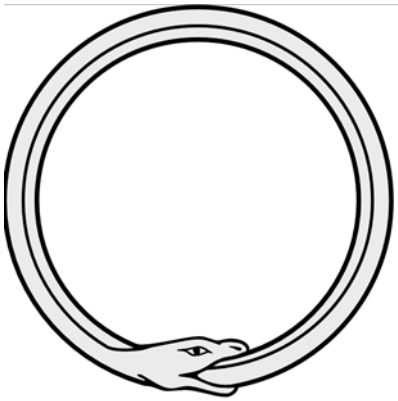

Disciplinary Grand Challenge

Archaeology within a Modern Material Context

Paul Reilly

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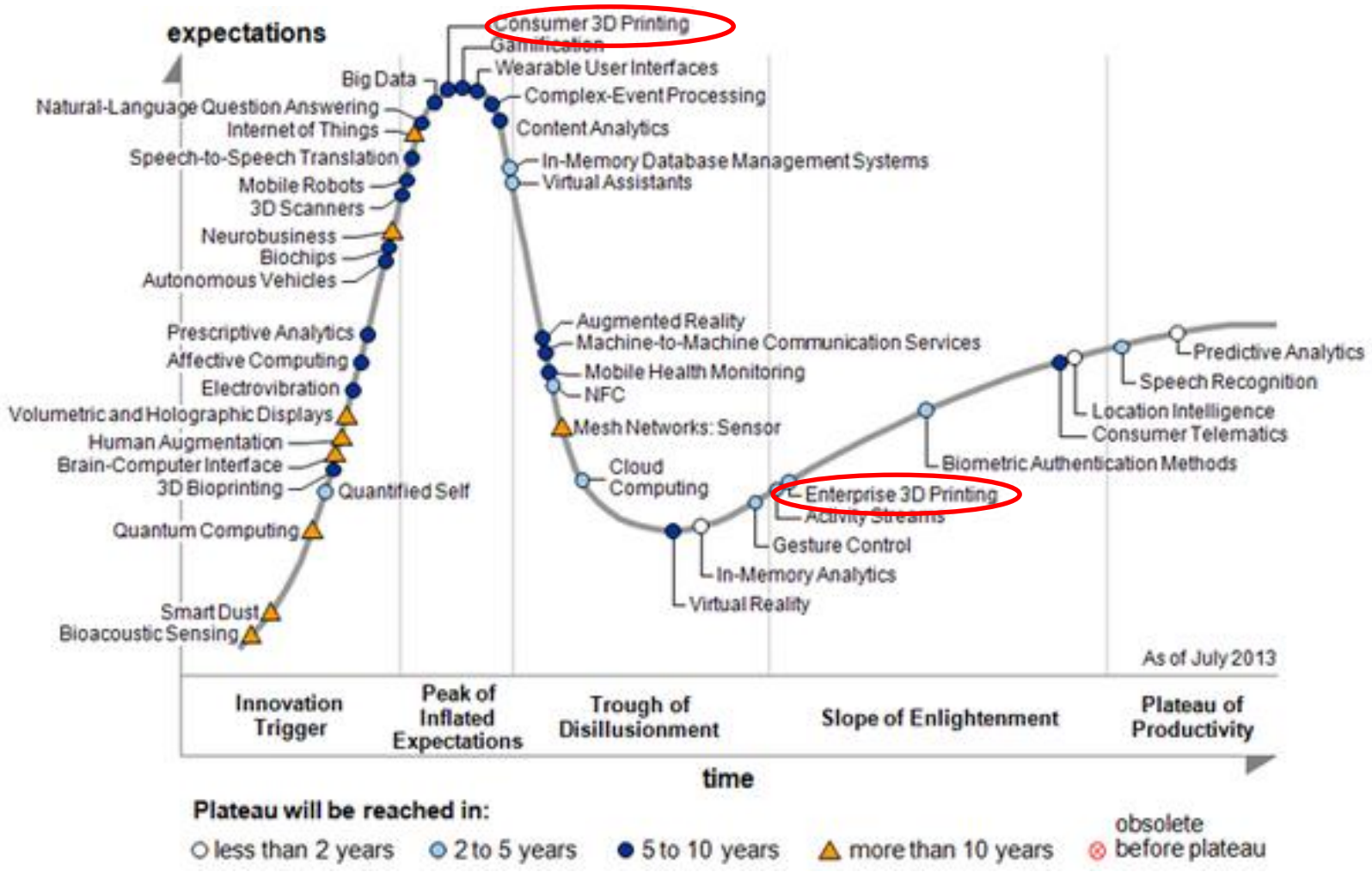
CAA 2014, Paris, What do you want from digital archaeology?
Round table 1

Many emerging technologies have potential applications in archaeological practice. Additive Manufacturing is a prime candidate to re-engage the spirit of virtual archaeology



Hype Cycle for Emerging Technologies 2013. Source: Gartner

The evolution of Additive Manufacturing can be summarised as three phases of gaining control over physical matter: geometry, composition, and behaviour

Geometry

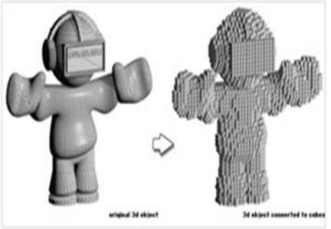
- Unprecedented control over the *shape* of objects
- 3D printers can already fabricate objects of almost any material in any shape

Composition

- Control over the *composition* of materials
- Multi-material printing, multiple 'entangled components' co-fabricated simultaneously

Behaviour

- Control over the *behaviour* of discrete units of material (voxels)
- *Programmable matter*: digital materials designed to function in a desired way

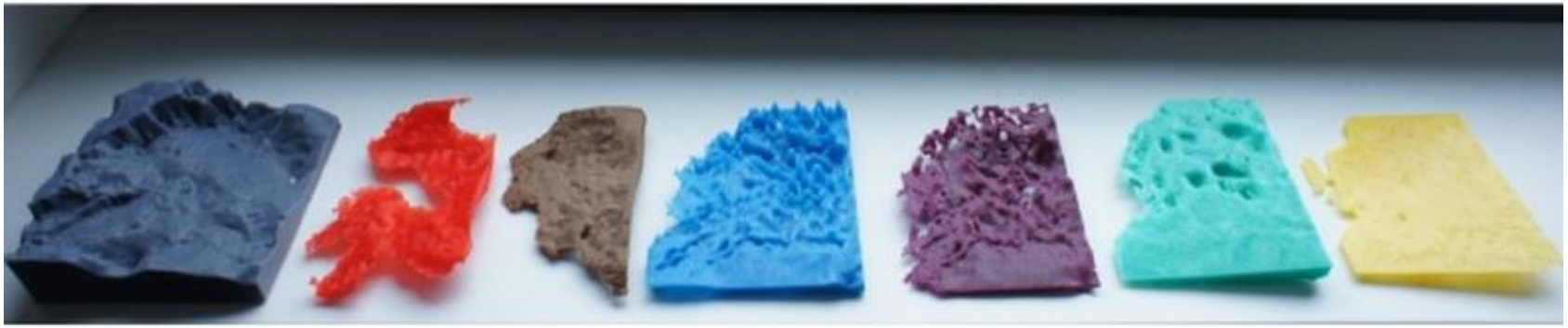


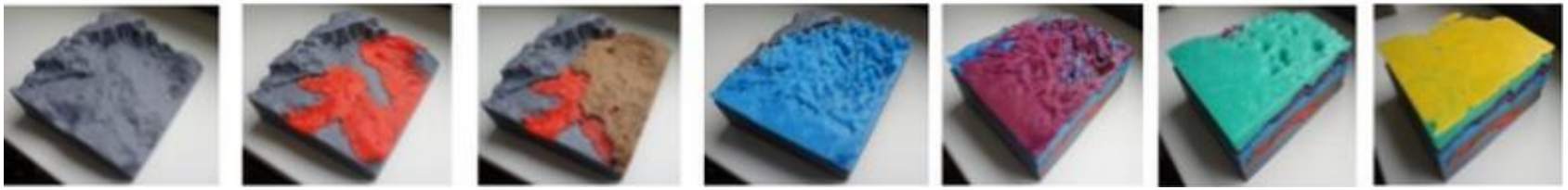
H. Lipson and M. Kurmar, *Fabricated: the new world of 3D printing. Wiley, 2013.*

Control over shape provides a bridge between existing 3D modelling formats and 3D printed physical objects

LANDSCAPES & TOPOGRAPHY

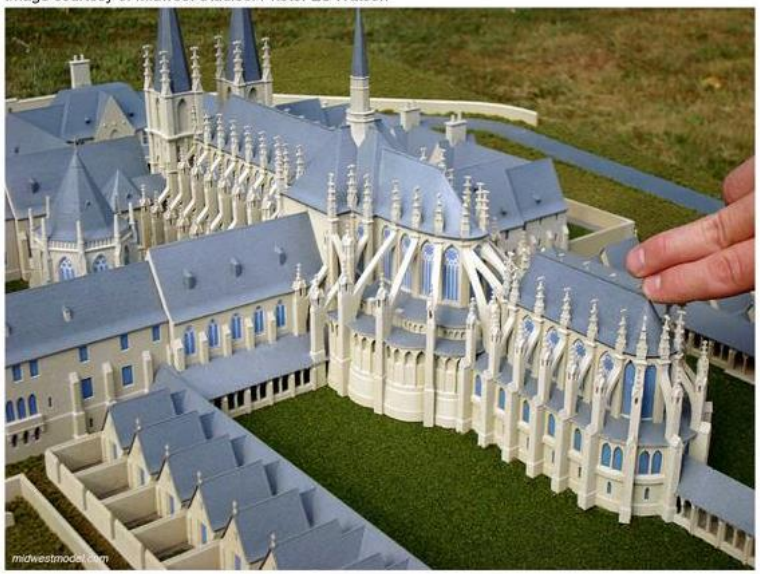
- Point clouds, TINs, and solid models, can be 3D (re)printed using the STL format, via CAD, GIS, etc., systems
- E.g., Topography and stratigraphic interfaces





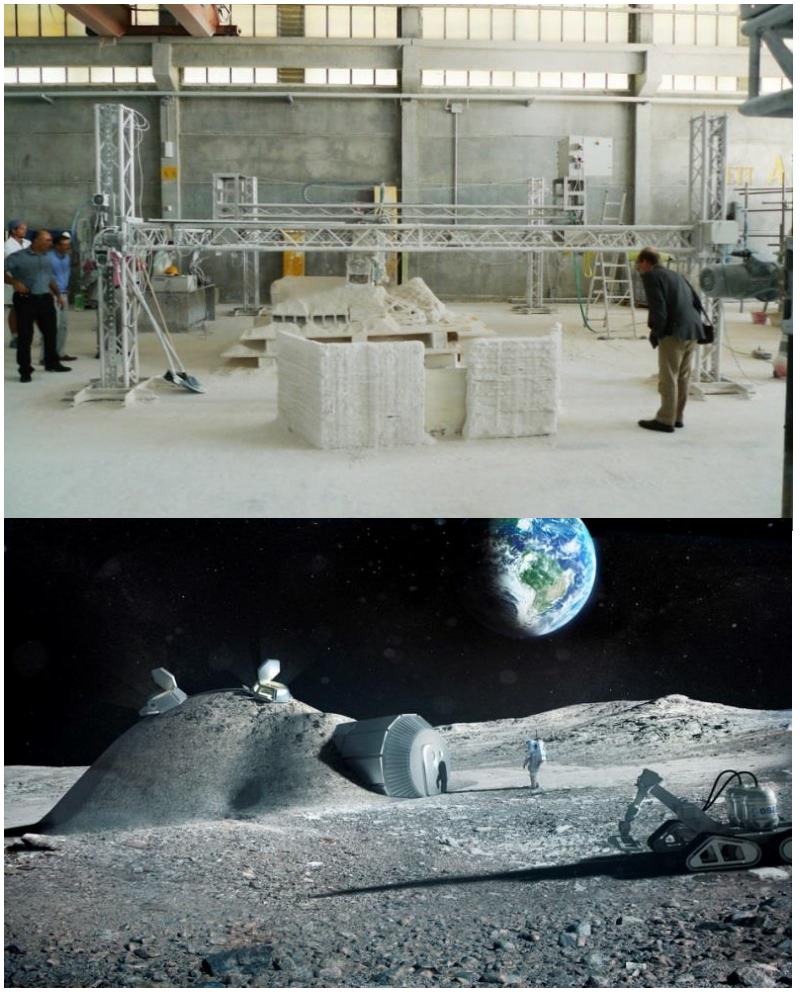
Architects already 3D print model- to full-scale buildings, architectural elements and even prototype lunar bases, and other immersive spaces

Image courtesy of Midwest Studios. Photo: Ed Watson



http://www.digital-grotesque.com/#2

MONUMENTS



http://www.esa.int/Highlights/Lunar_3D_printing

3D printing affords tangible non-intrusive interaction with artefacts materialised at multiple scales (bigger and smaller)

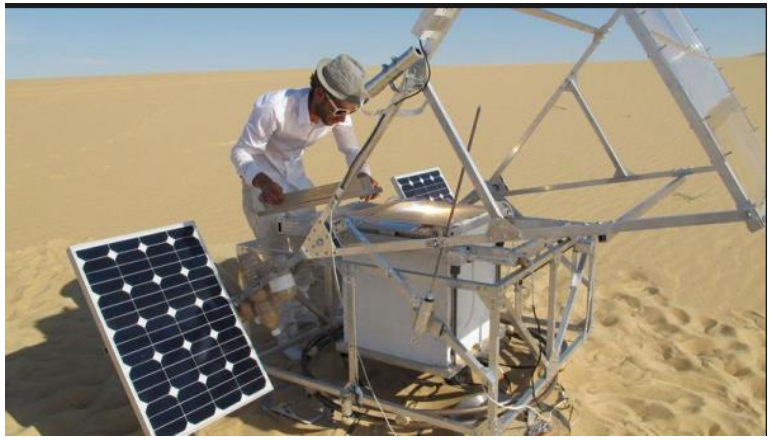
ARTEFACTS

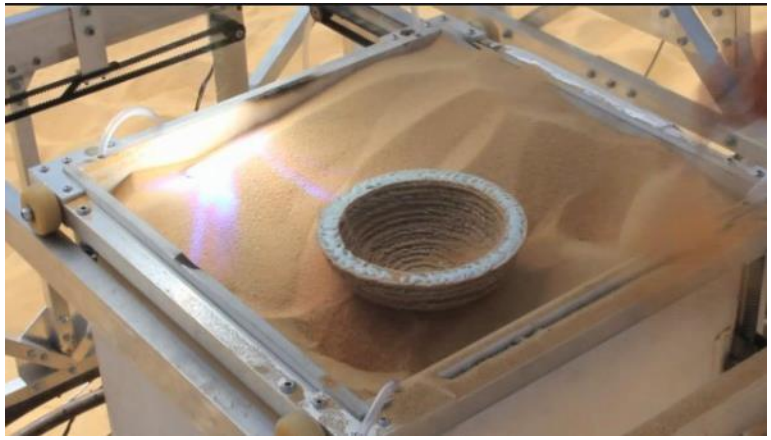
- CT scanning combined with 3D printing allows study of the writing with minimal handling of originals
- Cuneiforms replicated in different materials at different scales
- Interior features of the cuneiform facsimiles can be ‘opened’ so that sealed writing can also be studied without damaging the original artefacts
- The spirit of virtual archaeology moving beyond the purely visual to include the tangible

Project Members: N. Gangjee, H. Lipson, D.I. Owen. Cornell University

Additive Manufacturing materials case studies: printing sand (glass) and soil with organic material inclusions

MATERIALS





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Solar Sinter - http://www.markuskayser.com/

http://www.treehugger.com/gadgets/students-create-3d-grass-printer.html

Near *in situ* virtual (re)excavation of some contexts, soils and archaeological components revealing their intricate and detailed structure and form non-intrusively

MATERIAL COMPOSITION

Computer Tomography (CT) with 3D printing provide the ability to examine the structure of soil 'close up' and, for example, set-up multiple experimental investigations

W. Otten & R. Falconer, Abertay University

CT allows a detailed, non-intrusive investigation of a coin hoard in situ within a pot, with individual coins being isolated virtually from the fill and 3D printed

R. Boardman, G. Cox , M. Mavrogordato & J. Miles, University of Southampton
https://vimeo.com/45452797

Materialisation: the Additive Manufacturing File (AMF) format encapsulates all the elements of an archaeological context record

Context Record Elements

SHAPE PLAN
SHAPE SIDES
SHAPE BASE
X/Y/Z CO-ORD
LEN./WIDTH/DIAMETER/DEPTH
SOIL COLOUR
TEXTURAL CLASS
COURSE COMPONENTS
ARCHAEOLOGICAL COMPONENTS

AMF Elements

OBJECT
GEOMETRY
COLOUR
MATERIAL
CONSTELLATION
METADATA

making possible a closer alignment between virtual and physical worlds

A Disciplinary Grand Challenge: Move beyond recording just geometry and 3D fabricate an excavation

Challenge the discipline to 3D fabricate an excavation

- Innovate and transform traditional archaeological practices of recording
- Explore the disaggregation and reassembly of a rematerialised archaeological intervention
- Establish an exemplary platform for strategic innovation


Merci
Thank You