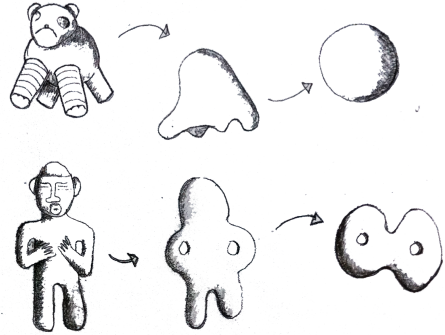


Name \_\_\_\_\_

## American Museum of Natural History Topology Trail

Welcome to the Hall of Mexico and Central America. As you follow the trail, you will be looking closely at the figures and pottery as a topologist would – examining the shapes, mentally distorting them, and thinking about the genus of each one.



1. Begin at Costa Rican Stone Sculpture. It is in the middle of the room and has a yellow background.



Costa Rican Stone Sculpture

- a. How many sculptures of genus 0 are there?

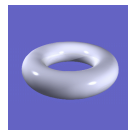
- b. Which figure in the display is the most topologically complex? What makes it complex?

- c. Two of the figures are standing up with their hands placed on their bellies. Name three specific differences in the figures that are NOT topological differences.


- d. What makes the figures *topologically* different?

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- e. There is one figure in this display that is topologically equivalent to a torus:



torus

Which figure is it? What part of the figure makes the hole of the torus?

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2. Next, walk over to the blue case with the sculptures from the Nayarit and Jalisco cultures in Western Mexico.



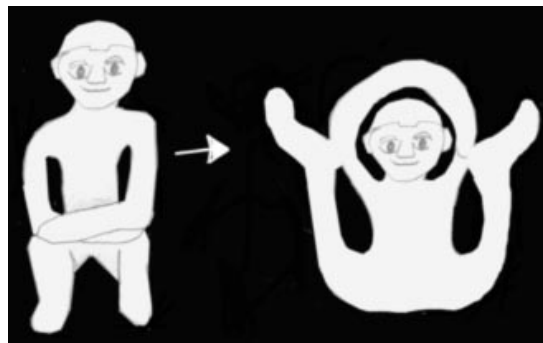
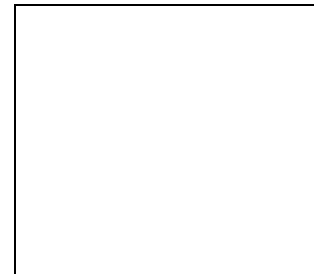
Nayarit and Jalisco

- a. In this case you will find a figure with a "protruding mouth." What is its genus? (Look very carefully at the way the legs are folded!)

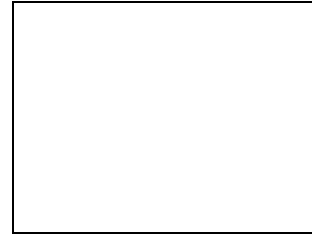


- b. There are several figures that are seated with their hands or arms resting on their knees. These figures are topologically complex, but it helps to imagine that they were made of rubber and stretched out on a flat surface.

What is the genus of the figure in the sketch below?



- c. How many seated figures do you see in the case that are topologically equivalent to the figure in the sketch above?<sup>1</sup>



(Be sure to look carefully at the way their arms and legs are touching. They are not all the same!)

3. Walk around to the other blue case with the figures from the Colima culture of Western Mexico.

Notice that many of the pieces in this case are containers meant to hold liquid, and some of the containers are in the form of animals or humans.



Colima

- a. How do we know that some of these pieces were meant to hold a liquid? (What feature do they share?)

- b. Look at the sketch below and think about the genus of a simple cup.



Notice that a cup is equivalent to a plate and that the "hole" of a cup is not a true hole because it doesn't go all the way through.

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<sup>1</sup> Some of the large figures are hollow and have a hole in the back of the head. Ignore the head-holes and imagine the figures as though they were solid.



What is the genus of a cup?



- c. Now look for other containers that are topologically equivalent to a cup, and describe or sketch four of them below.

Look *carefully* because some containers look similar but have small differences that make them *topologically* different.


- d. Look for the two parrots – one large and one small. Which one is *not* equivalent to a cup? Why not? What makes it topologically different from the other?

4. Walk back toward the center of the room, and find the yellow case with pottery from Costa Rica and Panama. Find the seated figures in that case.



Costa Rica and Panama

- a. Circle the one in the picture with the highest genus. What is its genus?

- b. What part of the figure's body makes the extra "hole"?

- c. There are also many little stone "tables" in this case. The simplest ones have genus 0. How many are there with genus 0?

- d. One stone table in this case has genus 1. Describe it. What part of the table creates the hole?

- e. Which stone table has the greatest genus? Describe it.

- f. Look for the display below (in the same case).



What were these pieces used for?

- g. How many of the pieces in the picture above are equivalent to a torus?

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If you finish early: Find and sketch one figure of each genus.

Genus 0	
Genus 1	
Genus 2	
Genus 3	

Answers:

1.

- a. 5
- b. animal/ table – decoration with many holes in legs
- c. One is larger than the other, one is male and the other is female, etc.
- d. The larger one has holes in the ears and in the headpiece.
- e. It two joined figures with their arms around each other. The space between them forms the hole.

2.

- a. There are at least 4. The arms each form a hole, and the legs are touching in a way to form 2 more holes. Students may also notice that the hole in the ears goes all the way through to the other ear.
- b. 3
- c. There are at least 2. Many are superficially similar but have more holes.

3.

- a. They have spouts. (Note that having a spout is not a topological property.)
- b. The genus is 0. Many cups, like coffee cups, have handles, which means that they have genus 1. These simpler cups, like paper cups or “tumblers” have genus 0.
- c. 2 duck-shaped jugs, 1 parrot-shaped jug, 1 sleeping dog jug, 1 man-bending-backwards jug . . .
- d. According to the caption, the small one is a whistle, so students can reason that its genus must be at least 1. In fact, if you look carefully, there is a hole at the end of the tail and there are two on the chest. The genus is 2.

4.

- a. the medium-sized one -- genus 4
- b. The hand touching the mouth creates another hole.
- c. 2
- d. dog-shaped table – The tail wraps around, touching the leg and creating an extra hole.

- e. There is a small, round table with a base that looks like netting with many holes. Its genus is at least 20.
- f. They are decorations placed on the end of a wooden mace.
- g. 8 of the 9 are genus 1. The top left is more complex.