

# USE OF TED.COM and GAPMINDER.ORG IN TEACHING APPLICATIONS OF MATHEMATICS AND STATISTICS

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## **Abstract**

In this paper, we will demonstrate the use of two popular web resources in technology-based mathematics and statistics instruction: TED.com and Gapminder.org. We will present selected examples and animation of statistical results from Ted talks and the Gapminder with particular emphasis on Trendalyzer that converts and transforms statistics related to global issues into dynamic and interactive graphics.

**Keywords:** TED.com, Gapminder, Trendalyzer, Statistical visualization, Web resources

## **Introduction**

At Texas Lutheran University, we have used technology in the mathematics and statistics classes for over twenty years [1, 2]. We strongly believe that technology, when used properly, can be a powerful tool to enhance a student's understanding of complicated topics. Until just a decade ago, technology in mathematics instruction was limited to the use of graphing calculators, Computer algebra Systems (CAS) and Statistical software. In the past few years, we have seen an explosion of web-based resources for undergraduate mathematics and statistics. In this paper, following the theme of Technology -based teaching, we will investigate TED.com as one example of the innovative use of Web resources. Specifically, we will provide the results of the talk by Sean Gourley [3] about modelling the probability distribution of the human casualty as a function of the number of attacks in regional conflicts around the globe. We will then expand our study to Gapminder [4] which incidentally was introduced to us in another talk archived at the TED.com site. We will present examples to show that Gapminder.org indeed provides a wealth of information and tools for mathematics educators to utilize in teaching applications of mathematics and statistics using real data.

## **A survey of popular web-sites**

Following is a list of some of the most recent and by some accounts most popular web-sites which, we believe, can be incorporated into teaching introductory mathematics and Statistics courses:

**Wolfram alpha** (all purpose knowledge): <http://www.wolframalpha.com>;

**Sage Mathematics Software**, <http://sagemath.org> ;

**Ted Talk** (Talks about technology and science): <http://www.ted.com>;

**Gapminder** (Trendalyzer) <http://www.gapminder.org>

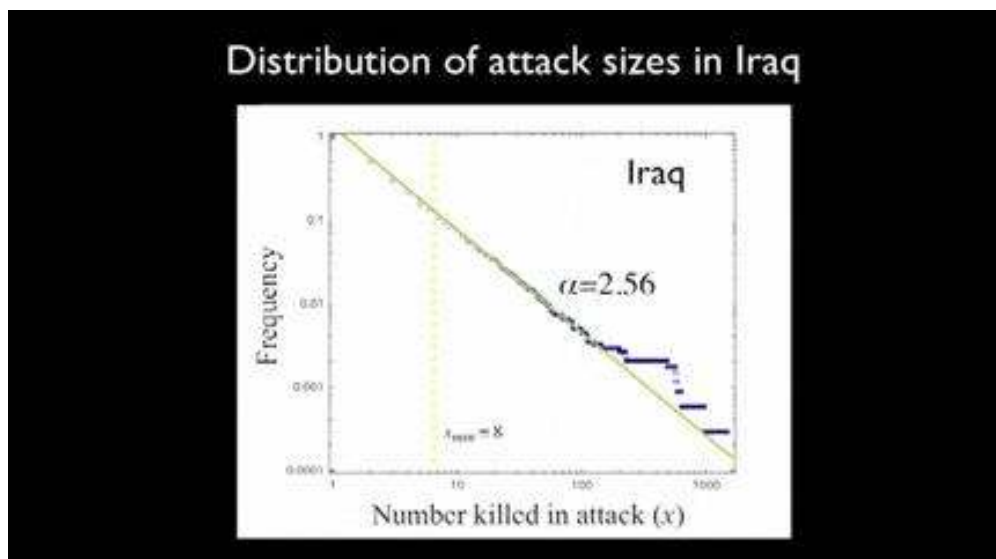
*Wolfram-alpha* is a popular web site that was launched two years ago by Steven Wolfram (who wrote the popular software Mathematica). It is an all-purpose computational knowledge engine which uses built-in knowledge created by experts to compute on the fly responses to a specific question. It is somewhat of a dynamic Wikipedia for computing and statistics.

*Sage* is a popular open-source mathematics software program which contains some of the features of CAS (*Maple, Mathematica, etc*). Sage is still being developed so it is too early to evaluate its functionality com-

pared to other CAS. We will now discuss the main focus of this paper, namely TED.com and Gapminder.org in the next two sections.

### TED.COM

TED (Technology Entertainment and Design) is a set of international conferences which was founded in 1984 and is currently supported by the non-profit Sapling Foundation. According to the organization's home page the main goal of the organization is to disseminate "ideas worth spreading." TED's mission statement asserts, "We believe passionately in the power of ideas to change attitudes, lives and ultimately, the world. So we are building here a clearinghouse that offers free knowledge and inspiration from the world most inspired thinkers, and also a community of curious souls to engage with ideas and each other." Hundreds of talks are available through TED.com. A large percentage of these talks are devoted to scientific and mathematical presentations which can easily be used in any classroom. We have chosen Sean Gourley's talk on modelling the distribution of the attacks size as an example. He looks at the raw data on violent incidents in the global conflicts and discovers a surprisingly strong mathematical relationship between the number of dead and frequency of attacks. Specifically, in his talk he examines data collected from several conflicts (Somalia, Iraq, Afghanistan) and shows that the probability distribution for seemingly unrelated conflicts follows the same distribution governed by  $P(x) = Cx^{-\alpha}$  and furthermore the value of  $\alpha$  stays relatively unchanged as one models different conflicts. Figure 1 illustrates the graph of frequency of attacks (y) versus the number killed in the attack (x). The value of  $\alpha$ , for this specific conflict, is estimated to be 2.56.



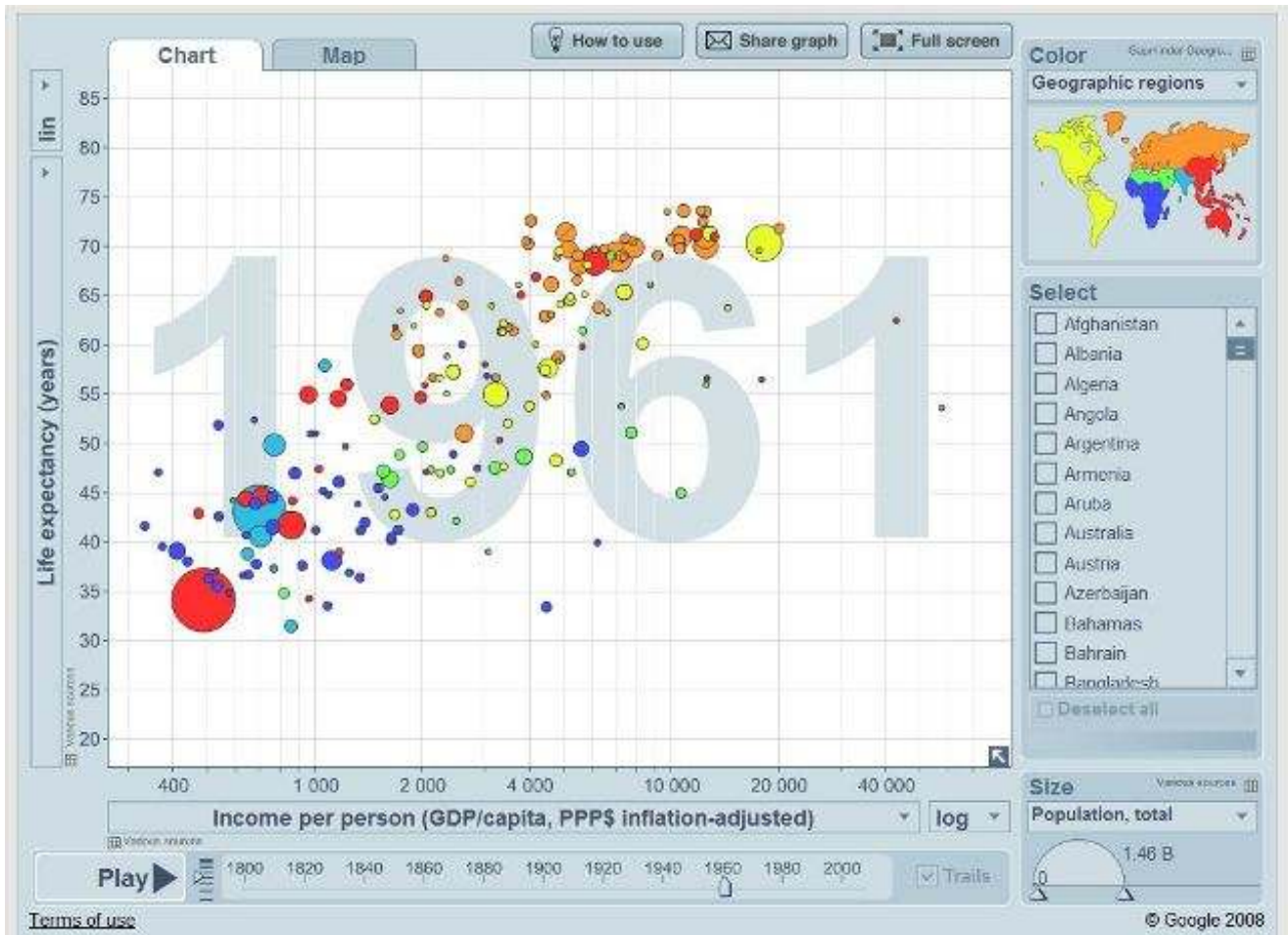
**Figure 1**

### GAPMINDER.ORG and its applications

Gapminder.org is the brainchild of Hans Rosling who is a professor of International Health at Karolinska Institute and the director of the Gapminder Foundation which developed the Trendalyzer software. The most important feature of this graphing software is its ability to illustrate changes over time of multiple indicators. This gives the data consumer a much richer picture of the data than tables or a series of static graphs. A typical Trendalyzer display might show a number of countries, their regional location, their population, their gross domestic product per capita, and the life expectancy of their citizens, year by year, from 1800 through 2009. That's a lot of data to take in with tables and static graphs. But with Trendalyzer the data is dynamically displayed before your eyes.

The Gapminder Foundation has a collection of almost 500 different data sets available for anyone to use. The Foundation adds additional sets on a regular basis. As a result many topics of interest can be investigated by selecting a set of indicators and watching the interactions. In addition, one can build custom data sets through the free spreadsheet application at Google Docs. An account with Google Docs is free. With

your account you have access to very sophisticated applications, such as word processing and spreadsheets, plus, you get free storage so that your documents are available from any computer that has internet access. Creating a data set for Trendalyzer is not conceptually difficult, but because of the large amount of data required, it is tedious. Full directions are available from the Google Docs spreadsheet. Figure 2 is a snapshot of a basic Treadalyzer display.



**Figure 2**

We have given several presentations using Gapminder and the audience response has been encouraging. It is gratifying to present complex sets of data and to have the audience stay after the presentation and request additional examples.

## CONCLUSIONS

We are observing a rapid shift away from sole investigators toward teams that confer, collaborate, use multiple technology tools and share their work on line. Open source software is becoming dependable and is available to all investigators. Open source tools are very responsive to the communities' needs and quickly incorporate new ideas and techniques. This is a very dynamic arena. The possibilities for engaging our students are limitless.

## ACKNOWLEDGEMENT

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## REFERENCES

- [1] R. O. Abbasian and John T. Sieben, *Shortcomings and Misuses of Technology (Maple, TI calculators) in Undergraduate Mathematics*, proceedings of the International Conference on Technology in Collegiate Mathematics, Chicago, USA, November 2003.
- [2] R. O. Abbasian and John T. Sieben, *a Survey of the Use and effectiveness of Technology-based mathematics Instruction among Texas High schools, Colleges and Universities: A preliminary report*, proceedings of the International Conference on Technology in Collegiate Mathematics, Chicago, USA, March 2010.
- [3] S. Gourley, *Mathematics of War*, TED talk, February 2009
- [4] H. Rosling, *Trends in Health and Economics*, TED talk, February 2006