Terevaka Archaeological Outreach (TAO) 2016 field report: Exploring a new dimension

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Introduction

Since 2003, Terevaka Archaeological Outreach (TAO) has provided educational opportunities for local high school students within the Rapa Nui community. The program was created in an effort to restructure the traditional priorities of international scientific expeditions to the island, and since 2003 the three primary goals of TAO have remained the same: (1) To offer experiential learning opportunities specific to cultural and natural resources that surround the local community; (2) To promote awareness and expertise in conservation measures and sustainable development; and (3) To document and study both cultural and natural phenomena of the past and today.

The uniqueness of TAO, among other non-governmental programs that have emerged on the island, is that the curriculum for local students is generated each year based on cutting edge archaeological research projects. Local students learn a tremendous amount about the island's cultural heritage and conservation while making significant contributions to advance our understanding of the island's prehistory.

TAO projects are all designed to be non-invasive, reinforcing the notion of sustainable development on the island, and promoting resourcefulness and expertise in a wide variety of professional careers (Petney et al. 2015; Rutherford et al. 2008; Shepardson 2006, 2010; Shepardson & Torres 2009; Shepardson et al. 2004, 2009, 2010, 2011, 2012, 2013, 2014, 2015; Torres & Shepardson 2005).

Toponymy Activities

The 2016 program continued to build on our island toponymy project of 2015 (Shepardson et al. 2015). Students used archival documents from both the 19th and 20th centuries to add to a growing geographic information system (GIS) database of place names and related information (Charlin 1947; Duque 1982; Thomson 1891).

However in 2016, students also plotted several courses across the island to visit particular sites referenced in historic documents, to acquire updated global position system (GPS) data for each site's location, and to build a systematic database of digital photographs for each site (Figure 1). The project has now documented more than 400 location names on the island, and provided translations for over 300 historic descriptions of places from Spanish to English.

Figure 1. TAO students exploring sites included in the toponymy database with TAO instructor and expert guide, Omar Monares.

Three Dimensional Photogrammetry

While most projects undertaken by TAO students have generated multimedia databases for two-dimensional presentation in an interactive Google Maps GIS format, students of TAO 2016 also ventured into three-dimensional data recording with a new high-tech non-invasive project on the island, developing digital 3D models of both megalithic statues that reside at archaeological sites in the field and artifacts curated by the Museo Antropológico Padre Sebastián Englert. In the process, students learned about photography, GPS technology, GIS technology, and photogrammetry software.

Each 3D model began with students taking multiple digital photographs from a variety of angles, in an effort to align the camera lens orthogonally to the different natural faces of each artifact (Figures 2 and 3). Students photographed objects using a Canon EOS-6D DSLR body and Canon EF 24-105mm f/4L IS USM

Figure 2. TAO students photographing an object from the Museo Antropológico P. Sebastián Englert collection.

lens. With museum artifacts, the camera remained stationary while objects were flipped and rotated; with *in situ moai*, the students moved around the statue and used an adjustable monopod to take photographs from varying heights and angles.

The next step was to align the digital photos, using Agisoft PhotoScan Professional Edition (*www.agisoft.com*). In most cases, this required "masking" of extraneous background imagery in each digital photo before the aligning process could begin. When working with statues outdoors, the software takes advantage of GPS data collected by the camera as each individual photograph was taken. Once photos were aligned, a series of steps within the software converted the digital imagery to a cloud of points, a planimetrically-corrected image map, and eventually a realistic surface rendering for the model (Figures 4-7). The entire processing time (after taking digital photographs) for each artifact varied between 1 and 12 hours. The software is known to generate 3D digital models with an accuracy of down to 1mm for close-range photography (Agisoft 2015).

Future Directions

TAO continues, as always, as a community-based initiative. All students and all staff contribute their time, effort, and expertise voluntarily. Each year more of our alumni contribute to the initiative, many having now embarked upon successful careers in education, history, conservation, and archaeology. Friends and family joined our group for a variety of events and excursions that we opened to public participation during the two-week program in July (Figures 8 and 9).

We were also lucky to have, once again, an excellent series of local experts providing educational presentation for the TAO students during their two-week experience. Merahi Atam (Secretaría Técnica de Patrimonio Rapa Nui and TAO alumna) motivated TAO students with information about archaeological conservation issues within the "downtown" Hanga Roa area. Sebastián Yancovic Pakarati (Manu Project) presented his work in conservation of both marine and terrestrial bird species around the island, including highlights from a recent trip to Motu Motiro Hiva (approximately 250 miles from Easter Island, formerly known as Sala y Gómez). Paula Valenzuela gave a presentation on technical aspects of conservation and

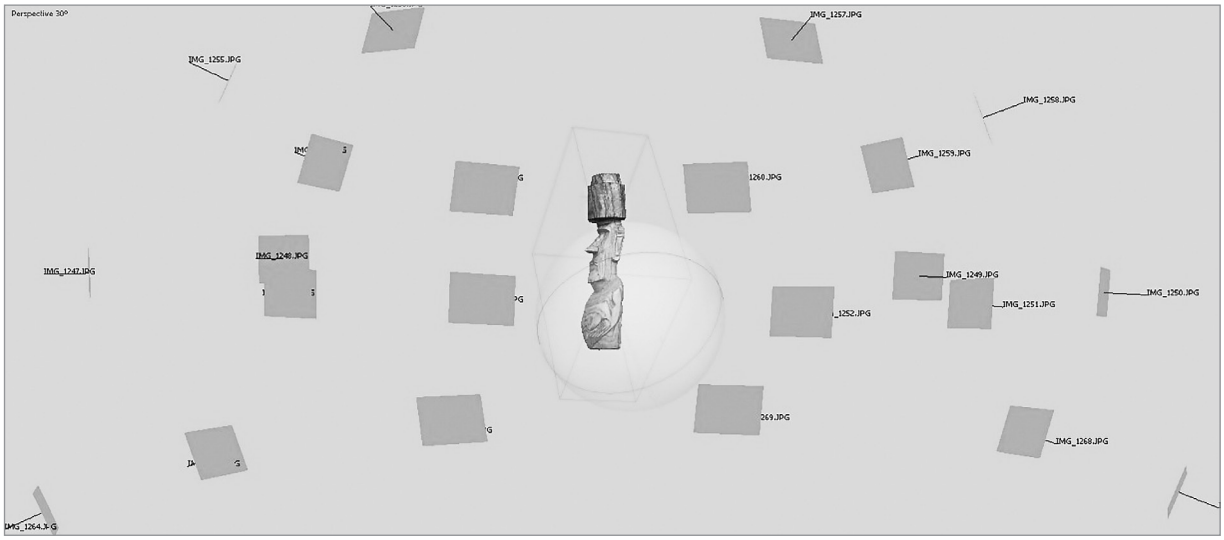

Figure 3. Image generated in Agisoft PhotoScan displaying planes for camera angles from which the object was photographed.

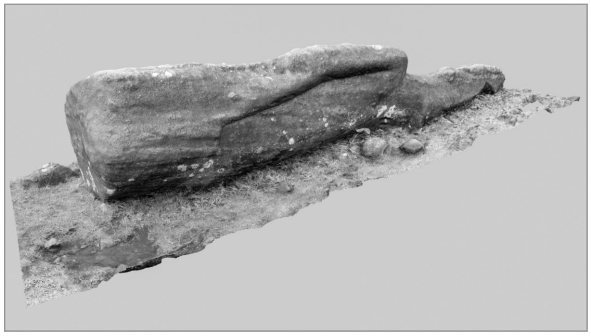

Figure 4. Completed 3D photogrammetric model of a tuff *moai* (approximately 6.5m in length) based on 70 photographs.

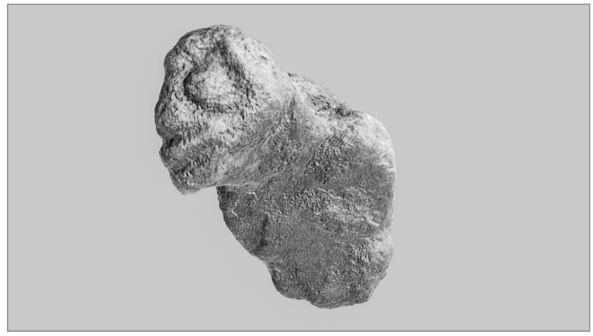

Figure 5. Completed 3D photogrammetric model of a stone anthropomorph (approximately 20cm tall) from the Museo Antropológico P. Sebastián Englert collection, based on 74 photographs.

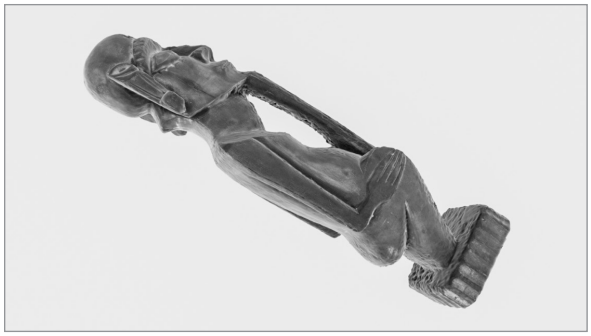

Figure 6. Completed 3D photogrammetric model of a squatting, bearded wooden figure (approximately 30cm tall) from the Museo Antropológico P. Sebastián Englert collection, based on 99 photographs.

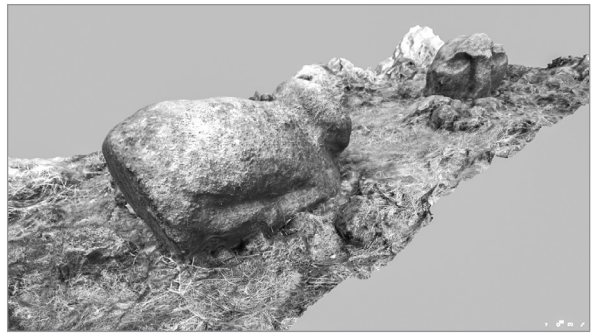

Figure 7. Completed 3D photogrammetric model of a tuff *moai* (approximately 3m in length) based on 75 photographs.

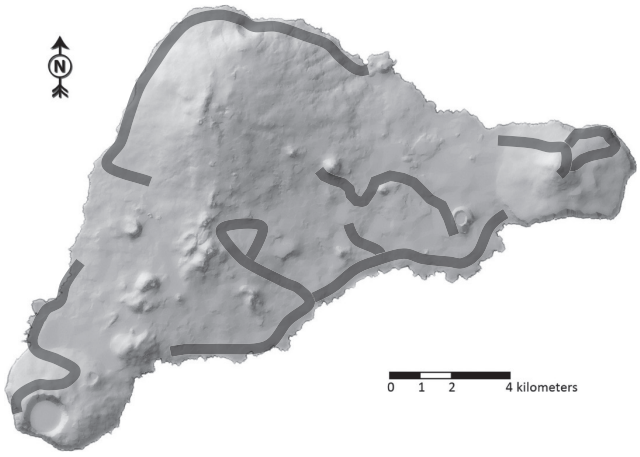

Figure 8. Shaded areas on the map indicates areas of the island that students visited with expert guides during TAO 2016.

chemical compounds applied to prehistoric statuary for preservation purposes. Francisco Torres (Museo Antropológico Padre Sebastián Englert) offered a summary of the island's volcanic history. Our guest lecture series finished with Cristián Moreno Pakarati (Ahireŋa Historical Research) presenting an innovative new manner of dividing and conceptualizing Easter Island's prehistoric and historic times thematically.

Images and information stemming from the TAO 2016 project are publicly available on interactive webpages hosted at *www.terevaka.net*. As TAO begins to plan for the 2017 program, we once again encourage support from readers of the *Rapa Nui Journal* and friends of the Easter Island Foundation. TAO is funded entirely by donations to Terevaka, a USA-based 501(c)(3) non-profit organization. As our program and curriculum continue to grow, we hope to purchase additional technology that will keep our on-island education, our conservation efforts, and our contribution to the advancement of research. To support our grassroots approach to education, conservation, and research, please make a tax-deductible donation to TEREVAKA or see *www.terevaka.net* for more information.

Figure 9. Students, staff, friends and family of TAO 2016 on our hike across the north coast of the island.

Acknowledgments

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