# The Neolithic Age

## The Neolithic and the development of agriculture

DynaLearn level 3 | Version 1.0

| Summary |
| --- |
| In this lesson, you will learn about the Neolithic age. After the last ice age (about 10,000 BCE), human societies made a transition from hunting and gathering to an agricultural way of life. What has caused this transition? Which processes were involved? During this lesson, you will construct answers to these questions. |

| First name | |
| --- | --- |
| **Surname:** | |
| **Class:** | |
| **Date:** | |
| **Comments by teacher:** | |
| | |

# 1. The Neolithic age – Introduction

In this lesson, you will learn about the Neolithic age. After the last ice age (about 10,000 BCE), human societies made a transition from hunting and gathering to an agricultural way of life. What has caused this transition? Which processes were involved? During this lesson, you will construct answers to these questions.

## Characteristics of hunter-gatherers

You have probably heard of hunter-gatherers. The images below give you an impression of how these people lived and still live.



**Figure 1.** Native North American Tribe – the Shoshone (source: Jackson, 1870).



**Figure 2**. Modern hunter-gatherers in Tanzania (source: Gibbons, 2018).

1.  Describe for both characteristics how hunter-gatherers live.

| | |
|---|---|
| *Nomadic* (moving from one place to another) | |
| Source of food | |

## Introduction video about the Neolithic age

You are going to watch a video about the rise of agriculture and the beginning of the Neolithic age. Also called the New stone age (neo = new, lithic = stone).

This is the link to the video: videolink. Note that, you only need to watch part of the video!

2.  Watch the video during: 00:00 - 04:45 minutes.

3.  Describe three causes for the beginning of the Neolithic age.

1.

2.

3.

4.  Watch the video during: 04:45 - 06:02 minutes.

5.  Describe three effects that agriculture had on people's lives in the Neolithic age.

1.

2.

3.

Introduction video about the Neolithic age

## 2. Start DynaLearn

There are several ways to log in. Use one of the two options below. Then check whether the login was successful (see 'Let's check').

Via a code:
1. Go to DynaLearn (https://create.dynalearn.nl/).

2. Click on 'log in with code', at the bottom left.

3. Enter the project code and your (school) email address.

4. Copy the code from the confirmation email received from *dynalearn.nl* (see spam folder if needed) and fill in the other details.

5. Log in to DynaLearn.

By email invitation:
1. Copy the login details from the invitation email received from *dynalearn.nl*.

2. Go to DynaLearn (https://create.dynalearn.nl/).

3. Log in to DynaLearn.

---

**Let's check!**

After logging in, you will automatically enter in the white workspace of the assignment. You can recognize it by the question mark on the right side of the screen . Is the question mark missing? Then first do the following:

- In DynaLearn, click , and click on 'Select template'.
- Choose 'Neolithic age' and press 'Load'.

---

Save model file and start:
1. Click on  top left. Change the name to 'Neolithic age' and click 'Save'.

2. How do you proceed? Just follow the steps in this workbook. Note! You can't skip steps. Ask for help if you do not understand a certain step. The video function  in DynaLearn shows how a model ingredient can be created. The sources contain information about the greenhouse effect and the boxes contain a brief explanation about the model ingredient. Put a check mark √ next to the step you completed. This way you keep track of where you are in the assignment.

# 3. Hunter-gatherers

We are now going to study in more detail how climate change has affected human societies. To do this, we create a model in DynaLearn.

The beginning of the model has already been prepared (see figure 3). Note, if you do not you see a beginning as shown in figure 3, then go back to the previous page at 'Let's check!'
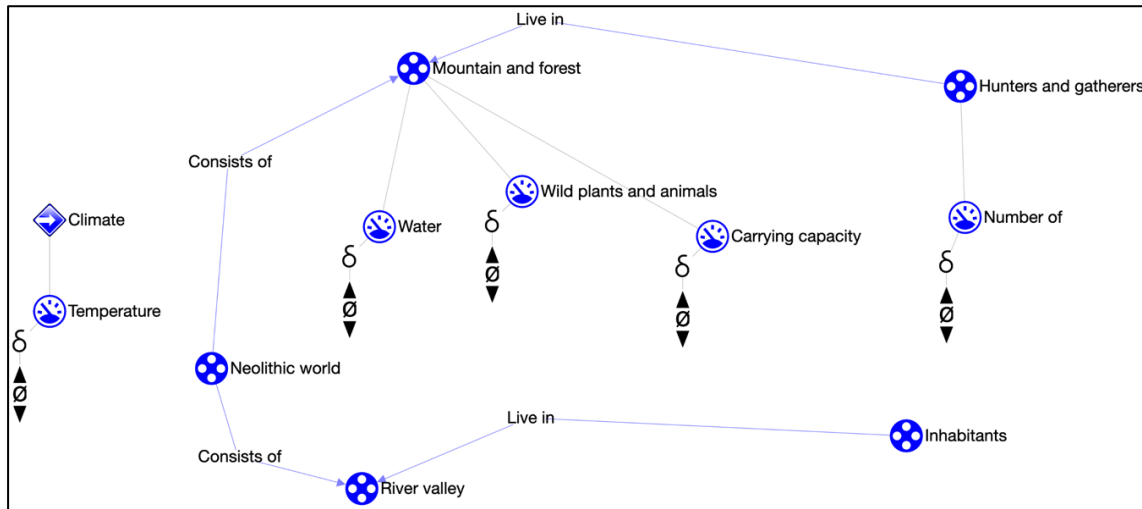


**Figure 3.** Initial situation when building the model.

1. Read box 1 (to refresh your memory).

> **Box 1.** Entity and quantity
>
> An entity ⊛ is usually a physical thing in a system (e.g., car, human).
>
> A quantity 🕹 is a measurable property of an entity (e.g., temperature, length).
>
> An agent ◆ is usually a physical thing with a measurable property that affects the system from the outside (e.g., government, sun).

2. There are already several quantities in the model. The quantity *Carrying capacity* is not discussed in the video and can be defined in multiple ways.
   o Provide a definition of *Carrying capacity* that fits the current lesson (you can search for it online in Wikipedia).

> *Carrying capacity is...*

3. Read box 2.

> **Box 2.** Help function.
>
> If the question mark ❓ or an ingredient in your model ⊛ is red, then something is wrong.
>
> Click the question mark ❓ for a hint. Then click on a number, for example ① to see where the error is in your model. Only use the question mark if you can't figure it out yourself!

4.  Try the help function by misnaming the entity *Mountain and Forest* (choose any name from the drop-down list). Click on (?) see what notification you get.

5.  Change the name back again.

6.  Read box 3.

> **Box 3.** Cause-and-effect relationships.
>
> In DynaLearn, there are two types of cause-and-effect relationships:
> - Positive relationship (+): the quantities change in the same direction (if quantity 1 increases, then quantity 2 increases also)
> - Negative relationship (−): the quantities change in opposite direction (if quantity 1 increases, then quantity 2 decreases. Or vice versa: if quantity 1 decreases, then quantity 2 increases)

7.  Create the four causal-and-effect relationships ((+) or (−)) between the five quantities in the current model. The quantities are already in the right order (from left to right). Use what you have learned from the video and the answers you have filled in above. Make sure that everything is connected and that there are no errors (see ◼ → ◢◣ ).

8.  Read box 4.

> **Box 4.** Change of a quantity.
>
> A quantity ⊙ can change. This is indicated by $\overset{\delta}{\underset{\blacktriangledown}{\overset{\blacktriangle}{\varnothing}}}$ . The delta symbol (δ) is the mathematical sign for change (also called the derivative). The down arrow (▼) is a decrease, the zero (∅) is constant and the up arrow (▲) is an increase.

9.  There are three possible starting situations. The *temperature* may decrease, remain the same or increase. Set the initial change of the temperature to increase:

    o Click for *Temperature* on ▲ and select ➤ (see ◼ → ➤ ). It will look like this: $\overset{\delta}{\underset{\blacktriangledown}{\overset{\blacktriangle}{\varnothing}}}$ ..

10. Start the simulation by clicking ⊙ (see ◼ → ⊙) and investigate what happens.

11. Read box 5.

> **Box 5.** Help function.
>
> If the explanation mark appears (!), something is wrong during the simulation. Click on the explanation mark (!) for a hint. Then click on a number, for example **1**, to see where the error is in your simulation.

12. Read box 6.

---

**Box 6.** Read the outcome of a simulation.

After starting a simulation (with ⊘ ), a window appears on the right in which the possible states of the system are indicated. There is one possible state in this example ①.
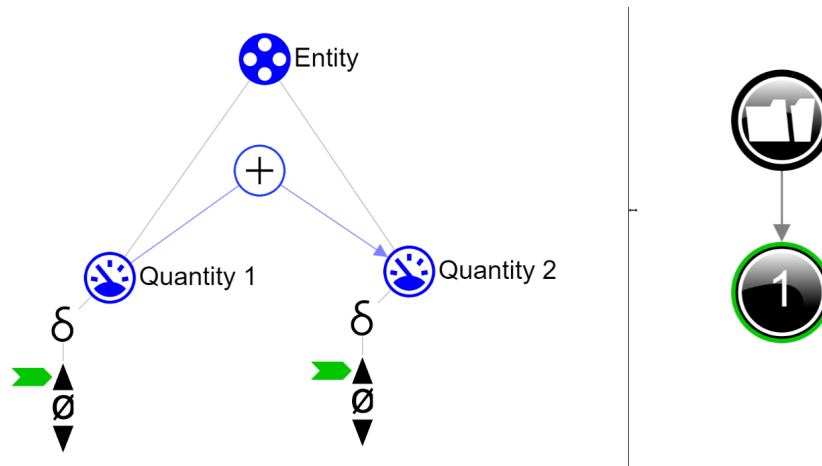


You can click on the state to view the outcome. The state icon then gets a green circle. In the model, the change for this state is indicated by green arrows ➤. The model shows that in state ① *Quantity 1* increases and that therefore *Quantity 2* also increases.

---

If all went well, the result of your simulation will also show one state:

13. Select ① to see how increasing temperature affects the hunter-gatherer society.

14. Choose the right words in the sentences below (cross out wrong answers):

---

At the end of the last ice age, climate change causes a global *increase/decrease* in temperature. One of the effects was that the availability of water in the mountains and forests *increased/*decreased. This, in turn, led to an *increase/decrease* in the available wild plants and animals. As a result, the carrying capacity of the ecosystem *increased/decreased*. And therefore, the number of hunters and gatherers *increased/decreased*.

---

# 4. Model extension: Inhabitants of the river valley

We are now going to add agrarian societies to our model. The images below give you an idea of how these people lived.


**Figure 3**. Rise of agriculture and the rice revolution (source: Heritage of Japan, 400 B.C.).


**Figure 4.** A Neolithic settlement (source: Zdenek Burian, 1957).

1.  Describe for both characteristics how agrarian societies live.

| | |
|---|---|
| *Sedentary* (living in one place) | |
| Source of food | |

After the last ice age, river valleys became attractive for settlement.

2. **Add** the three quantities *Crop production*, *Food supply* and *Number of* to the appropriate entity (see ■ → ☺).

3. **Add** the causal-and-effect dependencies ( ⊕ or ⊖ ) between these quantities. One of the quantities is directly influenced by the *Temperature* (*tip: If necessary, take a look at the first part of the* [introduction video](*)*) (see ■ → ◢ ).

4. **Click** ⚡ to align everything neatly.  **Click** ↗ to make your model fit on your screen.

5. **Start** the simulation by clicking ⊙ (with initial value *temperature increasing*).

6. **Choose** the right words in the sentences below.

> The increase in temperature after the last ice age had a *positive/negative* effect on the number of hunters and gatherers and a *positive/negative* effect on the number of inhabitants of the river valleys, because... <write your explanation here>

# 5. Emigration

As the carrying capacity of the mountains and forests decreased (due to the decreasing availability of water), hunters and gatherers became hungry and thirsty. In response, they began to migrate to the settlements in the river valleys. Emigration from the mountains and forests reduced the number of people living in hunter-gatherer societies.

1. Add quantity *Emigration* to the correct entity in the model (see text above) (see 🎥 → 🎛️).

2. Add the causal-and-effect dependencies ( ⊕ or ⊖ ) between the quantity *Emigration* and the other quantities in the model. There is **one** quantity that has an influence on emigration. Emigration has an effect on **two** other quantities. So, you have to make three new causal-and-effect dependencies (see 🎥 → 📊 ).

3. Click ⚡ to align everything neatly. Click ⤢ to make your model fit on your screen.

4. Start the simulation by clicking ▷ (with initial value *temperature increasing*).

5. Choose the right words in the sentences below (with initial value *temperature increasing*).

> The temperature increase after the last ice age had a *positive/negative* effect on the carrying capacity of the mountains and forests. As a result, the emigration of hunters and gatherers *increased/decreased*.
> - Emigration of hunters and gatherers had a *positive* effect on: <write name quantity and associated entity>
> - and a *negative* effect on: <write name quantity and associated entity>

# 6. Food supply

The inhabitants of the river valleys became better and better at growing crops. They started domesticating animals in addition to agriculture (not in our model). This increased the nutritional value of the food and provided additional resources for growing their crops, such as manure and pulling power. This led to a situation where food was no longer scarce, but became available in abundance. This was a turning point in human history. We are going to add this event to our model.

1. Read box 7.

> **Box 7.** Quantity space.
>
> A newly created quantity ⊕ does not yet have a quantity space. By adding a quantity space, you can indicate which values a quantity can take on. A quantity space consists of alternating points (■) and intervals (▮).
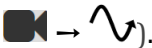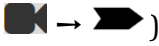> - A *point value* is only one value. For example, a *boiling point*. A special point is the zero point, for which there is a separate symbol (∅) in DynaLearn.
> - An *interval* is a set of values. The liquid phase of a substance is an example of an interval. In the case of water, the interval 'liquid' contains all values between 0 °C and 100 °C. The values 0 °C and 100 °C are respectively the 'melting *point*' and the 'boiling *point*' between which the interval 'liquid' is located.

2. Food supply can be *scarce* or *surplus*. Between these two **intervals** there is a certain **point** where food supply goes from one to the other situation. For convenience we call this point *transition*.
   - Create the quantity space (see 🎥 → ☰ ) for the quantity *Food supply*. Use the values as described above. Make sure they are in the right order (scarce at the bottom).

3. Read box 8.

> **Box 8.** An exogenous influence.
>
> If you want a quantity to decrease, remain stable or increase throughout the whole simulation, you must add an external influence (an exogenous influence) to the quantity.

4. Add an exogenous influence that keeps *Temperature* increasing during the simulation (see 🎥 → ⤳).

5. Set the initial value of the quantity *Food supply* to *scarce* (see 🎥 → ➤ ).

6. Start the simulation and choose the right words in the sentences below.

> The increasing temperature after the last ice age had a *positive/negative* effect on the food supply. Initially, food was *scarce/surplus*, *but thanks to an increase/decrease in crop production, food became scarce/surplus.*

# 7. Completing the model: Society is changing

The number of inhabitants of the river valleys is increasing and the societies are changing from semi-sedentary to agricultural. Most likely, this transition is directly related to the situation in which a surplus of food is produced.

1.  Add the quantity *Society type* to the entity *Inhabitants*.

2.  Create a quantity space for the quantity *society type* with the values *semi-sedentary, transition,* and *agriculture.* Pay attention to the order! (see 🎥 → ☰ ).

3.  Add the causal-and-effect dependency ( ⊕ or ⊖ ) with the quantity that influences the quantity *Society type* and thereby changes it.

4.  Set the initial value for *Society type* to *semi-sedentary* (see 🎥 → ▶ ).

5.  Start the simulation and investigate the result.

6.  Does the result of the simulation look like the image on the right? This may not be what you expected, and it is certainly not what we aim for.

    o  Examine the outcome. There are too many possible routes: which numbers indicate a correct sequence of events?

    o  Cross out the wrong numbers in the row below.

       | 1 → 2 → 3 → 4 → 5 → 6 → 7 → 8 → 9 |
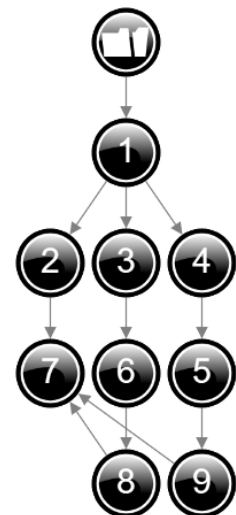
7.  Read box 9.

> **Box 9.** Correspondence.
>
> In a system, it can happen that certain values of different quantities can only occur together. You can then make a **correspondence** between the quantity space of those quantities.

8.  Create a directed correspondence (see 🎥 → ⇄) between the quantity space of *Food Supply* of the entity *River Valley* and the quantity space of *Society type* of the entity *Inhabitants.*

9.  Read box 10 (same as box 5 on page 5).

> **Box 10.** Help function.
>
> If the explanation mark appears ⓘ, something is wrong during the simulation. Click on the explanation mark ⓘ for a hint. Then click on a number, for example ①, to see where the error is in your simulation.

10. Run the simulation.

   o An exclamation mark appears ⊕ (at the top right of the screen).

   o Click on ①.

   o Remove the initial value for quantity *Society type* (select ➤ and 🗑) of the entity *Inhabitants*.

11. Click ⚡ to align everything neatly. Click ⤢ to make your model fit on your screen.

12. Run the simulation again and choose the correct words in the sentences below.

> The temperature increase after the last ice age had a positive effect on the food supply. Initially, food was *scarce/surplus* and the society type was *semi-sedentary/agriculture.* Due to the increasing crop production, food became *scarce/surplus* and the society type changed to *semi-sedentary/agriculture.*

13. Read box 11.

> **Box 11.**  Progress bar.
>
> At the bottom of the screen is the *progress bar* (see example below).
>
> Entity says: ⚙ 4/4/0, this means: 4 created, 4 needed, 0 error. For quantity it says ⏱: 5/17/1: this means: 5 made, 17 needed, 1 error. If all the numbers are green, that type is settled.
>
> <div style="border:1px solid;padding:4px">⚙ 4/4/0   ⚙⚙ 3/3/0   ⏱ 5/17/**1**   ⚞ 0/26/0   # 12/24</div>
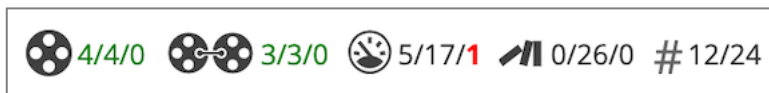
14. Is your model finished? Check whether everything is **green** in the progress bar at the bottom of the screen. If not, add the missing ingredients or fix any errors.