

Line Printing: A Process for Exploring Mathematical Concepts

by Cathy Weisman Topal



As a studio art teacher for over 20 years, I have had the privilege of observing and working with many young children. I'm always fascinated to watch children who have access to drawing, writing, and painting tools begin to generate a variety of line, shape, and design configurations sometime between the ages of 3 and 5½. You have probably noticed patterns, symmetrical designs, radial designs, borders, or simply pleasing arrangements of lines and shapes in the work of your students. Line printing is a process to offer when you see these interests developing within a group of children.

Repetition

Printing is a repetitive process, which makes it a great way to practice **counting** without placing the focus on counting alone.



To Print A Line: Dip a piece of corrugated cardboard into paint. Press the edge onto paper. Lift carefully and repeat. Encourage children to stand while printing.

How many clear, strong prints can you make with only one dip into the paint?

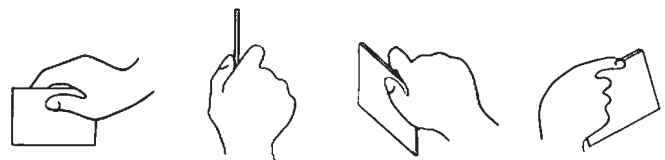
Cathy Weisman Topal has been a studio art teacher for over 20 years. She teaches at the Center for Early Childhood Education and the Smith College Campus School at Smith College. She also teaches visual arts education in the Department of Education and Child Study at Smith College. She is the author of *Children, Clay and Sculpture; Children and Painting, Beautiful Stuff: Learning With Found Materials* that she co-authored with Lella Gandini.

Line Formation and Spatial Orientation

Printing with a line-stamping tool has an added advantage. Subtle changes in a child's hand and body position can dramatically change the direction and quality of the printed line. In the process of exploring line printing, children become aware of spatial orientation. Simply by changing hand and body position, children learn to change the direction of their lines. With the guidance of a teacher, children can identify and use language to name and distinguish between horizontal, diagonal, and vertical lines.

Throughout my many years of teaching I continue to be amazed by how naturally children pick up and use these terms and other mathematical terms when they hear them being used in the classroom. If teachers listen carefully, they will also hear children invent wonderful descriptive words, such as "lying down," "exploding," and "straight up" to describe lines.

long
short
longer than
shorter than
length
height
taller
wider
equal
parallel
perpendicular
geometric
shape
square
triangle
rectangle
hexagon
octagon



Creating horizontal, vertical, and diagonal lines is important for patterning and shape formation. It's also important for letter formation and recognition and is a pre-reading and writing skill. Offer children many opportunities to practice printing horizontal, vertical, and diagonal lines and to experiment with lengthening, crossing, and building lines.



BEGINNINGS WORKSHOP

Practice Printing Horizontal, Vertical, and Diagonal Lines

Be sure to spend some time enjoying and inviting children to describe the lines in their work. Here is Bryce's recipe for making a star that came out of a discussion:

Shape Formation — As children experiment with vertical, horizontal, and diagonal lines they will discover ways to elongate, cross, connect, and space their lines. Often

Bryce (age 4) developed this recipe for printing a star:

- 1 horizontal line
- 1 vertical line
- 2 diagonal lines

children will construct shapes and other line formations that they might not be able to draw or write. Children just entering the stage of representational drawing sometimes make a huge leap when offered line printing as a tool for composing pictures, letters, numbers, and shapes.

Geometrical shapes such as squares, rectangles, triangles, diamonds, trapezoids, and hexagons slowly emerge as children have many opportunities to explore line printing with guidance and support.

Patterning and Design

Patterning — Line printing is a great tool for experimenting with patterning. In fact, as children explore, you will often hear the refrain, "I made a pattern!" There are ways to foster this new awareness. Some children might make a pattern by using the variable of **spacing**. Others may change the **number** in a **grouping**. Still others might change the **direction** or **position** of their lines, or even **alternate** lines. Designing is not only an aesthetic process, it's also a mathematical process! I have found this chart to be a helpful reminder of some of the variables that I can use to help children identify and explore ways to create and change patterns.



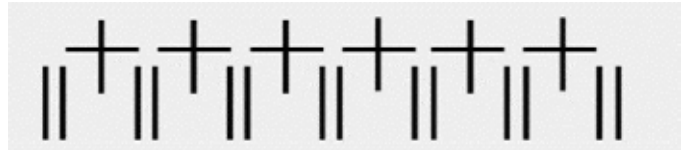
■ Repeat a line in the same direction with the same spacing.

■ Change the number in a grouping.

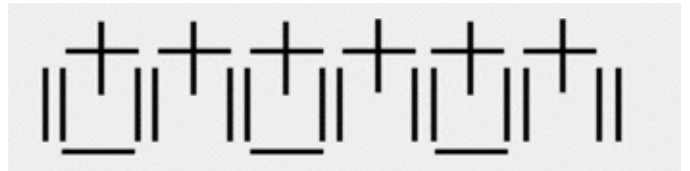


■ Change the position of your line. Go up or down.

■ Change the direction. Try horizontal, vertical, and diagonal lines.



■ Alternate the spacing.



■ When your pattern becomes too complicated, print a long line to mark off your pattern, and begin a new pattern.



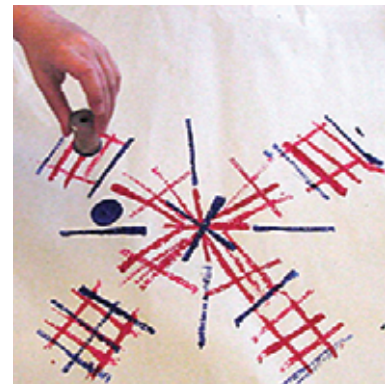
Radial Design — Radial designs are actually variations on patterning. However, they are more complicated, since the position and spatial orientation of each line changes in each section of the design. Radial designs start at a center point and radiate out like the rays of the sun or the spokes of a wheel.

I believe that these explorations took off because they are developmentally appropriate.

Radial Design Suggestions — When children want to know where to begin a radial design, you might offer the following suggestions:

■ Start by printing + or X in the middle.

■ Repeat the same line in the same position in each wedge.



Turning the paper as you work helps with placement and spacing.

■ Try crossing and connecting lines. Keep working out to the edge.

A small bottle cap, spool, or found object that has a flat surface can always be offered to enrich an exploration. I'll often have a few objects ready to use — but out of sight — in case I need them. Too many objects can take away from the challenging problem of spatial orientation that children enjoy solving when working with a single line. Offering a shorter line, half the width of the large cardboard tool, is another alternative.

Sometimes I'll bring out dried prints to look at and discuss a day or two later. We'll share discoveries, and then I'll offer objects — and perhaps another color of paint — for children to make additions to their prints. Children love to revisit their work in this way and enjoy a new challenge that builds upon their discoveries or the discoveries of a classmate.

Supplies

When you are ready to try line printing with your children you'll need some corrugated or heavy cardboard cut to the size of a credit card — about 3" x 2½". After many years of



experimenting, I've found this size to be ideal for easy gripping. If you are using corrugated cardboard, make the long — 3 inch side of the printing stamp the side that you can look through.

Cut some pieces that are 1/2 size too, to offer when papers begin to fill up.

You'll also want to have some paper, liquid tempera paint, and paper plates or trays for containing paint. Resting inky cardboards on the side of the container, inky side down, allows children to easily pick up their cardboards when they are ready to return to printing. It also helps to keep hands and work spaces much cleaner. Standing while printing allows children to see a bigger workspace. It also allows them to use the weight of their bodies to make a stronger, bolder print.

Offer many opportunities to explore line printing throughout the year — each with a slightly different challenge. To introduce a new focus, hold up a few of the children's line explorations and use them as a lead-in to a discussion. Ask children to suggest ways to expand an idea and then invite them to add to their line explorations. Line printing is rich with possibilities for exploring basic math concepts of number, shape formation and geometry, patterning, design, and much more.

Resources

Illustrations for this article are adapted from Cathy Topal's new interactive CD-ROM *Thinking With A Line*. The CD-ROM and the books listed earlier are available from Davis Publication, Inc., 50 Portland St., Worcester, MA 01608. Phone (800) 533-2847 or visit the web site: www.davis-art.com.

Using Beginnings Workshop to Train Teachers by Kay Albrecht

Studio art in the classroom?: Topal shares her knowledge and experience about how children explore creative media. She helps us to understand ways in which the simple studio art process of line printing can also be an exciting way to explore a variety of mathematical concepts. This is another instance where experience is the best teacher. Set up a space for teachers to explore the possibilities of line printing, learning by doing how to implement Topal's suggestions in their classrooms. It is very important for teachers to gather together after the experience to analyze the results of the explorations, and to discover for themselves the mathematical significance — and other connections — that might grow from these exploratory experiences. Send teachers back to their classrooms ready to try out line printing by handing out door prizes of the cardboard rectangles, recycled materials, paper, and paint that they will need.