

CosmoQuest MoonMappers: Citizen Lunar Exploration

P.L. Gay (1), I. Antonenko (2), S.J. Robbins (2), G. Bracey (1), C. Lehan (1), J. Moore (1), D. Huang (1) and the CosmoQuest Team

(1) Center for STEM Research, Education, and Outreach, Southern Illinois University Edwardsville, Edwardsville, IL 62026. (pgay@siue.edu) (2) Planetary Institute of Toronto, 197 Fairview Ave. Toronto, ON M6P 3A6, Canada (PlanetaryInstituteofToronto@yahoo.ca) (3) LASP, UCB 392, University of Colorado, Boulder, CO 80309. (stuart.robbins@colorado.edu).

Abstract

The MoonMappers citizen science project is part of CosmoQuest, a virtual research facility designed for the public. CosmoQuest seeks to take the best aspects of a research center – research, seminars, journal clubs, and community discussions – and provide them to a community of citizen scientists through a virtual facility. MoonMappers was the first citizen science project within CosmoQuest, and is being used to define best practices in getting the public to effectively learn and do science.

1. Science Tasks

MoonMappers has Community Members (CMs) identify craters in two different interfaces. The first, "Simply Craters" (SC), is basic crater identification. The second, "Man vs. Machine" (MvM) gives users the same interface as the first, but the image is seeded with craters that were identified by an automated crater detection code. This data will be used to create a large, scientifically robust, and geographically broad catalogue of lunar craters and other features. Specifically, to identify, catalogue, classify, and analyse features including: small impact craters (10-1000 m in size), atypical impact formations (e.g., elliptical craters; exogenic dark-haloed craters; bright rays; ejecta exclusion zones), volcanic structures (e.g., vents, endogenic dark-haloed craters, rilles), and other unusual/interesting geology that can be used to help answer fundamental questions in lunar science.

2. Learning Environment

One of the fundamental goals of CosmoQuest is to create a community of people bent on advancing our understanding of the universe together; a community of people who are participating in doing science, who

can explain why what they do matters, and what questions they are helping to answer. In order to achieve this goal, we provide educational scaffoldings to all our projects. MoonMappers is supported by: a detailed content base, including an extensive lunar surface features glossary; a blog where new results are discussed; a forum and social media where community members (CMs) can ask questions and receive mentoring; and a series of weekly online seminars utilizing Google Hangouts on Air technology, which facilitates questions and back-channel dialogue.

While CosmoQuest's primary audience is adult citizen scientists, we also facilitate teachers using MoonMappers in their classrooms. We are developing a lunar surface science curriculum focused on how craters and volcanism reshape planetary surfaces, and on the formation and evolution of the solar system. Hands-on activities not only get kids using MoonMappers, but also teach students what craters are, how to identify them, and how to use them to study variations in age from region to region on the Moon.

3. MARIA Concept Inventory

To help us understand what CMs are learning as they engage with CosmoQuest, we have developed a concept inventory that addresses lunar science content and lunar science alternative conceptions. This inventory, called the MARIA (Moon's Albedo, Regolith, & Impact Assessment), is a 25-question instrument focused on specific content presented in the MoonMappers' tasks as well as related lunar content that CMs may encounter as they interact further with CosmoQuest's learning environment. MoonMappers-specific questions probe CMs' understanding of crater formation and structure,

albedo features, solar incidence angle effects, and imaging effects. Related questions look at CMs' understanding of the Moon's formation and evolution.

The MARIA is currently undergoing an extensive piloting process in undergraduate astronomy and geology classrooms across the United States. Lunar scientists and educators are establishing content validity for the instrument, and student and instructor interviews are planned to look at how these groups are thinking about the content as they answer each question. This instrument will be part of a larger database of questions that will address comparative planetary surface geology content and will be an essential tool for assessing learning in future CosmoQuest citizen science projects.

4. Facility Usage

As of 30 April 2012, 669 people had annotated more than 144,000 craters in more than 15,000 images of the Moon. While the median CM had marked 49 craters in 8 images, this statistic hides the vast diversity in site interactions. 38% of the CMs had viewed 10 or more images, with 4% viewing more than 100 images. Not all users of the site use MoonMappers, and so far 1351 registered users have

explored the site, with 22% of the users hitting 10 or more pages; the MoonMappers Tutorial and Features Guide are the most referenced content pages.

5. The Future

MoonMappers is still a nascent project as of this writing. By mid-July, it will have been engaging CMs in learning and doing science in its version 1 interface for four months and for two months in public beta. We will present an analysis of how users are engaging in the project, the results of focus group discussions on what features and aspects of design drive engagement, and on what issues cause users to leave the project. This project is also working to join forces with the MyMoon project, and results of introducing a teenage audience to programs that encourage them to do science in their free time will also be discussed.

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