

**Additional File 1 for:**

2

**4 Benefits And Limitations Of Three-Dimensional Printing Technology For Ecological Research**6 Jocelyn E. Behm<sup>1,2\*</sup>, Brenna R. Waite<sup>1</sup>, S. Tonia Hsieh<sup>3</sup>, and Matthew R. Helmus<sup>1</sup><sup>1</sup>Integrative Ecology Lab, Center for Biodiversity, Department of Biology, Temple University, Philadelphia, PA, USA8 <sup>2</sup>Department of Ecological Science – Animal Ecology, VU University Amsterdam, Amsterdam, the Netherlands<sup>3</sup>Department of Biology, Temple University, Philadelphia, PA, USA10 **\*Correspondence:**

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14 Table 1: Software for designing, modifying, and analyzing 3D files

| Name                 | Cost<br>(in 2017)                    | Purpose  | Edit<br>3D<br>image | Generate<br>image from<br>photo | Build 3D<br>image<br>from<br>scratch | Image<br>analysis | Studies |
|----------------------|--------------------------------------|--|---------------------|---------------------------------|--------------------------------------|-------------------|---------|
| 3D Lightyear         | Free                                 | Preparing 3D file to print; inputs STL/SLC files and prepares them for part building in other software | Yes                 | No                              | No                                   | No                | [1]     |
| Agisoft<br>PhotoScan | Reduced rate<br>academic<br>licenses | Photogrammetry software for processing digital images and generating 3D spatial data                   | Yes                 | Yes                             | No                                   | Yes               | [2]     |
| Amira                | Contact sales<br>rep                 | Visualizing, manipulating, and understanding data from CT, MRI, microscopy, and                        | No                  | Yes                             | No                                   | Yes               | [3]     |

|                        |                                      |  |     |     |     |     |            |  |
|------------------------|--------------------------------------|--|-----|-----|-----|-----|------------|--|
|                        |                                      | other imaging methods.   |     |     |     |     |            |  |
| AutoCAD<br>(Autodesk)  | Reduced rate<br>academic<br>licenses | Computer-aided design and<br>drafting software for 3D<br>modelling | Yes | No  | No  | No  | [4]        |  |
| Blender                | Free                                 | 3D image modeling, rigging,<br>rendering                           | Yes | No  | Yes | No  | [5]        |  |
| Checkpoint             | Reduced rate<br>academic<br>licenses | 3D modeling, landmark<br>collection and editing.                   | Yes | Yes | No  | Yes | [6]        |  |
| CTan                   | Free                                 | 2D and 3D micro-CT dataset<br>analysis and visualization           | No  | No  | No  | Yes | [7]        |  |
| FreeCAD                | Free                                 | 3D modeling and modifying  | Yes | No  | Yes | No  | [8]        |  |
| Geomorph               | Free                                 | Geometric morphometric<br>shape analysis in R<br>environment       | Yes | No  | No  | Yes | -          |  |
| ImageJ                 | Free                                 | Image enhancement,<br>analysis, and editing                        | Yes | No  | No  | Yes | [5,7]      |  |
| Inventor<br>(Autodesk) | Free<br>Academic<br>License          | 3D mechanical design,<br>simulation, tooling                       | Yes | No  | No  | No  | [5]        |  |
| InVesalius             | Free                                 | Reconstruction of CT &<br>MRI                                      | No  | No  | No  | Yes | [7]        |  |
| Maya<br>(Autodesk)     | Free<br>Academic<br>License          | 3D animation, modeling,<br>rendering, simulation                   | Yes | No  | Yes | No  | This study |  |
| MeshLab                | Free                                 | Editing, cleaning, healing,<br>inspecting, rendering and           | Yes | No  | No  | No  | [7]        |  |

|                         |                                |   |     |     |     |     |         |  |
|-------------------------|--------------------------------|---|-----|-----|-----|-----|---------|--|
|                         |                                | converting unstructured 3D scans  |     |     |     |     |         |  |
| Meshmixer (Autodesk)    | Free                           | 3D sculpting and image manipulation   | Yes | No  | Yes | Yes | [9]     |  |
| MorphoJ                 | Free                           | Quantitative analysis of geometric morphometrics  | No  | No  | No  | Yes | [10,11] |  |
| OpenSCAD                | Free                           | Focuses on CAD rather than artistic aspects of generating and manipulating 3D modelling         | Yes | Yes | Yes | No  | [12]    |  |
| PhotoModeler Scanner    | \$2,495                        | Alternative to 3D laser scanning to create 3D models from photographs                           | No  | Yes | No  | Yes | [10]    |  |
| PhyloNimbus             | Free                           | Landmarks & linear/curve measurement of 2D or 3D projects                                       | No  | No  | No  | Yes | -       |  |
| Polyworks (Innovmetric) | Contact sales rep              | Comprehensive 3D modeling software system with universal file formats                           | Yes | Yes | Yes | Yes | -       |  |
| SketchUp (Google)       | Reduced rate academic licenses | Designing 3D imagery from scratch   | No  | No  | Yes | No  | [13]    |  |
| Solid Works             | Contact sales rep              | Most aspects of 3D image generation and manipulation  | Yes | Yes | Yes | Yes | [12]    |  |
| TinkerCad               | Free                           | Highly accessible, web-based tool for designing new 3D models and, modifying existing 3D models | Yes | No  | Yes | No  | -       |  |

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16

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