

With Astronomy Rewind, citizen scientists bring zombie astrophotos back to life

March 22 2017



At left is a photograph of the Orion Nebula from page 396 of the June 1905 Astrophysical Journal — without coordinate labels to fix its celestial position and orientation. Astrometry.net was able to recognize the star pattern, after which the image was rotated more than 180° to put north up and placed in context on the sky in WorldWide Telescope. Credit: American Astronomical Society, NASA/SAO Astrophysics Data System & WorldWide Telescope.

A new citizen-science project will rescue tens of thousands of potentially valuable cosmic images that are mostly dead to science and bring them fully back to life. Called Astronomy Rewind, the effort, which launches today (22 March 2017), will take photographs, radio maps, and other telescopic images that have been scanned from the pages of dusty old



journals and place them in context in digital sky atlases and catalogs. Anyone will then be able to find them online and compare them with modern electronic data from ground- and space-based telescopes, making possible new studies of short- and long-term changes in the heavens.

"There's no telling what discoveries await," says Alyssa Goodman (Harvard-Smithsonian Center for Astrophysics, CfA), one of the project's founders. "Turning historical scientific literature into searchable, retrievable data is like turning the key to a treasure chest."

<u>Astronomy Rewind</u> is the latest citizen-science program on the Zooniverse platform, which debuted at Oxford University a decade ago with <u>Galaxy Zoo</u> and now hosts more than 50 active "people-powered" projects across a variety of scientific disciplines. After going through a short exercise to learn what they're looking for, users will view scanned pages from the journals of the American Astronomical Society (AAS) dating from the 19th century to the mid-1990s, when the Society began publishing electronically. Volunteers' first task will be to determine what types of images the pages contain: photos of celestial objects with (or without) sky coordinates? maps of planetary surfaces with (or without) grids of latitude and longitude? graphs or other types of diagrams?

The images of most interest are ones whose scale, orientation, and sky position can be nailed down by some combination of labels on or around the images plus details provided in the text or captions. Pictures that lack such information but clearly show recognizable stars, galaxies, or other <u>celestial objects</u> will be sent to Astrometry.net, an automated online service that compares astrophotos to star catalogs to determine what areas of sky they show.

Modern electronic astronomical images often include information about where they fit on the sky, along with which telescope and camera were



used and many other details. But such "metadata" are useful to researchers only if the original image files are published along with the journal articles in which they're analyzed and interpreted. This isn't always the case—though it's becoming more common with encouragement by the AAS—so some electronic journal pages will eventually be run through Astronomy Rewind and Astrometry.net too.

Thanks to these human-assisted and automated efforts, many thousands of "new old" images will ultimately end up in NASA's and others' data repositories alongside pictures from the Hubble Space Telescope. They will also be incorporated into the Astronomy Image Explorer, a service of the AAS and its journal-publishing partner, the UK Institute of Physics (IOP) Publishing, and viewable in WorldWide Telescope, a powerful data-visualization tool and digital sky atlas originally developed by Microsoft Research and now managed by the AAS.

The scans of pages from the AAS journals—the *Astronomical Journal* (*AJ*), *Astrophysical Journal* (*ApJ*), *ApJ Letters*, and the *ApJ Supplement Series*—are being provided by the Astrophysics Data System (ADS), a NASA-funded bibliographic service and archive at the Smithsonian Astrophysical Observatory (SAO), part of the CfA.

Astronomy Rewind is built on a foundation laid by the ADS All-Sky Survey, an earlier effort to extract scientifically valuable images from old astronomy papers using computers. "It turns out that machines aren't very good at recognizing celestial images on digitized pages that contain a mixture of text and graphics," says Alberto Accomazzi (SAO/ADS). "And they really get confused with multiple images of the sky on the same page. Humans do much better."

Accomazzi's CfA colleague Goodman, who runs a collaboration called Seamless Astronomy to develop, refine, and share tools that accelerate the pace of astronomical research, helped bring ADS and Zooniverse



together. According to Zooniverse co-investigator Laura Trouille (Adler Planetarium), 1.6 million volunteers have made about 4 billion image classifications or other contributions using the platform over the last 10 years. "This isn't just busywork," says Trouille. "Zooniverse projects have led to many surprising discoveries and to more than 100 peer-reviewed scientific publications."

If Astronomy Rewind attracts volunteers in numbers comparable to other <u>astronomy</u> projects on Zooniverse, Trouille estimates that at least 1,000 journal pages will be processed daily. Each page will be examined by five different citizen scientists; the more of them agree on what a given page shows, the higher the confidence that they're right. It shouldn't take more than a few months to get through the initial batch of pages from the AAS journals and move most of them on to the next stage, where the celestial scenes they contain will be annotated with essential information, extracted into digital images, mapped onto the sky, and made available to anyone who wants access to them.

"You simply couldn't do a project like this in any reasonable amount of time without 'crowdsourcing,'" says Julie Steffen, AAS Director of Publishing. "Astronomy Rewind will breathe new life into old journal articles and put long-lost images of the night sky back into circulation, and that's exciting. But what's more exciting is what happens when a volunteer on Zooniverse looks at one of our journal pages and goes, 'Hmm, that's odd!' That'll be the first step toward learning something new about the universe."

More information: astronomyrewind.org/

Provided by The American Astronomical Society



Citation: With Astronomy Rewind, citizen scientists bring zombie astrophotos back to life (2017, March 22) retrieved 27 April 2024 from <u>https://phys.org/news/2017-03-astronomy-rewind-citizen-scientists-zombie.html</u>

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