3D printing for accessible graphics: A progress report

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# Outline

* ARC project
* Education
* Mapping
* Building Capacity
* Next Steps

[Image: 3D printed tactile grid with axes and circular coordinate points, each with a hole in the centre for push pins]

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# ARC Linkage

[Image: 3D printed DNA strand with coloured connectors]

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## ARC Linkage Project

“Investigating the use of 3D printed models for access to graphics by people who are blind or have low vision”

Partners:

* Round Table   
  (with special support from SPEVI)
* Department of Education, Victoria
* NextSense
* Guide Dogs Victoria
* RSB

Project goals:

* Clarify when 3D prints are best suited for touch readers
* Build capacity within the national accessible format provision sector for the production and use of 3D prints

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## Project Timeline

October 2018 - Project launch

October 2021 - Original project end

May 2021 - 2021 Round Table Conference

March 2022 - Expected extended end date

May 2020 - ANAGG 3D printing group formed

[Image: 3D model for a braille clock]

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## Evidence supporting the use of 3D printing for touch readers

3D printed models:

* Can be understood more easily than tactile graphics
* Are more engaging
* Allows more time for teaching concepts
* Are more inclusive
* Can be used by blind and sighted together
* Therefore seen as of more value for use/display in public places

[Image: Event map with white paths, green felt grass, blue textured lakes, and 3D printed icons]

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# Education

[Image: 3D printed geometric shape accompanying a question in print with graphics using perspective]

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## Education

We have examined:

* What tools and materials are currently being used in the K-2 classroom, and where are the gaps?
* What 3D printing models are available for BLV students?
* What 3D printing models are most popular for BLV students?

> [“Top Ten” 3D printable models](http://accessiblegraphics.org/2021/03/22/top10_3d/)

Next steps:

* Feedback from classrooms

[Image 1: hexagonal tiles with elements of the water cycle and square tiles with raised arrows, arranged to show a simple water cycle. Print, braille, tactile and visual icons are included.]

[Image 2: 3D printed tiles with print and braille letters arranged on a scrabble board]

[Image 3: black qwirkle tiles with coloured shapes and braille indicators]

[Image 4: 3D printed boggle cubes with print and braille]

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# Mapping

[Image: 3D printed map of Round Table Conference venue in Melbourne]

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## 3D printed maps - Round Table 2019 workshop

Round Table 2019 workshop outcomes:

* 3D icons are helpful
* 3D icons do not need to be tall
* Indented roads make sense

[Image: 3D printed street crossing map with lowered streets and raised traffic light poles]

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## School Maps

* Whole school layout
* Year 7 area with doors, stairs and garden beds indicated
* 2-storey building with rooms and stairs

[Image 1: Tactile map with 3D printed buildings and textured tape for pathways.]

[Image 2: 3D printing design for map with several buildings with stairs and with textured garden beds]

[Image 3: Two 3D printed maps of an indoor space. They are roughly the same shape. The bottom maps has stairs leading upward. The top map has holes for stair openings and sits on external walls.]

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## 3D printed maps - street crossings

Based on consultation with O&M professionals.

3D prints are helpful because they are:

* Portable (light and durable)
* Customisable
* Easy to understand by touch
* Professional in appearance

Creation of 3D printed components that can be used to teach concepts for street crossings.

[Image: 3D printed tiles with black road; raised teal land areas with footpath, ramps, textured nature strip and low fence line; and added traffice lights, vehicles and people]

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## 3D printed cruise ship

* Floorplan with icons
* Ship model illustrating relationship between upper levels

Stephens, Butler, Holloway, Goncu & Marriott (2020) Smooth Sailing? An Autoethnography of Recreational Travel by a Blind Person, *ASSETS*

[Image 1: 3D printed map of a ship deck with textured floor, raised rooms and icons for features like toilets, swimming pool, icecream store (a soft serve in a cone) and nail salon (hand)]

[Image 2: 3D printed model of a ship with indented windows on the side and several layers on top with decking, swimming pools, theatre, etc.]

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# Building Capacity

[Image: 3D printed building blocks with alphabet letters in print and braille]

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## ANZAGG 3D printing group

Members:

* Australia, New Zealand and international guests
* Mainly in VI education sector.
* At all stages in adoption of 3D printing

Activities:

* Monthly zoom meeting
* Sharing files and ideas via Teams
* Assisting with guidelines

[Image: screen capture from Microsoft Team with discussion of 3D printed models]

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## Guidelines

<http://printdisability.org/about-us/accessible-graphics/3d-printing/>

* [When to use 3D printing for touch readers](http://printdisability.org/about-us/accessible-graphics/3d-printing/when-to-use-3d/)
* [Where to find 3D printing designs](http://printdisability.org/about-us/accessible-graphics/3d-printing/repositories/)
* [3D printing design software](http://printdisability.org/about-us/accessible-graphics/3d-printing/design-software/)
* [3D printing by people who are blind or have low vision](http://printdisability.org/about-us/accessible-graphics/3d-printing/blvmakers/)
* [Finishing – Preparing 3D prints for touch readers](http://printdisability.org/about-us/accessible-graphics/3d-printing/finishing/)
* [Understanding 3D prints through touch](http://printdisability.org/about-us/accessible-graphics/3d-printing/touch/)

[Image: Printed and bound copies of various Round Table guidelines]

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## 3D Printed Textures

[Image 1: Fingers touching 3D printed square tiles, each with a different 3D texture]

[Image 2: Girl reaching her hands into a cloth bag in the library at Parliament House Victoria]

[Image 3: Girl looking at what she has pulled out of a touch bag with surprise]

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# Next steps

[Image: 3D printed footstep on the moon]

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## Multi-level 3D Printed Maps

What presentation of 3D printed floor plans is most useful in developing a mental model of multi-level buildings?

* Flat
* Tiered
* Sliding
* Rotating

[Image: 3D printed floor plans of a three-story building]

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## Interaction

Audio labelling

[Image: Plastic box with channels and wires leading to 3D printed planets on bases. Labels are give for planet, stand, touch point, instructions and overview.]

Reinders, S., Butler, M., & Marriott, K. (2020). "Hey Model!" – Natural User Interactions and Agency in Accessible Interactive 3D Models. *CHI Conference on Human Factors in Computing Systems*

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## The future of 3D printing for accessible graphics

* Already being adopted as a new format for accessible graphics
* Standards coming soon
* Lots of models available for touch readers
* Vibrant ANZAGG 3D printing group

[Image: 3D printed robot figure leaping forward]

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## Sonification

Experimental Infosonics created and tested

* Working towards future project:
* SonoKids

Seeking partners

[Image 1: Audio icon]

[Image 2: line graph illustrating COVID-19 infections and recoveries over time, with additional text labels for important events]

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## Questions?

[Image: 3D printed Mario puzzle cube with raised question marks on the side]

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## Contact Us

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<http://accessiblegraphics.org/research/3dprints/arc/>

[Image: 3D printed mobile phone stand in the shape of an old rotary dial phone]

[End of presentation]