Weaving Codes

Overview

In this PDF, you will find instructions for the **Weaving Codes** activity.

In a separate file (**WeavingCodes-Templates PDF**) you will find templates, cutting guides, and Program Codes that you can either print off, or use as a reference (i.e. you can easily copy the information for the codes onto paper or index cards, and cut the paper using a ruler or approximation - if you do not have access to a printer).

Find a space, preferably on the floor or a table that is the appropriate height for the child. This should be a space where you can easily lay out all of our materials in an orderly way, without immediate clutter or distraction.

This activity is intended for children ages 3 - 9; we encourage you to adapt to your child(ren) and circumstances as you see fit. There are 3 different sizes of templates and codes (small / medium / large) to accommodate different ages and levels. For example, a younger child will start with the smallest, whereas an older child may progress to using the medium and the large activities.

Key Concepts and Connections

Weaving and Codes:

A code is a set of instructions that provides a series of steps that can be followed and repeated.

For weaving, we can use simple codes that will function as instructions to create a pattern. Here, our instructions are very simple: we will either thread the paper OVER or UNDER. But with just two possible steps, we can create all sorts of beautiful and unique patterns!

This activity draws on similar concepts that are represented in the **Pixel Boards** material. With the Pixel Boards, children follow simple codes of 1s and 0s that represent individual pixels to create patterns with mosaic tiles.

Weaving Codes

Did you know that modern computing was originally inspired by weaving?

It's true! One of the first computational machines was the Analytical Engine, created by Charles Babbage and Ada Lovelace. This machine was directly inspired by the Jacquard Loom, a mechanism that allowed for weaving patterns to be recorded and woven through the use of punch cards. These physical punch cards inspired Ada Lovelace when she created the first programs for the Analytical Engine. They were the first computer programs! Punch cards provided instructions that could be carried out consistently by a machine. With something so simple as punches in the card, information such as a pattern of a weave or numbers to be crunched could be stored and processed entirely by the machine—so that we can calculate big numbers or weave beautiful patterns.

"We may say most aptly that the Analytical Engine weaves algebraic patterns just as the Jacquard loom weaves flowers and leaves."

- Ada Lovelace

Overview and Set Up

Materials
- assorted paper: whatever you have on hand works—even magazines and newspaper. Color is helpful to create striking visual patterns, but not necessary. You can also start with your little ones by painting paper with quick watercolor washes.
- ruler
- pencil
- scissors

Preparation
- cut assorted paper based on the templates or guides in the WeavingCodes-Templates PDF
- print out and cut the **Program Cards** (they have the dots). You can also create your own, using index cards, pieces of paper, or graph paper and copying them by hand.
- find a spot that is clear of distractions, such as a table appropriate for the child's height.

What if I don't have access to a printer right now?
No problem! We have included measurements here, so that you can use a ruler and simple letter-size paper (or any size paper for that matter) to cut out exactly what you will need. Just follow the guides in the WeavingCode-Templates PDF.

For the **Program Cards**, you can hand-write these on index cards (or pieces of paper) and/or use graph paper. The important thing here is to create rows of instructions (clear to follow), that will be the dots—either filled in (BLACK) or empty (WHITE).

Weaving Codes

Activity 1: Small Weaving - 4 x 4

Objective

Children will learn how codes can provide instructions for woven patterns.

Setting Up

1. Cut the paper that you will need, depending on the size of your weaving. For younger children, it is best to start with the smallest size, that is the 4 x 4 grid. You can either print out the template, and cut the paper; or follow the measurements on the guide to measure and cut out your own.

For the 4 x 4 Small Weaving, you will need:
- cut paper: 1 Small Weaving Frame + 4 Strips
- Program Cards: print and cut out; or create your own handwritten ones using the Template as a guide.

Key Questions

2. Find woven things in the household. *Do you see a pattern? Can you describe the pattern? How do you think this was made?*

3. Explain to the child that we are going to learn about weaving and codes. *What is a code?* In computer science, a code is a set of instructions.

For our weaving, we can use codes as simple instructions that will create a pattern. If we follow a code correctly, we will have the same pattern every time. You can make your own designs! And then write down the code so that you can make it again or share it with someone else.

New Vocabulary:

Warp: the lengthwise, vertical threads in a weave that are held stationary in tension. (labeled in this doc as **Frame**)
Weft: the horizontal threads that are inserted over and under the warp. (labeled in this doc as **Strips**)

Process

4. Lay out your paper frame and the 4 strips of paper. The paper frame should have vertical cuts (the *warp*). With a strip of paper, demonstrate how to weave the paper over and under the vertical ones (the *weft*), saying the words *OVER* and *UNDER* aloud as you go.

5. Let the child try on their own for a bit, in order to understand how to weave the paper strips over and under the vertical strips.

6. Remove the strips. Place a Program Card next to the paper. Point to the dots on the Program Card, and explain: This card gives us instructions to create patterns for our weaving.

When the dot is **filled in (BLACK)**, we thread the strip **OVER**.
When the dot is **empty (WHITE)**, we thread the strip **UNDER**.

7. With a Program Card, allow the child to try and follow the code to create a pattern for the weave, reminding them as they go that the filled dot instructs us to thread OVER, and the empty dot instructs us to thread UNDER.
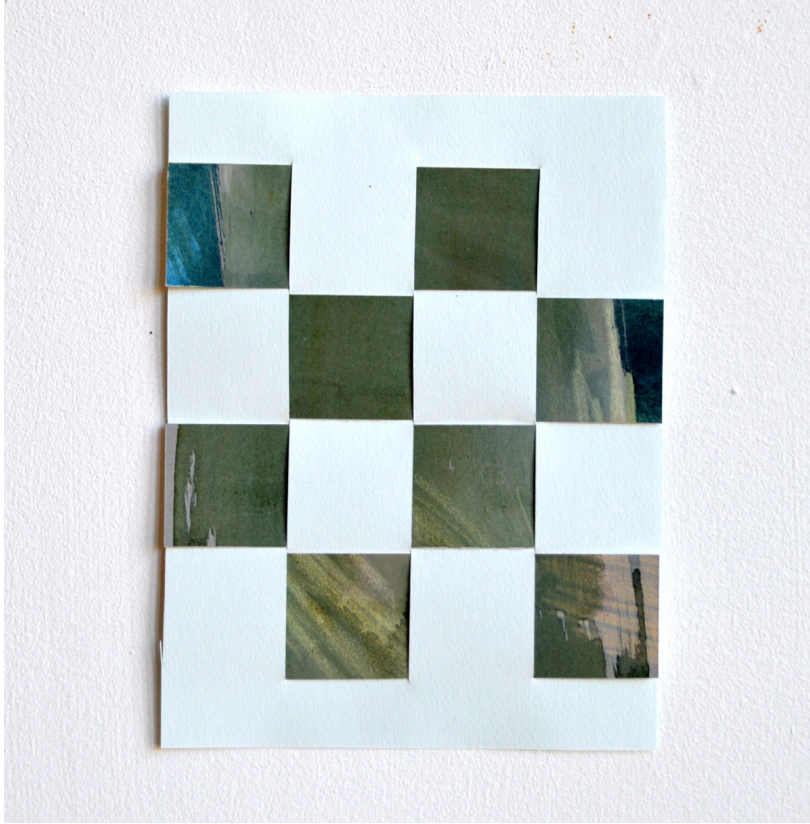
Checking for Errors

8. When the child has finished the card, look at the design together, and ask if it is correct. You can check dot by dot, using your finger to point from the card to the weaving.
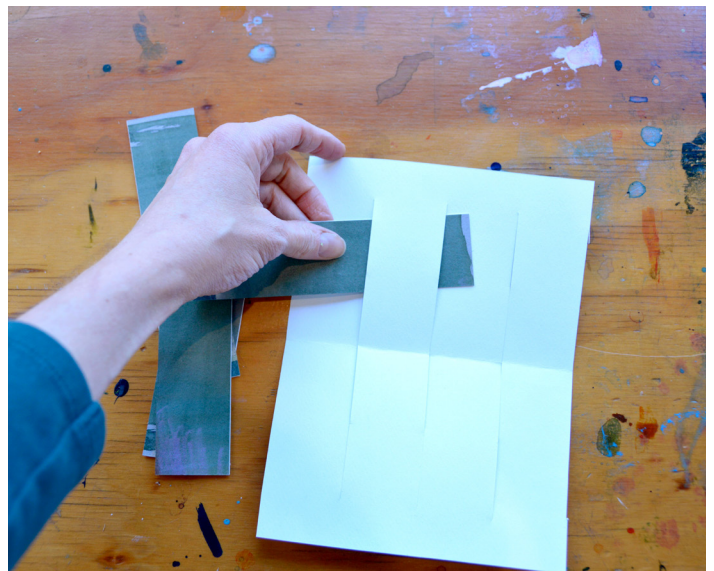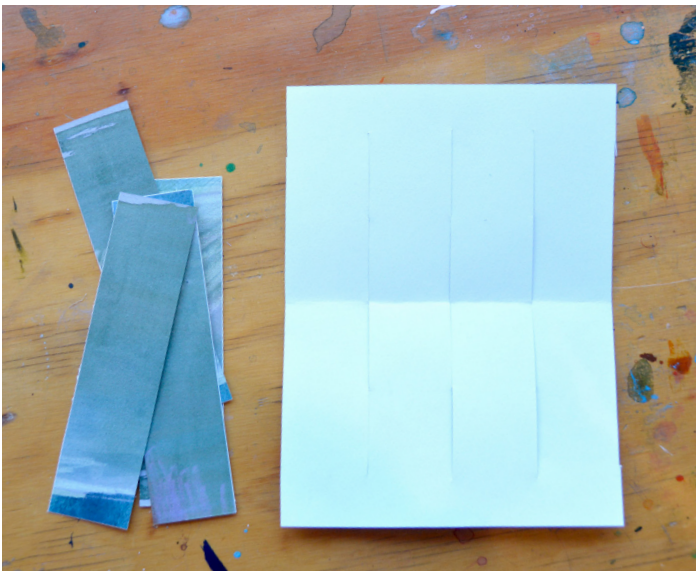
Small 4 x 4 Weaving Example

Weaving Codes

Activity 2: Medium / Large Weaving (8 x 8 and 16 x 16)

Setting Up

1. Cut the paper that you will need, for the medium (8 x 8 grid) or the large (16 x 16 grid) weaving patterns. Print out and cut out the corresponding program cards.

Continue as before, so that the filled (black dot) equals OVER, and the empty (white dot) equals UNDER.

Place a black piece of paper over the Program Card, so that only the row that the child is following is visible.

Checking for Errors

When the child has finished the card, look at the design together, and ask if it is correct.

Activity 3 - Create your own code

Children can save their own designs as codes! Children can create a design with paper weaving and then write the code as dots

Remember:
filled / solid = OVER
empty / blank = UNDER

Or start with writing a code, and then try it out!
Share it with someone else at home, so that they can follow the code!

Medium 8 x 8 Weaving Example

You can try using different color paper for the weft (the horizontal strips); here two colors are alternated to follow the code.

Large 16 x 16 Weaving Example