

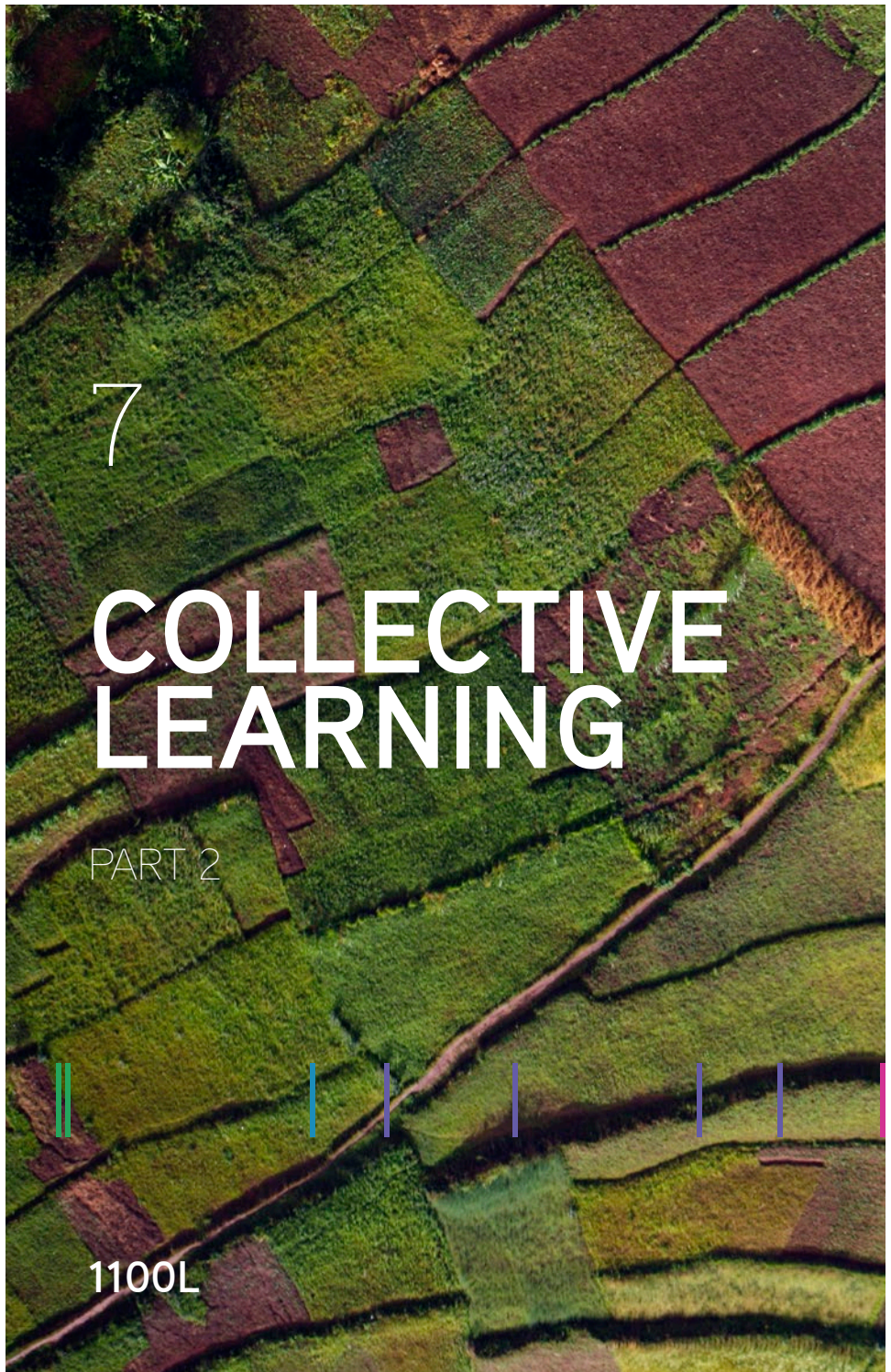
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COLLECTIVE LEARNING

PART 2

1100L

BIG HISTORY PROJECT



COLLECTIVE LEARNING

AGRICULTURE AND THE
POWER OF NETWORKS

By David Christian

In the second essay of a four-part series, David Christian explains how the spread of agriculture and the rise of civilizations generated powerful networks of collective learning.

Farming speeds up the pace of collective learning

When agriculture appeared, history seemed to speed up. Five thousand years after the appearance of agriculture, the number of humans had increased almost tenfold, from just a few million to almost 50 million. This rapid growth was made possible by an increase in the number of innovations. Farmers spread into wooded and semi-arid zones, designed new types of buildings, discovered ways to domesticate animals, pioneered new uses for clay and metals, and began to develop simple forms of irrigation.

With the appearance of agrarian civilizations, the rate of innovation increased again. Architects designed monumental architecture like pyramids and temples; metalworkers made refined tools and weapons; writing appeared, providing more reliable ways of storing and preserving information. With the domestication of horses and camels, goods and people were moved over large distances; meanwhile, sailors and merchants figured out how to travel across the Indian Ocean and into the Pacific Ocean. There was also innovation in government and lawmaking, in the types of religion, and in art and literature. New goods, including glassware, jewelry, and the coins that enabled trade and taxation to evolve, were made.

Defining networks

Collective learning was accelerating, but to understand how and why, we need to think about how humans exchange ideas. When several individuals are linked, they form a “network.” Networks appear in many different varieties. The Internet is a network of computers; economies are networks of individuals who are buying and selling; proteins within a cell form networks linked by different chemical reactions; the electricity grid is a network. All networks contain two main kinds of things: points, and links between the points.

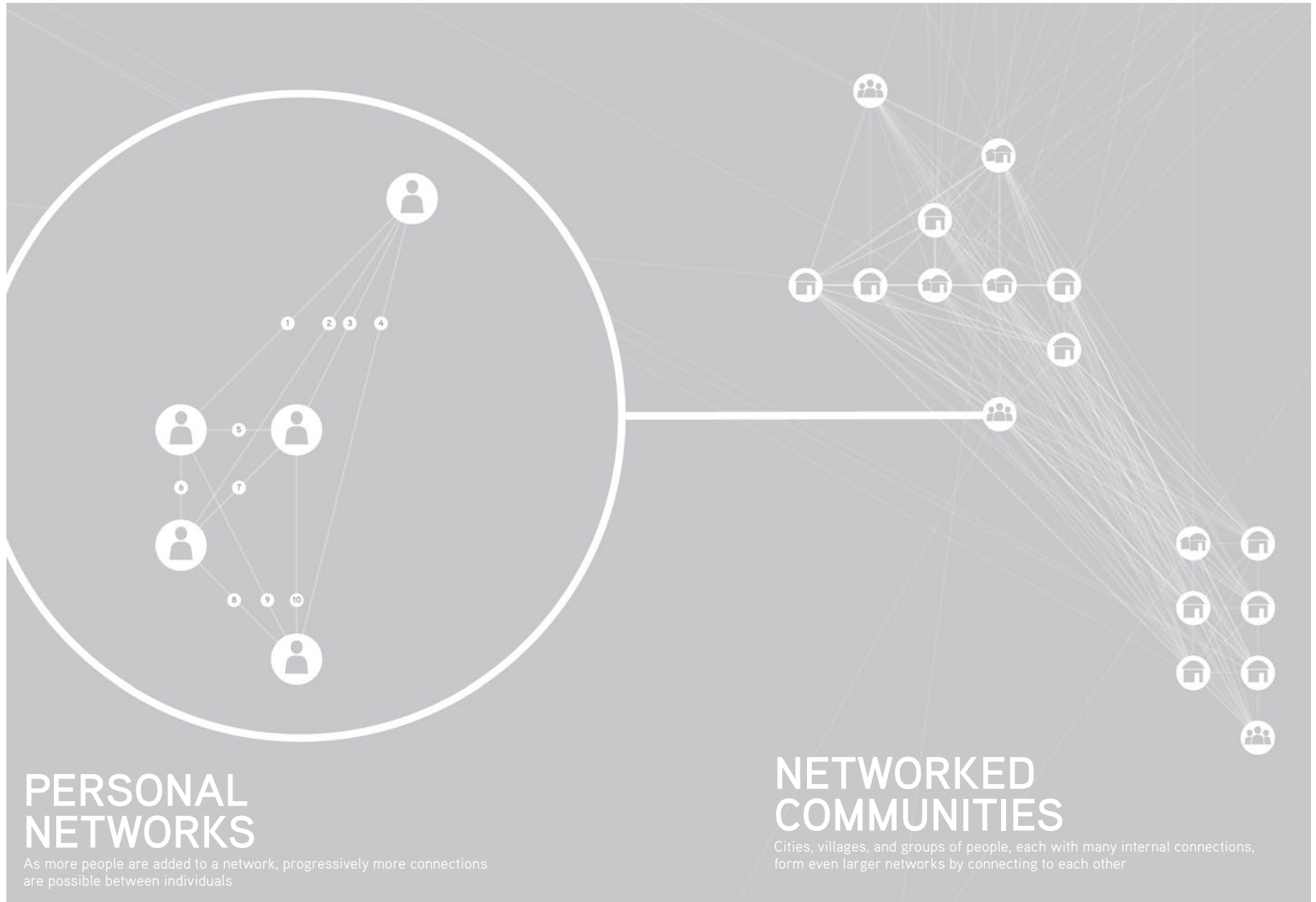
The first rule about networks: Size matters!

It may seem obvious that more ideas can be exchanged if there are more people. But as ideas are shared they often change in subtle ways as different people contribute their own ideas. So the act of sharing can add new information.

In addition, the sheer number of possible exchanges increases very quickly as the number of people rises. How many possible links are there between three friends? The answer is three. Between four friends? The answer is not four; it is six. You can see this by drawing lines between four points. How many links are there between five friends? The answer is 10. We can calculate the relationship between nodes and edges precisely using a mathematical formula but the main trend is that, as groups get larger, the number of possible links within the network increases much faster than does the number of people. So in large groups, the possibilities for sharing information are much greater than in small groups.

This tells us something powerful about the impact of agriculture. Remember that in the Paleolithic era, most communities were tiny, usually with fewer than 40 or 50 people. Much larger communities — villages with, say, 2,000 inhabitants — developed with the appearance of agriculture. A village this size would produce a network of 2 million possible links.

Of course, not everybody would link up with everyone else, but the possibilities were there. Once you had towns with, say, 10,000 people, almost 50 million links between individuals were possible. With the rise of agriculture, collective learning seems to have accelerated, generating more ideas much faster than ever before.



PERSONAL NETWORKS

As more people are added to a network, progressively more connections are possible between individuals

NETWORKED COMMUNITIES

Cities, villages, and groups of people, each with many internal connections, form even larger networks by connecting to each other

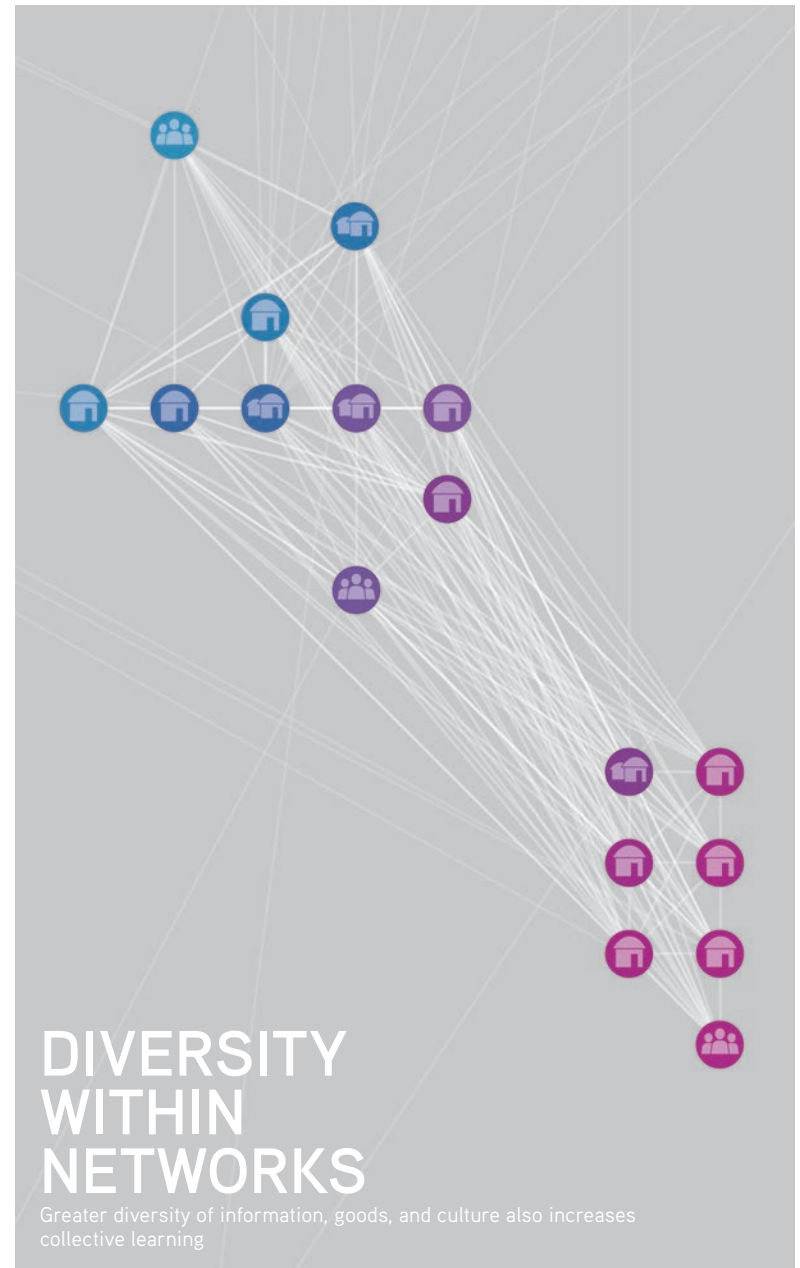
Diversity is as important as size

The diversity of people and information in a network is as important as a network's size. If everyone lives and thinks exactly like everyone else, there won't be much new information to exchange. But in reality every individual has something new to contribute. In our network model (opposite), we can imagine that the blue area represents people living near the coast, while the other shades represent people living in fertile woodlands and in arid desert lands. Each community would have slightly different ways of providing food and shelter, slightly different forms of clothing, different rituals, and different stories. An anthropologist might say that each group has a slightly different "culture," just as today your family may have different rules about eating or studying or cleaning up than your friends' families have.

Now imagine an individual moving from a coastal group to a desert group. Perhaps a man from the desert visits his cousins on the coast, marries one of the women living there, and the new couple travels back to the desert. He, from his brief visit to the coast, may have learned a bit about fishing, and she will certainly have to learn how to live in the desert. Both will know more about the world as a whole.

Most collective learning probably happens in small, almost invisible stages. In fact, it's a bit like natural selection, with the appearance of tiny variations in knowledge, some of which will prove interesting or valuable or inspiring enough to catch people's attention and spread more widely within a network. In other words, we expect to find more innovation and more new ideas in networks in which people live and work and pray and think in different ways.

Agrarian civilizations were much larger and more diverse than the societies that preceded them. This was particularly true at their borders, where merchants, soldiers, and officials met foragers, independent villagers, and horse herders. There was also great internal variety. With more productive farming methods, farmers could produce enough food and raw materials to support small groups of non-farmers: kings and queens, scribes and soldiers, poets and priests, potters and weavers.



Historians describe this process as the emergence of a division of labor, but it was also a division of knowledge. Different types of specialists acquired different skills and different types of information. Merchants, for example, had to learn about costs and prices in foreign countries; soldiers had to learn about weaponry and tactics; priests had to learn about religious traditions and rituals. The total amount of available information increased rapidly with the development of a division of labor.

So networks of collective learning were both larger and more varied in agrarian civilizations. No wonder these societies seemed to generate more technological, artistic, religious, social, and political innovation, as well as more power and more wealth!

The study of networks can also help us understand two important features of agrarian civilizations: how they encourage flows of information and how information flows support an uneven distribution of wealth and power.

As networks get larger, the amount of connectedness of any single node compared with another node gets more and more uneven. You can see this in our diagrams and in real-life situations. Google, for example, is very well connected because it links to more or less anyone who does a search; meanwhile, your school network is connected mainly to those who work or study at your school. We can see the same quality in agrarian civilizations: isolated villages had limited connections; townships with markets or temples were much better connected; and capital cities were connected to the entire kingdom.

The uneven distribution of information and connectedness can help us understand why wealth and power are distributed so unevenly in agrarian civilizations. An individual connected to 10 other individuals can form alliances or teams with those individuals. But an individual connected to 1,000 other individuals has access to more information and can form greater and more powerful alliances. (This is perhaps why we say of powerful people that they are “well connected.”) More connectedness seems to mean not only more information but also more wealth and power.

Specifically, in all agrarian civilizations we find elite groups that are wealthier and more powerful than most of the population. If you were to map information exchanges in society, you would find that the wealthy and powerful are also information hubs; to a great extent, they maintain control of the storage and dissemination of information. If you are a king, you have scribes and priests and spies who can store large amounts of information for you and carry out your orders. You also have long-distance links with a whole class of nobles and officials and merchants, who in turn are connected to the farmers who provide most of society’s wealth. If you are a peasant living in a remote village, your connections will be fewer and less diverse.

Image credits

Terraces in Rwanda

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Networks,

The Big History Project

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