

The Equilateral Triangle Paradigm: a Mathematical Interpretation of the Theory of Tertiary Sources on the World Wide Web

Dariush Alimohammadi

**Web Developer, Library, Museum & Documentation Center
Islamic Consultative Assembly
Tehran, Iran**

Introduction

Among the pure sciences, mathematics has had the most important impact on the rest of human knowledge, because it has provided a powerful basis for human reasoning. Mathematics is building block for all disciplines. Information Science (IS), as an emerging discipline, is included in this principle. Some mathematical formulae have been frequently used in IS, ranging from theoretical discussions in information theory to applied investigations in information retrieval (Goldfarb, 1997; Kantor, 1983; Kantor, 1984; Ota, 2005; Shibata, 1995).

This paper uses figures and formulae to make a mathematical interpretation of the theory of tertiary sources on the World Wide Web. The theory was developed in a recently published guest commentary (Alimohammadi, 2005). It takes a new approach to categorizing information resources. Different and even incoherent opinions have been provided about primary, secondary and tertiary sources (Boeninger and Smith, 2003; Chua, 2003; CQU Library, 2002; Hageman, 2002; Harris, 2005; Hooper, 2005; Instructional Web Pages Committee, 2005; Laverty, 1998; Macvean, 2005; Net Navigator, 2005; Saylor and Hooper, 2005; University of Maryland Libraries, 2004; Wiggins, 1997). These opinions include the librarian's view of information, as well as various analytical perspectives. For example, textbooks are categorized in both primary and secondary sources, while dictionaries are classified in both secondary and tertiary sources. Moreover, they may be also defined as texts which are suitable for historical and interpretative studies.

Tertiary sources are those which provide information itself or referral to other sources. In other words, s/he looks at the collection of available sources as textual or referral. From this perspective, categorization of

information resources is in fact a relative conceptualization process. Sometimes, s/he refers to an encyclopedic article as an informative text and at some other times as an intermediate source which refers her/him to additional resources. Other textual and referral sources can be treated the same. According to the proposed perspective, primary sources provide end-users with the first hand and/or raw data/information; and secondary sources refer them to the primary ones. Based on this statement, tertiary sources are also intermediates that introduce secondary sources in an arranged fashion. For example, journal articles and web pages can be treated as primary sources when we extract a piece of information from them; bibliographies and webliographies can be treated as secondary sources when we identify some other sources through them; and bibliography of bibliographies and webliography of webliographies can be referred to as a tertiary source which introduces bibliographies and webliographies. Under this holistic view, quaternary, quinary, senary, septenary, octonary, nonary, and denary sources would be realized some day.

Mathematical Interpretation of the Theory of Tertiary Sources

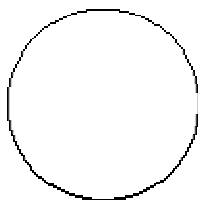
In this section, some form of logical reasoning is provided. The reasoning is based on two figure-oriented and formula-based approaches and is needed to facilitate understanding the Equilateral Triangle Paradigm.

A. figure-oriented approach

Let us reason:

1. Suppose the world is in its infancy and the time/space is 0 (Figure 1).

Figure 1. The infancy of the world or a virgin world



2. An accident - the first one - is occurred or experienced and the first fact (*Data*) is subsequently produced. Based on the human inference or human

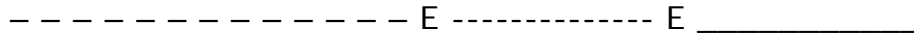
processing, the result will be in fact the first information particle, a little bit; but not a computer bit (Figure 2).

Figure 2. The first information particle



3. The accidents and/or experiences are repeated and particles (*Information*) are produced again and again. Each particle is a point and a collection of points comprises the line (Figure 3).

Figure 3. The process of line establishing



4. The line can be interpreted as the first collection of information resources or texts. It is looked and interpreted as human knowing or *knowledge* . The viewer or a given end-user stands exactly on the line; where s/he is able to understand it and to develop whatever is intended. According to the theory of tertiary sources, the content of the line i.e., information resources can be called primary sources (Figure 4).

Figure 4. A proposed picture of the viewer situation

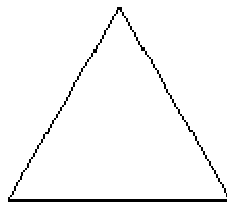
Where the viewer stands



Where the line or the collection of primary sources is situated

5. The viewer tries to use the available knowledge for making the life easier; and because of this reason s/he has to look at the line in limitation of his/her view radius. This process is resulted in shaping the equilateral triangle of information resources (Figure 5).

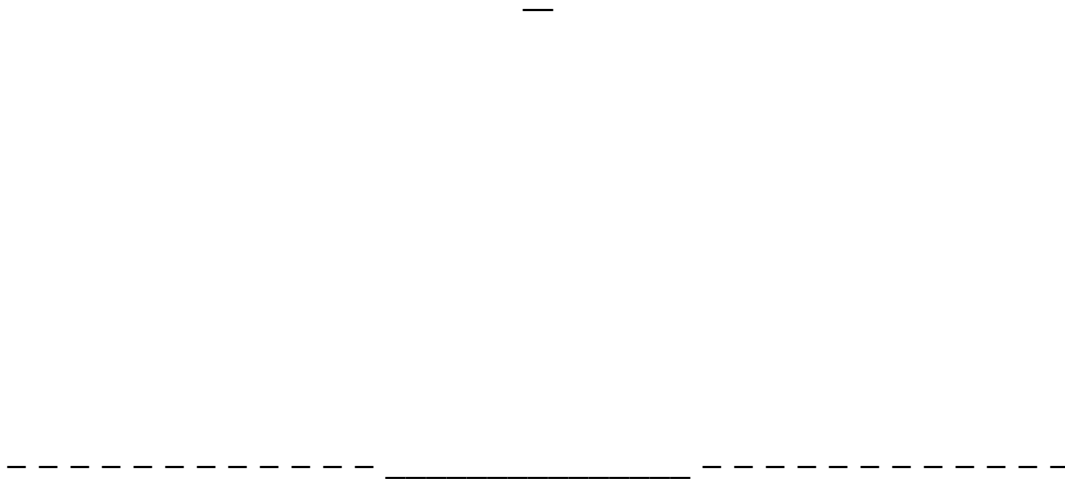
Figure 5. The equilateral triangle of information resources



6. The accidents and/or experiences are not paused. Therefore, the information production is continued and the knowledge is subsequently doubled. Here, we have a developing line, so that the viewer will not be able

to control it mentally (Figure 6). Therefore, our equilateral triangle is transformed to an isosceles triangle.

Figure 6. An uncontrollable line



7. Under such condition, the viewer has to change his/her position; i.e. s/he must go up in order to achieve a new position through which looking at the produced information and applying it in a daily manner would be possible (Figure 7).

Figure 7. The new position

—



8. In this new situation, the viewer is so far away from the context. For this reason, s/he can not make use of it and as a result can not keep pace and cope with the developed knowledge as good as past times. This is the time of secondary sources (Figure 8).

Figure 8. The equilateral triangle of secondary sources

The viewer

—

Secondary sources

—————

Primary sources

—————

9. By using secondary sources, the viewer can seek and identify the primary sources through which his/her information needs are met. The story is an ongoing one. The information is produced more and more and the knowledge is interpreted very much more than ever before. The given end-user will be encountered with huge amounts of information some day, so that identifying, collecting, analyzing, interpreting and applying it would not be more possible. This is another era: the time of tertiary sources (Figure 9).

Figure 9. The equilateral triangle of tertiary sources

The viewer

—

Tertiary sources

—————

Secondary sources

—————

Primary sources

—————

Above figures are one-dimensional and simply-understandable illustrations. They can be applied to help reader get a fast and at the same time a thorough understanding of the connections that have been established among sources of information during the past centuries. Based on a geometric viewpoint, a formula-based discussion is presented here; to make the interpretation more reasonable and justifiable. It is also applicable to show coordination of the balance and the consistency principles between figure-oriented and formula-based approaches.

B. formula-based approach

Let us reason:

B-1: Function

The existing difference between figures 8 and 9 can be interpreted by function formula, as follows:

$$y = f(x)$$

Where:

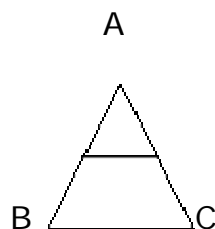
y: The surface area of the newly formed equilateral triangle of tertiary sources

f: The need of users' community for establishing a new level of sources

x: The quantity of resources on the third line of the equilateral triangle of tertiary sources

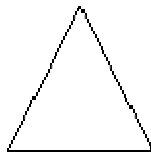
B-2: Thales' theorem

1. The ABC is an equilateral triangle.
2. A line (called EF) connects two sides of the triangle to each other.
3. The AEF is a micro model of the ABC.

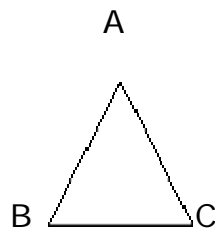


B-3: The surface area of the equilateral triangle

1. Return to the equilateral triangle of information resources.



2. Name it ABC.



3. Do an imaginary calculation on the surface area of the equilateral triangle by using an ancient but a permanent formula, which is as follows:

$$\text{Let : } S = \frac{1}{2} BC * H$$

Where:

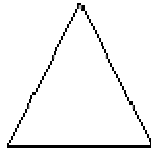
S: The whole of the surface area

BC: The base of the triangle

H: The height

4. Having the secondary sources in mind, suppose that a new equilateral triangle is being emerged (called A 1 B 1 C 1):

A1



B1 C1

And a new formula should be written, as follows:

$$S 1 = \frac{1}{2} B 1 C 1 * H 1$$

Where:

S 1: The whole of the surface area

B 1 C 1: The base of the triangle

H 1 : The height

5. The same process should be repeated for the equilateral triangle of tertiary sources:

Figure 10. The equilateral triangle of tertiary sources

The viewer

—

Tertiary sources

—————

Secondary sources

—————

Primary sources

—————

With the following formula:

$$S^2 = \frac{1}{2} B^2 C^2 * H^2$$

$$B^1 C^1 < B^2 C^2$$

Where:

S² : The whole of the surface area

B² C²: The base of the triangle

H²: The height

6. The formula can be adapted with an infinite value:

$$\text{If and only if: } N = \{1, 2, 3, \dots, K\}$$

$$\text{Then: } S_n = \frac{1}{2} B_n C_n * H_n$$

$$B_1 C_1 < B_2 C_2 < \dots < B_n C_n$$

Where:

S_n : The whole of the surface area

$B_n C_n$: The base of the triangle

H_n : The height

Conclusion

In this complementary note a mathematical interpretation of the theory of tertiary sources on the Web was developed. For making a more understandable interpretation, figure-oriented and formula-based approaches were adopted. For another time, it was understood that information science concepts have the capability to be enhanced by mathematical approaches. The balance and the consistency principles were followed simultaneously during the reasoning process. Unlike the state of the art of the World Wide Web, it was also found out that the most ideal form of the triangle of information resources is equilateral, because the balance principle is just observed in such a model. Moreover, some consistency was shown among geometrical figures and mathematical formulae. Finally, it can be concluded that although mathematical solutions have been frequently utilized in information science, but more investigations are needed in this field of study; such as an examination on the existing unbalance between the rapid growth of information production and the necessity of designing some tools for information control on the Web through exploring internal angles of various triangles (calculation of the surface area of various triangles), and integral and rate of change formulae.

Acknowledgments

Mahshid Sajjadi is acknowledged for her revision on the text. AliReza Tayarani and Kouros Alimohammadi are also thanked for their helpful criticisms and comments on mathematical formulae.

Works Cited

Alimohammadi, D. (2005). "Annotated webliography of webliographies: a proposal", *The Electronic Library*, Vol. 23 No.2, pp. 168-172.

Boeninger, C. and Smith, T. (2003). "How do I identify primary, secondary, and tertiary sources?" available at:

<http://www.library.ohiou.edu/libinfo/howto/sources.htm>

Chua, H.H. (2003). "Using Primary Sources on the Web" available at

<http://www.lib.washington.edu/subject/History/RUSA/>

CQU Library. (2002). "Managing tertiary, secondary and primary sources of information" available at

http://www.library.cqu.edu.au/tutorials/info_management/managing.htm

Goldfarb, V.I. (1997). Proceedings of the Symposium on Informational Mathematics in Information Science, Izhevsk, Moscow .

Hageman, M. (2002). "Primary, secondary, and tertiary sources" available at

http://www.stthomas.edu/libraries/guides/e_guide/information_formats/primary.htm

Harris, K. (2005). "What other things do you need to consider?" available at

http://www.une.edu.au/library/coursegenie/eskills/page_03.htm

Hooper, H. (2005)' "Types of information sources – primary, secondary, tertiary and refereed journals" Retrieved August 18, 2005, from

<http://www.library.jcu.edu.au/LibraryGuides/infosrcs.shtml>

Instructional Web Pages Committee. (2005). "Types of resources: primary, secondary, tertiary sources" available at

<http://library.csun.edu/mwoodley/primary.html>

Kantor, P.B. (1983). "The Role of Mathematics in Information Science" A lecture presented at the *University of North Carolina Library School*, Chapel Hill NC .

Kantor, P.B. (1984). "The Role of Mathematics in Information Science" A lecture presented at the *Northwestern University Library*, Evanston IL .

Laverty, C. (1998). "Publication cycle and resource types " available at

<http://stauffer.queensu.ca/inforef/instruct/tools.htm>

Macvean, K. (2005). "1b. Primary, secondary and tertiary sources" available at

<http://www.rmit.edu.au/browse/OurOrganisationFRMITUniversityLibraryInfo-trekFNeedtoknowF1b.Primary,SecondaryandTertiarysources/>

Net Navigator. (2005). "Validating web sites" available at <http://www.glasgowcolleges.ac.uk/slic/textonly/netnavigator/unit1cprimary.html>

Ota, S. (2005). "Mathematics for information science" A course offered at the Department of Art and Information Design, School of Design in Kyushu University.

Saylor, W. and Hooper, H. (2005). "Primary, secondary and tertiary sources" available at <http://www.library.jcu.edu.au/LibraryGuides/primsrsrcs.shtml>

Shibata, M. (1995). Discrete Mathematics for Information Science (Computer Science). Corona Pub, Tokyo .

University of Maryland Libraries. (2004). "Primary, secondary and tertiary sources" available at <http://www.lib.umd.edu/UES/primary-sources.html>

Wiggins, G. (1997). "The publication process: primary, secondary, and tertiary sources" available at <http://www.indiana.edu/~cheminfo/C471/471pubproc.html>