MorphoSource
Open Use 3D Data Repository

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Gregg Gunnell / Director of Fossil Primates (Duke)
Seth Kaufman / CEO & Founder Whirligig Inc.
Started 2013

A place for 3D Data on vouchered specimens

Emulates a museum experience

www.morphosource.org
3D Data
Adhere to best-practice standards (Davies et al. 2016)

**Volume**
Modality – CT, MRI
Formats – tiff, dicom, jpeg, bmp

**Surface**
Modality – Laser, structured light, photogrammetry
Formats – ply, stl, obj
Outline

• Why do researchers need a repository for 3D data?
• How do researchers interact with MorphoSource?
• Sustainability and future growth
Why do we need a repository for 3D data?

- 3D data are critical to research
- Transparency in science means access to these data
- Time consuming, costly, and risky to specimen
- Obligation to avoid taxing museums by rescanning specimens

Google Scholar: “Physical anthropology” 3D scan

Doubling time: 4.8 years

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Why do we need a repository for 3D data?

Benefits

• **Advance research** (quick access, bigger samples, more sophisticated analyses)

• **Support museums** (improved real & demonstrable value of collections, reduced demand for new scanning)

• **Empower science education** (access to previously off-limits collections)
Why not use generic archives?

- ‘publication packet’ organization
- Lack metadata specific to 3D formats and biological specimens
- Hinder accessibility, discoverability, and long term readability
They should.....

• Costly to start and manage a digital archive
• Dividing data among isolated platforms limits discoverability
• Researchers need control of when and how they publish raw data
• Redundancy is not necessarily a bad thing

Shouldn’t museums host data on their specimens?

www.morphosource.org
Outline

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Researchers contribute their datasets

Find & Download Datasets

BROWSE or

enter search terms

Useful Info

- Information for Users
- Information for Contributors
- Terms
- User Guide

Interested in creating a MorphoSource project?

BECOME A CONTRIBUTOR

www.morphosource.org
Researchers contribute their datasets

www.morphosource.org
Researchers contribute their datasets

Project: AMNH Mammal Collection

0 Project Specimens

Your project has no specimens. Use the "NEW SPECIMEN" button to add specimens, to which media may be added.
Researchers contribute their datasets

Project: AMNH Mammal Collection

55 Project Specimens
Group by: Specimen Number | Genus | Species

www.morphosource.org
Researchers can obtain data GUIDs (DOIs)

DNMNH-G-22149, *Procavia sp.*
And/or increase accessibility of collections

Project: Digitizing the Florida Museum of Natural History's Herpetology collections

80 Project Specimens

Order by: Specimen number | Taxonomic name

UF-11978, Sphenodon punctatus
UF-H-100788, Spea multiplicata
UF-H-14110, Sphenodon punctatus
UF-H-43506, Kinosternon hirtipes tarascense

www.morphosource.org
Researchers control levels of access

Access

• On upload, data are hidden from public database.
• Data can be made visible with author-approved or open downloading.
• Reuse of shared data is regulated through cc licenses.
Anyone can get data from MorphoSource

Exploring specimens & media

Find & Download Datasets

BROWSE

or

Ptilocercus skull

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LOGIN OR REGISTER
Anyone can get data from MorphoSource

Exploring specimens & media
FOSSIL HOMININS

- 91 specimens of newly described South African hominin
- *Homo naledi* (eLife 2015)
Data on MorphoSource

PRIMATES
• ~1000 primate skulls
• 95% of all species
• (Nature Scientific Data, 2016)
Data on MorphoSource

**FISH**

- Sharks
- Rays
- Teleosts

www.morphosource.org
Data on MorphoSource

INVERTEBRATES

• Beetles, Bees, Centipedes, Molluscs

Specimen Information

Specimen: CBSS-CHP517-1, *Eupolybothrus cavemicolus*, Unvouchered, Female

The Croatian Biospeleological Society (CBSS) is a non-governmental, non-profit organization acknowledged, registered and supported by the Ministry of Science, Education and Sport that has been working successfully since its foundation in 1996. It is an organization for biospeleology that deals with research and conservation of subterranean fauna and its habitats on the whole territory of the Republic of Croatia with its members being both scientists, experts and cavers.

Locality: country: Croatia; stateProvince: Knin; locality: NP Krka, village Kristanj, Hydroelectric power plant Miljacka, cave Miljacka II; verbatimElevation: 115 m; 44.000306, 16.016250

Institution: Croatian Biospeleological Society (CBSS), Zagreb, Croatia

www.morphosource.org
Educational Collections

25,000 views, 2,200 downloads

CR: Megan Hendrickson
Leveraging other work

- See talk by *Winchester et al.* today
Is MorphoSource being used?

User/use growth since 2013 (quarterly data)

4,000 users
Is MorphoSource being used?

User/use growth since 2013 (quarterly data)

4,000 users

52,000 downloads
Is MorphoSource being used?

Growth of holdings since 2013 (quarterly data)

1,220 taxa

Homo sapiens  
Hyla medusa  
Salmo salar  
.....
Is MorphoSource being used?

Growth of holdings since 2013 (quarterly data)

1,220 taxa
- *Homo sapiens*
- *Hyla medusa*
- *Salmo salar*

5,700 specimens
- AMNH 127167
- USNM 400854
- MCZ 83459
- UF 211391
Is MorphoSource being used?

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Growth

Storage

• MorphoSource occupies 15Tb with 25,000 datasets
• Cleared for 10Tb/year growth by Duke
• But one project alone (oVert) could add 30Tb in 5 yrs
• Plan???
Growth

*Many hands make light work*

Grow through addition of consortium members who provide a finite storage commitment
How?

Duke
Partner B
Partner C
Partner D
Partner E
How?

Leverage state-of-the-art open access digital repository platforms

Duke  Partner B  Partner C  Partner D  Partner E
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The open source parts and their functions

**Fedora** ([Fedorarepository.org](http://Fedorarepository.org))
- Digital Asset Management platform
- Allows integration of multiple data nodes

**Hydra** ([projecthydra.org](http://projecthydra.org))
- Provides the database structure for interacting with Fedora

**DuraCloud** ([duracloud.org](http://duracloud.org))
- Provides bitrot prevention
- Manages full redundant cloud copy through Amazon Glacier
- Provides integration with Archivematica
• **3D data are now vital** and maximizing their accessibility and discoverability will be transformative.

• **MorphoSource archives 3D data on vouchered specimens** for any researcher and serves it in a setting that emulates a museum collection.

• **An integrated effort is needed** to manage preservation of 3D digital data from museums.
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