



3D PRINTED BOOKMARKS

Contributed to the Library as Incubator Project by Teen & Youth Librarian Michael Cherry. *Michael Cherry is the Teen & Youth Librarian at the Evansville Vanderburgh Public Library in Evansville, Indiana.*

3D printed bookmarks are a fun and easy project for librarians interested in 3D printing. They are a great way to introduce patrons to computer-aided design (CAD) and don't require as many light years to 3D print. Their quirkiness will appeal to technophobes and gadget enthusiasts alike. Moreover, they are a unique, outside-the-box project that will engage teenagers, while making a fun Teen Read Week or teen book club activity.

To create a 3D printed bookmark your library will obviously have to own or have access to a 3D printer. If your library does not currently own a printer but is shopping around, one of the best resources available is Make Magazine's annual review of 3D printers.

In addition to the printer, program participants will need to have access to computer-aided design tools. Many of these tools are free and tutorials can be found online. Open source software tools include Autodesk 123D and Sketchup Make.

In addition, Autodesk's Tinkercad provides the best introductory platform for 3D design. Tinkercad is a browser-based 3D design and modeling tool. Users can set-up an account via the Tinkercad website and design online. All of the designs are stored in the user's Tinkercad account.

Prior to having patrons design in Tinkercad, it is best to screen the "Tinkercad Tutorial Video" by Autodesk Tinkercad. This video can be accessed via YouTube or by following the link here: https://www.youtube.com/watch?v=KCaenAGeK_Q. Patrons unfamiliar with computer-aided design may need a little practice before getting started.

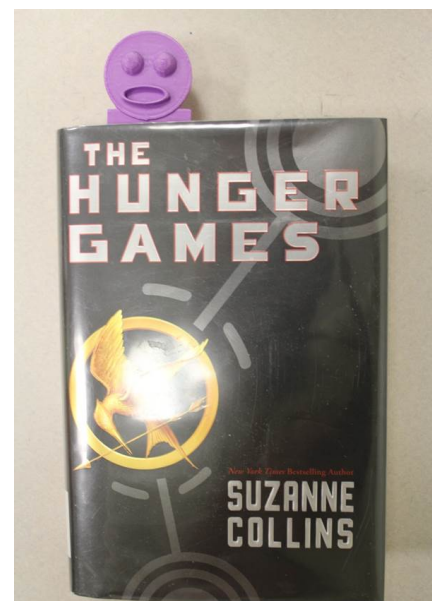
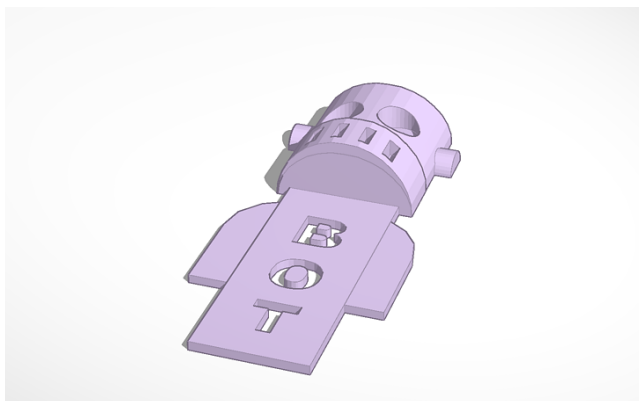
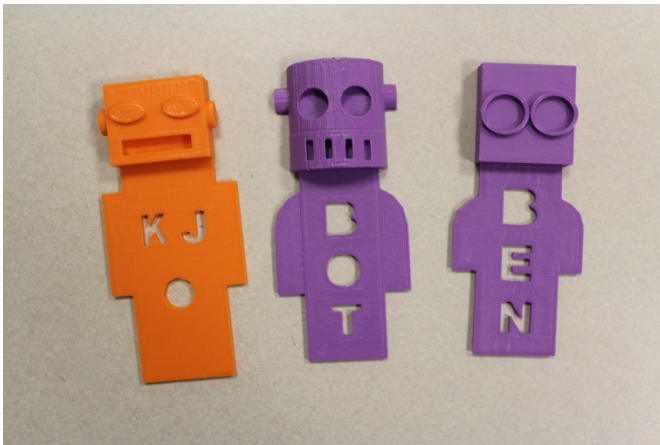
In order to design the bookmark, program participants have several options. There is the mashup technique whereby they could search for open source designs using Tinkercad's search bar. For example, patrons might search for a face that they could then attach to a body which they design. They may also modify open source designs by changing a character's face or adding additional

features. The beauty of the 3D printed heads is that they will pop out the top of the book, while the body remains flat marking the reader's page.

Another option is to have participants create the entire bookmark from scratch. The shape of the bookmark can be made by stretching and flattening a few solids. The head can introduce beginning users to negative shapes, such as an eye or mouth cavity, as well as grouping and stacking objects. The latter technique will require repositioning the picture plane as one builds upwards. This technique is demonstrated with the boat example in the "Tinkercad Tutorial Video."

Lastly, participants do not have to design a face but could try other shapes, figures, and symbols to their delight. When patrons are finished with their bookmarks it is wise to have them set their creations to "public" under the properties setting. This will make their design open source so that it can later be retrieved. Staff can search for it by title and copy the design into a staff account before printing. Otherwise, it would require knowing the username and password of each individual account.

Additional resources about this fun and simple 3D design project can be found in the library program toolkit below. Happy making!



Materials:

- 3D printer with PLA (polylactic acid) filament. The print bed should be at least 5.5” x 5.5”. An unheated print bed will require painter’s tape or adhesive, such as a glue stick, to keep the print secured to the bed while printing.
- Computer-aided design (CAD) tools such as Tinkercad, Autodesk 123D, or Sketchup Make
- Laptop with design software or Internet connection
- Tinkercad account
- Slicing software (Slicing software converts the design file into G-code. G-code is the language which could be understood by the printer. It is the blueprint that the extruder will follow when it layers the filament. Different printers will be compatible with different types of slicing software such as ReplicatorG, Cura, and others.)

Method:

1. Have program participants create a free Tinkercad account.
2. Screen the “Tinkercad Tutorial Video” by Autodesk Tinkercad. This video will show participants how to group and size objects, how to create holes or negatives, and how to stack objects for height, among other useful advice.
3. Change the size of the work plane or grid to 5.5” x 5.5” to correspond to the size of the print bed. In addition, turn the snap grid function to off. This will make it easier to arrange shapes together.
4. Demonstrate how to search for open source designs.
5. Assist participants as they have questions about their design.
6. Title and save the design as “public” upon completion (Example: Michael_Bookmark_EVPL).

Tip: The average bookmark will take 60-90 minutes to print at 200 microns (print resolution). While this may seem like a lot of time, other types of 3D prints can take twice as long to print. Given the length of time it takes to print, the slicing and printing process may need to take place outside of the program.

Enhance Your Program:

- Discuss different parts of the 3D printer including the X, Y, and Z axis and the heated extruder. Demo a 3D printer while participants work on their creations. They could pause and look at the printer in action.
- Discuss file types such as STL (stereolithography) and OBJ (object).
- Explain how the slicing process works.
- Describe how the “raft” helps stabilize the 3D print to the print bed. The support raft is a thin, initial layer that resembles mesh. The raft function can be turned off in the slicing

software prior to printing. In the case of the bookmarks, the raft was turned off on all of the prints. This made for a smooth finish on the underside of the bookmark.

- Lastly, provide examples of 3D printing in the world around us. This can include bioprinting, contour crafting, costume fabrication, and much more! One of the most bizarre videos is titled “3D Printed Concrete Castle.” It is accessible via YouTube and demonstrates a life-size 3D printer that prints concrete castles!