A Decade of Garfield Readers[1]

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This brief note discusses Garfield's continuing influence from the perspective of the Mendeley readers of his articles. This reflects the direct impact of his work since the launch of Mendeley in August 2008. In the last decade, his work is still extensively read by younger scientists, especially in computer and information sciences and the social sciences, and with a broad international spread. His work on citation indexes, impact factors and science history tracking seems to have the most contemporary relevance.

Introduction

Eugene Garfield's enormous citation indexing legacy is well known in the scientometrics community. His ideas and initiatives probably influence most working scientists today. Ironically, his influence cannot be measured by citation analysis with his citation index because of its nature: providing tools for working scientists and research evaluators in a way that they do not need to cite.

This brief note takes the long-term lasting and widespread influence of Garfield's work as an accepted truth and focuses on one small facet of this influence: on recent scholarship. The approach used was to use the social reference manager Mendeley to track registered readers of his works in the past decade and to analyse their origins and the most read documents.

Data

Scopus and WoS were queried on 4 September 2017 for publications written by Eugene Garfield, with WoS returning 1487 and Scopus 249. The large discrepancy was due to WoS indexing 1132 essays (not peer reviewed) in the *Current Contents* publication/alerting service published by ISI/Thomson Reuters/Clarivate Analytics. The essays covered indexing topics (e.g., Mysteries of ISI's International Oats Library Service Revealed), data-supported explorations (e.g., Do French Scientists Who Publish Outside of France and-or In English do Better Research) and other research issues (e.g., Radio - Neglected Medium for Scientific Communication). For insights into these, see Mahesh's (2010), comments or read one (Garfield, 1984). Some of these are highly cited, such as "The impact factor" from 1994 with 559 Google Scholar citations, but few are registered in Mendeley.

Both WoS and Scopus do not include some of Garfield's key contributions, such as his book, "Citation indexing: Its theory and application in science, technology, and humanities" (1979) with 2597 Google Scholar citations. This was added to the list.

The WoS and Scopus lists were submitted to Mendeley to identify their reader counts using title/author/year and (if present) DOI searches to get the maximum possible number of results (Zahedi, Haustein, & Bowman, 2014). Mendeley reports the self-declared subject occupations, subject categories and countries of readers and these are also reported.

Most users add articles to Mendeley that they have read or intend to read (Mohammadi, Thelwall, & Kousha, 2016) and so Mendeley reader counts are a good indicator of readership. They are biased because a minority of active researchers use Mendeley (5% in

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the social sciences, arts and humanities, 8% in science and engineering: Van Noorden, 2014), researchers sometimes read articles without citing them and non-researchers also read articles. To correct for the first of these, a conservative approach would be to multiply Mendeley reader counts by 100/8=12.5.

Readers

Despite most of Garfield's works having been written a long time ago, with a median publication year of 1989 in Scopus and 1983 in WoS, PhD and Master's degree students are major readers (Figure 1). Although the effect is exaggerated by younger researchers being more likely to use Mendeley (Mohammadi, Thelwall, Haustein, & Larivière, 2015), his ideas are clearly still relevant for new researchers today.

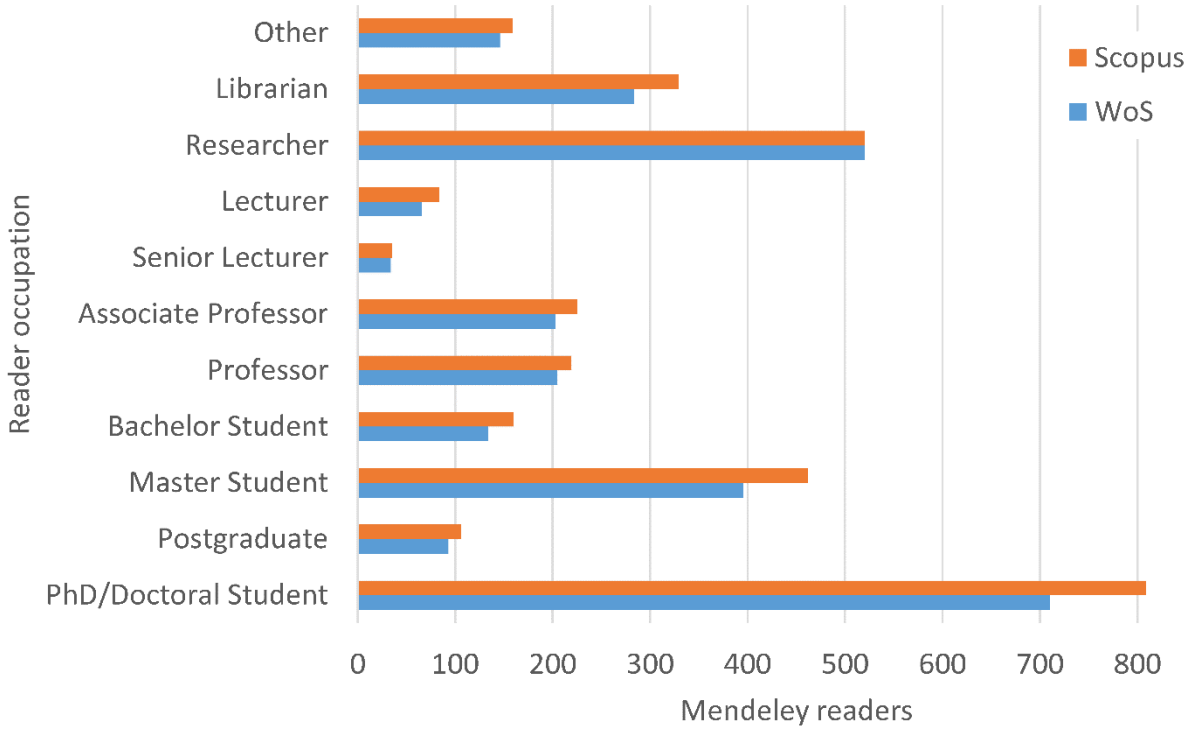

Figure 1. Declared occupations of Mendeley readers of Garfield's publications. Multiply by 12.5 to correct for researchers not using Mendeley.

The subject areas of the Mendeley readers of Garfield's articles span multiple disciplines (Table 1). The largest single category, Computer Science, probably encompasses many information scientists, as does the Social Sciences category. Readers in other areas might be researchers attempting to understand an aspect of citation analysis for their disciplinary work or could be researchers that are conducting scientometric studies of their fields.

Table 1. Mendeley readers of Garfield's publications by their declared subject area. Multiply by 12.5 (20 for Social Sciences and Arts & Humanities) to correct for researchers not using Mendeley.

Subject area	**Scopus**	**WoS**
Computer Science	754 (24.9%)	646 (23.8%)
Social Sciences	711 (23.5%)	642 (23.6%)
Medicine & Dentistry	249 (8.2%)	238 (8.8%)
Business, Management & Accounting	268 (8.8%)	225 (8.3%)
Agricultural & Biological Sciences	255 (8.4%)	224 (8.2%)
Environmental Science	106 (3.5%)	124 (4.6%)
Arts & Humanities	129 (4.3%)	114 (4.2%)
Economics, Econometrics & Finance	108 (3.6%)	98 (3.6%)
Engineering	102 (3.4%)	85 (3.1%)
Psychology	68 (2.2%)	69 (2.5%)
Physics & Astronomy	42 (1.4%)	43 (1.6%)
Mathematics	42 (1.4%)	37 (1.4%)
Biochemistry, Genetics & Molecular Biology	23 (0.8%)	25 (0.9%)
Earth & Planetary Sciences	29 (1.0%)	24 (0.9%)
Linguistics	26 (0.9%)	23 (0.8%)
Chemistry	25 (0.8%)	21 (0.8%)
Philosophy	15 (0.5%)	16 (0.6%)
Sports & Recreations	13 (0.4%)	13 (0.5%)
Design	14 (0.5%)	12 (0.4%)
Nursing & Health Professions	13 (0.4%)	10 (0.4%)
Materials Science	10 (0.3%)	9 (0.3%)
Pharmacology, Toxicology & Pharmaceutical Science	10 (0.3%)	9 (0.3%)
Decision Sciences	4 (0.1%)	4 (0.1%)
Neuroscience	5 (0.2%)	4 (0.1%)
Immunology & Microbiology	2 (0.1%)	3 (0.1%)
Chemical Engineering	5 (0.2%)	2 (0.1%)
Veterinary Science & Veterinary Medicine	1 (0.0%)	0 (0.0%)
Total	3029	2720

Garfield's Mendeley readers are widely geographically dispersed (Table 2) with 83% being international (from his perspective).

Table 2. Mendeley readers of Garfield's publications by country for countries with at least 5 Mendeley readers of Garfield's WoS articles. 35 other countries had Mendeley readers. Multiply by 12.5 to correct for researchers not using Mendeley.

Country	WoS	Scopus
United States	125 (16.8%)	139 (16.9%)
Brazil	74 (9.9%)	79 (9.6%)
Spain	72 (9.7%)	70 (8.5%)
United Kingdom	58 (7.8%)	61 (7.4%)
Germany	46 (6.2%)	52 (6.3%)
Canada	30 (4.0%)	33 (4.0%)
Malaysia	30 (4.0%)	31 (3.8%)
Mexico	30 (4.0%)	34 (4.1%)
Portugal	24 (3.2%)	27 (3.3%)
France	21 (2.8%)	27 (3.3%)
Australia	19 (2.6%)	21 (2.6%)
Denmark	18 (2.4%)	21 (2.6%)
Netherlands	17 (2.3%)	18 (2.2%)
Japan	14 (1.9%)	15 (1.8%)
Switzerland	13 (1.7%)	16 (1.9%)
Colombia	12 (1.6%)	15 (1.8%)
South Africa	12 (1.6%)	18 (2.2%)
Croatia	10 (1.3%)	9 (1.1%)
Hungary	8 (1.1%)	6 (0.7%)
Poland	8 (1.1%)	7 (0.9%)
Russia	7 (0.9%)	9 (1.1%)
Sweden	7 (0.9%)	6 (0.7%)
Belgium	6 (0.8%)	8 (1.0%)
India	6 (0.8%)	12 (1.5%)
Peru	6 (0.8%)	5 (0.6%)
Austria	5 (0.7%)	5 (0.6%)
Italy	5 (0.7%)	6 (0.7%)

Publications

A list of Garfield's publications with the most readers (Table 3) points to three trends. First, his Journal Impact Factor (JIF) is attracting continued interest and is represented by the top article and several others. Second, the concept of a citation index for science is still attracting readers, despite the original article being published in 1956. Several articles describing its applications are also extensively read, including one for research evaluation. Third, Garfield's HistCite software and related articles on mapping science evolution over time through citation analysis have generated substantial interest.

Table 3. The 20 (one repeated) Garfield publications with the most Mendeley readers. Multiply by 12.5 to correct for researchers not using Mendeley. Google Scholar citations from 5 September 2017 are reported in the final column.

Authors	Title	Year	Source	Readers	GS cites
Garfield E.	The history and meaning of the Journal Impact Factor	2006	J Amer Med Assoc (JAMA)	498	2036
Garfield E.	Citation indexes for science. A new dimension in documentation through association of ideas	1956/ 2006	Science / Int. J Epidemiology	385	2369
Garfield E.	Citation analysis as a tool in journal evaluation	1972	Science	381	2704
Garfield E.	Citation indexing: Its theory and application in science, technology, and humanities	1979	[book]	192	2597
Garfield E.	Journal Impact Factor: A brief review	1999	Can Med Assoc J (CMAJ)	179	705
Garfield E.	From the science of science to Scientometrics visualizing the history of science with HistCite software	2009	J Informetrics	171	141
Garfield E.	Is citation analysis a legitimate evaluation tool?	1979	Scientometrics	168	661
Garfield E.	Historiographic mapping of knowledge domains literature	2004	J Information Science	112	196
Garfield E.	The evolution of the science citation index	2007	Int. Microbiology	86	115
Garfield E.	Citation indexing for studying science	1970	Nature	81	391
Garfield, E	How can Impact Factors be improved?	1996	Brit Med J (BMJ)	78	608
Garfield E., Pudovkin A.I., Istomin V.S.	Why do we need algorithmic historiography?	2003	JASIST	57	151
Garfield E.	Random thoughts on citationology. Its theory and practice	1998	Scientometrics	49	122
Pudovkin A.I., Garfield E.	Algorithmic procedure for finding semantically related journals	2002	JASIST	48	180
Small H., Garfield E.	The geography of science: Disciplinary and national mappings	1985	J Information Science	43	240
Garfield E.	The unintended and unanticipated consequences of Robert K. Merton	2004	Social Studies of Science	33	16
Pudovkin A.I., Garfield E.	Rank-normalized Impact Factor: A way to compare journal performance across subject categories	2004	P. ASIST Annual Meeting	33	128
Garfield E., Welljams-Dorof A.	Citation data: Their use as quantitative indicators for science and technology evaluation and policy-making	1992	Science & Public Policy	33	191
Garfield E.	Long-term vs. short-term journal impact: Does it matter?	1998	The Scientist	31	155

Summary

Eugene Garfield's work is continuing to be read all over the world and in many different disciplines, including by young researchers. Whilst his influence through the Web of Science and most other citation indexes today is enormous and cannot be quantified, the Mendeley reader data shows that many of his writings are widely relevant today.

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