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Is that a Crater? Designing Citizen Science Platforms for the Volunteer and to Improve Results

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Abstract

Citizen science platforms allow non-scientists to take part in scientific research across a range of disciplines, and often involve the collection of volunteered scientific analysis from remotely sensed imagery. What these systems ask of volunteers varies considerably in terms of task type, level of user required and user freedom. This work studied the Zooniverse's Planet Four project and investigated the effect of task workflow design on user engagement and data outputs. Results show participants found the more guided, less-autonomous interface more frustrating, while the less complex, repetitive interface resulted in greater data coverage.

1. Introduction

The seemingly relentless advance of modern day technology has not only made the world a more connected place, but has also increased our capacity to collect and store information to an unprecedented level. This has resulted in a flood of data being produced, particularly be increasingly advanced and automated instruments carrying out large-scale surveys. Mars alone has been the subject of at least 16 NASA missions, with more planned in the future, each carrying more advanced instrumentation able to collect data in greater abundance with unprecedented levels of detail.

Citizen science, or "public participation in scientific research" [1], can be described as research conducted, in whole or in part, by amateur or nonprofessional participants often through crowd-sourcing techniques. It increasingly utilises Virtual Citizen Science (VCS) platforms [4] that gather scientific analysis from remotely sensed imagery, both of the Earth and other solar system bodies, through a website interface. Due to the abundance of data, planetary science is a prime candidate for, and adaptor of, citizen science and more specifically VCS platforms.

Despite virtual citizen science being a relatively new form of work, there has been a growing field of research considering citizen science practices in their own right, beyond the scientific problems they address. Particularly, studies involving interface HCI, platform functionality and public engagement have grown in number, contributing to a growing body of citizen science scholarship [2, 5]. However, there has been relatively little attention paid specifically to human factors issues regarding this type of data collection. This comprises a significant research gap, given that the success of a citizen science venture is directly related to its ability to attract and retain users, both to gather the large amount of data required, and to ensure the utility of the data collected [3].

In this study we make a first step in considering how virtual citizen science systems can be better designed for the needs of the volunteer, exploring whether manipulating task flow would affect both the information collected, as well as the volunteers' experience of user the interface.

2. Methodology

In order to investigate the effect of task workflow design on user experience and VCS output, a new version of the Zooniverse's Planet Four project has been developed. The new site allows users to mark craters on images of the Martian surface. A laboratory study has been carried out to both consider task workflow factors and also act as a technical test, identifying any general functionality and usability issues before a public launch.

The platform has been developed to include three different interfaces for marking craters that vary in task type, number of tasks available to the user and user freedom. They include: FULL - users have

access to all the tools and can complete all crater marking tasks for each image in any chosen order, STEPPED - all tools are made available to the user and all tasks completed in a predefined order (increasing in complexity) for each image, which cannot be diverged from, and RAMPED - users have access to one tool and complete one crater marking task for a set number of images, then use another tool and complete another task (increasing in complexity) for the next set of images etc.

Thirty participants took part in the lab study between January and March 2014. There were no specific prerequisites for participation. Each participant used each interface in a random order, and afterwards completed a questionnaire asking them to share their views across themes including design & usability, tasks & tools and imagery.

3. Experimental Results

In terms of the number of crater markings per image, a statistically significant difference is shown ($F(2.656, 201.83) = 7.416$, $p < .0005$). The RAMPED (position) interface resulted in a greater number of markings (3.61 ± 4.67) compared to the FULL (2.46 ± 2.93, $p < .001$), STEPPED (2.55 ± 4.17, $p < .003$) and RAMPED (mark) (2.24 ± 2.85, $p < .001$) interfaces.

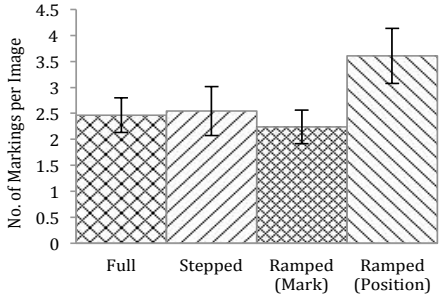

Figure 1: Crater marking results

4. Conclusions

This study found that altering the task workflow design of the interface does have an effect both on the user experience and on the resulting VCS output. When considering usability, participant comments were much greater in number for the stepped interface and predominantly negative regarding the restriction of choice, as explained by participant S19: *"I don't like to be forced to use a certain task order, and I couldn't go back or switch tools…"*

The ramped interface resulted in a much higher number of crater clusters being identified. This is an important result, as reducing the number of null returns would in turn reduce the time spent on data reduction by the science team.

When considering task workflow design, future citizen science platforms will need to perform a balancing act, weighing up the importance of user satisfaction, the data needs of the science case and the resources that can be committed both in terms of time and data reduction, more than likely on a case-by-case basis.

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References

[1] Hand, E.: Citizen Science: People Power, Nature, Vol. 466(7307), pp. 685-687, 2010.

[2] Jordan, R., Crall, A., Gray, S., Phillips, T., and Mellor, D.: Citizen Science as a Distinct Field of Inquiry, BioScience, biu217, 2015.

[3] Prather, E. E., Cormier, S., Wallace, C. S., Lintott, C., Raddick, M. J., and Smith, A: Measuring the Conceptual Understandings of Citizen Scientists Participating in Zooniverse Projects: A First Approach, Astronomy Education Review, Vol. 12(1), 2013.

[4] Reed, J., Rodriquez, W., and Rickoff, A.: A Framework for Defining and Describing Key Design Features of Virtual Citizen Science Projects, Proceedings of the 2012 iConference, pp. 623-625, 2012.

[5] Sprinks J., Houghton R., Bamford, S., and Morley, J. G.: The Impact of Task Design on Citizen Science Results, 181st AAAS Meeting, San Jose, CA, 12-16th February 2015.