TOWARDS E-CONVIVIALITY IN WEB-BASED SYSTEMS

Sascha Kaufmann and Christoph Schommer
Department of Computer Science, University Luxembourg, 6 Coudenhove-Kalergi, 1359 Luxembourg, Luxembourg

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Abstract: Our belief is that conviviality is a concept of great depth that plays an important role in any social interaction. A convivial relation between individuals is one that allows participating individuals to behave and interact with each other following a set of conventions either shared, commonly agreed upon or at least understood. This presupposes implicit or an explicit regulation mechanism based on consensus or social contracts and applies to the behaviours and interactions of participating individuals. With respect to web-based systems, an applicable social attribute is to assist another user, guide him/her in unclear situations and help him in making the right decision whenever a conflict arises. Such a convivial social biotope deeply depends on both implicit and explicit co-operation and collaboration of natural users inside a community. An individual conviviality may benefit from the "wisdom of the crowd", which means that a dynamic understanding of the user's behaviours heavily influences the individual well being of other persons. To achieve that, we present the system *CUBA* which targets at user profiling while making a stay convivial via recommendations.

1 INTRODUCTION

We are concerned with the question of how e-conviviality can be achieved in a web-based system. In general, a concrete definition of e-conviviality does not exist and there is neither a clear model nor a singular vision of how it can be realized. A usage of the word in a communication environment like the World-Wide Web is often understood as a layout problem. Moreover, the relationship of conviviality to terms like amicability or comfort ability remains fluent: does conviviality refer to a place or a situation where someone is welcomed and/or feels well? Can conviviality be computed by algorithmic parameters, being adjusted and adapted? May external signal be considered and internal rules be activated such that we can obtain conviviality?

In literature, there exist several definitions of what natural conviviality is, e.g. (Britannica, 2008). But especially in the area of computer science, a convincing definition for e-conviviality is missing. It is mentioned that e-conviviality is widely used as a synonym of a user-friendly event, being often equated with Graphical User Interfaces. It occurs also in conjunction with digital cities and normative agents (Caire, 2007), Design Processes (Fischer and Lemke, 1988) or more generally in the context of sharing and enjoying a "good time" with others.

An interesting idea is proposed by (Illich, 1998) who associates conviviality with software tools as the result of a conscious decision: "I am aware that in English convivial now seeks the company of tipsy jolliness, which is distinct from that indicated by the Old English Dictionary and opposite to the austere meaning of modern eutrapelia, which I intend. By applying the term convivial to tools rather than to people, I hope to forestall confusion." And, in fact, (Illich, 1998) intends to bring the technology to the level of "ordinary" people making it accessible (and hence usable) to everybody. The idea is to enable (potentially all) users to use technique in a better/smoother way. Instead of certain specifications on how convivial (software) tools should look like or should be used, Illich proposes some characteristics of convivial (software) tools. Unfortunately, these guidelines have not been intended to the World Wide Web.

2 WISDOM OF CROWD

With respect to e-conviviality, a promising approach is to foster the principles of wisdom of crowd. The term has been populated by (Surowiecki, 2005), who argues that situations exist where a group of people (crowd) come up with a better solution to a problem than the group's smartest individual (person, expert).

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However, to be authentic, a certain number of conditions must be fulfilled to gain from the wisdom of crowd. Following (Surowiecki, 2005), the diversity of the existing points of view, a decentralisation and the independence of the participants, and a form of aggregation must exist. The main idea behind the diversity of points of view is that knowledge – being unavailable for experts (the so called private or local knowledge) – must be collected when it is used for the final solution. To ensure that such knowledge is not influenced by other group members, there exist certain requirements such as decentralisation and independence. At the end, an independent instance aggregates the different knowledge to the wisdom of crowd. This can be obtained in different ways, which means that there is no well-defined way of coming up with the perfect solution.

We believe that e-conviviality is a concept of greater depth that plays an important role not only in social interactions but also in the internal regulation of social systems. Convivial relations between individuals are the ones that allow individuals to behave and interact with each other following a set of conventions either shared, commonly agreed upon or at least understood. This presupposes implicit or explicit mechanisms, which are based on consensus or social contracts, and applies to the behaviour and interactions of participating individuals. We think that individuals inside the community may benefit from the wisdom of crowd, which means that a dynamic understanding of the users' behaviour may heavily influence the well being of individuals.

3 A CONVIVIALITY ENGINE

With CUBA (Conviviality and User Behavior Analysis), we follow the given concepts and focus on aspects that are concerned with usability and content awareness. We foster presentation of the right information at the right time in a direct way through the principle of personalization. We believe that this will influence the level of conviviality during the stay on the web page. The aim is to allow the visitor to use the environment in a free way and to recommend him content, which he might be interested in. This is accomplished by an analysis of: a) how does user organize his content, b) how does he act during his stay at the web system and c), to what extent can the crowd reasonably contribute. Our understanding is that the combination of these factors helps the user to experience conviviality.

3.1 A Set of Topics

We primarily take advantage of the Non-Obvious Profile (NOP) approach, which was introduced by (Mushtaq et al., 2004) and extended in (Hoebel et al., 2006). The main idea is to define a set of topics Tp_i that describes the content of a web site in a proper way

$$Topics = \{Tp_i\} \tag{1}$$

with $i = 1,\ldots,n$. With respect to this, a topic Tp_i also corresponds to a certain area of interest. A weight indicates the relative importance of a topic to the content, having a value between

$$0 \leq Tp_i(content_h) \leq 1 \tag{2}$$

and reflects the level of interest ranging from *not relevant* to *very relevant* ($i = 1,\ldots,n$ and $h = 1,\ldots,m$).

3.2 Zone Weighting

In its first version, CUBA implements a newsreader, where users can selec feeds they are interested in. Each feed f_i is displayed in its own zone $Zone_{f_i}$ with associated topic weights $Tp_i(f_i)$, reflecting the content of the feed.

CUBA allows web pages with an individual layout of sets of zones. Note that in our case it is therefore not possible to assign static topics and values to such web pages. To calculate $Page_j(Tp_i)$ we come up with the following model: in general, a page reflects the interests of an user. CUBA supports the (re-) arrangement of feeds that will usually lead to a placement of interesting feeds at the top of the page. We then calculate $Page_j(Tp_i)$ by targeting all zones $Zone_k(Tp_i)$ of $Page_j$ weighting each zone with respect of the importance for the user. For this, a diverse number of strategies has been considered, where some of them are presented in Figure 1:

- the dovetailing strategy follows the assumption that the more a user is interested in a content the higher the assigned value will be.
- the coating strategy says that the left-most/topmost content receives the highest weight again but that in contrast to the dovetailing strategy each following inverse coat – identified by the diagonal – is assigned the same weight.
- the waving strategy, where we perform a weighting following the radius around the top content.

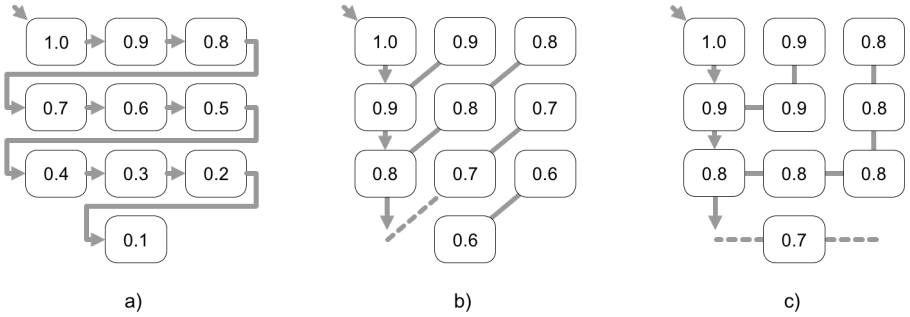

Figure 1: Example of possible value assignment strategies for a layout with 3 rows (a) *dovetailing*, b) *coating*, and c) *waving*). The boxes represent content with their (relative) importance for the user. Arrows represents the way of calculation.

3.3 Interest Profile

We see an Interest Profile (IP) as a way of modeling the level of the users' interest in topic Tp_i. Within a session, the visiting time and all actions on each page are recorded. When the user quits the system, the NOP-algorithm automatically computes the interest profile of the user. This is done in two steps, each considering a different approach: in the first step, the Duration Profile $DurP(i)$ for each topic i is calculated. We hereby take into account the duration of viewing $Page_j(Tp_i)$ in relation to the total time of viewing all pages. This part reflects the users' "general" interests, because it considers the page layout and how long the user "read" (i.e. stayed at) a page:

$$DurP(i) = \frac{\sum_j (duration(Page_j) * Page_j(Tp_i))}{\sum_t duration(Page_t)} \quad (3)$$

Next, we determine the Action Profile $ActP(i)$ for all Tp_i. We include all actions involved with Tp_i and multiply this value by the number of topics Tp_i of the zone where they occurred. The result is also set in relation to the total sum of all actions that are involved with Tp_i during the whole session. This part takes the current interests of a user into account. It is also possible to model different kind of actions (e.g. open an article may be a stronger indicator than reading the article's preview):

$$ActP(i) = \frac{\sum_k (\sum_l Action_l(Tp_i) * Zone_k(Tp_i))}{\sum_s Action_s(Tp_i)} \quad (4)$$

Finally, we combine both profiles by calculating

$$NOP_{Session}(Tp_i) = \alpha * ActP(i) + \beta * DurP(i) \quad (5)$$

where $\alpha + \beta = 1$ and $i = 1, \ldots, n$ in order to determine the $NOP_{Session}$ for this session.

The new NOP then replaces the old one (if existing). This is done with

$$NOP_{new}(Tp_i) = \frac{\sigma * NOP_{old}(Tp_i) + \gamma * NOP_{Session}(Tp_i)}{\sigma + \gamma} \quad (6)$$

with $i = 1, \ldots, n$ where we multiply the current non-obvious profile NOP_{cur} by number of sessions σ and add it to $NOP_{Session}$ with a factor γ. We finally divide it with $\sigma + \gamma$. Here, γ signalizes how strong the impact of $NOP_{Session}$ to the new profile NOP_{new} will be. We inform the user explicitly about his current interest profile. In case the user updates his interest profile IP_U we use

$$NOP_{U_{new}}(Tp_i) = \frac{NOP_{U_{cur}}(Tp_i) + IP_{U_{new}}(Tp_i)}{\kappa} \quad (7)$$

with $i = 1, \ldots, n$ and $\kappa = 2$ to re-calibrate the user's current non-obvious profile for further usage.

If the visitor asks for support, then CUBA compares the current interest profile with similar existing profiles inside the community and recommends content that may fit following the match. By now, the euclidean distance between the users does this matching:

$$d(U_j, U_k) = \sqrt{\sum_{i=0}^{n} (NOP_{U_j}(Tp_i) - NOP_{U_k}(Tp_i))^2} \quad (8)$$

This allows CUBA to identify users with similar interest profiles. As an alternative, we consider to use the Pearson correlation, because it helps to identify users with similar differences in their topics. This could results in different recommendations.

The feedback to the given recommendations (accept or reject) will influence the visitor's profile on CUBA again. This is being done in an indirect way: if the user accepts a recommendation, the chosen feeds

will become part of his web site. As a result, the page will be considered as new and its topic weights will be recalculated and will become part of the duration profile (3).

However updating all the user profiles may become very expensive. We therefore foster the usage of clustering in CUBA. The idea is to cluster the profiles of the community in a regular interval. When the profile is modified, we then simply put it in the best fitting cluster to do further recommendations.

3.4 Measuring Conviviality

The question of how to measure the corresponding level of conviviality in CUBA leads to asking explicitly about the feelings and attitudes of an user. We can do this for example by introducing a button on each side, which is something like "I got the desired information". But it will be an additional action for the user, with no immediate benefit. Instead of using an explicit determination of the level of conviviality we chose an implicit approach by using a diverse number of web-analytic concepts (Sterne, 2002) like for example

- The duration of stay on the Web Sites. We may assume that a "longer" stay indicates interest and corresponds therefore to a higher level of conviviality (3). This practice is also applied to the duration of reading, for example the summary of an article.
- The question of how many actions the user performs during his visit? A high number of actions may indicate some kind of satisfaction (4).
- The interval of returning to a web site. A regular return may indicate a basic interest in the content provided by the web site.
- The number of accepted recommendations. Accepted recommendations may also be an indicator of conviviality because we can derive the quality of the recommendation algorithm. On the other hand, it will also be of interest to know how long the visitor keeps the chosen feeds to get a feeling how good it covers his needs.

3.5 Introducing Feeds

Taking the former actions and parameters into account, CUBA creates diverse interest profiles for each visitor. These profiles are updated regularly whenever a visitor performs an action. In case that CUBA finds profiles that are similar to the given profile, CUBA can recommend interesting feeds or articles. This is an important topic as the users gain from the knowledge of all other users. With respect to this, CUBA also helps to get in touch/contact with other visitors: this is an essential aspect of the traditional definition of conviviality of having a good time together.

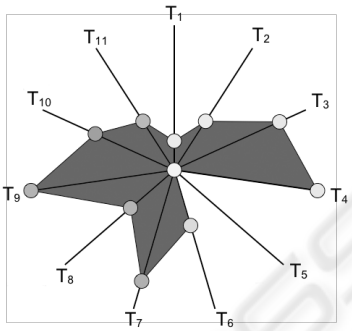

Figure 2: Graphical representation of a computed Non-Obvious Profile. Each dot represents a topic. The topic values are represented by the dots' positions along the axes, where they varies between 0 (non interests/center) and 1 (very high interest/outer edge of the wheel). Here, Topic T_5 has a value of 0, while T_4 and T_9 have a value of 1.

In general, the visitor may subscribe, re-subscribe, and arrange feeds on the personal page. He is allowed to update, open and close them, to read a preview of the selected content and to access it directly. While a user performs these actions CUBA builds an interest profile of that user as follows: a cancellation of a feed is understood as a non-interest in its related topics, whereas other actions like reading a preview or refreshing a channel are acceptable indicators for an interest in a channel and its topics. In addition, a closed channel is understood as a "basic but no current interests in the feed". Another indication might be the recording of the time with respect to the articles' previews. Even the position of the feed can be taken into account, where a "top-feed" (a feed that is at the top position) may be more important to the visitor than others. This is, because the user can read it immediately and without scrolling, even after the personal page is accessed. In Figure 3, a snapshot with the areas of the subscribed feeds is presented.

As mentioned in (Fischer and Lemke, 1988) it is also important to inform the user, why the system is doing an action to achieve any conviviality (we want avoid the impression the user is controlled by the system). CUBA respects this by giving the user the opportunity to examine his current non-obvious profile (Figure 2) and let him modify his interest profile. In a future release it is also planed to present informations about the community to the user.

Figure 3: With CUBA (www.cuba.lu) to foster on Illich's concept of conviviality. (1) shows a preview of a message, whereas (2) points to a currently closed channel. In (3), possible actions for a feed are presented, which are – from left to right – check for new feed entries, open/close a channel, and remove a channel from subscription.

4 CONCLUSIONS AND FUTURE WORK

In this work, we have introduced our concept of achieving e-conviviality by using the principles of wisdom of crowd and presented the "conviviality engine" CUBA . CUBA is a newsreader which allows the user to perform several actions. These actions are used to build (non-obvious) profiles which are the basis for CUBA's recommendation system along with mining profiles of "similar" users. But many questions still occur: what are generally the reasons for the user's actions? It may be normal in a long session to perform more actions than in a short one, but if many actions occur in a short session, we have to guess the reasons (e.g. is it an experienced user who knows how to navigate quickly, or does not he find the desired information and left the site). We may avoid this by introducing a button on each side, which is something like "I got the desired information" to get a way out of this dilemma. But it will be an additional action for the user, with no immediate benefit.

The best proof of an increased conviviality may be the visitor's loyalty, which can be expressed in different ways. If the user returns to the web-site in regular intervals, this possibly shows that the interests and emotions are met. To achieve this, probably the quality of the content (news) and the possibility to configure a personal environment is an acceptable argument, but other ways of attraction like award rankings or offer special services for people with a high loyalty are interesting as well.

By now, the implementation is performed in a closed environment. We already have explored the acceptance of CUBA by a diverse number of user sessions, being focused on the usability to raise the further acceptance of the visitors. We have got valuable comments but mostly positive feedback as well as important clues to improve the web site.

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