

# Quantifying the CV: Adapting an Impact Assessment Model to Astronomy

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## ABSTRACT

In July 2013, the Becker Medical Library at Washington University in St. Louis held a workshop for librarians on the Becker Model, a framework developed by research assessment librarians for quantifying medical researchers' individual and group outputs. Following the workshop, the Becker Model was analyzed for content to adapt it to the physical sciences. This poster presents the process and results of applying their model to the curriculum vitae of a Yale University astronomy professor.

## OBJECTIVES

- Examine commonalities and differences between medical and physical sciences fields regarding research impact.
- Review literature on scholarly assessment in astronomy to determine the types of assessment that matter.
- Apply the Becker Model to citation data and ancillary CV data of an astronomy faculty member at the institution as a proof-of-concept for adapting the Model.
- Create a program for research impact workshops to address a diverse physical, life, and social sciences clientele.

## YALE CONTEXT

- FOUNDATION:** Attended Washington University in St. Louis Becker Medical Library workshop on research impact, along with two medical librarians. Our goal was to learn about the model and work to adapt it to a Yale context.
- TARGET:** To educate researchers (graduate students, postdocs, tenure-track faculty, grant-based collaborations) about types of impact. Our goal was to provide proof-of-concept work that we could use as education examples in workshops.
- PROGRESS:** We have presented two workshops, one on research impact and the Becker Model and the other on tools such as Sci<sup>2</sup> and d3.js that can be used for network visualization. Moving forward, we hope to engage more deeply with departments and scholars.

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## BECKER MODEL AND ASTRONOMY

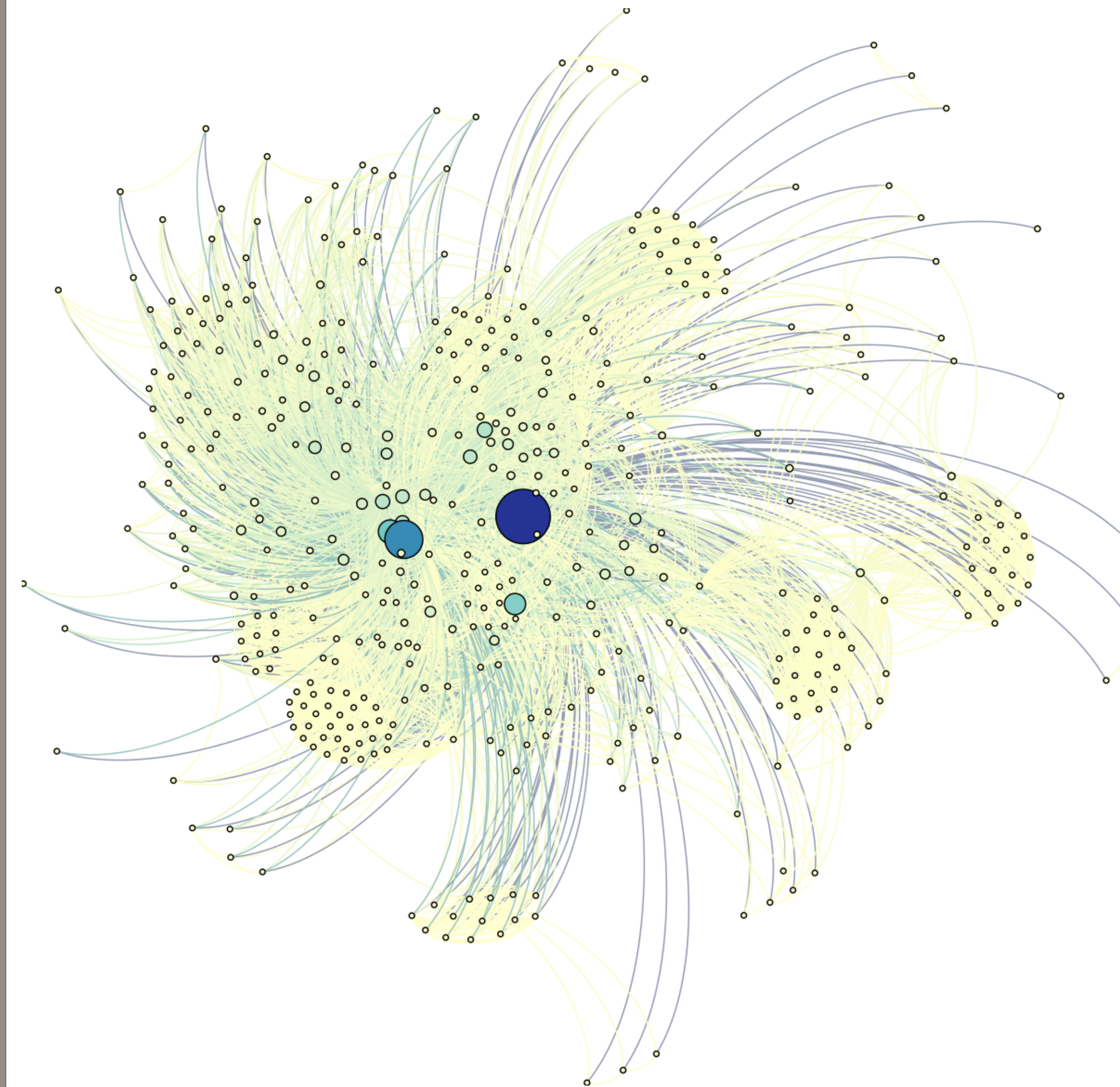
### Traditional Metrics

Professor A has an h-index of 81. He has published 224 articles in peer-reviewed journals since the early 1990s, with a total of 17,425 citations to his articles in the literature. 17 of his publications have been cited more than 100 times. On average, an h-index of 20 after 20 years of research is considered good in most fields, so his performance is excellent.

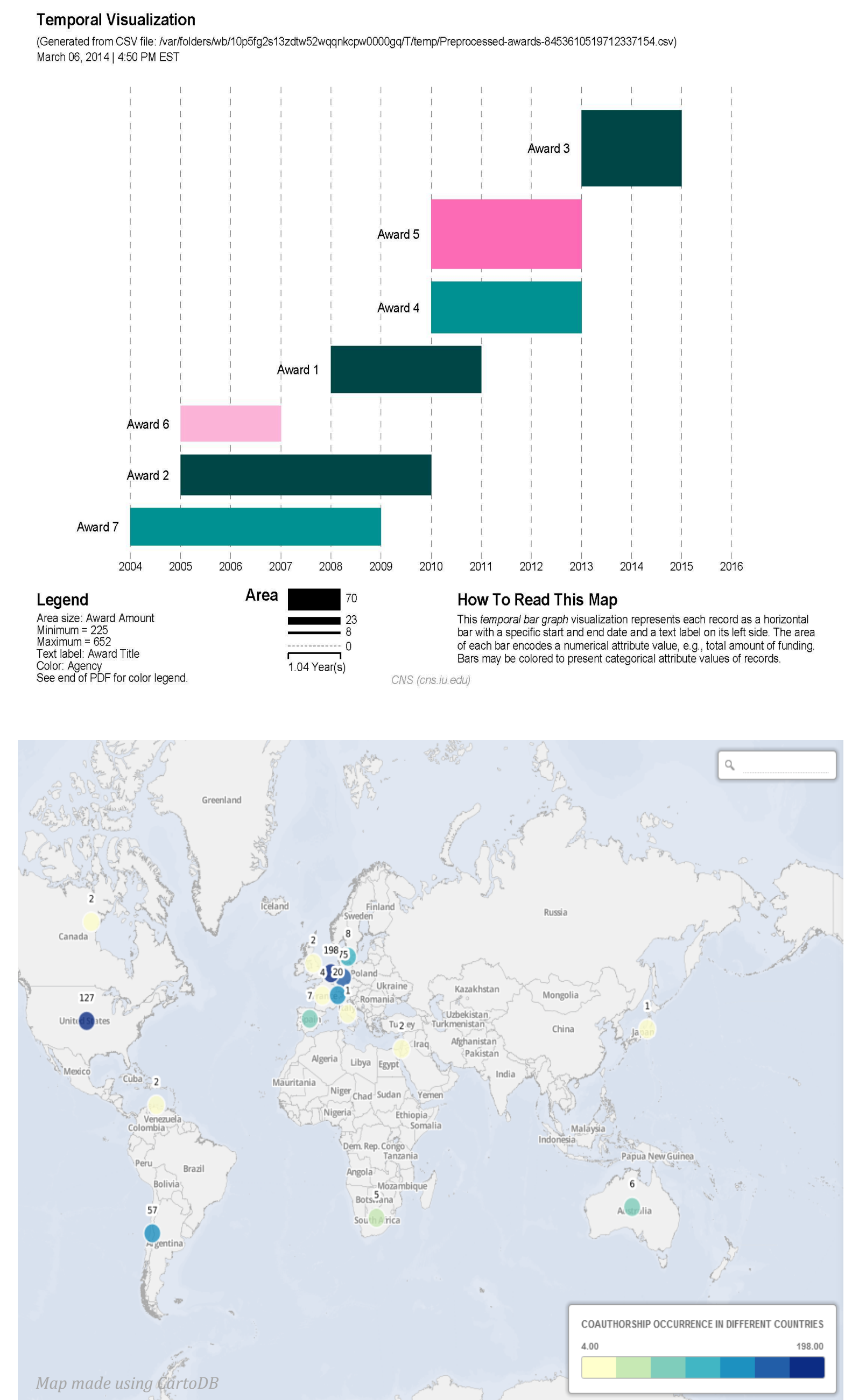
### Becker Model

Researcher A works in a department at Yale with a strong Yale-Chile research program. Papers produced with a Chilean coauthor rank 3rd after the Netherlands and the United States for the most papers coauthored. Outside of these papers, he has collaborated primarily with European researchers and with researchers in South Africa and Australia. The network of papers provides a snapshot of his strong connection to a global research community.

Researcher A maintains a strong publishing relationship with his advisor. In his 2+ decades studying in astrophysics, he has penetrated research groups focusing on deep surveys, stellar masses in brightest galaxy clusters, and GRBs (as shown by the tight clusters hovering around him). He has also advised a large number of graduate students, many of whom have led to strong collaborative relationships.



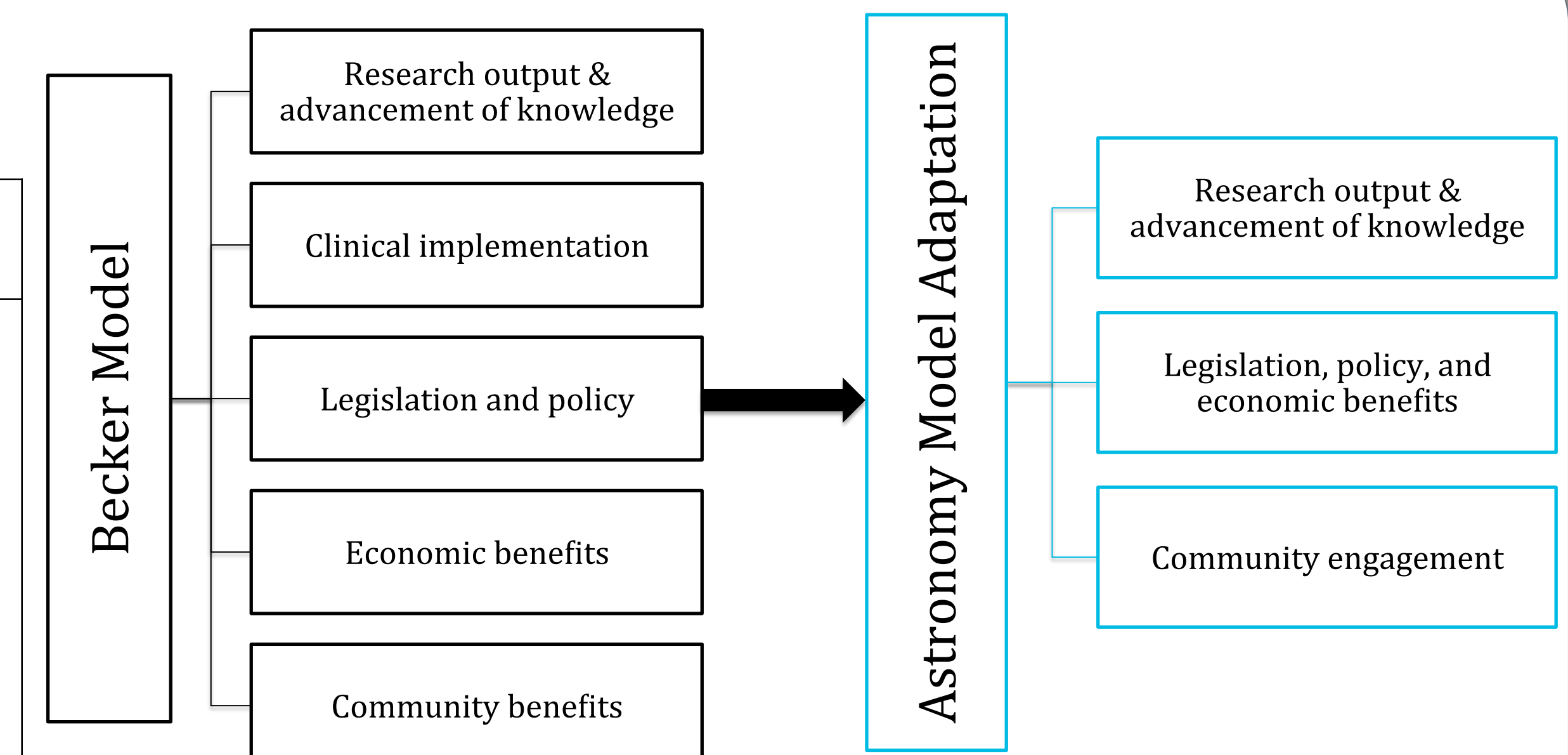
This image was generated using the Science of Science (Sci<sup>2</sup>) Tool and Gephi using the citation data from a professor. The data was generated from ADS in BibTeX format, cleaned, and ingested into the platform. Author names have been withheld from the network.



## THE BECKER MODEL VERSUS PRACTICES IN ASTRONOMY

Category	Notable Subcategories <sup>†</sup>	Connections to Astronomy
Research output & advancement of knowledge	Grey literature materials; collaborations; measurement instruments; conference/lecture outputs; journal articles; new research methodologies; social media and alternative metrics; data and instrument citation; new and renewed grant awards; web site statistics; software and program downloads/citation	<i>High-level overview:</i> Harley, D., Acord, S. K., Earl-Novell, S., Lawrence, S., & King, C. J., 2010 <i>Traditional metrics:</i> Garfield, E., 1979; Seglen, P.O., 1997; Bormmann, L., & Daniel, H., 2009; Lozano, G., Larivière, V., & Gingras, Y., 2012; Pepe, A., & Kurtz, M. J., 2012; Havemann, F., & Larsen, B., 2014; <i>arXiv:</i> Jamali, H., & Nicholas, D., 2009; Larivière, V., Sugimoto, C., & Macaluso, B., 2014 <i>Altmetrics:</i> Priem, J., Piiwovar, B., & Hemminger, B. M., 2012 <i>Data citation:</i> Lawrence, B., Jones, C., Matthews, B., Pepler, S., & Callaghan, S., 2011; Tenopir, C., Allard, S., Douglass, K., Aydinoglu, A. U., et al., 2011; Hourclé, J., 2012; Uhlir, P., 2012; Socha, Y. M., 2013
Clinical implementation	Enhancement of resources and expertise; new laboratory methods or procedures; disease prevention, management, and clinical practice; life expectancy/quality of life improvements	Other areas may be applicable in the case of collaborations such as the Astronomical Medicine Project at Harvard University or supplemental research in support of the human space program.
Legislation and policy	Committee participation; creation of guidelines, legislation, & regulation; standards input; testimony or witness to legislative bodies	Participation in National Academies and government agency studies or committees; testimony given to Congress; consulted on providing new input for grant standards at NASA, NSF, and other funding agencies.
Economic benefits	New and renewed grants resulting in economic growth (jobs); startup companies; industry buy-in	"... astrophysics is a small field with little to no commercial potential ..." (Harley, Acord, Earl-Novell, Lawrence, & King, 2010, 139).
Community benefits	Public awareness outreach; community partnerships; tools developed by the research study adopted by community	Community benefits include outreach via lectures, summer schools, &c.; participation in health advocacy groups such as the National Dark Sky Association; and creating crowd-sourced astronomy projects such as Galaxy Zoo (see Fortson, Masters, Nichol, et al., 2012) or Planet Hunters to foster community engagement with research data and techniques.

<sup>†</sup> The content in Table 1, Notable Subcategories, is a concise summary of aspects of the Becker Model. Please visit the Becker Model's web site to download a full explanation of all categories: <https://becker.wustl.edu/impact-assessment/>



## WHAT QUALIFIES AS IMPACTFUL ACTIVITY?

- Some types of scholarly communication, such as posting circulars and telegrams, creating software or instruments, and writing or contributing to textbooks are not weighted highly because these activities are difficult to quantify (Harley, Acord, Earl-Novell, Lawrence, & King, 2010).
- arXiv preprints are most deposited on submission or after acceptance by a journal (Jamali & Nicholas, 2009), but this does not count arXiv gray literature (i.e., reports, conference materials). Download statistics and citations to arXiv gray literature could be an important supplemental metric to traditional publishing.
- Teaching and outreach (which fall under "community benefits" in the Becker Model) are downplayed in favor of citation metrics and journal publishing record (Harley, Acord, Earl-Novell, Lawrence, & King, 2010).
- Data citation remains a problem. Data sets may be cited as "proxy papers" (Socha, 2013, 42), but different stakeholders have different attitudes towards data citation. Assigning data Digital Object Identifiers (DOIs) (Hourclé, 2012) and combined efforts from DataCite, DataONE, ICPSR, and other major science and social science data organizations may improve this.
- The unknown is the enemy of the early adopter — if people don't make a habit of including something in their CVs or portfolios, it will have less weight with colleagues due to their lack of familiarity with the nouveau scholarly output.