Then Try This • Algorithmic Pattern Salon

Mitos

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Published on: Nov 11, 2023

DOI: https://doi.org/10.21428/108765d1.54222d07

ABSTRACT

Mitos is an exploration of 4-shaft weaving patterns generated from isolating and sequencing my mitochondrial DNA then mapping the mtDNA sequence to threading and treadling drafts.

Background

A big motivation for me is the significance of the mitochondrial DNA (mtDNA). All of our mitochondria come from our mothers because the mitochondria live in the cytoplasm and when an egg is fertilized, its cytoplasm comes from the egg and not the sperm. Furthermore, in this mitochondrial DNA are hypervariable regions (HVR) which contain mutations that have been shown to have high correlation with one's ethnicity and/or geographic origin. Hence, mitochondrial DNA has been crucial for studying population migration and one's maternal ancestry. [1,2]

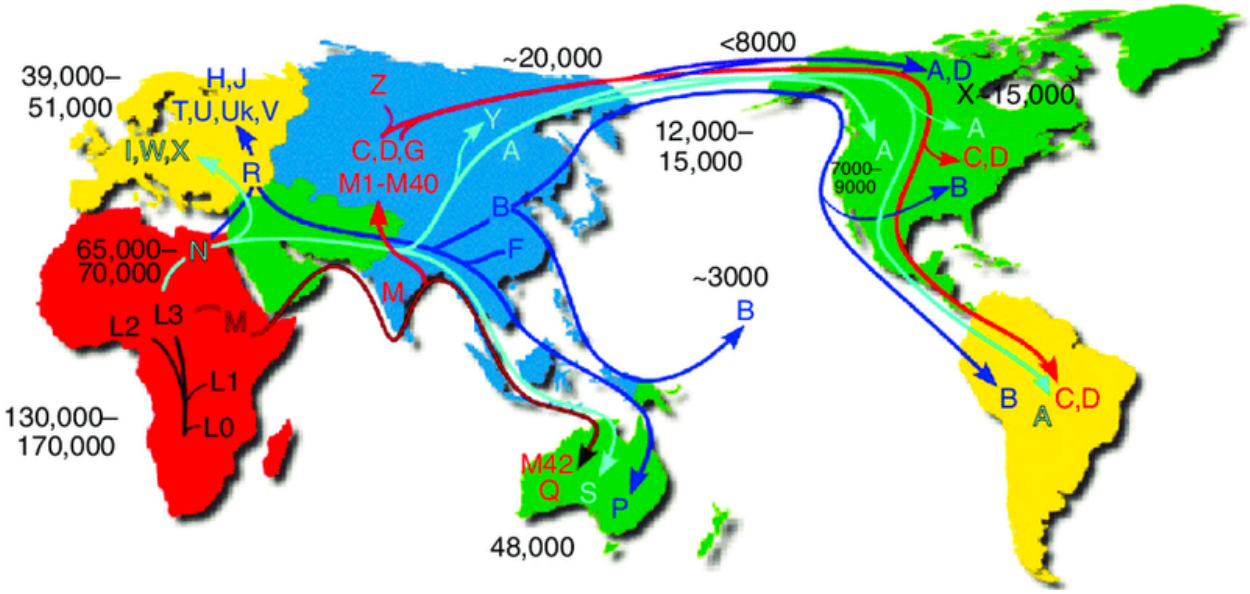

Figure 1
Diagram of the migratory history of the human mtDNA haplogroups. [3]

After going through the process of isolating and sequencing my DNA [4] from my cheek cells at Genspace, a community biology lab in New York, I was awestruck by how the mtDNA that my mom passed to me captures how I fit in this vast scale of time and human history. I felt moved to make art with this newfound appreciation and inspiration. After learning that the root word of mitochondrion is "mitos" which is the Greek word for "thread" [5], weaving felt like a natural medium to manifest my personal ancestral data.

Process and Artifacts

To visualize my mtDNA sequence as a weaving pattern, I wrote a python script to map the resulting sequences consisting of A, T, G, C to the 4 shafts of a threading pattern and generate drawdowns based on different treadling drafts. I represented the patterns as matrices based on the equation from Lea Albaugh's Strange Loop talk "It's Just Matrix Multiplication: Notation for Weaving" where she showed how weaving drawdown is essentially a product of the treadling, transpose of the tie-up, and threading matrices. [6] The following figures show sample weaving patterns generated. The script used to generate these images could be found in: https://github.com/kongsally/Mitos

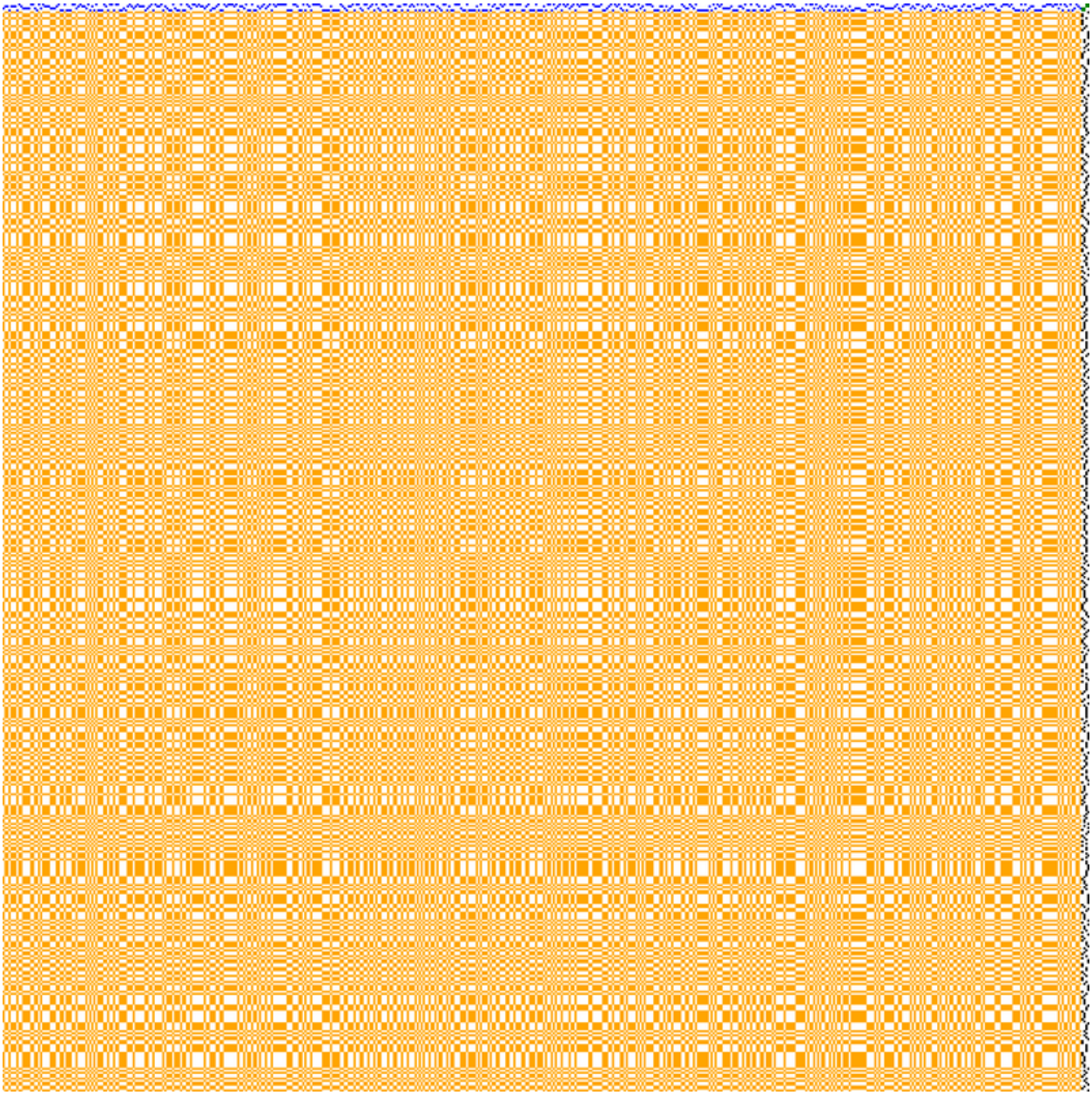

Figure 2
mtDNA mapped threading, basket weave tie up, complementary basepair treadling

My mtDNA is part of the M8 haplogroup which is common among East Asians. I was curious how much I differed from the “Mitochondrial Eve” or the L0 haplogroup where all haplogroups derive from. The differences in the visual representation were subtle, but it was still interesting to see the common graphical motifs between the two, and how my differences were concentrated in the first half of the sequence.

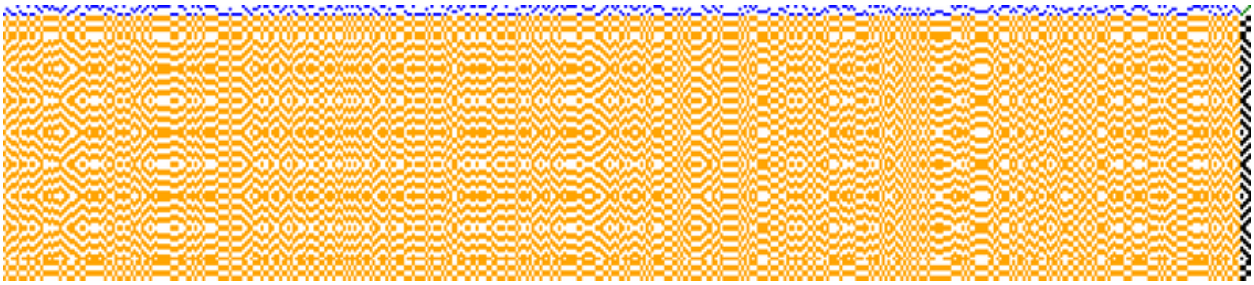

Figure 3
M8 mtDNA mapped threading, straight tie-up, twill variation treadling

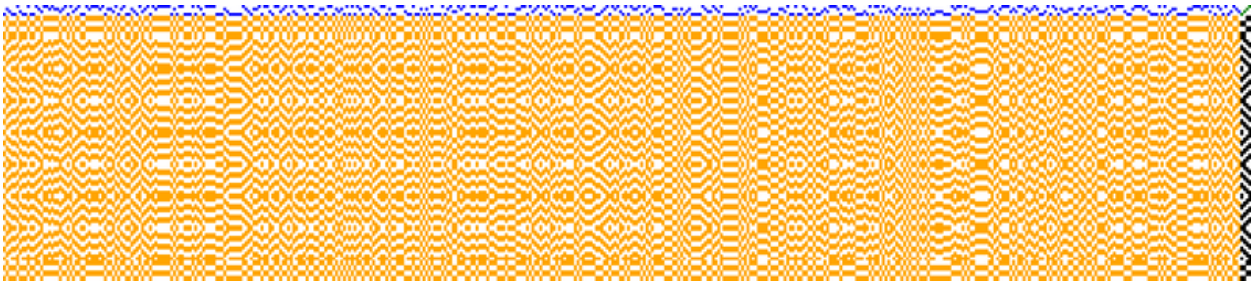

Figure 4
L0 mtDNA mapped threading, straight tie-up, twill variation treadling

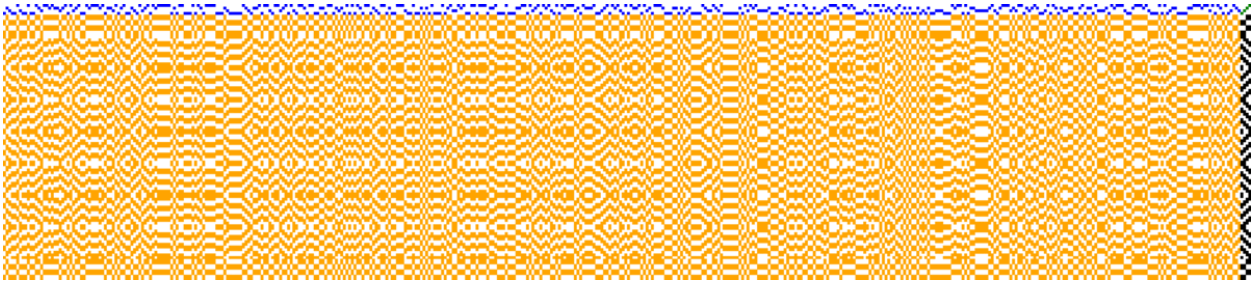

Figure 5
An animated gif toggling between the L0 and M8 driven patterns from figure 4 and 5, highlighting their differences.

These resulting drawdowns gave me a good idea of the graphical quality of the pattern. However, it lacked conveying the textural quality that would arise from the weaving structure of the pattern. I decided to create 3D models of the weave using a visual effects software called Houdini. Houdini allows me to inject custom python code along with its other geometry processing nodes. I reused my python script to calculate the drawdown matrix then I used its values to either raise or lower the curves for the warps and wefts.

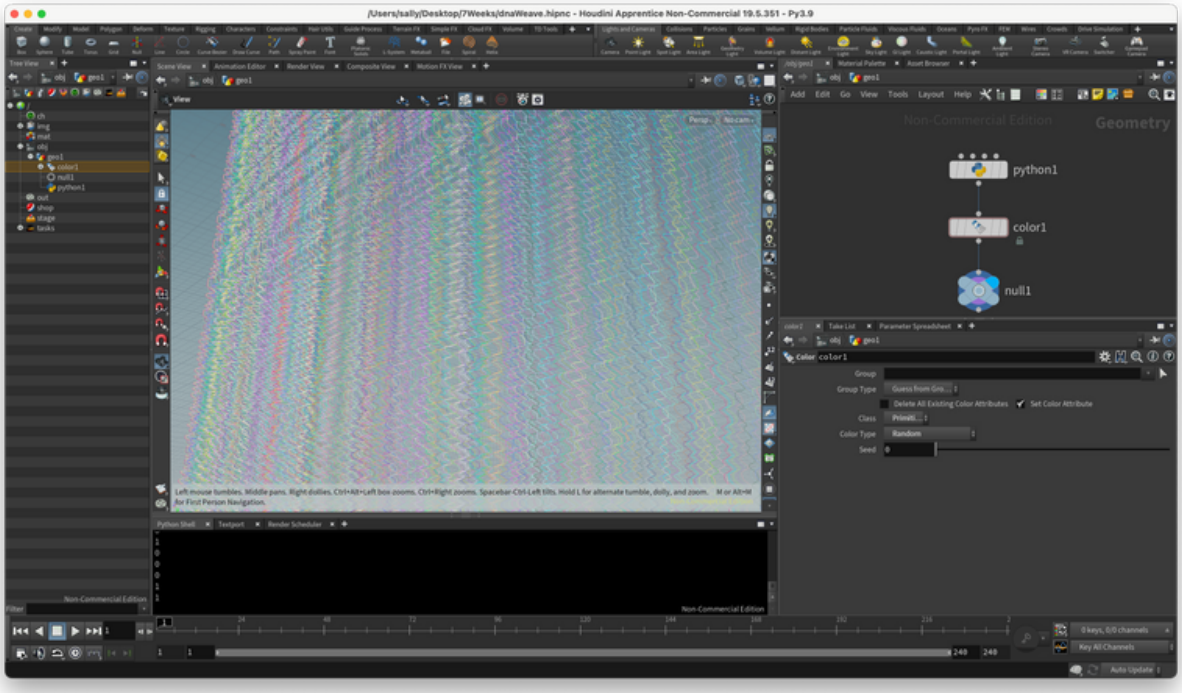

Figure 6
The warps and wefts represented with Non-Uniform Rational B-Splines Modeling curves (NURBS)

Using these curves, I then resampled points along the curves to generate a tubular mesh to encapsulate the curves.

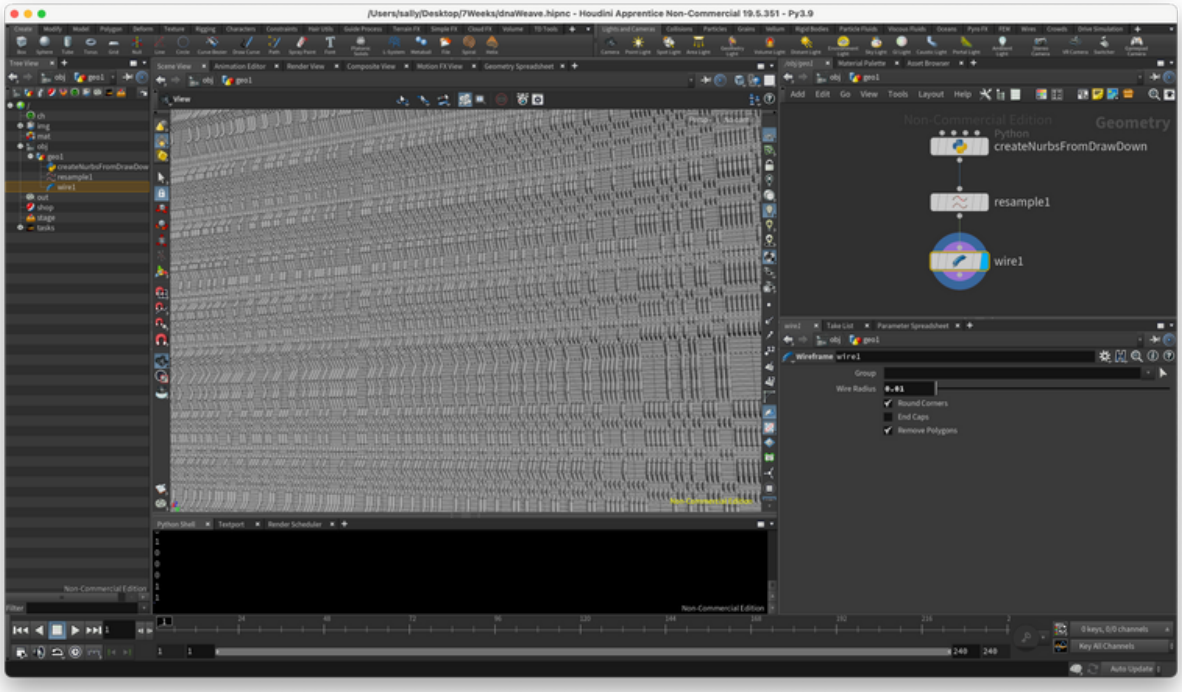

Figure 7
The warps and wefts represented as a tubular 3D mesh

After which I mapped the 3D mesh to a cloth simulation to get a physical sense of the pattern.

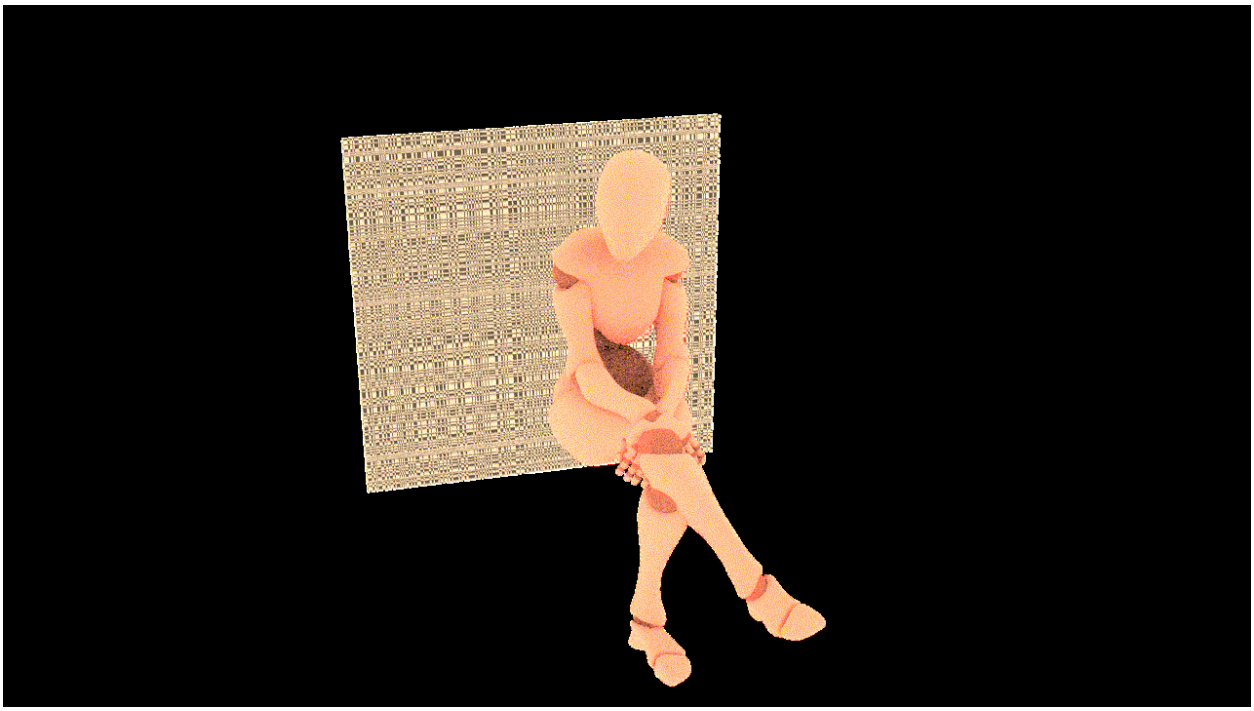

Figure 8
3D mesh mapped to a cloth simulation wrapping a seated body. The posed character was downloaded from Mixamo

From visualizing my mtDNA driven weaving pattern and simulating it wrapping a body, I was inspired to physically manifest this project. I finally decided to purchase a second hand 42” Schacht 4-shaft floor loom and wove the following piece.

Figure 9
Author's personal mtDNA sequence for threading, 2/2 twill tie-up, and improvised twill variations for treadling

Now I can be embraced by the gift of mitochondrial DNA passed down by my long lineage of mothers.

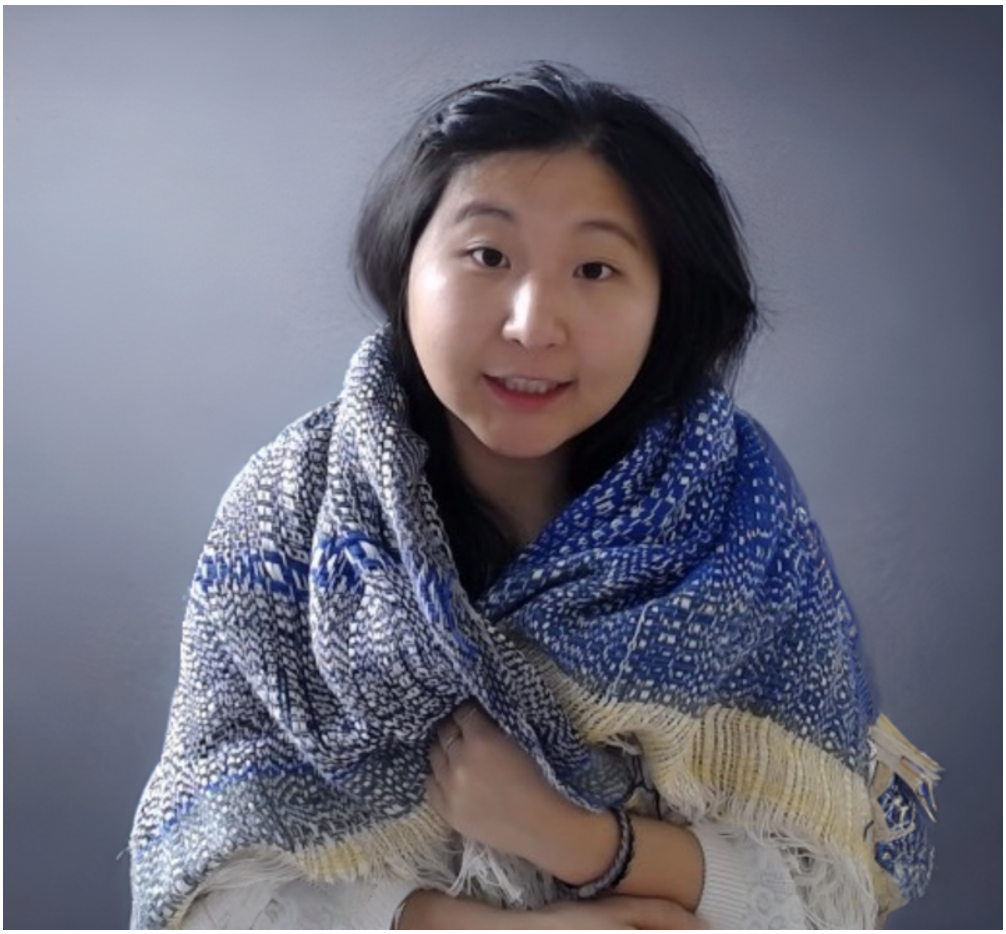

Figure 10
The author embraced by her mitochondrial DNA driven handwoven shawl.

References

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