

ARTFUL CONNECTIONS WITH MATH GRADE 3

Area & Perimeter Floor Plan Collage

2 - 3 Sessions – 90 minutes each

Essential Question: How do we use math and art to design our living spaces?

Lesson Goal: Students create a floor plan collage, using graph paper to calculate area and sewing with embroidery thread to calculate perimeter.

Lesson Objectives:

Students will be able to:

- know the difference between area and perimeter.
- understand the difference between a unit and a square unit.
- calculate the area and perimeter of their design.
- sew embroidery thread around the perimeter of their designed floor plan.
- create a collage/drawing that represents a living space.

Common Core State Standards for Mathematics:

Geometric measurement: understand concepts of area and relate area to multiplication and to addition.

5. Recognize area as an attribute of plane figures and understand concepts of area measurement.

a. A square with side length 1 unit, called “a unit square,” is said to have “one square unit” of area, and can be used to measure area.

b. A plane figure which can be covered without gaps or overlaps by n unit squares is said to have an area of n square units.

6. Measure areas by counting unit squares (square cm, square m, square in, square ft., and improvised units).

Geometric measurement: recognize perimeter as an attribute of plane figures and distinguish between linear and area measures.

8. Solve real world and mathematical problems involving perimeters of polygons, including finding the perimeter given the side lengths, finding an unknown side length, and exhibiting rectangles with the same perimeter and different areas or with the same area and different perimeters.

California State Visual Arts Content Standards:

ARTISTIC PERCEPTION 1.5: Identify and describe elements of art in works of art, emphasizing line, color, shape/form, texture, space, and value.

CREATIVE EXPRESSION 2.2: Explore ideas for art in a personal sketchbook.

HISTORICAL AND CULTURAL CONTEXT 3.1: Compare and describe various works of art that have a similar theme and were created at different time periods.

AESTHETIC VALUING 4.2: Identify successful and less successful compositional and expressive qualities of their own works of art and describe what might be done to improve them.



Materials:

- Scissors
- Colored pencils/oil pastels
- Collage material
- Graph paper (1" squares)
- Embroidery needles
- Embroidery thread
- Origami paper
- Colored construction paper
- Glue sticks

Preparation:

- Thread embroidery needles for students beforehand, if necessary.
- Assemble household images – “Google image” search household images, such as “sofa” and print out page of small images. Alternately, photocopy a page from a magazine that shows multiple furniture images, see example attached.
- If using chart paper for the 1” graph paper, cut down to the size of construction paper

Key Vocabulary:

Math: area; perimeter

Art: collage; sewing; overlap; space

PRE-LESSON MATH SESSION

Mathematics notes:

While these lessons focus on the geometric concepts of area and perimeter, it should be noted that teachers can use this lesson to reinforce the concept of arrays in modeling repeated addition (second grade OA 1, OA 4) and multiplication ((third grade OA 1, OA 3). Part of teaching the Common Core standards is connecting the standards with each other, while teaching within a subject or by connecting two subjects through a common meeting place (like math and art). Students can reinforce the idea of the array in the equal groups that can be made in the floor plans.

Prior to Session 1 for this lesson, review plane shapes and their attributes.

Focus Question: What parts of a plane shape can be measured?

- In pairs, give students 8 square attribute blocks. Instruct the class to create a rectangle with their attribute blocks. Walk around to make sure every pair has created a rectangle.
- Tell the students that each side of the square block measures 1 inch. Ask: How can we measure the distance around a two-dimensional shape? Instruct the students to work together to come up with a measurement of the distance around the rectangle. Ask pairs to share out, and ask them how they came up with the answer. Explain that the measurement around the shape is called the **perimeter**. To find the **perimeter** you just need to add up the length of all of the sides of the plane shape.
- The amount of space inside the boundary of a flat (2-dimensional) object is called the **area** of that shape. Teachers pick up one square and point to the space inside the square. Explain to the class that this is the area of this one square. For this one square, its area is one square inch.
- Ask the class to show you the area of your rectangle. (Walk around to see what students are pointing to on their desks. Give corrective feedback as needed.)
Ask: What is the area of your rectangle? Talk with your partner and explain your thinking.
- Have pairs now create a different plane shape of their choice using their squares. All the squares must touch at least on one side.
- Instruct your students to trace their shape on a paper.
- Next, ask the students figure out the perimeter and area of the shape. Ask: Did either measurement change from when the squares were formed into a rectangle?
- If there is time, instruct the students to get two more squares. Ask the students to predict how the perimeter and area will change when they add the two squares to the existing plane shape.
- If square attribute blocks are not available, give students graph paper and ask them to trace rectangles and other plane shapes. They can cut these shapes out, paste in their journal and calculate area and perimeter. This will be good preparation for the art-making activity.

Session 1 – Calculate Perimeter, sew around the perimeter of the floor plan

ACCESS PRIOR KNOWLEDGE (10 min)

- What did you learn about perimeter and area through the exercise we did with the square attribute blocks?
- Where do you see perimeter and area in everyday life?
- What do you think an architect does?
- How do you imagine an architect uses math and art to design a space?
- What do you think a floor plan is?

ART OBSERVATION (15 min)

Show students the two images of Frank Lloyd Wright's floor plans and ask the following compare and contrast questions:

- What do you see in these images?
- What rooms can you identify?
- How do the shapes of the floor plans differ?
- Why do you think the architect placed the different spaces next to each other?
- How would you describe the shape of the perimeter in each of the floor plans?
- What do you notice about the way the perimeter of each floor plan is drawn?
- How would you calculate the area of each floor plan?
- How would you calculate the perimeter?

WARM UP ACTIVITY (10 min)

1. Ask the students to draw an outline of an interesting geometric shape onto a sheet of graph paper; this will then become the perimeter of their dream house.
Note: Teacher can ask students to create a shape including only whole squares (so they will only have to calculate whole units). Or, to make the total area more difficult to calculate, teachers can allow students to create diagonal lines through squares, (so students will have to add half units).
Math note: Teachers may want to teach students to break larger shapes into smaller shapes to calculate the area and perimeter.
2. Instruct the students to then cut out the shape drawn onto the graph paper and glue it onto a colored construction paper.

ART ACTIVITY (45 min)

1. Begin by instructing the students to calculate the perimeter shape by numbering the sides of each individual square unit, and writing the corresponding numbers on the construction paper next to glued down graph paper.

Now show the students the photograph by Hagar Vardimon-van Heummen and ask the class the following questions:

- What is this an image of?
- Why do you think the artist used embroidery thread on top of their photograph?
- How does the embroidery on the staircase show perimeter?

- How would you calculate the perimeter of the door?
- 1. Next, using an embroidery needle, poke a hole at the corner of each square on the graph paper.
- 2. Ask the students to then choose a color of embroidery thread and begin to weave through each of the poked holes. Remind students that the thread will only appear on every other square.
Note: Needles may have to be rethreaded several times to avoid working with an excessively long string. When they come to the end of their embroidery floss, students can tape the string to the side of construction paper that the graph paper is pasted on, if tying a knot is too time-consuming.
- 3. Students will then choose another color of embroidery thread and to sew through the perimeter again, filling in all the remaining open spaces.
Note: Teachers may choose to instruct the students to draw in every other space instead of sewing it, and this can be done by using a different colored pencil.

CLOSURE (10 min)

- How did you decide what shape to make your floor plan?
- In what ways are the shapes of everyone's floor plans similar and different?
- What did you learn about sewing and using the embroidery thread in this part of the project? What was the purpose of using the embroidery thread? What will threading the needle through the outside of the shape help you remember?
- Which floor plan has the greatest perimeter? Least perimeter? Is there anyone who has the same perimeter as another student? Let's show the difference in the shape of their floor plan.

Session 2 – Calculate area, create collage

ACCESS PRIOR KNOWLEDGE (10 min)

- Who can describe what we did last week?
- What do you know about calculating the area of a floor plan?
- What is a collage?

Mathematics note: Students should be able to talk about the perimeter of a shape and where it is located. Before this session, you will want to review the pre-session lesson to refresh students, reviewing perimeter, but spending more time on the area part of the lesson.

ART OBSERVATION (15 min)

Show students the artwork from Richard Hamilton and ask the following questions:

- What do you see?
- What type of room is this?
- How is the space divided up?
- What media did the artist use to create this work?
- What do you notice about how the artist is using color?
- How did the artist create the illusion of three-dimensional space in this composition?
- Which objects seem to be closest to you and furthest away?

ART ACTIVITY (55 min)

Tell the class that they will create a collage of their dream house inside the area defined by their embroidery thread.

1. Begin by asking the class to calculate the area of their floor plans. Instruct the students to count each square of their graph paper, and write a number inside each square as they count.

Note: More advanced students can divide the floor plan into different rooms first, calculate the area of each room, and then calculate the area of the entire floor plan.

Math Note: Teachers can also have students map out “friendly numbers” such as five or ten, to have students count faster.

2. Ask students to then cut out selected household images from the furniture magazines. An example of these are:
 - a. Furniture/Accessories: Rugs, fireplaces, beds, dressers, dining tables, sofas,
 - b. Appliances: refrigerators, stoves, dishwashers, washer dryers, sinks, showers,
3. Once completed, instruct the students to turn over their construction paper to the side without the grid paper and glue their images onto their floor plan (inside the embroidery thread) as they design each room of their dream house.

Note: Students can also create furniture by cutting and folding origami paper and pasting it on to their floor plan.

4. Finally, ask your students to use colored pencils to draw additional household items and create detail inside the various rooms (e.g. carpet, painted walls, etc.). Students can also create a “landscape” by drawing on the construction paper surrounding their floor plan.

CLOSURE (10 min)

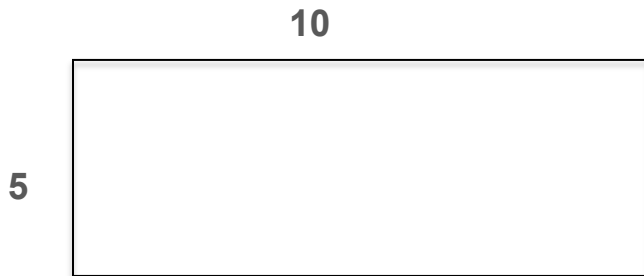
- Which parts of your collage composition are the most interesting to you and why?
- What room did you spend the most time on?
- Which parts of your collage composition would you change next time?
- How did Richard Hamilton's art influence your collage?

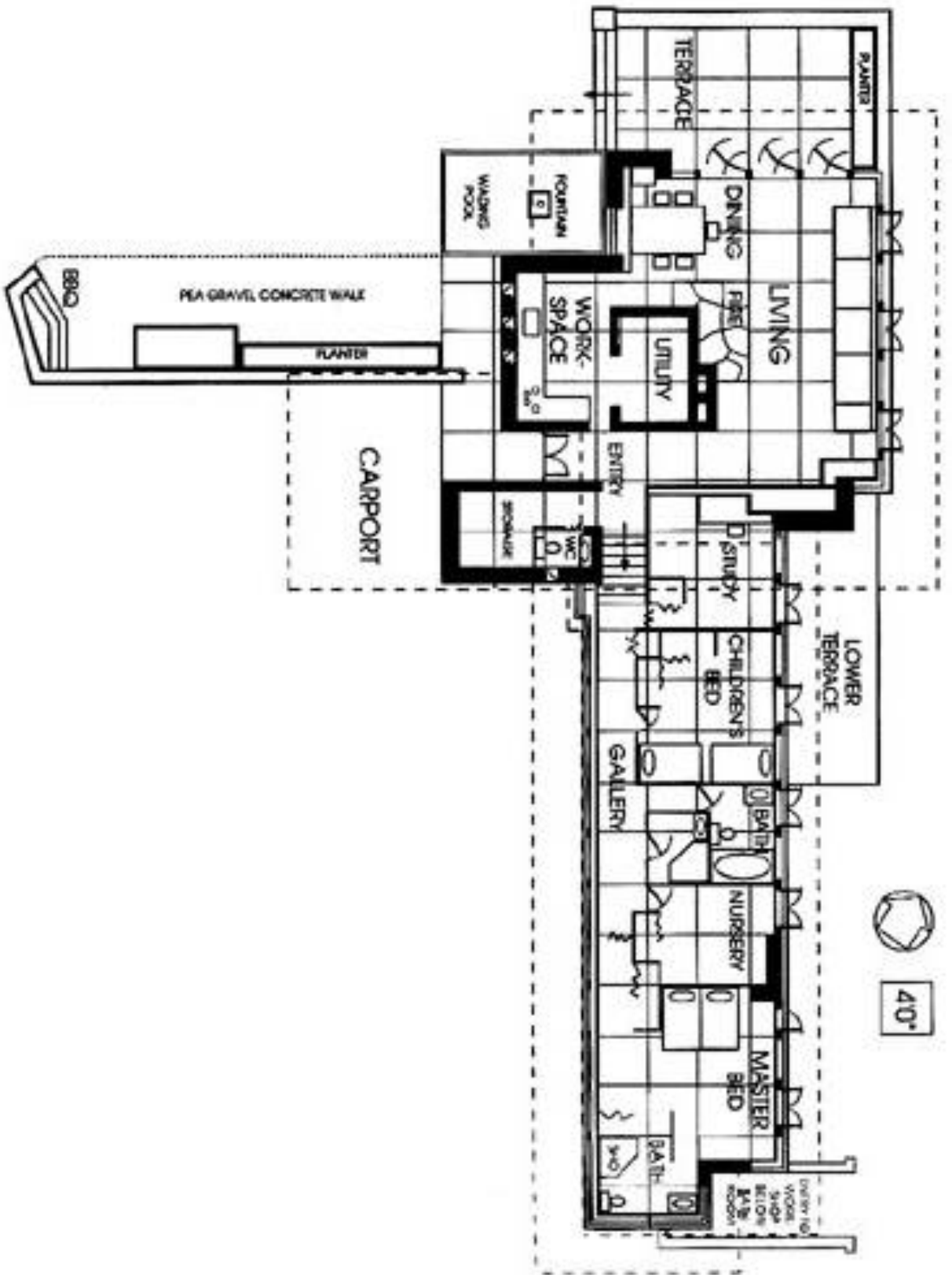
POST-LESSON MATH SESSION

Focus Question: What is the difference between perimeter and area?

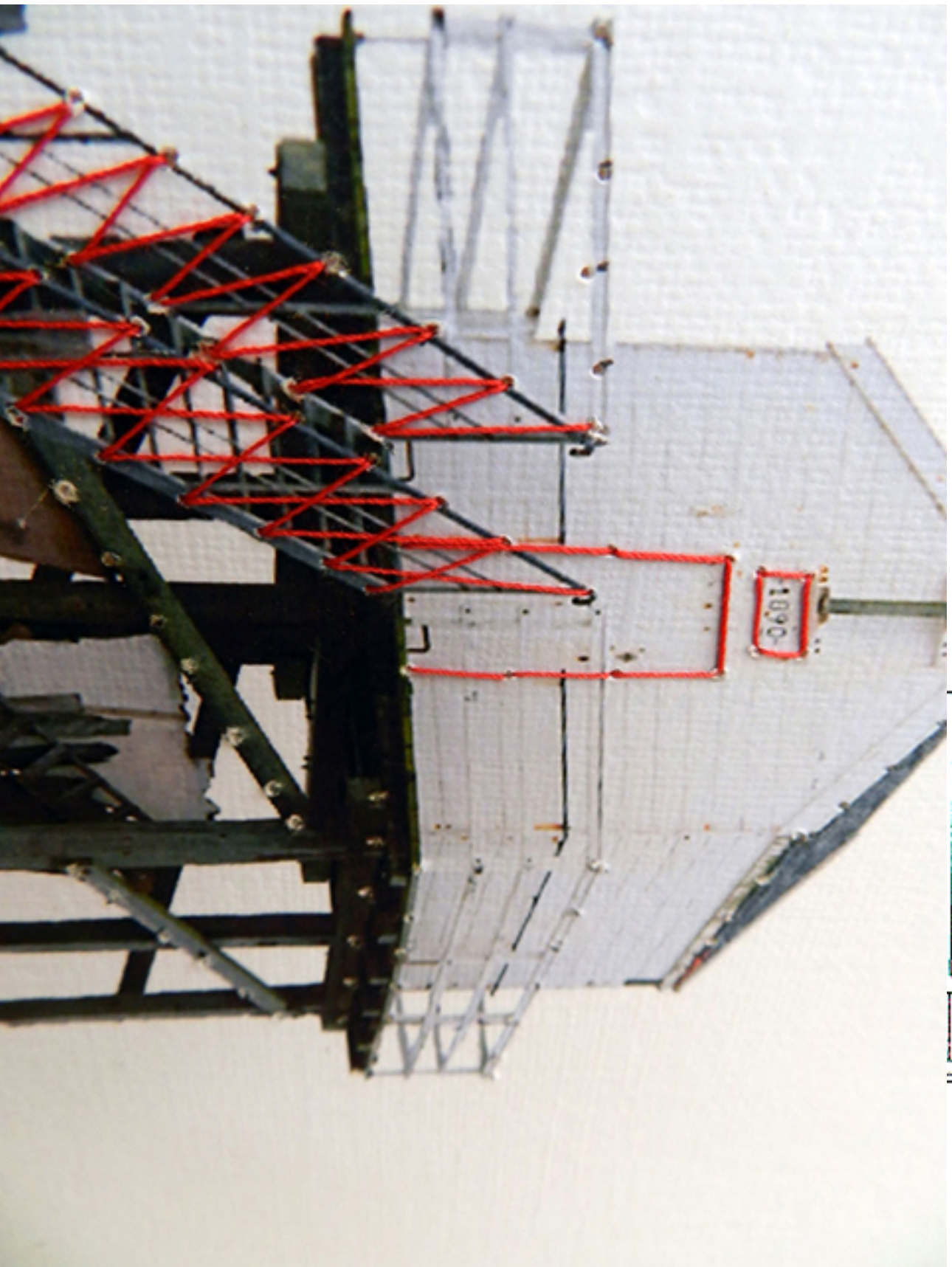
Ask the students to draw a picture and explain the following:

- Give students 7 square attribute blocks and ask them to design and trace a plane shape in their art journals. Using pictures and words, students will then calculate the perimeter and area of their shape.
- Once their designs are completed, instruct the students to speak to two classmates and explain how they arrived at their answer.
- Next, ask your students to draw rectangles in their journals and assign lengths and widths to each rectangle. Instruct the students to calculate the perimeter of the rectangle, using their knowledge of properties of rectangles to deduce if the length/width of each side is the same as that of the opposite side.



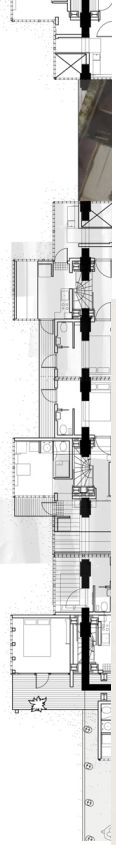


Frank Lloyd Wright. Seamour and Gerte Shavin Residence, Chattanooga, Tennessee (1950)

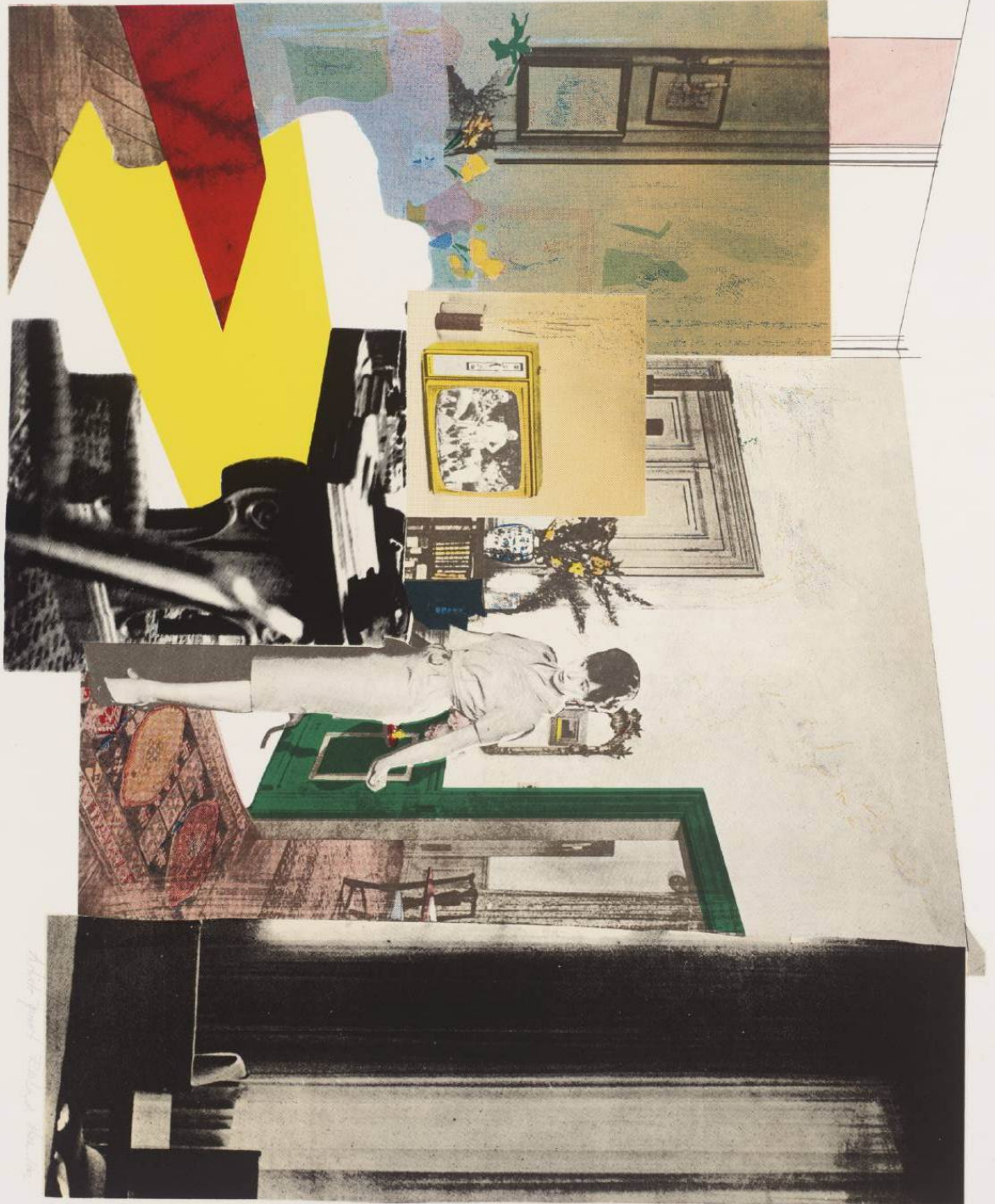


Images from Wright's "A Home in a Prairie Town" article in Ladies' Home Journal (February 1901)

Hagar Vardimon-van Heummen, *Lonely Houses*



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Richard Hamilton *Interior II*, 1964. Oil paint, cellulose paint, and printed paper on board.



Richard Hamilton, *Interior*, 1964, silkscreen
(Museum of Modern Art, New York)

Richard Hamilton

The painting *Interior II* was developed from a discarded photograph the artist discovered by chance. Hamilton was teaching art at Newcastle Polytechnic when he found a still from the film *Shockproof* (1949, director Douglas Sirk, screenplay by Samuel Fuller) lying on a classroom floor. The 1948 photograph became the generator for a series of works playing on the representation of an interior space. Hamilton was struck by the carefully arranged composition of the still, photographed in a specially constructed set. He explained, "Everything in the photograph converged on a girl in a 'new look' coat who stared out slightly to right of camera". A very wide-angle lens must have been used because the perspective seemed distorted; but the disquiet of the scene was due to two other factors. It was a film set, not a real room, so wall surfaces were not explicitly conjoined; and the lighting came from several different sources. Since the scale of the room had not become unreasonably enlarged, as one might expect from the use of a wide-angle lens, it could be assumed that false perspective had been introduced to counteract its effect – yet the foreground remained emphatically close and the recession extreme. All this contributed more to the foreboding atmosphere than the casually observed body lying on the floor, partially concealed by a desk. I made three collaged studies and two paintings based on this image of an interior – ominous, provocative, ambiguous; a confrontation with which the spectator is familiar yet not at ease. (*Collected Words*, p.61.)

Hamilton initiated *Interior II* as he completed *Interior I* (Erna and Curt Burgauer Collection). He had laid down the background of *Interior I* and required the image of the actress Patricia Knight (1915-2004) as she appeared in the film still to complete it. He had already created a screen print of Patricia Knight taken directly from the still, minus the end of one shoe and with the outline of a table edge cutting into her skirt. For the paintings, the printer Christopher Prater (1924-96) of Kelpra Studio, London prepared a photo silkscreen filling in the end of her shoe. In both paintings a new object covers the affected area of Knight's skirt. Prater transferred the newsprint onto the surface of the colored canvas of *Interior I* and the primed white canvas of *Interior II* before Hamilton decided how to compose the rest of the painting around her. In the event, the figure was placed in positions fairly similar to the place occupied in the still; in *Interior I* she is slightly further center and in *Interior II* she has been shifted further back and to the left.

Interior I and *II* are Hamilton's first treatment of an interior scene since his famous collage *Just what is it that makes today's homes so different, so appealing?* (Kunsthalle Tübingen) created in 1956. The technique of collage is central to these new interiors. Each painting shows a room superficially similar in structure to that created for the film still. Hamilton brought a full-length curtain covering a window on the left side of the still into the foreground of his paintings where it appears to open on the space depicted in the composition. In *Interior II*, the space behind the actress leading to another room has been retained, although the room is different. Hamilton derived it from a color photograph of the studio of the artist and musician Larry Rivers (1923-

2002) that he came across in *Esquire*. A small blue monochrome canvas propped against the wall in this space refers to the modernist artist Yves Klein (1928-62). A section of wall with a decorative column of square indentations in the plaster that appears next to the curtain in the still has been transferred to the right side of the painting in *Interior II*. It is next to a sepia photographic image of an interior half obscured by white paint. The perspectival vanishing points of the architectural features meet invisibly at a plug socket painted at the bottom of a lilac colored wall in the center of the image. Above this, a photograph of a television screen shows an image from footage of the assassination of John F. Kennedy on 22 November 1963 in Dallas Texas. The television and a standing lamp next to it are printed onto a section of canvas resembling a painting within the painting. In the bottom right corner of the image, realistically painted tiles anchor the painting. On these, where a rug might be, a rectangle of brightly colored abstract paint refers to the process of painting as representation. In front of Knight, who stands, apparently transfixed by something she can see beyond the viewer, the back of a Charles and Ray Eames 'La Fonda' chair, constructed in relief, and obscures a portion of the actress's skirt. The incorporation of elements that stick out of the painting recalls the Cubist practice of mixing real objects with images of them on a single canvas and further dislocates readings of the painting's representation of interior space.

Selection from www.tate.org.uk

Richard Hamilton

“But I would like to think of my purpose as a search for what is epic in everyday objects and attitudes.”

With the stated mission of expressing and critiquing, the essence of consumer culture, which he described as “popular, transient, expendable, low-cost, mass-produced, young, witty, sexy, gimmicky, glamorous and big business,” Mr. Hamilton went on to create many of the paintings that defined first-generation British Pop Art.

Richard William Hamilton was born on Feb. 24, 1922, in London. After studying painting at Westminster Technical College and St. Martin’s School of Art, he went to work for the advertising department of a commercial studio. During World War II he worked as a jig and tool designer.

After the war he returned to the Royal Academy, where he had studied briefly before the war, but he was expelled for “not profiting by instruction” and was drafted into the British Army. On completing his military service, he studied for three years at the Slade School of Art.

Mr. Hamilton initially made his living by making models and designing art exhibitions. Later he taught design at the Central School of Arts and Crafts in London and the University of Durham in Newcastle-on-Tyne.

An exhibition he organized at the Institute of Contemporary Arts in 1955, “Man, Machine and Motion,” signaled his fascination with modern technology and mass-produced images, toward which he adopted a critical but receptive stance.

“If the artist is not to lose much of his ancient purpose, he may have to plunder the popular arts to recover the imagery which is his rightful inheritance,” he wrote in 1961.

Selection from www.nytimes.com

Area & Perimeter Floor Plan Collage

	1 Does not meet Expectations	2 Approaching Expectations	3 Meets Expectations	4 Exceeds Expectations	Score
Understanding of Area & Perimeter	Neither area nor perimeter is calculated correctly.	Either area or perimeter is calculated incorrectly.	Area and perimeter are calculated correctly, but no work is shown.	Area and perimeter are calculated correctly, labeled with units, and work is shown.	
Artwork demonstrates the student's ability to sew using the embroidery thread.	Embroidery thread appears across paper rather than along perimeter of floor plan.	Sewing is shown along some parts of the floor plan perimeter, but is also on other parts of the page.	Sewing is shown along each unit, but some units are skipped or doubled.	Sewing is shown along each unit with two colors of thread woven intermittently.	
Artwork demonstrates an ability to create a collage.	Less than four household objects are glued to the floor plan.	More than four household objects are glued to the floor plan but they are randomly placed, and floor plan is difficult to understand.	Collage pieces are carefully glued down to the paper in a way that reads as separate living spaces.	Collage pieces are carefully glued to down to the paper using overlapping, and colored pencil is used to create a living space.	