

Revitalizing Heritage: Totem Pole Restoration Using Additive Manufacturing

Introduction

- ❖ Additive Manufacturing, also known as 3D printing, has only been developed for less than 100 years¹, where digital fabrication (the process of 3D printing) is used to create and print Computer-Aided Design (CAD) models using different materials and technologies such as various types of plastics, wood, concrete, resin, etc.
- ❖ Totem poles are wood-carved monument poles in Indigenous cultures that each hold a story, a family's traditions/legacy, and/or raise awareness to their ancestors.⁴
- ❖ Totem poles are individually unique with special carvings. Still, a similarity is that they all have an animal crest representing a specific Aboriginal tribe, such as a thunderbird from the Haida First Nation, which means power and strength.
- ❖ The process of both creating and restoring Totem Poles is very significant to Indigenous cultures' as it helps connect the carver and the community to important people in their lives and to their cultural heritage/practices.
- ❖ Manual Totem Pole restoration steps are to inspect, clean, fix damage, recarve/repaint, and use protectant solutions like water repellent to extend the lifetime of the Totem Pole.

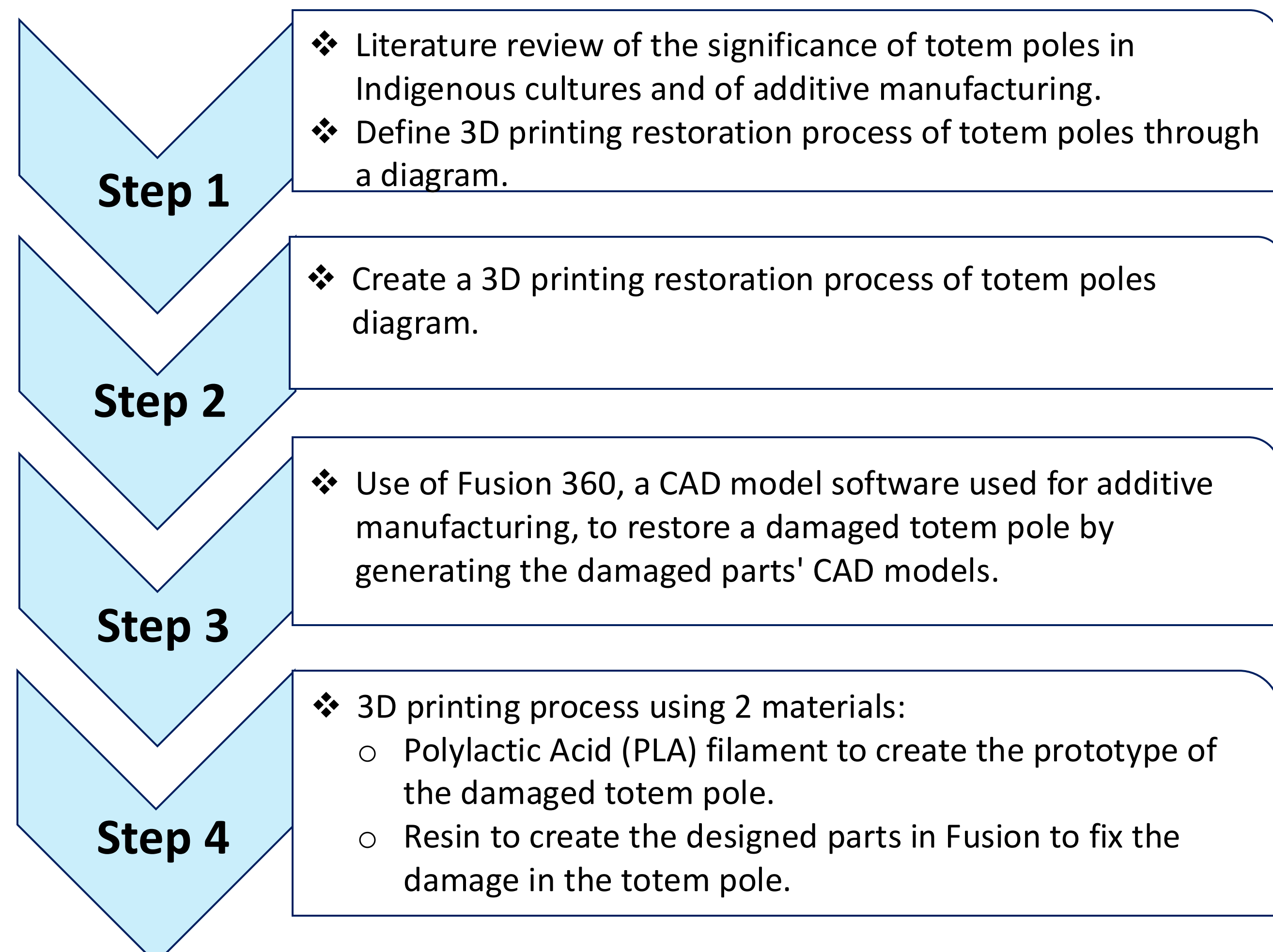


Fig. 1 - Thunderbird and Wolf Totem Pole. Adapted from <https://www.totempole.com/>

Objectives

- ❖ Propose a sustainable solution to restore totem poles to continue the legacy of their families, ancestors, and stories.
- ❖ Restore totem poles using 3D printing without creating waste while promoting reducing, reusing, and recycling.
- ❖ Define an additive manufacturing process that speeds the restoration process while Indigenous traditions are still culturally practiced and recognized so that further reconciliation can occur.

Methodology



Design Process

CAD Model : Fusion

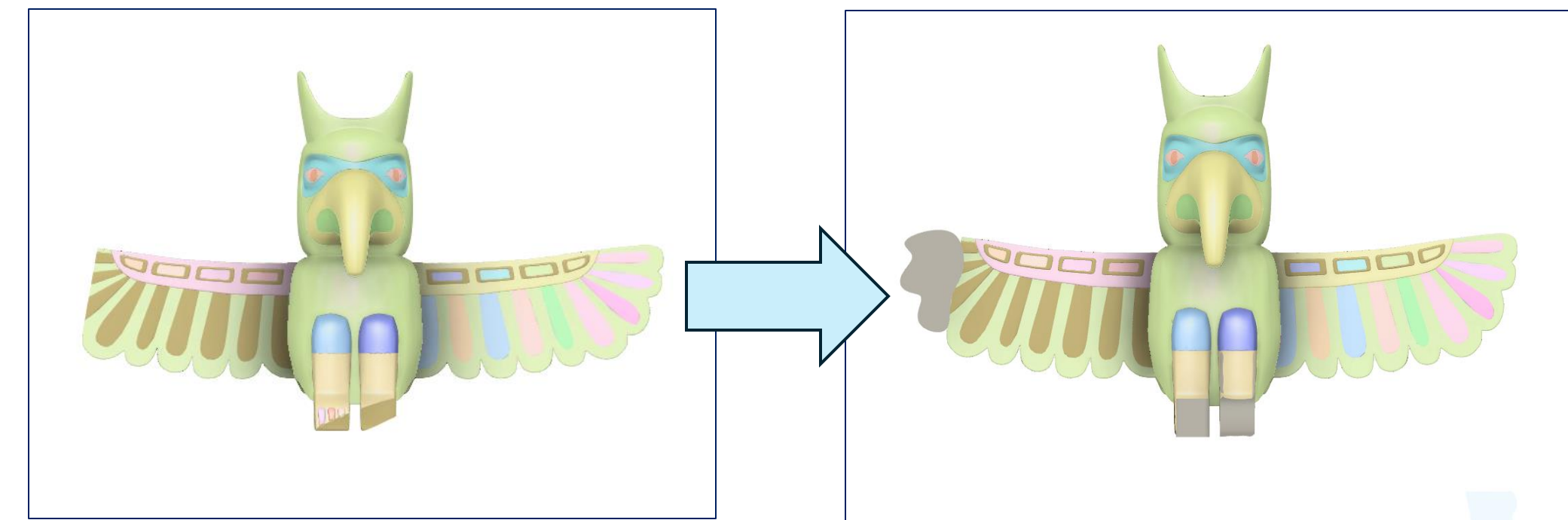


Fig. 2 - Original damaged thunderbird of a Totem Pole 3D Model.

Fig. 3 - Creation of models for the damaged parts of a Thunderbird on a Totem Pole.

Prototype Printing

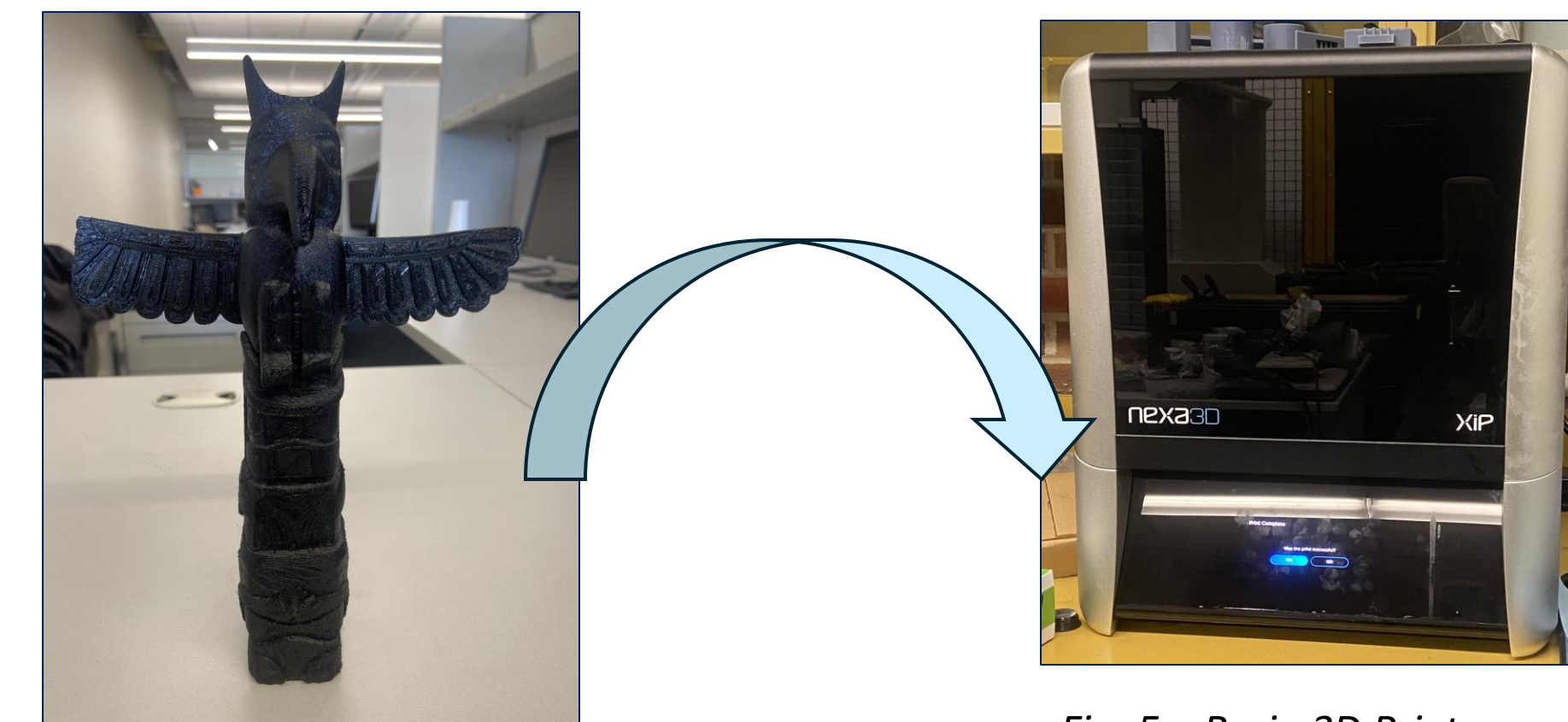


Fig. 4 - PLA printed model of damaged Totem Pole.

Fig. 5 - Resin 3D Printer used to print the parts to restore the damaged Totem Pole.

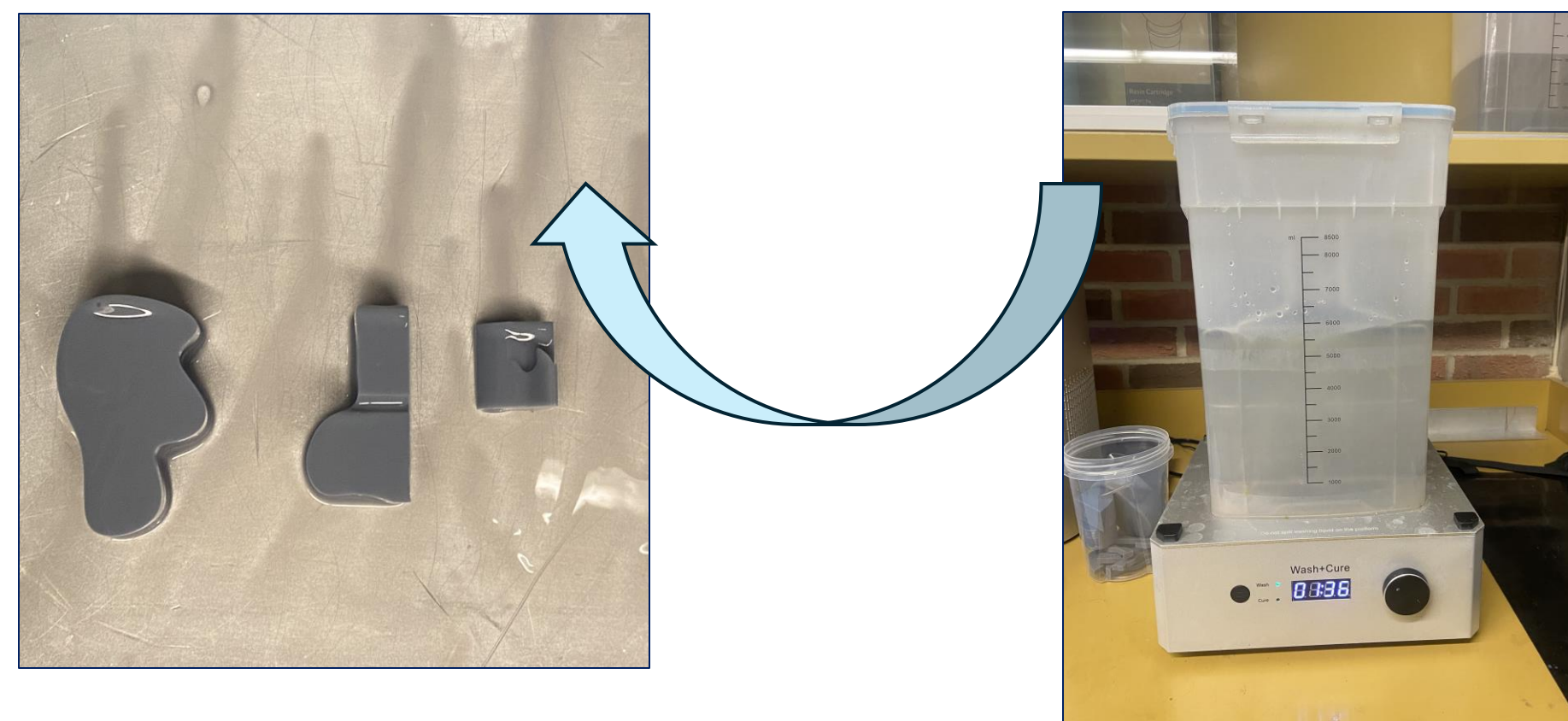


Fig. 7 - Newly created resin pieces to restore damaged Totem Pole.

Fig. 6 - After the resin pieces print, wash them in water and alcohol and use UV to cure to model to solidify and remove the toxins.

Prototype Aesthetics

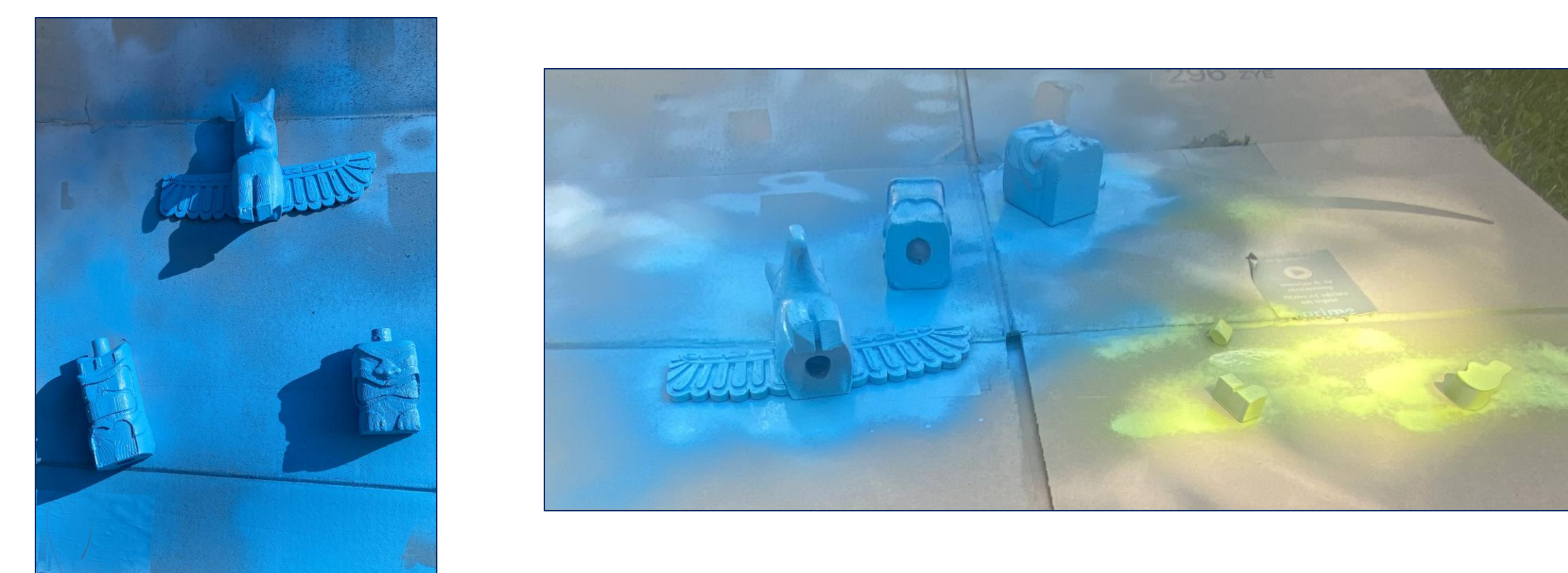


Fig. 8 & 9 - The usage of spray paint and acrylic paint to colour the damaged Totem Pole and restoration pieces as color is significant in the creation/repairing of Totem Poles.

Final Product / Results

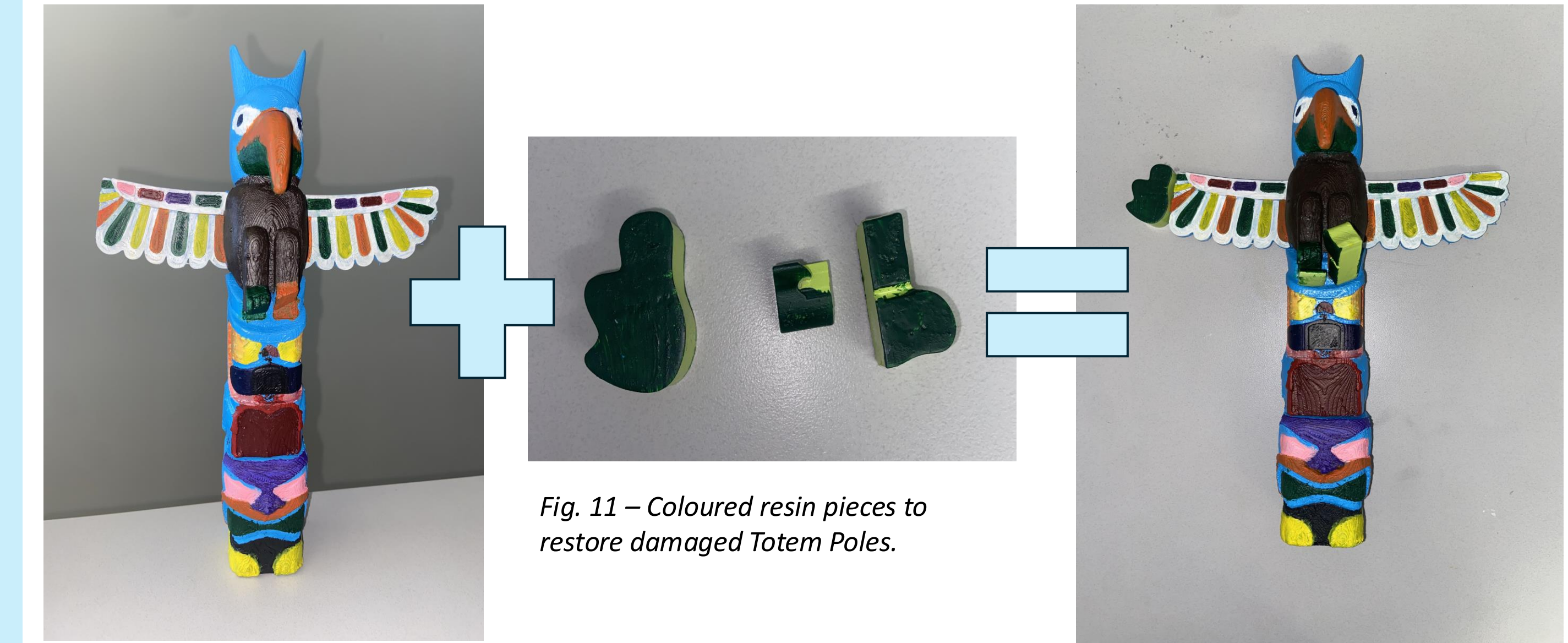


Fig. 10 - Same PLA printed model from Fig. 4, but painted to look more like a Totem Pole.

Fig. 11 - Coloured resin pieces to restore damaged Totem Poles.

Fig. 12 - The PLA model of the damaged Totem pole and the resin restoration pieces together.

Results: In the restoration process, instead of recarving necessary parts, digitalize and 3D print those parts to further recarve and repaint, which was done through the design process, resulting in the final product.

Future Research

- ❖ Experiment with the use of different materials to see which is best for seamless restoration.
- ❖ Recreate the damaged parts with specific dimensions so that they can perfectly connect with the Totem Pole.
- ❖ Experiment with the 3D restoration process with different carvings from animal crests to supernatural figures.

References

- ¹ El-Sayegh, S., Romdhane, L., & Manjikian, S. (2020). A critical review of 3D printing in construction: benefits, challenges, and risks. *Archives of Civil and Mechanical Engineering*, 20(2). <https://doi.org/10.1007/s43452-020-00038-w>
- ² Schwaar, C. (2023, August 16). *3D concrete Printing - the Ultimate guide*. All3DP Pro. <https://all3dp.com/1/3d-concrete-printing-guide/#how-to-3d-print-with-concrete>
- ³ Theias, M. (2023, August 3). *Wood 3D printer: How to 3D print wood*. All3DP. <https://all3dp.com/2/wood-3d-printer-all-you-need-to-know-about-wood-3d-printing-2/>
- ⁴ Totem poles. (n.d.). https://indigenousfoundations.arts.ubc.ca/totem_poles/
- ⁵ Totem pole. (n.d.). The Canadian Encyclopedia. <https://www.thecanadianencyclopedia.ca/en/article/totem-pole>
- ⁶ Totem pole maintenance. (2010, September 27). Ellen Carrlee Conservation. <https://ellencarrlee.wordpress.com/2010/08/18/totem-pole-maintenance/>

Acknowledgments

- ❖ Thank you to my Principal Investigator Dr. Rafiq Ahmad, my supervisor Jennifer, and the rest of the SMART lab team for helping me with my project and answering all the questions I had with interest!
- ❖ Thank you to my sponsors Motorola Solutions Foundation and WISEST for funding my passions - allowing me to participate in the Summer Research Program!
- ❖ Thank you to WISEST for giving me this life-changing opportunity to learn and grow as an individual, I'll forever cherish this experience!
- ❖ Thank you to my lab partner, Ella Smith, for always being there for me throughout this project!

Contact

Emails:
itisaam@ualberta.ca
rafiq.ahmad@ualberta.ca

Google Site: <https://sites.ualberta.ca/~rafiq1/>