The Polidoxa Shift: a New Approach to Social Networks

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Abstract

Access to global information is of primary importance in a global world. The Internet contains a huge amount of documents and it has a big potential as a news media, but the key is in the mechanism in which information is accessed. This paper describes a novel idea consisting in combining the potential of both social networks and search engines. We describe here the basic ideas behind a trust ranking algorithm based on the activities and networking performed by users on a social network. We motivate the need for Polidoxa, the combined social network and search engine, and we finally describe the advantages over traditional media, traditional search engine like Google and social network such as Facebook.

Keywords: Social Networks, Ranking Algorithm, Trust.

1 Introduction

These days the average citizen gets access to the information mainly by watching TV, especially the main national channels. Radio, newspapers and magazines represent a secondary source of information but they are hardly comparable to the power of TV. In particular, reading takes time and it does not well suit the frenetic life style of big cities. As a consequence, information obtained by reading books can be considered quite negligible for an adult citizen with an average level of education. Another major problem comes from the fact that the majority of the world population speaks just its native language while some information are not always accessible in that language. Furthermore, to have a complete unbiased (or at least, multibiased) source of information, it would be quite useful to access documents coming from sources in different languages. According to the A.C. Nielsen Co., the average American watches more than 4 hours of TV each day (or 28 hours/week, or 2 months of nonstop TV-watching per year). In a 65-year life, that person will have spent 9 years glued to TV. The percentage of Americans that regularly watch TV while eating dinner is 66%, while 49% say they simply watch too much of it [8]. These numbers are very alarming and raise health concern, but we believe there is an even bigger problem behind them. Accessing information mainly or exclusively from TV, as the common experience (plus statistics) shows, is obscuring the potential of other sources of information like radio, newspapers, magazines, books, the Internet or our community of trusted contacts. These other sources are generally able to provide a much wider range of viewpoints. Indeed, we are not really able to access unbiased sources (they simply do not exist) but we could get what we call a multibiased source, at least: a more heterogenous set of different viewpoints which then needs human critical thinking and cognitive interpolation.

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The problem with TV news is that the streaming of information is simply unidirectional, i.e. there is no possibility for the audience to control the process in any way. The media product passes through many levels of organizational processing on its way to the audience and, at each step of the process, the original data is filtered – reduced in length, edited for style and so on. Each step in the process can be thought of as a gate through which the data must pass on its way to the consumer, consequently this situation is known as gatekeeping (see figure 1). Gatekeeping is generally a very good and safe mechanism to ensure that irrelevant or misleading information will be not consumed by the general public. It determines a quality ensuring process and an expert evaluation similar to what happens in conferences/journals peer review system. However, there is also a potential drawback. With TV and its gatekeeping, audience is not able to give a real time feedback, misunderstandings are quite common and there is no active interaction. Furthermore, people are not able to decide the source of the information, they cannot choose the content or express the will to expand some topics. This means that the media tend to set the ”agenda”, i.e. the list of items that people will be discussing. This theory is known as *agenda-setting theory* ([21], [20]) and asserts that the news media have a large influence on audiences by their choice of what stories to consider newsworthy and how much prominence and space to give them. Agenda-setting theory's main postulate is salience transfer. Salience transfer is the ability of the news media to transfer issues of importance from their news media agendas to public agendas. Thus, the power of the media may lie not in its ability to determine people's opinions, but rather in its role of determining what issues will be considered important enough to discuss. Whatever is not appearing on the main media simply does not exist. This has a quite subtle consequence.

The German political scientist Elisabeth Noelle-Neumann has defined an important theory called the *spiral of silence* [23]. This theory asserts that a person is less likely to voice an opinion on a topic if he/she feels that idea belongs to a minority. This is for fear of reprisal or isolation from the majority. Thus, TV news can easily transfer this feeling to the watcher who is following the news from his home, maybe at a time of the day when the attention is not at its peak (remember: 66% of Americans regularly watch television while eating dinner and this is the time when news are usually broadcasted).

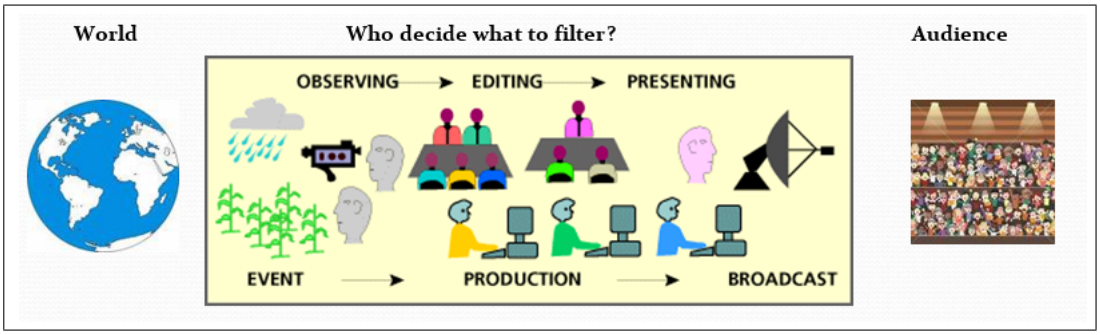

Figure 1: Gatekeeping process

In some cases, the fact that information goes through gatekeeping (i.e. every journalist has to go through several levels of approval like director, editor, company shareholders before the information is released to the public) can lead to situation which are unfavorable for the final information consumer. Consider, for example, the case in which news agencies are purchased and become part of a larger business where providing information may not be the main core business or even be affected by the company's position on the Stock Market. Example of this has been the concern that Reuters' objective reporting may be affected by recent merging with Thomson corporation, owning the 53% of the company, in contrast with the 15% limitation to share ownership historically imposed by its constitution to preserve

freedom and integrity of the agency [6]. Once the gatekeeping process has been understood, its risk and limitations have to be accepted together with its advantages. Now, if we consider how the main channels and news agency are more and more centralized (like every other business), it is not difficult to realize how the whole mass media communication process has the potential to be set under control in the future, especially in some countries where the democratic process is considered weaker [5].

2 Internet: a Step Forward?

Internet offers an open platform to exchange information and, in this sense, can be considered a revolution similar to the Gutenberg's one. It is indeed possible for the user to control the information he/she accesses, to choose the content he/she reads, and to interact with other users, bloggers etc... It is also possible to choose the timing for accessing the information. As said, people tend to watch the news while dining and this is certainly one of the weakest times for critical thinking. Internet has the full potential to invert (or at least minimize) the process leading to the agenda-setting theory issues or the spiral of silence condition. However, to exploit this potential users need some know-how since, given the limited control on the information on the Web, it is possible to find very good pieces of so-called alternative journalisms but also any kind of hoax or similar garbage. Internet is not a passive media like TV and users are expected to be active and critical thinking is stimulated. However, users have to be educated to use the media. The potential of Internet could be seriously reduced in the future if focal nodes will be set under control with the same gatekeeping process discussed for the traditional media. Again, also in this case gatekeeping is good to ensure quality but it limits feedback process and critical thinking. We always find pros and cons. At the best of our empirical knowledge, search engines like Google or social networks like Facebook are, for most users, the starting point of much of their research. So the important question is: how can we be sure these nodes are trustworthy? Let us briefly analyze the main characteristics of these two powerful instruments in the hands of Internet users.

2.1 Google: Pros and Cons

Search engines like Google [9] offer the possibility to look for specific topics of interest and, given some skills with the advanced search features, the source of information can also be decided. However, on the cons side, the user cannot directly configure the ranking algorithm, thus he/she cannot decide the importance of the information and its priority. This importance is decided universally and not for the specific user. The source of the information in the ranking algorithm is not decided by the users. Google could also delete or downgrade pages without the users being able to influence or configure this in any way. In some sense, the communication process is not bidirectional yet and it is quite unbalanced in favor of the search engine owners. When comparing Google with the traditional mass media, we immediately notice that a bad use of the gatekeeping process is still an open issue and Google could be set under control as easily as TV channels in the future. However, Google is much better than traditional media because, at least, users can decide the content they are interested in while this is impossible for TVs and magazines (with the exception of zapping through different channels or scanning different newspaper but this takes time).

2.2 Facebook: Pros and Cons

Social networks like Facebook are very different from search engines to this extent, especially because the source of information can be controlled by the users. A specific user, for example, can decide to follow a friend or a VIP. Users can also hide other users who seem to post information considered bad on not useful. Unfortunately, even with Facebook users are not able to rank information since all posts are

shown chronologically. Users are not able to set *content alerts* to be informed only about specific topics. Another problem is that users cannot enrich their posts linking information which is not on the Internet, although this is becoming less and less relevant in the moment in which all the other media are also posting their contents on the Web. As a social network service Facebook has a focus on collection and sharing of visual user data (family, friends pictures etc..) and personal interests and personal information. Being Facebook supported by advertising, this information are more critical in term of quantity, rather quality. The way Facebook is structured does not consequently promote or improve critical thinking among its users, learning, comprehension and discussion. Mechanisms such as "like", for example, are structured for giving just a quick evaluation, which, as a consequence, may be simply an accelerated feeling not moderated by critical thinking. According to a Nielsen's Company research, people are spending more and more time on social networks: global average time spent is in fact about five and half hours per month and this number is increasing, with Facebook currently dominating its position as a destination. Social networking is globally expanding and it is likely to deeply influence the way people will interact with each other in the future, promoting links going beyond the geographical limits [1].

3 Polidoxa: Combining the Strength of Search Engines, Social Networks and Traditional Mass Media

Polidoxa is a tool exploiting a synergy of search engines and social networks facilities (see Figure 2). It consists indeed of two parts:

- a *news search engine*
- a *trusted social network*

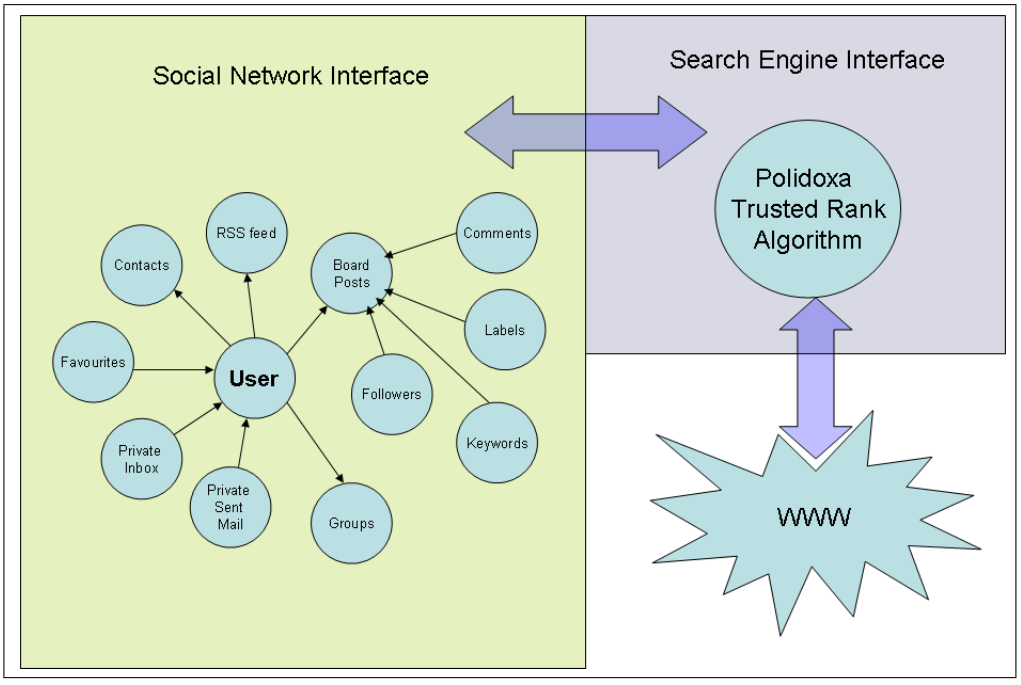

Figure 2: Polidoxa Platform

The news search engine is based on a configurable ranking algorithm (See Tables 1 and 2). The user can choose the sources from which the search engine should scan the news. Topics and priorities may also be selected by the user. The trustworthy social network allows the users to follow the information posted only (or mainly) by trusted users on specific topics which can be decided setting adequate constraints. In literature, other approaches can be found which support choices based on other people opinions, for example the GroupLens architecture where the basic idea is to evaluate users tracking data to make predictions about news recommendations ([24], [15], [22]). Polidoxa extends this idea proposing a built-in search engine and organizing *people* in a trustworthy social network where the news positively evaluated by linked users have an higher priority that the ones evaluated by indirect contacts: the higher the separation degree, the lower the priority.

Polidoxa guarantees users' freedom to be informed on topics of interest because the algorithm is based on the actual trustworthy network of every single user. The main difference with the Google Pagerank algorithm is that Pagerank evaluates the link relationships of a document looking at the entire Web, while Polidoxa evaluates the link relationships of the network community, giving more importance to the network activities within a shorter relational distance. We assume that users' direct contacts represent a guarantee of (subjective) quality. Furthermore, the algorithm evaluates self configured ranking parameters. This approach is also a way to solve the so-called *Web spam* problem [16]. The idea is that, in such environment, malicious entity are simply individuated and excluded by the community.

3.1 Algorithm Basic Principles

The basic principle behind Polidoxa is that information coming from sources we trust has an higher (subjective) quality. Thus, Polidoxa has a better feedback mechanism. Users are not passive anymore, they become active part of the information flow and they learn more. Overall, we have more informed and conscious users. It is outside the scope of this paper to describe all the details of the algorithm that we are planning to protect with a patent. In this work we want just to motivate the need for the Polidoxa platform and give an overview of its functioning. Polidoxa trusted rank algorithm is based on the following parameters to prioritize information:

- RSS feed's list of the user and of all the *first grade* user's contacts –i.e. people directly connected with him – (configurable in case of extension to more than one level)
- Favorites sites/blogs list
- Followers list
- For each user, the number of *likes* related to his posts: user popularity
- For each user, the ratio $\frac{\#Likes}{\#Dislike}$ (with $\#A$ cardinality of set A) for that user
- List of users that belong to subscribed groups
- For each group to which the user belong, number of the published posts on that group
- Number of user comments to posts coming from another user
- For each post of the user, the number of comments coming from another user
- Number of private messages between the user and another user
- List of configurable keywords

- Post labels
- Freshness
- Rate of activities (share, comments, like, dislike...) on a posted item within a temporal interval

Algorithm 1 Configurable Static Parameters

1: Evaluate **Trustworthiness of Contacts**: by creating a contact with another user of Polidoxa, the user is asked to weight the trustworthiness of that contact.
2: Evaluate **Trustworthiness of a Web page**: by configuring the search engine, the user is asked to weight the trustfulness of specific Web pages.

The trusted rank is directly proportional to the parameters described which will increase the trustworthiness of users and webpages. User or webpages with a large amount of *like* will get more trust. The algorithm should also suggest new contacts based on their activities and web pages based on topics and trustworthiness.

Algorithm 2 Dynamic Parameters depending on activities and degree of separation

1: Evaluate ***like* and *dislike***: the more 'like' an article gets the more important it is
2: Evaluate **comments in *like* thread**
3: Evaluate **amount and frequency of *share* function within a temporal interval**: a high frequency within a temporal interval is an indicator of a hot and important news
4: Evaluate the **number of comments** of the post
5: Evaluate the **number of private messages** exchanged with the poster.
6: Evaluate **keywords, labels match**
7: Evaluate **if the poster belongs to a shared group** and **the activities on that group**
8: Evaluate **the freshness** of a document/article/post

3.2 Polidoxa Ranking

Polidoxa ranking is based on the definition of trusted relationship between a user and a posted item. The immediate contacts have more influence while the other contacts see a reduction of their influence which is proportional to their distance. This issue is not entirely solved at the moment and we have in mind different possible solutions. The most obvious, simple but imprecise solution is when the trust value x of a user a for another user with distance n is x/n. However, this solution is imprecise because we know that trust is not a linear relationship, i.e. the contacts a person has at the third or even fourth level have a value which is generally close to zero while direct contacts or contacts of contacts are very valuable. We are currently also evaluating another ranking system based on a trust relationship inspired to a Kepler-Newton modeling system. During our life time we in fact trust our parents, relatives, friends, or even people we do not know creating our solar system, adding new planets which we critically found compatible to our beliefs of our mental galaxy and our contact links are based on a non-linear relationship, where the quality of trust increases when it gets closer to our beliefs, knowledge, commitment etc. Research in this area has been already developed at McGill University, Canada [18]. The Inverse Square Law on which the idea is based is shown in Figure 4. We can make a simpler analogy between this idea and how forces distribute over a sphere. By defining the intensity i of the Trust as: $i = T/A$ where T is Trust and A the area of the sphere, i.e. our social network, we get $i = T/A = T/(4\pi L^2)$ with L the radius. Thus, if $L2 > L1$ then $i2 < i1$ which means the more the contact is distant, the less powerful is

the Trust. In Figure 3 the formal definition of the trust parameter is shown with examples of different functions which can be exploited for this purpose. The table shows u and v as users represented as points in a bidimensional space. Given $u = (u_x, u_y)$, $v = (v_x, v_y)$ then the *distance* $d(u,v)$ between u and v is defined as $d(u,v) = \sqrt{(u_x - u_y)^2 + (v_x - v_y)^2}$. Among all the ranking parameters listed in Section 3.1, the user trust value is the most important for a document in our network.

$\text{TRUST}(u,v) = \alpha(d(u,v))$	
Linear	$\alpha(x) = \frac{1}{x}$
Quadratic	$\alpha(x) = \frac{1}{x^2}$
Gravitational	$\alpha(x) = \frac{1}{4\pi x^2}$
Exponential	$\alpha(x) = e^x$

Figure 3: Trust Definition

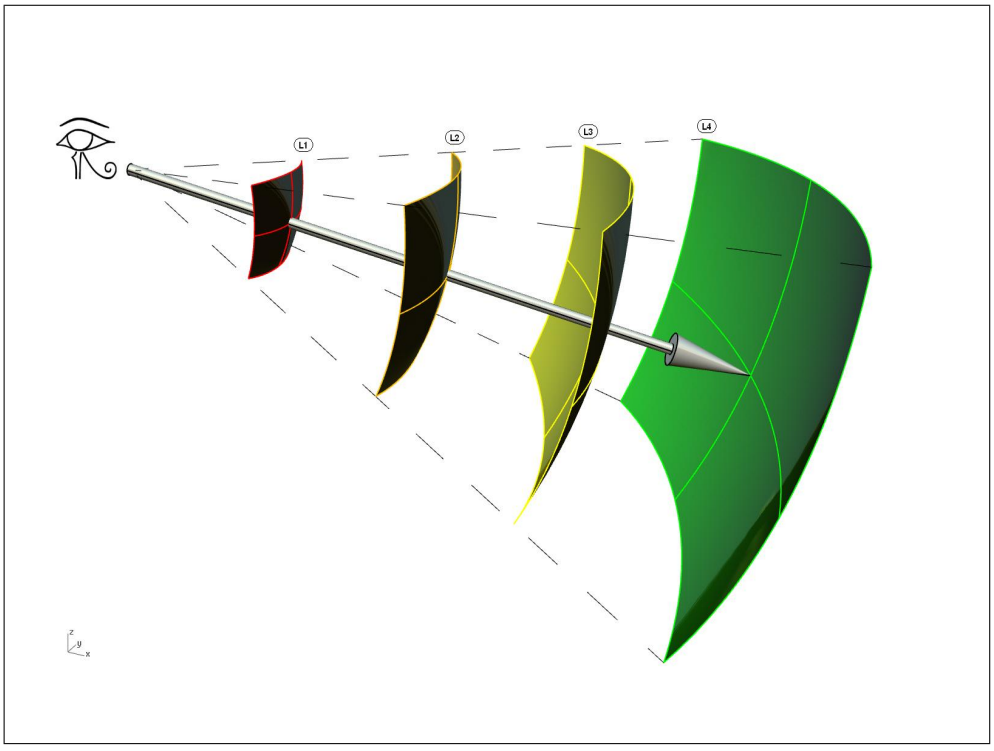

Figure 4: Inverse Square Law

Another research it is worth mentioning can be found in [11] where a gravitational algorithm taking into account the mass interaction has been proposed. This work considers the law of gravity as formulated by Newton:

$$F = G\frac{M_1 M_2}{R^2}$$

F is the magnitude of the gravitational force (Trust in our case), G is gravitational constant, M1 and M2 are the mass of the first and second particles respectively. Applying this intuition to Polidoxa it is something to be considered as a future work. For example, in our case F may represent the Trust intensity between two users).

3.3 Polidoxa and Related Works

In this section we compare the Polidoxa idea with Google and Grouplens. Pagerank is the parameter used by Google and it is based on the links received by a page and on the "authority" of certain pages. Thus, when a page is linked by another page with "authority", this gives more relevance to the page itself. The important question here is: how can we decide about the authority of a page? This is not clear and Google says nothing about it. Who works in SEO (Search Engine Optimization) — like one of the authors does — knows very well that inlinks evaluation (evaluation of links coming from other pages) is a process lasting for months. This means that a page with qualitatively valuable information actually needs months to acquire some "authority". With Polidoxa, everything instead depends on the networks's activity, without a delay of months but, in the worst case, of hours. The Polidoxa algorithm evaluates the news propagation speed inside the network giving more importance to those news which propagate faster inside the user's social network. While in Google the importance of information is decided like in a "black box" with a non transparent process, and it is therefore manipulable by SEO specialized agency (an online marketing branch which has the goal of bringing a page or document in search engines ranking top position), with Polidoxa we offer a very simple answer to this problem since the importance of information is determined by the user him/herself and by his/her social network. The importance of information is now transparent and cannot be influenced by SEO agency.

Polidoxa introduces a trust ranking algorithm where:

1. The user determines a trust parameter (a numeric value) which is a static parameter for the page to be indexed and for his/her first level network

2. The user's first level network determine a dynamic trust parameter on the basis of its activity (e.g., like, dislike, share)

3. The user further level network (indirect links) determine a trust parameter based on its activity and this value decreases with the distance (as discussed above)

The user has now an unique instrument for searching information which values more all the direct connections without limiting the use of traditional media or search engine. As a consequence, the user is forced to use his/her critical thinking when reading news, he/she is motivated to think about the sources and the process of news creation. Indeed, all the filters crated by the so-called "subject matter experts" of Grouplens [2] are, in reality, not very transparent. For example, who decides who is an expert? Furthermore, an "expert" can be easily manipulated. With Polidoxa the "subject matter experts" is instead precisely decided by the users and not by an unknown entity. Polidoxa gives the possibility to configure the search engine and the related ranking. It does not limit the general network activity but gives the user the possibility of monitoring the specific activity of his/her trusted network. The

fundamental idea is that we tend to trust more the people we know and with these persons we usually discuss more, get more feedback, interact more, etc... However, the possibility to follow famous people we do not directly know but for some reason we trust is not prevented since we can directly override the trust value of every element of our indirect network. This is because a user may want to follow a distant person who is considered a role/spiritual model. Certainly, also in this virtual trusted network all the persuasion/influence mechanisms may still be valid and alter the trust relationship in a not obvious way. These aspects are described in detail in [10].

Polidoxa users have the opportunity to be aware of the activity of the trusted network but still have to use their critical thinking to evaluate the information. This should give the opportunity to the "deep Web" (all that information not crawled by search engines) to eventually reach the Web surface. The Polidoxa ranking increases the quality of information, facilitates the discussion and could improve the lifestyle of participants simply exchanging information and sharing knowledge. Looking at the data of seo-scientist.com [3], we discover that about 80% of the users just click the first three results given by a search engine. As a consequence, ranking of information is of extreme importance and offering a trust ranking based on the users activities is fundamental to offer qualitatively better results because that means improving the first three positions according to the user priorities and preferences. With Polidoxa the user and his/her trusted network influences the ranking and everybody has the chance to receive a customized and configurable ranking.

3.4 A stigmergic behavioural system as in swarms

It is worth noting that Polidoxa is designed to work as a stigmergic system [7, 19], a strategy based on what can be found in biological systems. Let us consider, for example, how social insect colonies build up a complex system to tell each other where to locate sources of food or picking up materials. This happens in a collaborative way, without any external instruction, guidance or hierarchy [13]. In the same way, Polidoxa users, as a colony of brains, can share information, interact with it, generate discussion, enhancing the service itself, redefining how it will work, etc.. This happens like in a self organizing system which facilitates cooperative team work. This evolution from chaotic groups to self organized users groups without any central guidance, will help in the re-definition of how information can be delivered, offering a real alternative to traditional media top-down approach [14]. The idea behind this concept is also reinforced by recent studies developed at the University of Erlangen-Nuremberg, in Germany on swarm intelligence used for analysing opinions in online communities. Social interaction and networking is enhanced by the collective intelligence, which is superior to the the sum of knowledge of inviduals [12] and opinion trends can be predicted via swarm intelligent algorithms [17]. Polidoxa can offer a platform for discussion which elevate users to a higher level of knowledge, criticism and consciousness.

4 Case Study: the Issue of Cold Fusion

In this section we present a simple case study to show how traditional media, search engines and social networks are inappropriate when the user wants to search information outside the mainstream channels. We discuss a very small query to retrieve an information we received through our trusted networks of like minded friends. We are well aware of two scientists working in Bologna (Italy) who presented an official experiment about cold fusion on the 14 of January 2011. At the moment, we certainly do not know about the validity of this experiment and we do not have knowledge and experience on the topic to decide. However, we believe we have the right to read, discuss and evaluate the claim made by these scientists. We will then contact our trusted friends to ask about their viewpoint on the topic and only then we will

read material on the topic suggested by our contacts. Thus, what we are saying here is that, whatever the validity of an information like this can be, we have the right to evaluate it through our critical thinking and the critical thinking of people we directly know and trust. We do not want to end up in the spiral of silence, nor we want the media setting the agenda for us deciding what is worth discussing and what is not. We now discuss how this important piece of information can be retrieved by means of traditional media, search engines and social networks.

Nearly no information has been shown in the main TV channels worldwide (Italy included). If we try on the BBC website (usually recording also what has been broadcasted), what we get is visible in Figure 5: nothing is reported about the experiment. This is quite annoying. If we search on Google, we get what is shown in Figure 6 instead. There is huge amount of information here and it takes a significant amount of time to scan and to evaluate every single link. Which information should we trust then? Have trusted contacts in our social network already evaluated this information for us? With a more specific query, we get the information shown in Figure 7. This information is more focused but the user needs to know more details about what he/she is looking for and this is not always the case. On the other side, Facebook offers many groups on the topic, but the user has nearly no information on the trustworthiness of these sources.

To grasp a better understanding, we also experimented with alternative search engines. For example. when we typed "cold fusion energy bologna" in the Indian search engine www.guruji.com, we got just 10 links while www.equalo.com returned 10,109 links. However, the overall situation is even more complicated than this. Even using Google from different countries we got different results: typing "cold fusion energy bologna" in google.it returns 151,000 links, google.co.uk 308,000 links and google.com 111,000 links. Partly this is explainable with language considerations but not entirely. Of course the actual numbers can change over time and, if the reader tries the same, he may obtain (and certainly will) different results, but the point we want to make here is that, without the trusted information offered by our contact, we would have never known about this experiment which may open a new generation of green energy! There is also the possibility this is an hoax [4], but we have the right to get to know the information and evaluate it through our critical thinking and the one of our closest contacts (however, recent developments of this story gave us an even stronger confidence on the validity of the preliminary results). Polidoxa has an added value since it is capable to offer trusted information inside the user's inner circle of close contacts or, in general, the entire Polidoxa community. This means that, for every query, the algorithm will present on top the most relevant articles of first level linked contacts, and so on, in order to offer the user the potential of brain sharing in evaluating a piece of information. What we aim to is putting together human, and not computer, evaluations.

5 Conclusions

In this paper we emphasized the fact that people tend to passively receive TV information without verifying it. The gatekeeping process of traditional media, although generally safe and quality ensuring, poses new risks when control over the information is becoming more and more centralized. Internet has an enormous potential to fix this problem, but the current instruments commonly used like Google and Facebook lack the most important concept in this field: they do not embed the notion of individual trustworthiness of a source. Polidoxa, instead, connects local knowledges making them usable for everybody and it is conceived to promote public awareness and discussion in total freedom, like in an open piazza. Polidoxa is based on our philosophy: *we believe first in what we can directly verify, then in what our closest contacts have verified. We doubt about what people we do not know say about things we have never seen (it does not matter if this is coming from official sources) until our network of trusted contacts allows us to trust it because it has been verified directly by them*. Today we tend not to verify mainstream

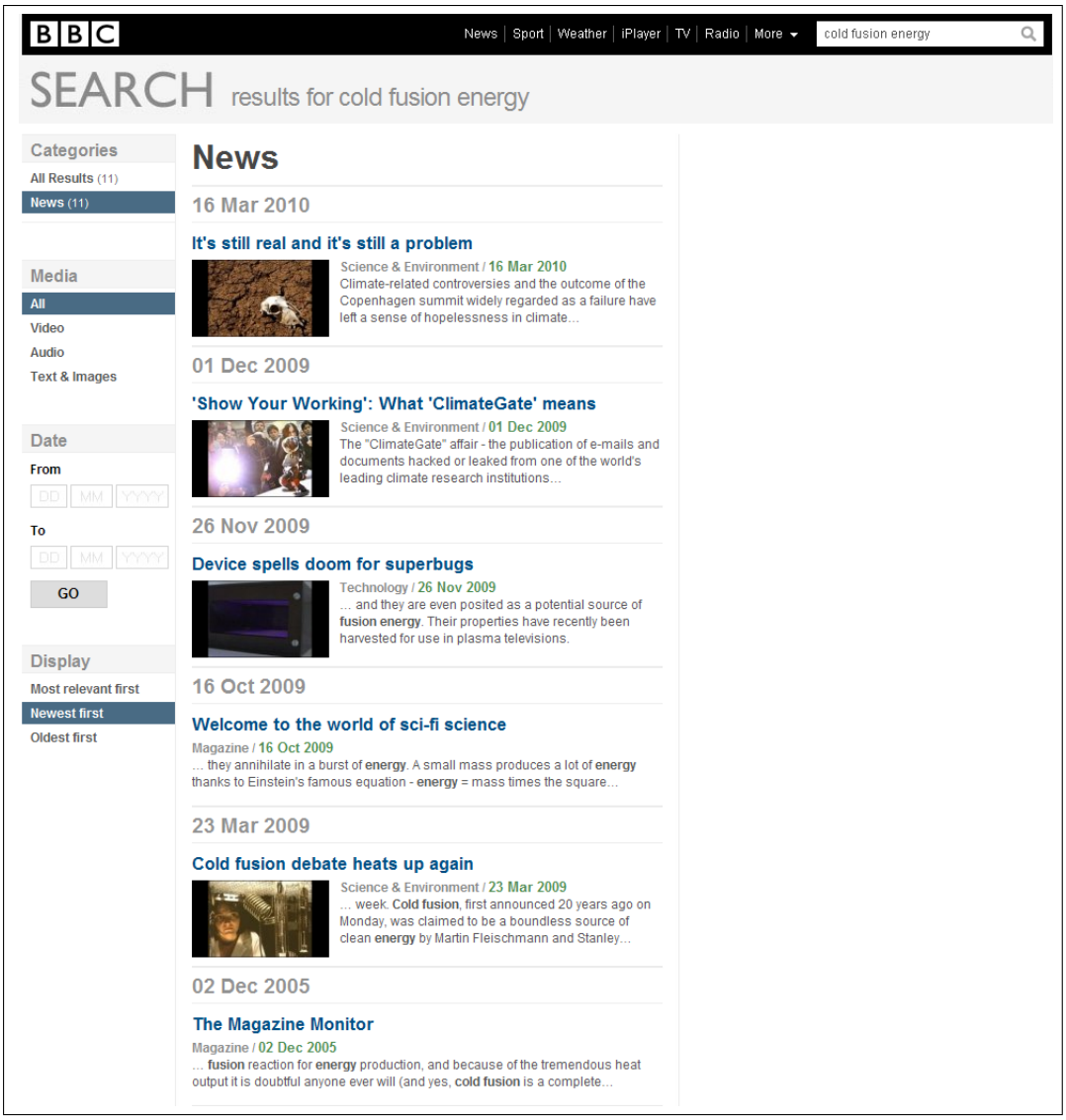

Figure 5: BBC Results for “cold fusion energy”

information and this has the potential to become a problem in the future. Polidoxa may be an answer to this problem.

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Figure 6: Google Results for “cold fusion energy”

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