

## Life in the Zooniverse: Working with Citizen Science

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It has become accepted orthodoxy in Literature and Science studies that relations between the two domains are a "two way street," and that literature and culture do not meekly reflect the new findings of their dominant partner, science, but are actively engaged in a dynamic, reciprocal set of relations with scientific practice and the development of scientific ideas. It is an attractive position (and one to which I have always subscribed), but such reciprocity is decidedly easier to track in historical context, before the consolidation of structures of institutional and professional science, than in the current period. The call for the AHRC "Science in Culture" large grants scheme was thus challenging: applicants were asked not merely to analyse reciprocal relations between science and culture, but to work directly with scientists, and to develop new insights and new methodologies for both sides. A tall order! Over the years I have participated in numerous workshops and conferences with scientists, trying to discover common ground, but never engaged directly in collaborative research. Originally Gowan Dawson and I had been envisaging a strictly historical project, addressing all those thousands of scientific and medical journals which lie mouldering in library basements (and are still largely untouched by digitisation). As historians we are familiar with the "big names", those journals like the *Lancet*, the *BMJ* or *Nature* which have survived into the present day, and whose dominance in the historical record is now reaffirmed by the digitisation of back numbers, making it easier for scholars to work with them. But what about all those local natural history journals, or medical or public health journals which have faded from historical memory?

Our aim, in working with these journals, was to uncover the networks which operated within Victorian science and medicine, and to rewrite in the process the metropolitan and professional focus of much historiography. Yet, such work would not involve any interaction with contemporary science. I had become aware, however, of the emerging phenomenon of "citizen science," particularly as supported by *Zooniverse*, the online citizen science platform run by Chris Lintott in the Department of Physics at the University of Oxford. It was clear that there were interesting parallels between, for example, the armies of people who participated in the development of natural history in the nineteenth century, and the "citizens" who now go online to help analyse scientific data, whether of astronomical phenomena, cancer cells, or the behaviour of wildlife. In the resulting AHRC project, "Constructing Scientific Communities: Citizen Science in the 19<sup>th</sup> and 21<sup>st</sup> Centuries," based at the Universities of Oxford and Leicester, and run in conjunction with our partners the Natural History Museum, London, the Royal Society, and the Royal College of Surgeons, England, we uncover forgotten histories of large-scale participation in science, and the role of journals in helping to create and consolidate these communities. We also bring such historical knowledge to bear on current practice, exploring ways in which earlier models of scientific communication and community building can help to inform the rapidly changing world of science in the digital age. In addition, the project has also created its own citizen science projects: Science Gossip and Orchid Observers.

Contemporary citizen science comes in many forms; Muki Haklay has argued that there are four levels, from lending your computer time to scientific projects (which I would judge as too passive a mode to count as citizen science) to what he terms "extreme citizen science", where concerned citizens participate in the problem definition, data collection and analysis, in a true collaborative project (Haklay 116). Examples here would be local activists involved in the measurement and analysis of pollution levels. *Zooniverse* projects sit mid-way in this table, placing huge datasets online, for analysis by individuals across the world. The emphasis is very much on active participation: the strap line is that *Zooniverse* "enables everyone to take part in real cutting edge research." Starting with *Galaxy Zoo* in 2007, which enabled participants to identify galaxies, the *Zooniverse* has now expanded to include humanities projects, of which Science Gossip is one. Led by one of our researchers, Geoff Belknap of Leicester University, and working in collaboration with the Missouri Botanical Garden, and the Biodiversity Heritage Library, this self-reflexive project involves participants in exploring forms of citizen science in the nineteenth century. Looking specifically at the role of illustration in early natural history journals, project citizens (over 9000 so far) have enabled us to identify not only the forms and content of illustrations, but also the largely forgotten artists and engravers who contributed so much to the making and communication of scientific knowledge in the nineteenth century. A methodology pioneered in the sciences, for the classification of galaxies, here helps open up new frontiers of humanities research, making possible for the first time detailed interrogation of the visual forms of nineteenth-century popular scientific culture on a large scale (with over 150,000 pages of illustrations classified so far). The platform is designed to foster community interaction, and the citizens of Science Gossip have themselves collaboratively developed new lines of research enquiry, actively participating, like their nineteenth-century forbears, in the creation of new knowledge.

The second citizen science project we created was, more challengingly, in the field of science. In parallel with nineteenth-century practice, we had been keen to create a project where "citizens" were not merely involved in analysing data online, but also in the design and development of active field studies. The result is "Orchid Observers," a project based at the London Natural History Museum, led by Dr John Tweddle and Kath Castillo of the Angela Marmont Centre and Dr Mark Spencer, Senior Curator of the British and Irish Herbarium, in collaboration with the Botanical Society of Britain and Ireland, an organization which can trace an unbroken history back to its roots in the natural history societies and field clubs of the nineteenth century. Working with the amateur orchid community, we developed a project to investigate what the changes in flowering times of 29 species of orchid could tell us about patterns of climate change. It is, we believe, the first large-scale citizen science project to combine field and online approaches. Participants were invited to photograph orchids in flower in their local area and to upload them to the project website, where they were then classified by online citizens. At the same time, online participants were asked to extract phenological information from historical herbarium sheets, spanning three centuries. The project thus uses historical research to open up past records, in combination with contemporary local field studies, and online analysis of results by participants spread across the globe. In this unique combination of the local and the global, of historical analysis and contemporary practice, of field study and online engagement, the project offers a powerful methodological model which highlights the potential of combining insights and practices from the humanities and

sciences, and of involving large numbers of participants outside the academy in the development of research.

If the historical perspective we bring has helped inform current citizen science practice, the reverse has also been the case. The term "citizen science" is obviously anachronistic when applied to the nineteenth century, but used as a lens, or heuristic tool, it has helped us to ask questions, and to develop areas of focus, which we might otherwise have neglected. In my own research this has led me into the realm of meteorology, and the work of G. J Symons and his army of dedicated rainfall observers in the nineteenth century (Anderson, *Predicting the Weather*, 99-104; Shuttleworth, "Old Weather"). Between 1860 and his death in 1900, Symons created a network of amateur rainfall observers who took detailed readings daily, before forwarding them to Symons. They were supported and encouraged by Symons through his two publications, the annual *British Rainfall* survey, which relied on their data, and Symons's *Monthly Meteorological Magazine* (1866-1920), in which he created a strong sense of community, encouraging observers to send in their findings, and stimulating debates on meteorological phenomena. In the absence of the internet, Symons had written, he estimated, to over 1400 weekly and daily newspapers to recruit observers so that he could establish coverage across the British Isles (Symons, "Report", 8). By the time of his death he had over 3400 observers (or staff as he liked to call them), in a network which he resolutely refused to allow to come under government control, valuing highly its independent and voluntary status. Throughout his work one finds a strong sense of the value of the historic record, both of the past and for the future. He sought out historic records wherever he could in order to build up information on shifts in weather patterns in the past which might help in predictions for the future—a concern which has a contemporary parallel in the Orchid Observers project and our interest in the valuable information on climate change hidden away in historic herbarium sheets. Symons instilled in his observers a proud belief that they were contributing to resolving not merely the practical meteorologically-related issues of the day, whether of agricultural production, sanitation, or water supply, but also those of the future, as they painstakingly constructed the records which now form an essential part of the British Meteorological Office data on historic weather patterns.

Symons was not solely interested in rainfall, but in its practical relevance, and in this guise he was a mainstay of the Sanitary Institute, serving as registrar from 1880-95. In exploring this aspect of his work, and the activity of the huge sanitary congresses which assembled each year, with over 1000 participants from a startling range of societies and organisations, I have had to revise radically my understanding of Victorian sanitary science. For the last few decades, and particularly for literary scholars, a largely Foucauldian interpretation has held sway: sanitary science, with its obsession with filth, is seen as the very embodiment of technologies of control, operating a class-based ideology that would sweep away the working classes, along with the city's excrement with which they are equated. The sanitarians are envisaged as hectoring, narrow-minded beings, operating intrusive systems of surveillance—male and female versions of Dickens' Mrs Pardiggle in *Bleak House*. In neo-Victorian fiction, such as Matthew Kneale's *Sweet Thames* (1992), the perspective is reinforced, as we witness obsessed (and sexually repressed) sanitarians waging war on a city of filth.

Sanitary science is a very broad label, however, covering a multitude of organisations and practices. Although many aspects of sanitarian practices no doubt

conformed to our negative stereotypes, one can also track the beginnings of environmental campaigning. Symons, for example, conducted experiments giving observers ozone test-papers to monitor air quality, and looked forward to the development of a "rough-and-ready test of the purity and healthiness of air in different localities" for use by households (Symons, "Presidential Address," 173). He anticipated, in other words, current developments in citizen science in which local groups are given basic equipment and encouraged to monitor air quality in their neighbourhoods. In the proceedings of local sanitary societies, or the annual Congresses, one can read the findings of dedicated groups of observers who often spent years creating daily recordings of air pollution (work that led up to the formation of the national Coal Smoke Abatement Society in 1898) (Crowther, Thorsheim). Records of discussion also capture the defiant voices of citizens, holding industrialists to account for the pollution they inflicted on communities. As one participant in Leeds observed, "To plead the requirements of industry was no justification for polluting the air or the stream common to all alike" ("Discussion of Papers" 609). One of the most telling moments of *North and South* is brought to mind, of Boucher's stained and discoloured body, after he had drowned himself in a brook "which had been used for dyeing purposes" (Gaskell 294). The pun is both harsh and poignant, linking industrial pollution of town and countryside to deaths from poverty and despair. As the Gaskell example suggests, there is a direct continuity between the literature of industrialism and the development of environmental campaigning (William Gaskell was a committee member, from its inception in 1852, of the Manchester and Salford Sanitary Association, one of the most energetic and effective of the local organisations).

One striking aspect of "citizen" activity in the nineteenth century, whether of local entomologists and botanists, or sanitary campaigners, was their awareness that their work was not merely for their peers, but was laying down records for the use of future generations. In our work on citizen science we complete that circle. At a time when the historical imagination, and optimism, of our predecessors is being dangerously eroded, it is salutary to note that our understandings of climate change are indebted to the painstaking work of Victorian citizens. It is also worth noting that many of the natural history societies founded in the nineteenth century are still going strong, such as the Ashmolean Natural History Society (1828-), the British Entomological and Natural History Society (1872-) or the Quekett Microscopical Club (1865-) which still meets in the Natural History Museum, London. Furthermore, expertise in local flora and fauna, and the development of the species records collated by the Biological Records Centre, still lie largely in the hands of the amateur community, not that of University science. Histories of the professionalization of science have tended to marginalise, or occlude, the continued activities of amateur communities.

In my previous project, *Science in the Nineteenth-Century Periodical (Sciper)*, the team explored the ways in which science permeated the culture of the period. Current citizen science could be seen as a modern equivalent of that periodical culture, bringing the potential to participate in science into the heart of domestic life. Although the Romantic in me regrets that the *Zooniverse* projects tend to focus on virtual participation, rather than activity in the field, it should be remembered that the Victorian periodical was first consumed by the fireside, before inspiring budding naturalists, or sanitarians, to head off into the field, or polluted cityscape. The *Zooniverse* platform itself has a strong educational ethos, aiming to stimulate further

scientific engagement amongst its participants, particularly through its "Talk" feature which in many ways mirrors the "gossip" and letters features of earlier periodicals, creating a space for discussion and mutual education.

The democratic potential of Citizen Science has in the last few years evoked great enthusiasm, particularly in the US, captured perhaps most succinctly in the title of a work by Caren Cooper, *Citizen Science: How Ordinary People are Changing the Face of Discovery* (2016) (Cooper is herself a university and museum-based researcher who has worked extensively with citizen scientist groups). President Obama's administration was deeply supportive, encouraging all government agencies to explore ways to work with citizen science. Perhaps most hearteningly for historians, the 2016 announcement of the top 100 initiatives that have expanded US capacity in science, technology and innovation, listed at number 15 the use of citizen science by federal agencies to "improve predictive models for coastal change and vulnerability to extreme storms and to tag millions of archival records for the National Archive" ("Impact Report," 2016). It appeared a transformational moment—work with historical archives, customarily viewed by politicians as the absolute nadir, the very embodiment of pointless, irrelevant research, is heralded as cutting edge, innovative science (and citizen science research on biodiversity is also given in the process a price-tag of \$2.5 billion in terms of in-kind contributions). With a climate sceptic in the White House, it is unlikely such a moment will be repeated anytime soon. The White House under Obama hosted Citizen Science pages, but these have now been removed. Citizen Science has developed its own momentum, however—*Zooniverse* alone now has 1.6m participants worldwide—and new tools, such as Panoptes on the *Zooniverse* platform, are enabling individuals and groups to set up their own projects with relative ease. For both humanities and scientific research there are exciting prospects—historical records of all forms can now be mobilised in contemporary research in ways that were unthinkable prior to the digital revolution. In "Constructing Scientific Communities", however, we contribute a further historical layer, placing contemporary work in the perspective of the past, and bringing to the fore those nineteenth-century figures whose labours, whether in natural history, meteorology, or other fields, are now proving crucial to the science of today.



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