- Information is not tangible, it is not solid or fluid, it does not have its own particle, but it is as physical as movement and temperature which also do not have particles of their own.
- Information is not a thing; rather, it is the arrangement of physical things. It is physical order.
- The universe is organized is a peculiar manner with information being hidden on the other side of chaos.

THE ETERNAL ANOMALY

- Humans, and some machines, have the ability to interpret messages and infuse them with meaning. But what travels through
 the wires or electromagnetic waves is not that meaning. It is simpler. It is just information.
- We infuse messages with meaning automatically, fooling ourselves to believe the meaning of the messages carried in the message. But it is not. This is only an illusion.
- Meaning is derived from context and prior knowledge. Meaning is the interpretation that a man gives to a message.
- We spend our lives passing on meaningless objects and meaningful messages: objects that augment our capacity to process information, and messages that affect our behaviors and attitudes towards others.
- Information must not be confused with meaning.
- "The main challenge of coach a team is not figuring out a game plan, but getting that game plan into the heads of the players."
 - Josep Guardiola

Crystallized Imagination

OUT OF OUR HEADS!



- "This world is but a canvas to our imagination." Henry David Thoreau
- Humans are special animals when it comes to information, because unlike other species, we have developed an enormous ability to encode large volumes of information outside our bodies.
- We are able to create physical instantiations of objects we imagine, while other species are stuck with nature's inventory.
- The finiteness of humans and of the networks we form limits our ability to accumulate and transmit knowledge and knowhow, leading to spatial accumulations of knowledge and knowhow that result in global inequality.
- "To invent, you need a good imagination in a pile of junk." Thomas Edison
- Thinking about products as crystals of imagination tells us that products do not just embody information but also imagination. This is information that we have generated through mental computations and then are embodied by creating an object that mimics the one we had imagined.

AMPLIFIERS

- There are fewer paths leading a system from disorder to order than from order to disorder.
- The correlations that characterize the information we transmit through human forms of communication are there whether we know how to decode them or not.
- "Information emerges naturally in the steady states of physical systems that are out of equilibrium." Ilya Prigogine
- Complex products are not just an arrangement of atoms that perform functions; rather they are an ordered arrangement of atoms that originated as imagination.
- "Everything should be made as simple as possible, but not simpler." Einstein

The Quantization of Knowhow



THIS TIME, ITS PERSONAL

- We form social structures to compensate for limited capacity, and these social structures learn how to process information.
- Inadequate institutions and technologies can trample our ability to form the networks we need to accumulate knowledge and knowhow, limiting the rate at which we can make information grow.
- The physical embodiment of information is the blood of our society. Objects and messages connect us, allowing us to push the growth of information into solid objects.

IN LINKS WE TRUST

- "We're constantly taking things other people evolved and spent their lives building. It's a wonderful ecstatic feeling to create something and put it into the pool of human experience and knowledge." - Steve Jobs
- Trust, which is an essential form of social capital, is the glue needed to form and maintain large networks.
- "Certain societies can save substantially on transaction costs because economic agents trust one another in their interactions
 and therefore can be more efficient than low trust societies, which require detailed contracts and enforcement mechanisms." Fukuyama
- Trust contributes to network size by reducing the costs of links, but also by providing porous boundaries that allow these
 networks to adapt to changes in markets and technologies.
- Shortcoming of traditional measures of human capital, such as years of schooling or scores on standardized tests, is that these measures fail to capture any information about the diversity of knowledge and knowhow that is embodied in a network of individuals.
- Countries' incomes are predicted by the complexity of their economies. To earn you need to make.

The Complexity of the Economy



THE EVOLUTION OF ECONOMIC COMPLEXITY

- A country's export structure is a fingerprint that tells us about the ability of people in that country to create tangible instantiations of imaginary objects as sophisticated products.
- When we start seeing products as embodiments of human imagination, we realize that there is an alternative to the balance of trade.
- The more prosperous countries are those that are better at making information grow.
- The diffusion of knowledge and knowhow explains differences in the ability of countries to make products, which are essentially differences in the ability of countries to make information grow.

THE MARRIAGE OF KNOWLEDGE, KNOWHOW, AND COMLEXITY

- The economy is a system that amplifies the practical uses of knowledge and knowhow through the physical embodiment of information and the context-specific properties that this information helps carry.
- The economy is a knowledge and knowhow amplification engine: a complex sociotechnical system able to produce physical packages containing the information needed to augment the humans who participate in it.
- The knowledge amplification powers of the economy are essential to liberate the creative capacities that allow our species to create new products -which continue to augment us- and endow us with new forms of artistic expression.
- "The intention of fixed capital is to increase the productive powers of labor, or to enable the same number of laborers to perform a much greater quantity of work." Adam Smith
- Social capital is focused not on machines or individual knowledge but on the economic value from the ability of people to connect.

The Evolution of Physical Order



FROM ATOMS TO ECONOMICS

- Economic development is based not on the ability of a pocket of the economy to consume but on the ability of people to turn
 their dreams into reality. Economic development is not the ability to buy but the ability to make.
- Unfortunately, it is common for people to confuse the value of products with the value of the knowledge and knowhow needed to make them.
- Thinking about products as crystals of imagination helps us understand the importance of the source of the information that is embodied in a product.
- Prices transmit information about the supply of and demand for goods.
- We can describe physical capital in our language as the physical embodiment of information that carries the practical uses of knowledge and knowhow into their creation.
- Social capital is the ability of a society to connect the networks that are needed to accumulate knowledge and knowhow.
- The ability to form social capital hinges on personal values, communication technologies, standards, and trust.

THE SIXTH SUBSTANCE

- People are the ultimate incarnation of computational capacities of matter.
- Relational tacit knowledge: includes what we could describe in a principle but often fail to describe.
- Somatic tacit knowledge: relates to the things we can do with our bodies but cannot describe (like riding a bike).
- Collective tacit knowledge: draws meaning from social interactions, such as rules for language.
- In the universe defined mostly by empty space, our planet is an oasis where information, knowledge, and know how continue to increase, powered by the sun but also by the self-reinforcing mechanisms that we know as life.