Fabricating assistive cookware for people with disabilities using two part molding on the Mayku Multiplier.

Above: Adaptive knife created by SmashToast inc. for The Illinois Assistive Technology Program

Designing and fabricating devices for people with disabilities is a deeply needed service that requires in-depth knowledge of bespoke technical fabrication methods and a deep sense of empathy with users with disabilities.

The Illinois Assistive Technology Program (iatpmakers.org) is a government funded initiative in the USA that designs and fabricates assistive technology devices for people with disabilities. The IATP site hosts design files and the instructions of how to fabricate products so that anyone in the world can create their own assistive devices geared specifically towards their needs.

> Have you used the Multiplier for a project that you would like to share with the world? We'd love to hear from you!
>
> Email ben@mayku.me to let us know what you have been making.

We spoke with Barnabas Helmy of SmashToast inc, a product designer working closely with the IATP team in developing new types of assistive devices about how he uses the multiplier to manufacture bespoke assistive devices and to create and distribute the instructions needed to create them.

The Knife Project came out of the Tech Kitchen Program which set out to help people with restrictive disabilities to learn cooking skills in collaboration with chefs as well as teaching them about assistive technology options.

The user in question was a chef themselves with restricted arm function. They needed a new type of gripping mechanism for a knife which is what the IATP in conjunction with SmashToast sort to develop.

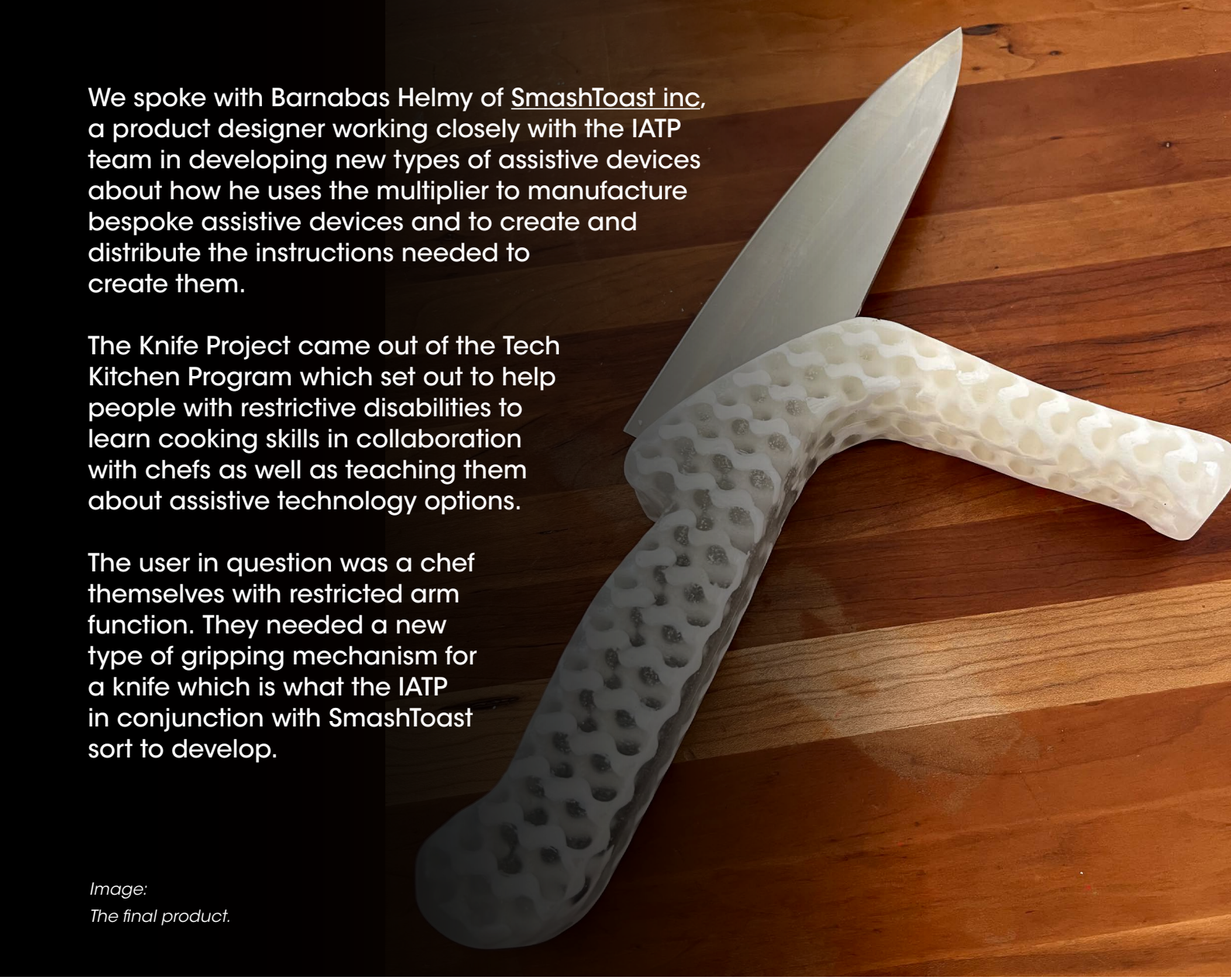


Image:
The final product.

The problem

Limited options are available for a chef with arthritis to continue cutting safely and comfortably. Most commonly available knives with adaptive handles have neither quality blades or handles strong enough for repetitive usage, nor were they designed for food preparation and cooking related tasks.

The issue with any bespoke knife creation is four fold:

1. The first is that the design and the manufacture of the knife needs to be completely bespoke to the customer and their specific disability, but customisable enough to be applicable to other people with adjacent disabilities.
2. The second is that the products produced need to adhere to strict health and safety standards for both sharp objects and cleanliness. Many 3D printing technologies fall short here because FDM products have a knack for collecting bacteria in between layers and many SLA materials are not certified for food use.
3. The solution needs to be dishwasher safe without any leaching of chemicals.
4. The handle needs to be fixed securely onto a pre-existing knife ‘tang’ - the metal component of the knife that needs to be embedded into the handle securely.

The solution

The design team developed and tested multiple prototypes and was able to create a knife that specifically meets the client's needs. The result is a strong, high-quality adaptive chef's knife that can be easily reproduced for others with similar needs.

The handle is placed along the back of the knife blade to allow forearm leverage as opposed to using the wrist. A wider handle is added to the blade to accommodate those needing wider grips.

The body of the handle uses a tessellated PLA form to reduce the amount of resin necessary as well as to add structural stability to the handle.

The use of resin over a 3D-form creates a clean, non-porous surface that will last as long as the blade.

Image: Adaptive chef knife being used.

The process

All of the parts to create this knife are available from the IATP site under a Creative Commons Attribution 4.0 International License: https://iatpmakers.org/product/adaptive-chef-knife/

Parts list:

3" C-Clamps (x4)
4" Vice (or similar to secure mold during pouring/curing)
Plastic bin for catching resin
Glue Gun
3D Printer (FDM)
Multiplier Pressure Former

3D Printing Instructions:

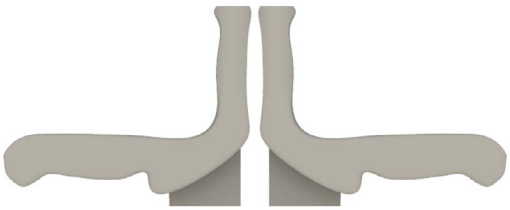
1. Download all parts from the IATP Maker Website.

2. The outer mold can be printed in PLA and does not require high resolution or high strength.

3. The pressure form molds are printed on a dual extruder FDM printer using Varioshore infill with Nylon CF walls. It is advisable to increase the wall layers (3-5) to help resist warping during the pressure-forming process.

Left & Right Knife Outer Molds (3D-Printed)

Left & Right Knife Handle Forms (3D-Printed)



Left & Right Pressure Form Molds (3D-Printed)

Pressure forming process:

1. They used the Mayku Multiplier pressure former with 1.5mm EVA sheets to create a flexible, removable inner mold allowing the resin part to be easily removed once cured.

2. They chose this method over silicone molding as it allowed a faster, more cost effective mold making process that in turn allowed them to iterate faster on prototypes without having to wait for silicone to cure. The simple to use nature of the machine ensured that the process would be scalable to others with lower skill barriers to that of casting silicone.

Resin casting instructions:

1. Place the weather stripping along the channel on either side of the outer mold.

2. Fit the flexible EVA mold in the outer mold with the weather stripping.

3. Insert the corresponding knife handle form into the EVA.

4. Before placing the knife tang, run a bead of hot glue along the EVA where the handle will meet the blade. Place the knife tang against the assembled form and run a second bead of hot glue along the exposed blade side. The hot glue helps prevent leakage along the blade.

5. Repeat assembly with the opposite side, but without the weather stripping.

6. Fit both sides together carefully (align channels) and secure using the c-clamps, distributing the tightening process.

7. Be sure the knife guard is in place. Suspend assembled mold so the funnel is facing up. Place a disposal bin beneath mold to catch spillage.

8. Slowly pour prepared resin into the funnel until full. Wait until fully cured before disassembling the mold.

*Using a vacuum chamber will help remove the bubbles from the resin, creating a more translucent finish.

Knife Tang (without Handle)

1/4" Weather Stripping

Finishing:

Carefully disassemble the mold and remove the knife. With guard still in place, use a Dremel or file to remove excess resin. Sand until smooth. Fill any air pockets with additional resin. Sand until smooth then coat with wax.

Name	Number of pieces	Price	Price per knife unit
Knife tang (without handle)	1	$20.00	$20.00
Handle form (3D printed)	2	$0.75	$1.50
Knife mold	2	$5.00	$10.00
Pressure formed mold (3D printed)	2	$0.75	$1.50
EVA inner mold	2	$10.00	$20.00
Weather stripping	1	$0.20	$0.40

Ready to start producing custom molds in-house with the Mayku Multiplier?

Creating bespoke molds with the Multiplier is quicker and more cost-effective than traditional methods such as silicone casting. The process is simple, allowing for faster prototyping and iteration, making it suitable for a wide range of users.

If you're interested in incorporating the Mayku Multiplier into your mold production workflow, get in touch with a Mayku Expert today.

Talk to a Mayku Expert

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