How Argumentation can Enhance Dialogues in Social Networks

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Abstract. Many websites nowadays allow social networking between their users in an explicit or implicit way. In this work, we show how the theory of argumentation schemes can provide a valuable help to formalize and structure on-line discussions and user opinions in decision support and business oriented websites that hold social networks among their users. A real study case is considered and analysed. Then, guidelines for website and system design are provided to enhance social decision support and recommendations with argumentation.

Keywords. Social Networks, Customer Support, Argumentation Schemes

Introduction

The current incarnation of the Web as a platform for computing and collaborative interaction, supported by the development of so-called Web 2.0 technologies and standards, has resulted in the fast proliferation of web-based communities and on-line social networks. Social networking is encouraged ever more often, in an explicit or implicit way. Together with declared leisure oriented social networking sites, like Facebook (www.facebook.com), Flickr (www.flickr.com) or MySpace (www.myspace.com), many more decision support or business oriented sites allow users to interact, share their preferences and profiles, form communities and give advice, recommendations and feedback about their experiences. This is the case of Amazon (www.amazon.com) or eBay (www.ebay.com) and consumer review sites, like Tripadvisor (www.tripadvisor.com) or Epinions (www.epinions.com).

Regardless of the purpose of the social networking, in all of these communities discussions arise from the difference of opinion between users, and individual views are mixed in the tangle of user-generated content posted in discussion boards, wikis and blogs. Mostly, this information is unstructured, and gives little opportunity for complex knowledge elicitation. When on the other hand information *is* structured, as in the typical recommender systems, usually there is no explanation of the reasoning process behind the recommendation, which is simply presented as the result of the application of the recommending algorithm. However, it has been shown that people trust recommenda-

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tions more when the engine can explain their rationale [10] and currently the notion of a "good" recommendation has changed from the one that minimises some error evaluation measure about the output of content, collaborative filtering or hybrid recommendation methods, to the one that really makes people more satisfied.

In this work, we discuss how Argumentation Schemes Theory [14] could help formalise and structure on-line discussions and user opinions. Although not directly applied to social networks, the work most relevant to our purposes is perhaps the work on recommender systems [1][7][4]. Here, research has investigated the impact of the social network dynamics on the recommendation, typically based on the notion of "social trust" [5,12]. The work in the present paper contributes to this area but from the different perspective of structuring and clarifying the reasoning process followed by users to provide pieces of advice and recommendations to other users of their social network.

We focus in particular business oriented websites that allow a social interaction among their users. We leave out of our analysis for the time being decision support, leisure or ethics oriented social networking sites, as the scope and target of on-line business websites makes them more suitable to define tools to analyse opinions and elicit knowledge from their users. In this paper, we formalise our notion of social network, and we show how this definition fits to Amazon, probably best epitomize how implicit social networks emerged from business websites. Finally, we discuss how argumentation schemes could be best utilised to improve social networking features.

1. Definition of a Social Network Model

We studied a number of social networks, focusing in particular to the argumentation activities that, either implicitly or explicitly, users would engage in. In particular, following the typology of argumentative dialogue in [13], we assessed how different social networks compare with this feature. From this analysis, we extrapolated a general abstraction of social network.

For our purposes, we consider a social network as an abstraction to represent social structures that link individuals or organisations. Links can stand for different types of interdependency, such as friendship, trade, shared knowledge, common hobbies, etc. We distinguish between **explicit social networks**, which openly represent users and links among them, so that users can, for instance, search their *contact list* to interact with other users, and **implicit social networks**, which may or may not store information about social relationships among users, but which usually do not make this information accessible to users, who cannot access their contact lists to retrieve previous partners or do not have an easy way of searching reports about previous exchanges. For both types, we identify the following features that define a social network in our model:

- Overall **purpose** of the network: e.g. friendship, business, shared hobbies.
- Permitted **tasks**: e.g. recommend, provide opinions, evaluate others' opinions.
- **Nodes** representing individuals or organisations.
- **Roles** that individuals or organisations can play in the social network.
- **Knowledge databases**: individual or shared knowledge databases associated with each node and representing information about the issues related with each role.
- **Ties**, or links, between nodes, which can be of different sorts, depending on the overall purpose of the network (e.g. values, visions, ideas, financial exchange,

friendship, personal relationships, kinship, dislikes, conflict, trade). Ties can be directed or not. Undirected links represent social relations that are present in the network, but whose related information is not stored nor explicitly supported.

- Social network **analysis measures**, used to evaluate the relations that a tie represents. Values of trust and reputation are common examples of these measures.
- Types of **argumentative dialogues** that can be held in the network.

In what follows we concentrate on a study case, analyzing arguably one of the most popular business oriented websites that allow social interaction among users, despite this not being their primary purpose: Amazon. We analyse the features that make it considered *de facto* social network, and we represent it in the light of the model we defined above.

1.1. Amazon

Amazon (www.amazon.com) is possibly the largest on-line retailer offering, either directly or via "marketplace" associated sellers, a very wide range of products, from books, to groceries, from furniture to clothes and shoes, and so on. Social networking features allow users to interact in different ways. Amazon's users can:

- write reviews about products, whether purchased or not. As part of their review, users can rate products. Reviews can be annotated with the nickname of the reviewer or his popularity as reviewer ("reviewer rank"), based on both positive and negative votes received, as well as the time when the review was published. In addition, other users can write comments on reviews, rate them as useful/unuseful, and report them to the company if they consider them offensive or inappropriate.
- leave feedback about "marketplace" sellers after a purchase, with a comment. Seller ratings are computed using the votes received over the transactions performed in a specific period of time. Sellers have the opportunity to respond to the comment/rating and rate the transaction, but they cannot rate buyers (only feedback submitted by buyers is considered to compute a seller rating).
- join customer communities: users can create a profile and share it with other users, join different communities, participate in forum, create *Listmania* lists with the Amazon products they like or recommend and *Wish* lists with the products they are interested in, suggest products to their communities by adding a tag, write *So You'd Like to...* guides to directly recommend products. Posts can be replied to, rated and reported, but these ratings are not used to compute customer ranks.

On top of this, Amazon website runs a powerful recommendation algorithm that matches each customer's purchased and rated item to similar items, and outputs a personalised recommendation list [9]. This algorithm follows an *item-to-item collaborative filtering* approach that scales to massive data, producing recommendations in real time with a brief explanation (e.g. "N% customers buying X also bought Y").

1.1.1. Amazon Social Network Models

Explicit social networks are formed by the users joining communities, while implicit social networks emerge from the activity of writing reviews and from sales and their subsequent feedback. In the spirit of our analysis, we focus here on the latter, and we analyse the social networks emerging from reviews and sales according to our model.
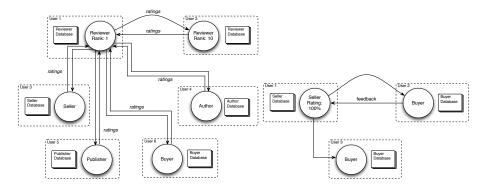
Figure 1. a: Amazon Social Network of Reviews; b: Amazon Social Network of Sales

Social Network of Reviews

Reviews that Amazon users write give rise to social relations from which emerges an *Amazon Social Network of Reviews*, with the **purpose** of sharing information on the products, and with **nodes** representing buyers, sellers, reviewers, authors (of books for example) and publishers/manufacturers. The **tasks** permitted are: writing reviews on Amazon products, writing comments on reviews, rating reviews or reporting reviews. The main type of **dialogue** enabled by this social networking activity is information seeking and sharing, but persuasion is also enabled by means of free comments and responses to them. Figure 1a is an example of a network of reviews with six Amazon customers playing each role that is involved in the activity of writing reviews. Arrows stand for **social ties** implicitly created from users' activity. In the example, User 1 reviewed a product related with other users (because they are sellers, authors, publishers or buyers of the product). Users 3, 4, 5 and 6 rated or reported the review of User 1, while Users 1 and 2 commented, rated or reported the same review, or each other's review. **Knowledge databases** are attached to each role, denoting the information that the website stores for each role, e.g. the reviews made by a reviewer and how they were rated, though not always the information is accessible to a user (e.g. there is no obvious way for users to check their list of reviews). **Analysis measures** evaluate users' performance in the social network, e.g. the reviewer's rank can be used as a reputation measure to evaluate the importance of a reviewer. Measures can also label ties, e.g. individual reviewers' trust measures could be computed from the usefulness ratings assigned over a certain period of time.

Social Network of Sales

The overall **purpose** of the *Amazon Social Network of Sales* is to run commercial transactions between its members and to inform about them. Therefore, the **tasks** permitted on the network are sell and buy products and leave feedback about these commercial transactions, while **nodes** are simply buyers and sellers (as feedback cannot be left unless a transaction has occurred). The main type of **dialogue** that these tasks enable is that of information seeking and sharing, by leaving feedback, and persuasion, by supporting this feedback and responding to it. Figure 1b shows an example of an Amazon social network of sales with one seller (User 1) and two buyers (Users 2 and 3) and their respective **knowledge databases**. As before, arrows show **social ties**: User 1 sold a product

to Users 2 and 3, while User 2 provided feedback about his sale with User 1. Amazon aggregates reviews to compute a seller rating, which can also be used as a reputation **measure** to label nodes that represent customers playing the role of sellers. The seller can also leave comments about the transaction and the feedback received, represented in the figure by the arrow from User 1 to User 2, but cannot rate the transaction (no label on the arrow).

2. Argumentation Schemes to Support On-line Dialogues in Social Networks

In this section, we concentrate on how argumentation could enhance the performance of the emergent activities carried out by the users of a social network, with a preliminary step towards the application of argumentation schemes to formalise the underlying reasoning shown in the dialogues held among the users of the networks in our cases of study. Argumentation schemes [14] are characterised by a set of premises and their underlying conclusion, and are associated with a set of critical questions (CQs) that stand for potential attacks that could refute the conclusion drawn from the scheme. This feature is very useful to guide argumentation dialogues. Thus, if a proponent of a position uses a pattern of reasoning that matches with an argumentation scheme, an opponent can try to pose one of its critical questions to attack that position. We analysed a number of typical dialogues held in the situation described in the Amazon study case, and we identify the following advantages of applying argumentation schemes to social networked business: 1) *to provide a formal structure to opinions and recommendations*, allowing for explanations and justifications that clarify the position of the reviewer; 2) *to provide a way of evaluating user opinions and recommendations*, by looking at their associated reasoning patterns, with critical questions as a way to show weaknesses and possible attacks and 3) *to provide a formal structure to the dialogue as a whole*, clarifying the dynamics of each individual contribution in terms of the overall argument.

To illustrate these advantages, consider for example the conversation extract (inspired by real posts on Amazon) shown in figure 2 reviewing book B. The argumentation can be summarised as:

- *User1* provides an argument in favour of the book:
  - **A1:** I am a scholar in the area of AI; I strongly recommend the reading of the book; THEREFORE this is a good reading
- *User2* replies with two arguments: an opinion about the topic and an attack to A1:
  - **A2:** I have read the 2nd book of the series of B; This wasn't a good reading; THEREFORE book B couldn't be a good reading either.
  - **A3:** *User1* says that book B and its series are good; *User1* posted a hard criticism and discouraged the reading of the book B in a previous review; THEREFORE the review of *User1* is inconsistent with what he said previously
- Finally, *User3* replies to *User2* with an argument that supports the argument of *User1*:
  - **A4:** *User1* is a scholar in the area of AI; *User1* discourages the reading for non-scholars of the 2nd book of the series of B; THEREFORE the 2nd book of the series of B isn't a good reading for non-scholars

Following [14], these arguments could be translated into argumentation schemes as:

A1: Argument From Expert Opinion
    Major Premise: Source *User1* is an expert in subject domain *AI* containing proposition

Figure 2. An example on Amazon reviews

book B is a good reading

Minor Premise: *User1* asserts that *book B is a good reading* is true

Conclusion: *book B is a good reading* is true

CQ1: How credible is *User1* as an expert source?

CQ2: Is *User1* an expert in the field *AI* for which *book B is a good reading*?

CQ3: What did *User1* assert that implies that *book B is a good reading*?

CQ4: Is *User1* personally reliable as a source?

CQ5: Is the proposition *book B is a good reading* consistent with other experts assert?

CQ6: Is *User1*'s assertion based on evidence?

A2: Argument From Position to Know

Major Premise: Source *User2* is in position to know about things in a certain subject domain *books on B series* containing proposition *book B is a good reading*

Minor Premise: *User2* asserts that *book B is a good reading* is false

Conclusion: *book B is a good reading* is false

CQ1: Is *User2* in position to know whether *book B is a good reading* is true of false?

CQ2: Is *User2* an honest source?

CQ3: Did *User2* assert that the *book B is a good reading* is true or false?

A3: Argument From Inconsistent Commitment

Initial Commitment Premise: *User1* has claimed that he is committed to proposition *book B and its series are a good reading*

Opposed Commitment Premise: Other evidence shows that *User1* is not committed to proposition *book B and its series are a good reading* since he discouraged the reading of the book *B* in a previous review

Conclusion: *User1's* commitments are inconsistent

CQ1: What is the evidence supposedly showing that *User1* is committed to proposition *book B and its series are a good reading*?

CQ2: What further evidence in the case is alleged to show that *User1* is not committed to proposition *book B and its series are a good reading*?

CQ3: How does the evidence from premise 1 and premise 2 prove that there is a conflict of commitments?

A4: Argument From Expert Opinion

Major Premise: Source *User1* is an expert in subject domain *AI* containing proposition *book B is a good reading*

Minor Premise: *User1* asserts that *the 2nd book of the series isn't a good reading for non-scholars* is true

Conclusion: *the 2nd book of the series isn't a good reading for non-scholars* is true (CQs as in A1)

By associating a scheme to each argument, opinions are given, obviously enough, a formal structure, which makes the pattern of reasoning explicit. Users could be asked to explain their arguments by using the critical questions of a schema. For instance, in the example above, A3 attacks A1 in fact by instantiating its CQ4. Or, A4 attacks A3 instantiating its CQ2. Moreover, users could be encouraged to clarify their position better: we have often found negative ratings of a product where the free text reveals that the bad experience was in fact related to the transaction (e.g. late shipment, item broken, etc.).

Of course for this situation to be realistic, users need to find the use of argumentation natural enough not to be discouraged to use it. Recent developments have introduced Web 2.0 standards to support on-line debate. Some contributions of this type are Cope_it! [8], which encourages collaboration by sharing opinions and resources; the semantic web-based argumentation system ArgDF [11]; Cohere [2], a web tool for social bookmarking, idea-linking and argument visualisation; the Argument Blogging project [15], which intends to harvest textual resources from the Web and organise them into distributed argumentative dialogues and the On-line Visualisation of Argument (OVA at ARG:dundee: www.arg.dundee.ac.uk) tools, which facilitate argument analysis and manipulation in on-line environments. Some examples of tools that are of a more formal and structured nature include the Parmenides system [3] and the Carneades system [6]. Despite the proliferation of these tools, their uptake by business oriented websites like Amazon is questionable, as their main interest is not to alienate users from their site by providing a seamless and natural interaction.

3. Conclusions: Desiderata for Argumentation enhanced Social Networks

In this work we showed how argumentation theory can provide valuable insights in formalising and structuring on-line discussions and user opinions in business oriented websites. We gave a model of social network, and we provided a case study of a commercial website, Amazon, fitting this model. Finally, we demonstrated how typical interactions in these environments could be seen as argumentation dialogues, and could in fact be enhanced by such features. Several conditions need to be verified before a more widespread uptake of argumentation techniques could be possible, however.

First, sites like Amazon should make each underlying social network explicit, so that users could exploit all information resources available in the website, in turn enhanc-

ing trust and reputation by providing public and transparent measures. Secondly, sites should provide easy-to-use tools for the quick and seamless identification of argumentation schemes in the line of reasoning that a user is following in a post. Although this aspect is more related to the advancement of the state of the art on argumentation and computation research, websites which decide for the uptake of a particular tool could grant some reward (e.g. positive feedback) to the users of these tools. Third, sites should provide tools to represent the dynamics of dialogues among users, so that attack and defense statements can be easily identified. Again, this comes at a considerable cost to the users (who would not necessarily be prepared to engage in a dialogue each time they want to leave a review for a product), so reward mechanisms should be used. Finally, sites should provide tools for summarising and analysing the information gathered from the schemes and attacks identification. A "summary" showing statistics and a graphical representation of debate on a product would represent a concrete added value for users, and an effective motivation to engage in argumentative activities. This it would allow, for instance, users to understand at a glance which is the most prominent view of a particular product they want to purchase, without having to read all reviews.

We believe that argumentation *can* make business driven social networking more rewarding, and we see this as one of the most promising application areas for research in argument and computation.

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