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## The influence of free encycopedias on science

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## Section 2: Research Trends

The influence of free encyclopedias on science

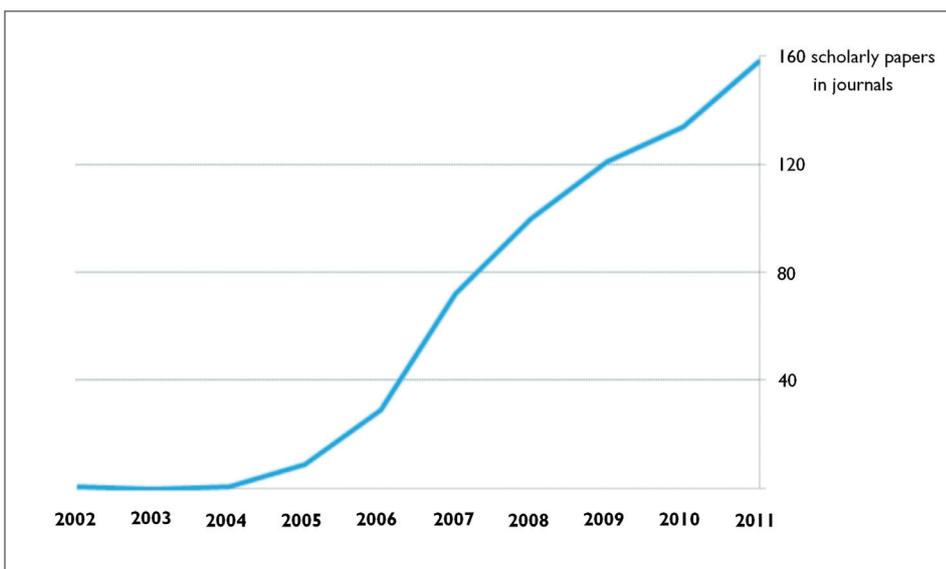
Sarah Huggett, MPhil

### Wikipedia's birth and growth

Since its launch in 2001 Wikipedia has seen incredible growth worldwide, counting more than 21 million articles published in around 280 languages (including nearly 4 million articles in English) in 2012<sup>1</sup>. Wikipedia has grown in size (number of Wikipedia entries/articles have been increasing over time) and is showing high reliability: a recent study<sup>2</sup> of historical entries found 80% accuracy for Wikipedia, compared to 95-96% for other sources. This means that for the entries checked in the study, Wikipedia contain on average only about 15% more errors than other sources including traditionally perceived authoritative sources such as Encyclopaedia Britannica. The research found that this difference was negligible. Adding to this Wikipedia's ease of access and wide coverage of topics explains why for many people it has become the first port of call for instant general knowledge on a variety of subjects.

### Wikipedia enters scholarly communications

What is perhaps surprising is that Wikipedia appears to be increasingly used by scholars for their research. Research published in 2011<sup>2</sup> looked at the visibility of Wikipedia in scholarly content, and found a steady increase of the amount of work about Wikipedia from 2002 to 2010. **Research Trends** replicated the study, looking for **"\*wikipedia\*"** in titles, keywords, or abstracts of scholarly papers published in journals covered in Scopus (see **Figure 1**), and found a staggering Compound Annual Growth Rate (CAGR) of 69% per annum since the first paper in 2002 to the 158 papers published in 2011. Even when looking at the past 5 years (2007-2011) CAGR was impressive at nearly 19% per annum.



**Figure 1** – Annual number of scholarly papers with **"\*wikipedia\*"** in their titles, keywords, or abstracts, published in journals only. Source: Scopus (note: data for 2011 may be incomplete).

**Through the back door of references**

More interestingly, there has also been a dramatic increase in the number of publications referring to Wikipedia as a source. The aforementioned recently published study<sup>2</sup> limited the search results to mentions of Wikipedia as a reference title, but extending the search to all reference fields reveals much wider use even with restrictions to scholarly content published in journals (see Figure 2). CAGR was an unbelievable 88% per annum since the first paper in 2002 to the 4006 papers published in 2011. Focusing on the past 5 years (2007-2011) CAGR was still impressive at more than 31% per annum.

**Wikipedia as a topic versus Wikipedia as a reference**

Figures 1 and 2 show data trends similar to a logistic growth curve, characterised by almost exponential growth at the beginning followed by levelling off, and then saturation. Interestingly, whilst Figure 2 does show some level of saturation for recent years, Figure 1 does not: use of Wikipedia as a reference in scholarly communications may be approaching a plateau but this is not matched by the level of interest in Wikipedia as a topic of research itself by the scientific community, which carries on growing rapidly.

At subject level, overall there is a strong correlation (correlation coefficient 0.83), between the number of papers about Wikipedia and the number of papers referencing Wikipedia: Social Sciences, Computer Science, Medicine, and Engineering make it into the top 5 prolific areas for both (see Figures 3a and 3b).

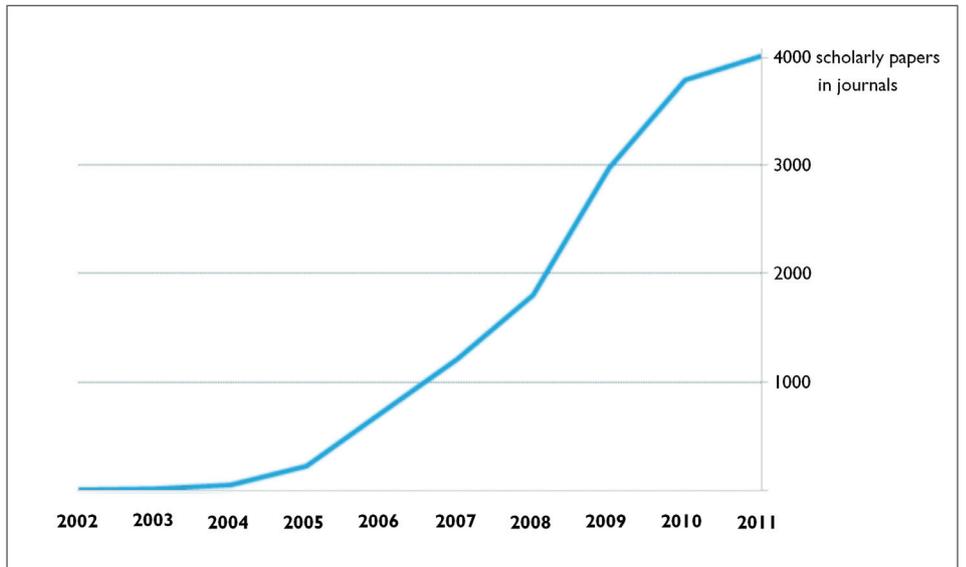


Figure 2 – Annual number of scholarly papers with '\*wikipedia\*' in their references, published in journals only. Source: Scopus (note: data for 2011 may be incomplete).

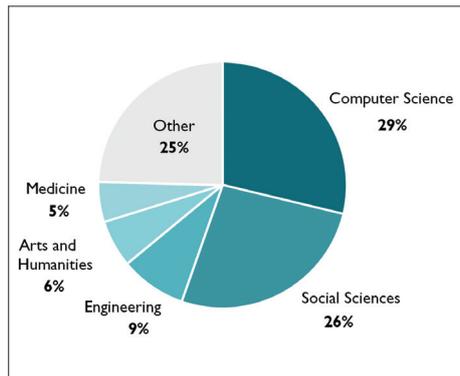


Figure 3a – Subject area distribution of 2002-2011 scholarly papers with '\*wikipedia\*' in their titles, keywords, and abstracts, published in journals only. Source: Scopus (note: data for 2011 may be incomplete).

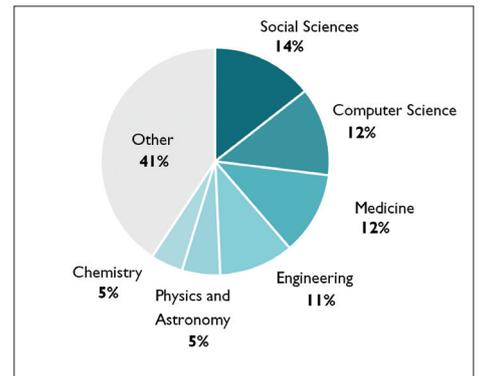


Figure 3b – Subject area distribution of 2002-2011 scholarly papers with '\*wikipedia\*' in their references, published in journals only. Source: Scopus (note: data for 2011 may be incomplete).

The correlation is even stronger at country level (correlation coefficient 0.96) between the number of papers about Wikipedia and the number of papers referencing Wikipedia (see Figure 4a).

The zoomed Figure 4b reveals some outliers: European countries such as Germany, France, Netherlands, Italy, and Spain tend to study Wikipedia proportionally more than they cite it, while the reverse is observed for Asian countries such as China and India.

**Which other ones?**

Research Trends also wondered if similar trends would be observed for other free online encyclopedias (see box for brief definitions of these encyclopedias). The above analysis was replicated looking at mentions of these other free online encyclopedias in references of scholarly papers published in journals covered in Scopus (see Figure 5 for the most referenced). Although growing trends were observed for most of the terms, the actual values were much lower than those observed for Wikipedia: the closest contender was Scholarpedia with astounding 80% growth per annum from 2007 to 2011 (27% for 2009-2011) but in 2011 it only reached about 5% of the number of papers referencing Wikipedia. None of the other sources came close, with each less than 50 papers referencing them in 2011.

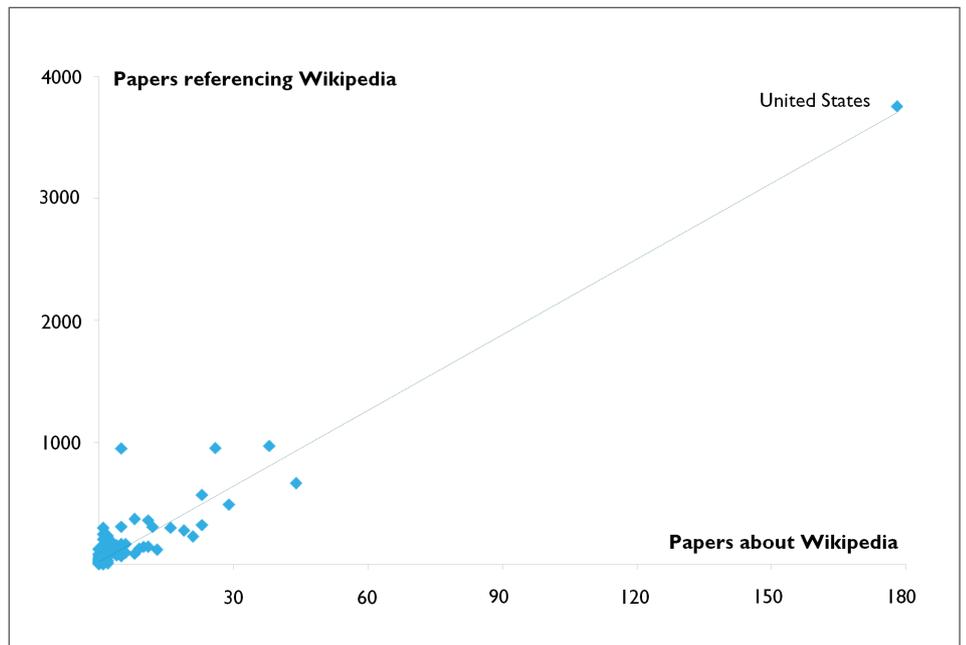


Figure 4a – comparison of number of 2002-2011 scholarly papers with “\*wikipedia\*” in their references and number 2002-2011 scholarly papers with “\*wikipedia\*” in their titles, keywords, or abstracts, aggregated by country and published in journals only. Source: Scopus (note: data for 2011 may be incomplete).

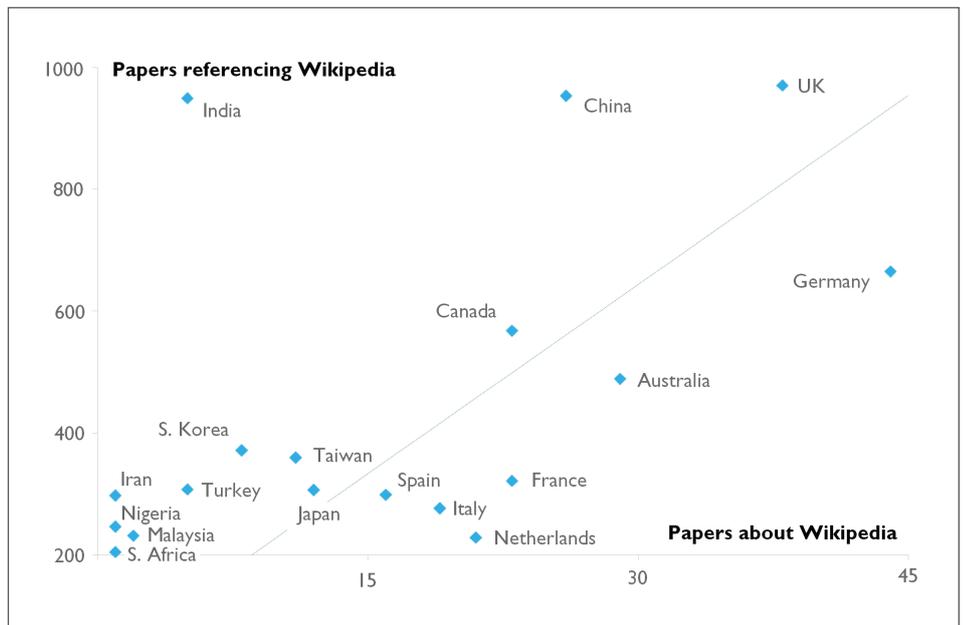
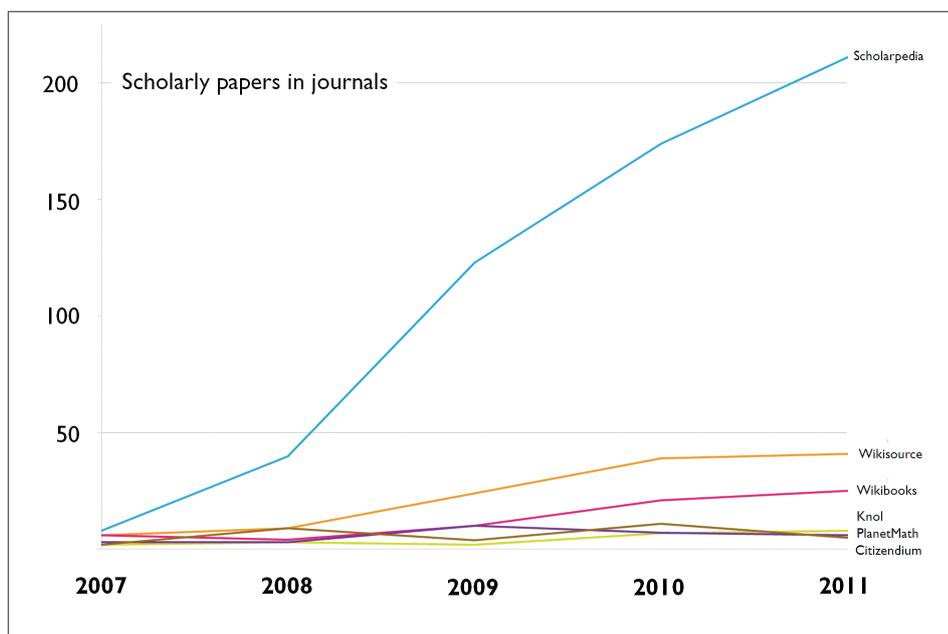


Figure 4b – comparison of number of 2002-2011 scholarly papers with “\*wikipedia\*” in their references and number 2002-2011 scholarly papers with “\*wikipedia\*” in their titles, keywords, or abstracts, aggregated by country and published in journals only – restricted to countries with 200-1000 papers referencing “\*wikipedia\*”. Source: Scopus (note: data for 2011 may be incomplete).

### Reference work in action

Although the growth of Wikipedia's influence on scholarly publications is impressive, the enthusiasm of researchers referencing free online encyclopedias has not yet transferred to other free online encyclopedia sources en masse. It could be that acceptance of these alternative reference works will take time, or that scientists find Wikipedia to be a sufficient and well established source within the free online encyclopedia category.

Wikipedia is frequently updated making it a very dynamic resource. This raises potential issues of version control and instability of references: a Wikipedia entry referenced in a paper published 5 years ago may have changed considerably to the extent that it may no longer be applicable to the specific paper it is referenced in. As Wikipedia's content is edited to reflect the latest scientific advancements (especially in fast moving fields such as biomedical sciences), it may retrospectively invalidate references found in older papers. In the coming years, academics will decide through their citation and referencing practices whether this is acceptable or not, and whether the advantages of free online encyclopedias outweigh their disadvantages.



**Figure 5** – Annual number of scholarly papers referencing various free online encyclopedia in journals. Source: Scopus (note: data for 2011 may be incomplete).

- Citizendium: “an English-language free encyclopaedia project launched by Wikipedia’s co-founder.”
- Knol: “Knol is a Google project including user-written articles on a range of topics.”
- PlanetMath: “a collaborative encyclopaedia focussing on mathematics.”
- Scholarpedia: “peer-reviewed open-access encyclopedia, where knowledge is curated by communities of experts.”
- Wikibooks: “a free library of educational textbooks that anyone can edit.”
- Wikipedia: “a free, collaborative, multilingual Internet encyclopedia.”
- Wikisource: “Wikisource is an online library of free content publications, collected and maintained by the Wikisource community.”

### References:

1. Wikimedia Foundation, Inc. (2012), “Wikipedia” entry, retrieved on 13 March 2012 from the World Wide Web: <http://en.wikipedia.org/wiki/Wikipedia>
2. Giles, J. (2005) “Internet encyclopaedias go head to head,” *Nature*, Vol 438, No 7070, pp. 900–901, <http://www.nature.com/nature/journal/v438/n7070/full/438900a.html>
3. Park, T. (2011) “The visibility of Wikipedia in scholarly publications”, *First Monday* [Online], Vol 16, No 8.