

# IBICT - Information Consumer Theory for the Internet, and its Application to News Websites

Patrick Letouzé and Rúbia Lúcia Oliveira

**Abstract**—This paper reviews IBICT, the Internet-Based Information Consumer Theory derived from Jean Baudrillard's work, and applies it to news websites. Its aim is to support the analysis and development of Internet applications, and to maybe promote a better understanding of Internet users' behavior. Specifically, the four object value dimensions (functional, exchange, symbolic and sign) are interpreted from an Internet information point of view and a mathematical model is proposed. Then as methodological framework, the four dimensions of Internet-Based Information value together with the mathematical model are used to support an analysis of some categories of Internet resources: websites for selling, social network websites and news websites. It is reviewed the example used to analyze a website for selling, where the four dimensions are highlighted and it is suggested that the mathematical model may lead to new models intended to improve its relation to the Internet user. For social network websites, the hypothetical example is reviewed that tries to explain users' decisions; this understanding might help improving the social networks websites functionalities and might help to create new ones. Web search engines are reviewed in accordance to the proposed theory that embodies recent advances and may promote further developments because current models do not clearly or even consider the four dimensions. The case of news website is analyzed and four major news website providers are compared in the IBICT perspective: "BBC News", "Le Monde", "The New York Times" and "The Straits Times". The result is the proposition of an educational project that would serve as a laboratory of innovations to news websites through a social network structure using IBICT.

**Index Terms**—IBICT, Information consumer theory, News website, Social networks.

## I. INTRODUCTION

The Internet-Based Information Consumer Theory (IBICT) was first proposed in [1]. Herein, we apply IBICT to analyze news websites and we present its possible use to combine a news website with an educational project that might not only improve learning, but should serve as a laboratory to test and support the refinement of the news website. Additionally, we review the concept of IBICT and its application in the analysis of websites for selling, of social network websites and of web search engines.

IBICT was proposed in an attempt to answer the following question: how does Baudrillard's object value system apply

to the information consumption in the Internet? Hence, we shall point out that in Baudrillard's work [2]-[5], the main drive in capitalist society was consumption rather than production. The focus was upon consumerism, and how different objects are consumed in different ways. From this perspective, an object may have four dimensions regarding its value [2]:

- *Functional*: it is the instrumental purpose value.
- *Exchange*: it is the economical value.
- *Symbolic*: it is the value that a subject assigns to an object in relation to another subject.
- *Sign*: it is the value within a system.

In reference [1] the four dimensions of value were interpreted for the internet and used to analyze the information consumption in some cases such as web search engines, social network websites and websites for selling. Also, a mathematical model was obtained through the new interpretation of Baudrillard's work, which might be useful for the development of new resources in web systems.

Finally, the organization of this paper is in accordance to the IMRAD structure: introduction, methods, results and discussion. Actually, the method part is divided in five sections: four analysis (websites for selling, social network websites, web search engines and news websites) and one educational project proposal. The first three are a review and the fourth is a new analysis.

IMRAD is adopted as part of the Uniform Requirements for Manuscripts Submitted to Biomedical Journals of the International Committee of Medical Journals Editors, 2008 update. We believe that adopting this structure would help search engines in international databases to store and to retrieve information within research papers in order to facilitate meta-analyses and systematic reviews.

## II. METHODOLOGY

IBICT methodology consists in considering the specific class of objects called information in the Internet paradigm and to understand it according to Baudrillard's object value system. Hence, IBICT provides a support to the analysis of the information consumption process over the Internet and a mathematical model for assigning value to information in the Internet.

We briefly showed the four value dimensions of an object proposed by Baudrillard in the introduction. However, in the Internet context, we should ask what the functional, exchange, symbolic or sign value of information is for an Internet user. In order to answer this question, we propose the following interpretation:

*Functional*: it is the utility value of the information for the Internet user. That is, how useful the information is to the

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Patrick Letouzé is with the Department of Computer Science at the Federal University of Tocantins (UFT), Palmas – TO, Brazil (phone: +55 61 3232-8027; fax: +55 61 3232-8020; e-mail: letouze@uft.edu.br or Patrick.letouze@gmail.com).

Rúbia Lúcia Oliveira is with the Department of Philosophy at the Federal University of Tocantins (UFT), Palmas – TO, Brazil.

Internet user.

*Exchange*: it is the economical value of the information. For instance, it is the value to buy or sell an advertisement, product, service, book, article, etc.

*Symbolic*: it is the value that a subject assigns to information in relation to another subject. That is, it is the credibility of information provided by a subject to the Internet user who is receiving it, observing that a subject may be an Internet user, an institution, a company, etc.

*Sign*: it is the value of the information within a system. For example, a website for selling third parties products may have rankings or labels that provide additional assurance over the quality or reliability of the third party seller which may influence the Internet user to buy its product, even if there is a cheaper seller in the same site, but without the label or in a lower rank.

When we say that an object has four value dimensions it is almost immediate to imagine a vector space model to it. In addition to that, through cardinal utility theory in economics [6], we may have a consumer's utility function as:

$$\Phi_{\text{value}}(x) = w_1 \phi_1(x) + w_2 \phi_2(x) + w_3 \phi_3(x) + w_4 \phi_4(x) \quad (1)$$

where "x" is the object, " $w_1, w_2, w_3, w_4$ " are weights, i.e., real numbers, and " $\phi_1, \phi_2, \phi_3, \phi_4$ " are functions that assigns value to each Baudrillard's value dimensions – indexes 1 for *Functional*, 2 for *Exchange*, 3 for *Symbolic* and 4 for *Sign*, that is, we have an utility function for each value dimension.

Function (1) may not seem useful for real world applications, but in the Internet context, where mathematical functions are hidden almost everywhere, it shall have its value.

### III. ANALYSIS OF WEBSITES FOR SELLING

A website for selling is an online site that sells or buys a product, service, book, article, etc., which implements what is called electronic commerce or e-commerce through the Internet. Some examples of web selling sites are Amazon [7] (web store), eBay [8] (auction site) and iTunes [9] (online music store).

All these websites intend to sell something, that is, they are consumer oriented. In order to better satisfy the possible client, or simply to sale, it is beneficial to seek a better understanding of the potential consumers. Particularly, according to Pawlett [10]:

"The system constructs us as free consumers, as people who buy the products that are for sale because we want them as they satisfy our needs. Indeed Baudrillard rails against the academic disciplines of sociology and economics for accepting the idea of *the consumer* as a given: as an ontological fact. For economists such as the influential J.K. Galbraith, humanity consists of free and self-conscious individual beings with identifiable sets of needs and the desire to satisfy them. But needs are not freestanding essences, instead *the system of needs is the product of the system of production*. Needs do not come about in response to particular objects, one by one, but are generated from a grid or code *as system elements*, not within a unique relationship between individual and object. The code then is a collective

and unconscious social constraint, a morality, an obligation. The tautology that Baudrillard seeks to expose then is the mutually constructing nature of needs, desires and consumer goods – an unbroken circuit. Once we are convinced we possess *needs* we have already consented to the consumer system because it generates the principle of abstract needs in search of satisfaction. We may recognize that the consumer system does not satisfy our needs *properly* or fully, or that it rips us off in the process – but we tend not to question the existence of these freestanding, objective *needs*. The principle of *need* is, for Baudrillard, the crucial ideological construct of the capitalist system. And once consumers have invested value in the commodities they consume these values are *real*, they cannot be dismissed as false or fake, though they are certainly ideologically structured. To be a consumer is to be self-coding and is a considerable accomplishment demanding much time and effort. The consumer is required to act: to reflect, to decide, to choose – yet always within the particular, ideologically structured frame of reference that they exist within."

Although this assertion was not aiming the consumer relation in the Internet, it is fully applicable to it, in particular to selling websites. Besides, it is natural to the Internet consumer to act. Actually, in order to consume a product through the Internet, an Internet user first consumes information and then he/she must reflect, decide and choose. Also, a product or object in the Internet is information, which may be more than a picture; it may be an entire website with text, photographs, videos, etc.

In the Internet context a consumer has many ways to decide to buy or not a product and many ways to get informed for choosing. The functional value may be clarified through different sites. The exchange value may be quickly compared within a site and among sites. Nevertheless, the symbolic and the sign values may have greater influence in the consumer decision and that assertion is corroborated by increasingly systems within the selling websites to rank products and sellers, to classify their quality and to allow individual consumers to express their satisfaction and to sum them up.

As an example, let us consider the case of an Internet user that wants to buy a TV through the Internet. He/She may choose to buy it from the Amazon website [7]. So he/she would choose *Electronics* in the search bar and type *TV*, then press the button *GO*. In December 30 of 2010, this procedure returned 57,514 results, which seems to be a little inconvenient to the potential buyer. But he/she may know the basic specification of the desired product, such as, an LCD TV of 42 inches. In that case, he/she may select in the website in the part named *FEATURED TVs*, the *Display Size* – 40 to 49 inches, and the *TV Display Technology* - LCD, which would return 445 results, still a significant amount. But what if he/she prefers a certain brand, it may be due to his/her nationalism or it may be influence of a friend who might happen to be a technician that works with TV. For a matter of exemplification, let us choose the first brand, which happens to be LG, and then it would return 77 results. It is worth noticing that there were 15 brands not displayed in alphabetical order. Hence, the website provides a final resource, a field named *Sort by*, which offers five options: *Relevance, Bestselling, Price: Low to High, Price: High to*

Low, and Avg. Customer Review. However, if the search started by choosing *All Departments* and typing *TV 42 inch LCD LG*, in the same day there would be 492 results, and the same search choosing *Electronics* would return 353 results. Amazingly, both new searches returned different values than the first procedure. Actually, the first search returned only TVs while the others returned also items as *Flat Screen TV Wall Mount Bracket*. For what is worth, this example was performed without user identification, in a computer without previous searches about TVs or any other electronics at all, that is, without history or profile of any kind.

In light of the Internet-Based Information Consumer Theory, regarding the first search, the choice of *Electronics* and *TV* are related to the functional value dimension. The second procedure, the choice of size and technology are still in the functional dimension, while the third procedure is in the symbolic dimensional value. The last possible choice presents five possibilities that are in different dimension. Both price options are in the exchange dimension. The bestselling and average customer review options are in the sign dimension. Unfortunately, we are not sure of what is the first criterion – relevance, hence we apologize for not classifying it. With regards to the second and third searches a search engine that considers all dimensions should produce the same result as the first and function (1) could be a starting point to do that.

Additionally, as websites for selling seek to improve their sales and their consumers' satisfaction, mathematical models are employed to evaluate the consumer profile in order to determine their individual communication to the potential consumer [11]. Again, function (1) may be used to better understand consumer behavior and to mathematically represent it, which could help to create new models to satisfy, influence or predict the Internet user needs and desires.

#### IV. ANALYSIS OF SOCIAL NETWORK WEBSITES

A social network website is an online site that implements a social structure made up of individuals or organizations called nodes, which comes from network theory. Each node is connected by one or more relations that may reflect friendship, kinship, common interest, etc. Some examples of social networks are Facebook [12], Orkut [13] and Twitter [14].

The Internet user of social network websites clearly values the symbolic and the sign value of information. User relations to other users or organizations, affiliations to communities, etc. show the importance of the symbolic value, while the use of resources within the website by the user shows the importance of sign value. Moreover, when a user enters a community, he/she may be doing so according to some preference, interest or suggestion.

For instance, let us consider a person that sign-in to a social network website due to a friend's invitation. Probably, he/she starts probing the website for common friends, that is, by browsing his/her friends list of relations. After that, he/she may look for some specific friends in the network and then invite others to be part of it. Moreover, while doing that he/she may enter a community. Therefore, when the decision is taken because of a friend's influence then it is probably in

the symbolic dimension, when the decision is due to a particular interest, as getting information about a specific equipment, then it is in the functional dimension, when the reason is a promotional event such as one held by a company where the first user to accomplish a certain task gets a product, a trip, etc., then it is an economical pursuit and that is in the exchange dimension, and finally, when being part of a community means some kind of acceptance in school, work or somewhere else, then it is in the sign dimension.

From the website's point of view, user profiling [15] is a requirement for user satisfaction and a growing field of research and investment, because it may be the difference why a user prefers to use one social network website instead of other. To understand why one user chooses one community or resource is the basis for developing new resources or improving existing ones. In that case, as profiling uses mathematical models, function (1) might be useful for understanding users' preferences. More than that in regards to a specific resource, to classify users' preferences in one dimension or to understand which dimensions it relies might help to improve it.

#### V. ANALYSIS OF WEB SEARCH ENGINES

A search engine is a computer program to retrieve information. As a research field in Computer Science, Information Retrieval (IR) [16] is a field that plays an everyday role in Internet users lives, because it is the core of search sites as Google [17], Yahoo [18] and Bing [19].

Information Retrieval systems are strongly based on mathematical models. In these systems, the IR problem is to partition a certain collection of objects in two subsets through a query, which would be a description of one of the subsets. The first subset would be the set containing the objects that best matches the query, while the second would be the set of objects that best differentiate from it.

A classical example is the Vector Space Model [16]. Normally in this model, documents are objects and queries are words, and in mathematical terms, both are represented by vectors. Then to do the partitioning, the similarity of a document vector to a query vector is obtained through the cosine of the angle between them. In the sequence, documents are ranked by decreasing cosine values. Actually, in this model different terms might also have different weights, similarly to function (1). Moreover, its mathematical function that computes the similarity of a document and a query may be written as our function (1), we may consider only the functional value dimension and its utility function would be the normalized dot product (or cosine), that corresponds to the specific query in question.

Basically, IR systems deal with the functional value of information. Although some of those systems already take into account the Internet user search history in an attempt to determinate the user preferences, it is not clear how to model or to evaluate it. However, in our Internet-Based Information Consumer Theory, three more dimensions may be used to model preferences.

Another approach to improve IR Systems was discussed in [20] by Benoit:

“An aesthetic turn might aid sincere inquiry into the

necessary presuppositions of knowledge that are applied in IR algorithms and consequently expand the scope and objective validity of knowledge and IR systems design.”

In regard to Benoit’s approach, because beauty is an imposed code within a system [4], beauty is part of the sign dimension. That is, function (1) considers aesthetic. Hence, it considers the functionality issue of usual IR systems and the aesthetic point of view altogether. Moreover, as a utility function for consumer preferences, it is an explicit mathematical model for Internet users’ preferences, where individual preferences are determined by the weights and the uniqueness of each IR system is obtained by modeling differently each dimension’s utility function.

VI. ANALYSIS OF NEWS WEBSITES

A news website is not only an online newspaper, or web newspaper, it is a site on the internet that provides news to the internet user. That is, it is not restricted in its origins to a newspaper that have decided to go online, such as “The Straits Times” [21], “The New York Times” [22] or “Le Monde” [23], but also others as “British Broadcasting Corporation” [24] or “AOL Inc.”, previously known as “America Online”. Despite many websites provide news, for analysis purposes, we only approach here the cases where the main objective of the website is to provide news to the internet user. Therefore, we present a comparison of the cited websites in tables 1 and 2. It is important to highlight that it is not a complete comparison of the resources used by the websites and it is just a sample of well known news websites, one American, two European and one Asian.

First it is interesting to note that all four news website evaluated employ the following resources: blogs, social networks, search engines, advertisement, education, time of news, related news and alerts. The last three are features or functions intrinsically related to news. The blog structure and the social networks are resources to communicate to the reader, search engine is a resource to help the reader find the desired information and advertisement is an income. Finally, education is a common concern where three of them treat the matter only through blogs, while “The Straits Times” invested in a dedicated website [26] with several Internet-based applications.

Analyzing from the four dimensional IBICT approach, the news and the resources related to them, clearly have a functional value. Advertisement, markets and subscription are mainly in the exchange dimension. Social networks and search engines were evaluated in previous sections individually, while blogs, forums, chats, video, surveys and comments may have similar analysis, that is, they should be analyzed individually from the four dimensional perspective. Additionally, the resources recommended for you, log in, RSS feeds and mobile have a strong connection to profiling.

Nevertheless, an entire category of resources are the “most (popular)...”, except for the most recent, which are mainly in the symbolic dimension, that is, all of them are measures of interest of the users in a quantitative way. Finally, the “top stories” and the “most recent” are in the sign dimension together with “time of news” in red, that is, as a sign “new”, “time ago” or “posting time”, which express a value within

the website.

Clearly, the symbolic and sign dimension are underestimated. Moreover, “The New York Times” is the only news website that makes use extensively of the “most...” category, all cited news website only use signs related to the “freshness” of the news. That underestimation suggests that new resources that explore the symbolic and sign values should be developed for news websites.

TABLE I. COMPARISON OF NEWS WEBSITES – PART 1.

Resource	BBC News	Le Monde	NY Times	Straits Times
Blog	Yes	Yes	Yes	Yes
Forum	No	Yes	No	Yes
Chat	No	Yes	No	No
Video	Yes	No	Yes	Yes
Survey	No	Yes	No	Yes
Social Network	Yes	Yes	Yes	Yes
Search Engine	Yes	Yes	Yes	Yes
Comments	No	Yes	No	Yes
Top stories	Yes	No	No	Yes
Most recent	No	No	Yes	Yes
Most Commented	No	Yes	No	Yes
Most e-mailed	No	Yes	Yes	No
Most shared	Yes	No	No	No
Most blogged	No	No	Yes	Yes
Most searched	No	No	Yes	No
Most read	Yes	No	No	No
Most video-audio	Yes	No	Yes	No
Most popular movie	No	No	Yes	No
Most popular topic	No	No	Yes	No

TABLE II. COMPARISON OF NEWS WEBSITES – PART 2.

Resource	BBC News	Le Monde	NY Times	Straits Times
Time of news*	Yes	Yes	Yes	Yes
Markets	Yes	Yes	Yes	No
Recommended for you	No	No	Yes	No
Log in	No	Yes	Yes	Yes
RSS feeds	Yes	No	Yes	Yes
Advertisement	Yes	Yes	Yes	Yes
Subscription	No	Yes	Yes	Yes
Related News	Yes	Yes	Yes	Yes
Alerts	Yes	Yes	Yes	Yes
Mobile	Yes	No	Yes	No
Education**	Yes	Yes	Yes	Yes
*	Main page: BBC News - “new” in red; Le Monde - nothing; NY Times - “date and time” in red; The Straits Times - “date and time” in red.			
**	BBC News: “learning” (blog) and “College of Journalism” (blog); Le Monde: several blogs; NY Times: “The Learning Network” (blog); The Straits Times: “Edumall 2.0”.			

VII. EDUCATIONAL PROJECT PROPOSAL

A news website cannot afford to take to many chances with innovation without risking losing a significant amount of readers. Consequently, a possible way to overcome that limitation would be to develop a special environment that should work as a laboratory of innovations.

If we consider that from our analysis the social network websites are more developed in the use of the symbolic and

sign dimensions, then a news website combined with a social network structure would be suitable to serve as the laboratory of innovations. Additionally, if we take into account that in the youth the individual is more receptive to innovations, then they would be a natural target for the experience.

We may select high school students as the main target of the news website laboratory of innovations and that may imply in a partnership with the government. It could be the federal, state or municipal government.

Therefore, the educational project proposal would be a parallel news website that incorporate or based on a social network structure for public high school students. In principle, to high school students reading news in an interactive way should promote education and their ability to judge content, most specifically in the Internet context.

In order to exemplify the possibilities of a social network structure to news website, let us imagine that using complex network theory [27], we could evaluate which is the most popular student in the news social network and through that study how the symbolic and sign dimensions are being used. Moreover, teachers would stimulate the use of the news social network and with the feedback of the studies would receive help to prepare the assignments aiming a more effective participation of students. The students' textual interactions could be analyzed as in [28].

Even out of a social network context, one resource that could be applied is the average reader/student opinion review, which is in the sign dimension. It could be part of the assignment, and additionally, students could rate the news or evaluate information, which would not only helps understand the sign dimension, but would also support further studies about how a news may be presented in order to be more accessed or read.

Finally, specific symbols could be developed to be used within the news social network, such as the top 10 news most read by top 10 students; the news read by the most popular students; or the recommended news read by math teachers. Furthermore, after a while the system could support studies aiming identify if the use of the system helped improve their grades comparing them before and after the use of the system; also, according to a classification of system's use, we could evaluate the students' grades evolution.

### VIII. DISCUSSION

In IBICT, we consider that information itself is an object within the system called Internet. Moreover, an object in the real world has its value changed in the Internet, because of the addition of information to it when it is projected into the virtual world.

Inspired in Baudrillard's work [2]-[4], IBICT defines four value dimensions for an Internet object and that provides a formal framework to analyze information consumption in the Internet. As a consequence, the Internet user behavior may be understood in a different light, which may lead to new insights.

Because the Internet is computer based, and computers need structured information and mathematical models, a simple and generic mathematical model to represent IBICT's

four dimensional system to value objects – function (1), may be useful. This mathematical model embodies existing Information Retrieval and user profiling models. It also extends them by highlighting other value dimensions such as symbolic and sign values.

In addition to that, advertisement seems to be almost everywhere in the Internet, especially in web search engines, social network websites, selling websites. The importance of advertising revenue in the Internet is proven by its grandeur. According to the Interactive Advertising Bureau [29], [30] "U.S. Internet advertising revenues hit \$6.4 billion in the third quarter of 2010, representing the highest quarterly result ever for the online advertising industry and a 17% increase from the same period in 2009."

Therefore, an Internet-based Information Consumer Theory may be helpful to support research on Internet advertising. Moreover, because of websites uses mathematical models in order to direct advertisement the proposed mathematical model may support future works.

A specific future work was presented in section VII. The educational project proposal would not only improve learning among high school students, but it would probably inculcate in them the importance of reading news, it would help develop the ability to judge information and it would promote a familiar feeling with the specific news website. Particularly, as a suggestion, it seems that "The Straits Times" is the best suited candidate to perform the educational project with the Ministry of Education of Singapore [31]. The reasons are: the Ministry of Education of Singapore is receptive to new technologies, online communications and collaborative tools [32] and a news social network website would be an acceptable improvement from the Edumall system [26], which is currently at its 2.0 version, that was launched in 1998 to provide a local point for ready access to online information services and educational resources [33]; one of the new features of Edumall 2.0 is the access newspaper articles, the is, articles from "The Straits Times".

### REFERENCES

- [1] P. Letouzé and R. L. Oliveira, "Internet-based information consumer theory: a Baudrillard's perspective", *Proc. 2011 International Conference on Social Science and Humanity (ICSSH 2011)*, Feb. 2011, vol. 2, pp. 250-253.
- [2] J. Baudrillard, *The Object System*, (1968) New York: Verso, 1996.
- [3] J. Baudrillard, *For A Critique of the Political Economy of the Sign*, (1972) St. Louis, Mo: Telos Press, 1981.
- [4] J. Baudrillard, *The Consumer Society*, (1970) London: Sage, 1998.
- [5] J. Baudrillard, *Simulacra and Simulation*, (1981) Ann Harbor: The University of Michigan Press, 1994.
- [6] P. Suppes and M. Winet, "An axiomatization of utility based on the notion of utility differences," *Management Science*, vol. 1, no. 3 & 4, Apr.-Jul. 1955, pp. 259-270.
- [7] [www.amazon.com](http://www.amazon.com)
- [8] [www.ebay.com](http://www.ebay.com)
- [9] [www.itunes.com](http://www.itunes.com)
- [10] W. Pawlett, "Against banality – the object system, the sign system and the consumption system," *International Journal of Baudrillard Studies*, vol. 5, no. 1, Jan. 2008.
- [11] J.A. Jacobi, E.A. Benson and G.D. Linden, "Use of electronic shopping carts to generate personal recommendations", United States Patent, no. US 6,317,722 B1, date Nov. 13, 2001.
- [12] [www.facebook.com](http://www.facebook.com)
- [13] [www.orkut.com](http://www.orkut.com)
- [14] [www.twitter.com](http://www.twitter.com)

- [15] E. Manners, S. Coppens, T. De Pessemier, H. Dacquin, D. Van Deursen and R. Van de Walle, "Automatic News Recommendations via Profiling", Proc. 3rd international workshop on Automated information extraction in media production (AIEMPro'10), ACM Press, Oct. 2010, pp. 45-50, doi>10.1145/1877850.1877863
- [16] C.D. Manning, P. Raghavan and H. Schütze, Introduction to Information Retrieval, 1st ed., New York: Cambridge University Press, 2008.
- [17] [www.google.com](http://www.google.com)
- [18] [www.yahoo.com](http://www.yahoo.com)
- [19] [www.bing.com](http://www.bing.com)
- [20] G. Benoit, "The beautiful in information – philosophy of aesthetics and information visualization," Proc. International Conference on the Theory of Information Retrieval (ICTIR 09), LNCS 5766, Sep. 2009, pp. 338-341.
- [21] [www.straitstimes.com](http://www.straitstimes.com)
- [22] [www.nytimes.com](http://www.nytimes.com)
- [23] [www.lemonde.fr](http://www.lemonde.fr)
- [24] [www.bbc.co.uk](http://www.bbc.co.uk)
- [25] [www.aol.com](http://www.aol.com)
- [26] [www.edumall.sg](http://www.edumall.sg)
- [27] R. Cohen and S. Havlin, Complex Networks: Structure, Robustness and Function, Cambridge University Press, 2010.
- [28] D. N.Prata, R. S. J. d. Baker, E. d. B. Costa, C. P. Rosé, Y. Cui and A. M. J. B. de Carvalho, "Detecting and Understanding the Impact of Cognitive and Interpersonal Conflict in Computer Supported Collaborative Learning Environments," Proc. Educational Data Mining, 2009, pp. 131-140.
- [29] [www.iab.net](http://www.iab.net)
- [30] [http://www.iab.net/about\\_the\\_iab/recent\\_press\\_releases/press\\_release\\_archive/press\\_release/pr-111710](http://www.iab.net/about_the_iab/recent_press_releases/press_release_archive/press_release/pr-111710) accessed in Nov. 30, 2010.
- [31] [www.moe.gov.sg](http://www.moe.gov.sg)
- [32] Press Release, "MOE Adopts Open Standard Internet Email and Collaboration Services for Over 30,000 Teachers," September 22, 2009.
- [33] Press Release, "Launch of Edumall and Singapore ONE@Schools," July 11, 1998.