

Part XII

Paper Cutting and Musical Frieze Patterns

The goal for this part is to recognize frieze patterns in paper folding and music.

Paper cutting

- ▶ Take a long strip of paper and roll it around several times into a cylinder. Do not flatten the cylinder, but cut through one side of it, cutting out an asymmetric motif. Unroll and classify the pattern.
- ▶ Fold a long strip of paper in a zigzag and cut out an asymmetric motif. Unfold and classify the pattern.
- ▶ Roll a long strip of paper around several times into a Mobius band (a cylinder with a half twist) and cut out an asymmetric motif. Unroll and classify the pattern.



- ▶ Devise methods for producing the other four frieze patterns by paper cutting.

"Mbius strip" by David Benbennick - Own work. Licensed under CC BY-SA 3.0 via Commons -

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Musical frieze patterns

- ▶ When a tune is played over and over again, it has a natural translation symmetry. You can hear the symmetry as repetition, and if you write the notes on a staff, you can see it.
- ▶ Is it possible to write a tune with reflection symmetry? Glide symmetry? Rotation symmetry?
- ▶ Pick a musical motif and write a short composition using one of the frieze symmetry patterns.

Musical frieze patterns using Noteflight

You do not have to know how to read music to do this project.

- ▶ Go to www.noteflight.com to make a free account. You'll need to find the email they send and confirm your email address.
- ▶ Make a new score, and enter a few measures of notes as your motif OR search for a tune you like and copy part of it to a new score as your motif .
- ▶ Create reflection or rotation or glide symmetry by entering new notes.
 - ▶ Use the mouse to place notes on lines or space.
 - ▶ Use the [and] keys and the period to change to different types of notes, or use the floating toolbox of symbols.
 - ▶ Use the up and down arrows to move notes or whole measures up or down.
 - ▶ Use control-Z to undo, and Edit ↵ Cut and Paste and Repeat to repeat things.

Vi Hart's Musical Frieze Patterns

Vi Hart has several videos involving frieze patterns, including:

- ▶ Frieze Patterns in Fruit By the Foot (see minute 2:40)
- ▶ Mobius Music Box video
- ▶ Folding Space Time
- ▶ Doodle Music

Homework

1. For each of the 7 frieze patterns, explain how to fold or roll paper so that cutting out an asymmetrical motif will make the frieze pattern.
2. Write a few sentences about the class. For example, what topics or activities have you liked the most so far? Disliked the most? This is a good opportunity to share suggestions and make requests.
3. Make a musical frieze pattern using Noteflight. Include at least one other type of symmetry in addition to translation symmetry. Export your composition to .xml format to submit it via Sakai. Please include the name and original composer of the piece, as well as the frieze pattern type, in the file using the Title / Subtitle / Composer fields at the top.