

## **From Hunter-Gatherers to Farmers: Students Study How Civilization Changed during the Neolithic Age**

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### **FROM PALEOLITHIC TO NEOLITHIC**

Human civilization underwent significant changes between the periods archaeologists characterize as the Paleolithic Age and the Neolithic Age. Why and how did people become less nomadic? What factors led to technological growth and the development of more complex societies? How did early civilizations solve problems as their populations grew?

Students in Grades 7 and 8 at Innovation Academy Charter School (IACS) in Tyngsborough, Massachusetts, study this interesting period of human transition. Teachers Jason O'Neil-Willoughby and Martha McClure use a variety of materials and techniques to guide students in their research and explorations. Students read texts, find web-based information, and engage in simulations as city-states grow and compete. They collaborate in groups to study how people from ancient times worked to solve problems. Systems tools help students synthesize the information they study and present their ideas and descriptions.

### **BEHAVIOR OVER TIME**

Students researched how human conditions changed, and could explicitly represent their ideas and assumptions by drawing behavior-over-time graphs. They tracked **variables** that were changing over time to make life more secure for the emerging Neolithic people.

- **Food supplies** grew as humans transitioned from hunter-gatherers to farmers.
- Learning to raise **crops** and **animals** maintained a reliable flow as agriculture was developed.
- **Life spans** rose, and **time available** for activities other than obtaining food increased.

Other changing aspects of life involved important advances in technology in the Neolithic Age.

- **Permanent and stable shelters** replaced caves or temporary dwellings.
- The **size of communities** grew as people settled into these sturdy houses, and larger community groups fostered more **cooperation** and **diversification**.
- **Tool-making** flourished along with important **crafts** such as weaving and pottery.
- **Trade** became more common among communities also.

Some variables were not completely advantageous, and students considered these as well. For example, the increased size and density of settlements made **contagious**

**disease** a potential threat, and the **proximity to domesticated animals** caused problems at times.

### **CONNECTING THE VARIABLES**

Having generated all these changing variables, the students needed a unifying structure to track their overall effects on Neolithic life. Much of the information in the textbook about these variables was presented in a linear way. Other resources concentrated on specific aspects of Neolithic life. Jason and Martha wanted to push the students further to consolidate their learning and see if they could make connections among the changing elements of Neolithic life.

Jason had attended a systems workshop in the summer during which he used connection circles to create causal loop diagrams. He and Martha decided to use the technique in class. They teach the unit twice per year, and, while the first set of students learned the material without using systems tools, the teachers wanted to go further with the second group.

Working in teams, students wrote the changing elements of Neolithic life around a connection circle and drew arrows of causality between the elements. They found that many of the changing variables affected each other in powerful ways.

"I found myself making more connections among the changing elements," Jason said, when he was reflecting on using connection circles with his students. The many arrows of causality the students drew indicated that they were finding connections as well. "The discussions were better."

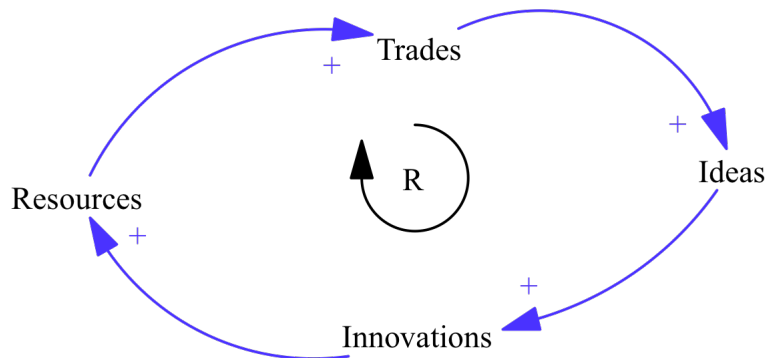
### **CLOSING THE LOOPS**

After the class used the technique of building connection circles, they traced paths among the dynamic elements that started and ended with the same variable. Students were able to discover important feedback loops that drove some of the most significant changes in human history. These first simple causal loops connected elements within the system that aren't always explicitly linked in student learning, including **volume of trade, sophistication of shelters, permanence and differentiation within communities, resources available, technology,** and other characteristics of complex societies.

## EXAMPLES OF STUDENT LOOPS

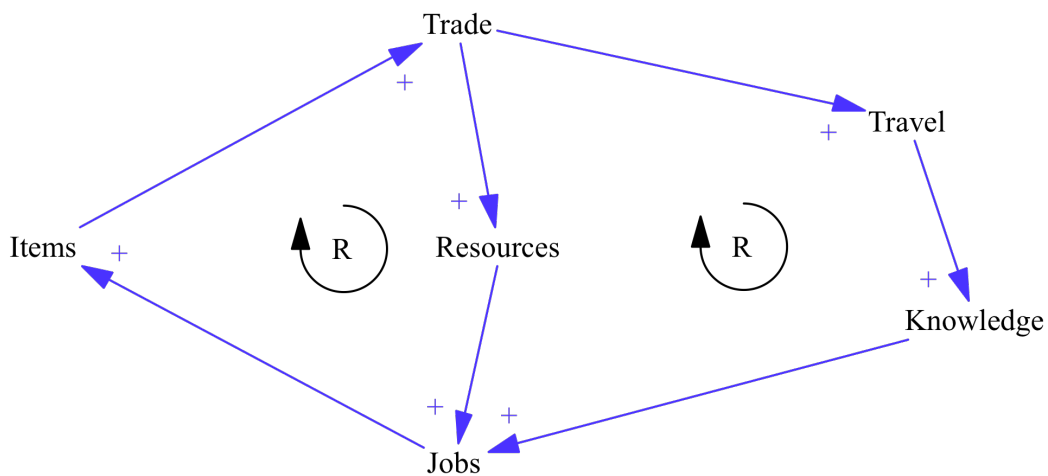
Here are a few of the loops students drew. While the spelling has been changed in some cases, the words and phrases are copied verbatim:

### Trading and Innovation Loop



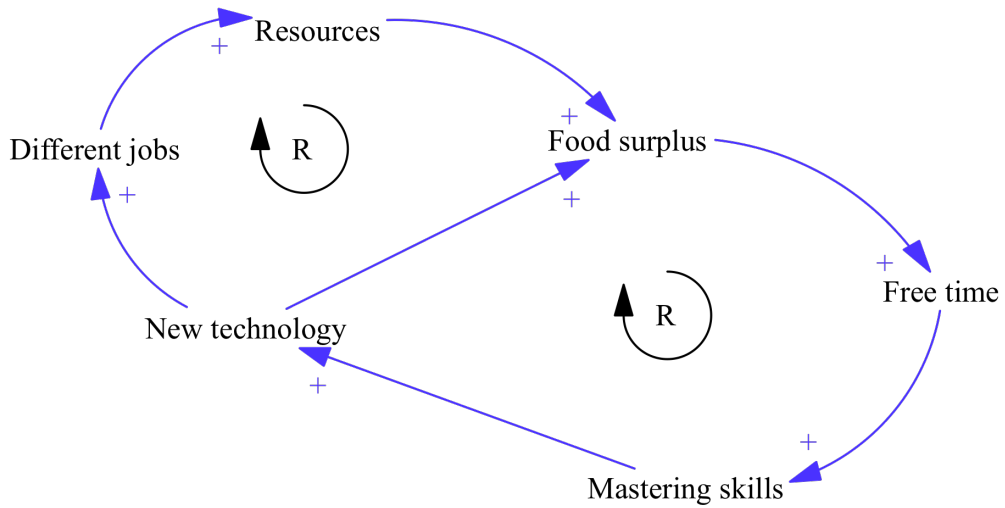
The "Trading and Innovation Loop" was typical of one type they traced. As trading increased, new ideas and technology were incorporated into a society. The innovations allowed for better use of resources, which in turn increased opportunities for trade. The same loop might be used to describe the advantages of globalization in modern times.

### Trading and Knowledge Loop



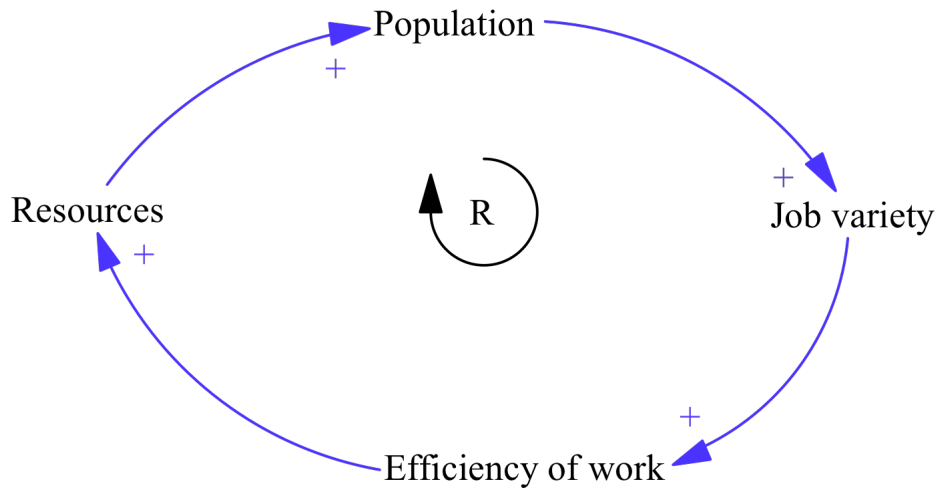
A similar loop, the "Trading and Knowledge Loop," described how trade increased job specialization through new resources and knowledge gained from other societies. Those jobs increased production ("items"), which created opportunities for more trading.

### Technology and Food Surplus Loop



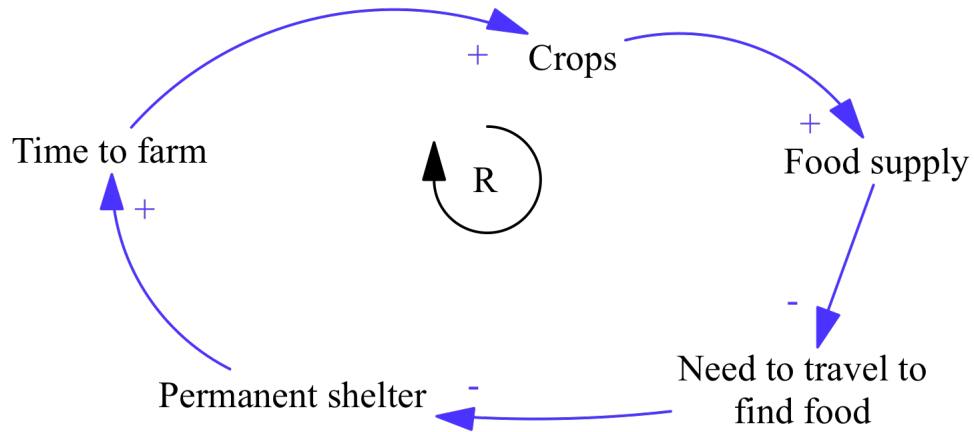
In the "Technology and Food Surplus Loop," students reasoned that the food surpluses brought about by new technology increased the time available to develop new skills and technology.

### Population Increase Loop



The team who developed the "Population Increase Loop" reasoned that the growing ability of humans to specialize and work efficiently increased the availability of resources. A larger population could be supported and became even more adept at skilled work.

### Farming and Shelter Loop



While another team built a reinforcing loop like the others, notice that in the "Farming and Shelter Loop" two causal connections have negative polarity. As the food supply increased, the need to travel as hunters and gatherers decreased. When the need to travel decreased, the establishment of permanent shelter increased. Students were able to describe how elements in the loop continued to be driven in one direction rather than oscillating (alternating increases and decreases).

#### STUDENT REACTION

Students in the class commented on the use of behavior-over-time graphs and causal loops in a self-reflection sheet filled out after the unit was completed.

Mary wrote, "They were very helpful in learning about relationships between the variables. The Neolithic variables (pop., food supply) can have more than one relation to another."

Spencer wrote, "The systems thinking helped me because I could see how everything is connected."

Kaitlyn's summation seemed to represent the perspectives of many of her classmates: "The causality loops were fun to make and think about. They taught me a lot about what we were learning and were understandable."