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*Putting Trust into E-commerce - One Page at a Time**

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Putting Trust into E-Commerce – One Page at a Time...

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ABSTRACT

One of the most important phenomena in E-Commerce is trust - customers are unlikely to complete transactions if they do not trust the web site they are using. Much thought has been given to aspects of buyer-seller trust in the area of how much the seller trusts the buyer, or at least how to ensure 'trust.' However, to date there has been little headway into the concept of how much buyers trust sellers, with some notable exceptions. In this paper, we present an architecture for E-Commerce web sites which uses a formalisation of trust to allow the *individual web pages* in such a site to reason about the amount of trust a browsing customer has in them and to adapt accordingly. This architecture builds on work in several areas, including personalisation technologies, retail management, HCI and multi agent systems. The paper discusses the concept of trust reasoning web pages, their implementation, and a proof of concept design architecture.

Keywords

E-Commerce, Trust, Personality in Web Pages, Adaptive Web Sites.

1. INTRODUCTION

Trust is a major factor in all kinds of relationships (see, for example, [10,1,9]), not the least of which is the buyer seller relationship [7]. It is important to realize that trust is, in fact, a two-way phenomenon. This is perhaps no more relevant than in E-Commerce. Were I not trusted to be who I say I am, an online company would not sell me anything... Credit card companies such as Visa and MasterCard have made great strides in ensuring for a trader that the people they do business with are trusted (or at least, are who they say they are, and that their bills will be paid, somehow). It is a sobering thought, however, that much smaller strides have been made in how much online traders are trusted. This is in fact despite the growing realisation that buyers trust in

sellers is an increasingly important aspect of E-Commerce [cf. 3,14,18].

A recent study [3] examined the phenomenon of trust in E-Commerce. With the intense focus on trust in E-Commerce that presently exists, this does not seem unusual. The study, however, was groundbreaking in that it was among the first work to concentrate on how much consumers trusted online stores or suppliers, and what could be done in order to facilitate that trust. The study in fact presented some worthwhile conclusions, many of which reinforced traditional views of trust (for example, that trust is inherently a *developing* phenomenon which starts out at certain levels and matures – there is no difference in E-Commerce trust, it seems). Many of the recommendations were also straightforward and, indeed, to be expected, and followed traditional lines such as providing security brands (such as Verisign or TRUSTe) and designing for proper navigation. Ultimately, however, the study was still disappointingly seller-oriented and focussed on 'experts' in the domain rather than the real people that will use such sites (with interesting results – while Cheskin might say a TRUSTe mark is a good idea, many online discussion sites are filled with comments from people who disagree, mainly because of a lack of trust in TRUSTe itself due to that organisation's past history [see, for example, 6]). Arguably the most important conclusion of the study was that "enhancing the perceived trustworthiness of a site significantly enhances the ability of a site to compete." [3, p.28]

In a recent paper [13] we suggested that the addition of trust to products that have already been developed and deployed (including web sites) was at best an unsatisfactory solution to a credibility problem that exists in technology and design. The solution is to incorporate models of trust and its facilitation into the design of products and technologies from their inception [ibid.]. Nowhere is this more important than in E-Commerce, where, for example, one in four purchases fail due to bad design or unsatisfactory service, with the additional result that 6% of purchasers would boycott a physical store if one existed due to their online disappointments [2]. We argue that designing to enhance trust can do no other than improve these statistics.

This paper introduces the concept of trust reasoning web pages, with a focus on E-Commerce. In section 2, we discuss the phenomenon of trust with regard to enhancing Marsh's computationally tractable formalisation in [10], and its possible

benefits. Section 3 expands on this discussion by focussing on web site design, how to build web sites that can help in enhancing trust, and providing some principles for such design (many of which are very straightforward). Sections 4 and 5 present more detailed discussions of web site design for trust, starting with basic implementation steps, and ending with complex, adaptive web sites where individual pages are responsible for their own adaptation to specific users with regard to not only trust, but also other social phenomena. In section 6 we provide an overview of a prototype web site architecture for trust facilitation based on these ideas, discussing its extension and future development, along with work in similar directions, in section 7. We conclude in section 8.

2. TRUST IN GENERAL

When discussing phenomena such as trust it is useful, if not necessary, to determine in advance what exactly is being talked about. Such social phenomena are difficult to clarify simply because everyone already ‘knows’ what they are. This, however, is not the place to enter into philosophical and sociological discussions of the basis of trust and its operation. For insight into this, see [10,5]. Much recent work has in fact gone into the trust phenomenon, and many definitions abound. One of the clearest, derived at least in part from Deutsch’s work [4], comes from Rousseau *et al.* [16], *vis*:

Trust is a psychological state comprising the intention to accept vulnerability based on positive expectations of the intentions or behaviour of another. [16, p.395]

This will do as well as any definition, and is more all encompassing than many. Indeed, it encompasses the E-Commerce trust problem very well, from both sides. Much of our own work has focussed on making trust computationally tractable, that is, enabling its incorporation into artificial agents [10]. One aspect of this work which extends the above definition in a certain way is that trust is inherently a *situational* phenomenon: the amount of trust we have in others varies according to the context in which we find ourselves, as well as prior experiences and present expectations. In other words, while I may trust a colleague to drive me to work in her car, but this trust might be vastly diminished should the mode of transport be a motorcycle, for example. Such situational considerations abound in all walks of life, and no less in E-Commerce. For example, I may trust a supplier to sell me a pair of socks online, but I’d feel wary about buying a motorcycle helmet. Why is this? Because trust is subjective, based on experience and domain knowledge, and situational. Interestingly (and purely subjectively!) I’d probably be happy to buy a car online, so the cost, to me, may not be that much of a barrier to E-Commerce trust.

In [10] we introduced a formalisation for the concept of trust which has since been adapted and applied to many different areas where trust is important (see, for example, [5]). While this is not the forum for rehashing the formulae, we briefly discuss it here. The basic premise is that of situational relevance as discussed above. In each situation, an agent can estimate the amount of trust it has in others via certain formulae. Put simply, the agent estimates trust in the situation from looking at its experiences in similar situations if possible, with the trustee, if possible. There

are several ways to work out the trust value for a specific situation, one of which is the mean of trust values from the outcomes of similar situations (which we refer to as a ‘realist’ view [11]). The second part of the equation refers to whether or not the agent will ‘cooperate’ (i.e., proceed with) in the interaction. This involves evaluating a ‘cooperation threshold’ in the situation, which is in its most basic form a $\text{risk_in_situation}/\text{competence_of_other_agent}$ equation. Should the amount of trust be greater than the cooperation threshold, cooperation occurs. Otherwise, cooperation either does not occur or requires certain safety nets. We conjecture that this formalisation can be applied to E-Commerce web sites, allowing a web site, page by page, to estimate the amount of trust a browser has in the site, and adapt accordingly to ensure greater trust.

One of the problems with this proposal is that trust is an inherently subjective measure which it is hard for the trustee to estimate. It’s even harder if the trustee is a web site. There are two ways in which we can in some way work towards eliminating that problem by ensuring web site ‘trustability.’ The first involves the static design principles of a web site, and the second, the dynamic reorganisation of the site, page by page, maintaining personality of site, amongst other phenomena. The next few sections address these mutually constructive approaches.

3. TRUST ME – I’M A WEB PAGE

While much of what follows is applied directly to E-Commerce sites, and is indeed applicable only to such a genre of sites, there are specific principles which apply to the design of any kind of web site. Recently, much interest has been shown in the proper design of web sites [14] and this paper is no exception. We argue that one of the major barriers to the building of trust in web sites per se is their poor design and execution. Broken links, bad grammar, useless pictures and long download times are sure ways to alienate the browsing public. That many of these principles are already known is not our main concern, since we focus on further aspects also. We do not apologise, however, for including them in this discussion. The building of ‘trustable’ web sites is an exercise which demands more than fancy adaptation. In other words, just because we can do something does not mean it should be done. Applying the adaptation suggested below in the wrong places will result in less, not more, trustable sites. The reader is encouraged to look to an understanding of which of the principles discussed below can be applied to different kinds of web sites, and further, to interface design.

4. BASIC STEPS IN TRUST FACILITATION IN E-COMMERCE WEB SITES

As researchers and practitioners have focussed on the usability of web sites it has become clear that the usability of a web site plays a large part in allowing successful transactions to take place. Usability is generally a product of good design - a conscious attempt by the creators of a web site (or any other product) to

anticipate the needs of their users and cater for them. One of the goals of designing a good web site is to establish oneself as a professional, credible organization. The quality of design, the effort taken to present clear, coherent and relevant information, appropriate use of graphics, etc. may be seen to serve a similar function as high quality interior design in a regular store or office. The marble pillars in a Bank imply permanence, solidity, wealth. They are intended to inspire trust in the Bank's customers (e.g. see [14]).

The design recommendations from web usability studies (e.g. [14,17]) can therefore be seen as recommendations that will improve the likelihood of a user completing a transaction on the site. In the most general sense, good design (and good usability) can therefore be seen to increase the trust a user might place in a web site.

Issues of usability design also seem to be directly linked to the degree to which users trust a site. In addition to issues of branding the Cheskin study [3] also found that navigation significantly impacts perceptions of a web site meeting consumers needs, particularly for lesser-known brands. For well-known brands, when fulfillment is weak, good navigation plays an important role in increasing the perception that a web site can meet customer needs (p29).

Although it is clear that good design and good usability play an important part in encouraging users to interact with a web site, many issues of design are static, and are fixed at the time of implementation. While good design attempts to provide the best solution for a wide population of users, software - and the web in particular - allows the personalization and tailoring of information to small audiences. The dynamics of trust, and the ability to adapt a design to improve the fit with a user, requires a more active approach to page design.

5. ADVANCING THE CAUSE – WEB PAGES AS AGENTS

The previous section's discussion raises several points about how proper web site design can help build a situation where a site becomes more attractive to a potential browser. This, coupled with trust-building mechanisms such as reputation and word-of-mouth recommendations, help attract browsers. The trick then is to build trust and confidence such that the browser turns into a buyer, or at least will be encouraged enough to return to the site at a later date. In other words, to further the concept of the 'sticky' site.

While the design principles above will no doubt contribute to site 'stickiness,' we conjecture in this work that there are other tools the site can use. In our case, we are focussing on the deliberate fostering of trust as a person browses a site. To do this, we use the novel concept of *web page as agent*, extending this concept with a site maintained user profile which we build transparently from the user, and with no explicit prompting of the user – the profile is built from interaction history alone.

The resultant site:

- maintains the user profile,
- enables each page to examine the profile and present itself accordingly to the user,
- enables each page to reason with and about trust, personality, and potentially other social phenomena,
- becomes adaptive on a micro level – each page adapts, rather than just the complete site,
- is a continuously learning and improving tool for the user.

The remainder of this section discusses the ideas of page as agent and automatic user profile generation. We then discuss how we use these tools to provide a site where each page adapts to the user, presenting information in the manner in which the page reasons the user will want it, and how we envisage this will increase user trust.

5.1 Page as Agent

The major focus on adaptation in the E-Commerce site is that of page as agent. In this paradigm, each web page has the responsibility to present its information in a manner which ensures that the user's needs are met. In this respect, each page has information to present, and a user profile which represents the information that can be obtained from the user's browsing history (see section 5.2). Using these data, and hard wired rules about how to construct web pages in specific styles (see section 5.4), each page agent constructs a web page for display on the user's browser. In fact, this is an extension of the principles of adaptive server page technology (we use Sun's JSP technology, as discussed in section 6).

The rules available to a page agent are specified centrally, and are dependent on the site's author. In our experiments, we concentrate on aspects of trust facilitation and personality construction. In specific, we follow rules such as those given in section 4. In addition, we use Reeves and Nass' work [15] to produce web pages that reflect a personality. In this work, we focus on providing personalities which match the perceived personality of the user, rather than its opposite (although the jury is still out about which approach is best [8]). In other words, we provide a 'submissive' presentation of information to those users we perceive are submissive, and similarly as regards dominant personalities. This approach is discussed further in sections 5.4 and 6.

Trust facilitation is a more complex issue since estimating user trust presents unique difficulties. It is hard to estimate trust values at the user's first visit, although subsequent visits may allow us to infer a higher trust each time. We discuss this in section 5.3. In our approach, we take a dynamic view of trust as given in [10]. In other words, the user's trust is a value on a continuous scale, which we represent in the range [-1,+1] (for a discussion on the reason the range is as it is, see [10]). This trust value is re-evaluated at each interaction. In other words, each page re-

evaluates the user's trust and adapts accordingly. Our approach, however, evaluates trust as being *in the site* rather than in each page. Thus, the site and the user are two agents in an essentially cooperative interaction, while the individual pages are the tools the site uses to communicate with the user.

5.2 The User Profile

The key to the adaptation and maintenance of trust reasoning web site remains the user's profile. While the site uses web pages to communicate with the user, the only means the site has to be communicated to from the user are the user's click throughs. In other words, we do not require anything of a user other than that they use the site as a normal web site. From a user's browsing history, we attempt to create a meaningful user profile. Naturally, this results in a usually less than perfect representation of a user. In our initial implementations of the user profile this is reflected in the simplicity of the data we aim to create. In this scheme, a user is represented by a few items of data only:

- Trust value estimate
- Personality inferred
- Browsing history, this interaction and previous visits
- Other data able to be gleaned, including browser type, machine type, email address, etc. as possible.

Thus, we do not require any user information above that which is readily available to any web site. Additional information is inferred and not guaranteed to be correct, thus is not available outwith the site, and is of little relevance anywhere else in any case.

5.3 Trust Reasoning Pages

Each page in the site is able to reason with and about perceived user trust in order to attempt to facilitate and increase the level of trust the user has in the site. To do this, each page uses the browsing history and trust value estimate. In addition, perceived personality and actual browsing behaviour can be used to estimate trust (see section 5.4).

Reasoning about trust requires that each page has a sensible foundation to work from. There are, in fact, only two real situations in this scenario:

- User is new to site, no interaction history available
- User is not new, interaction history (however limited) is available

Both of these cases can be handled by the trust formalisation in [10], and subsequent interactions serve to increase our estimate's accuracy by providing more data.

In the first instance, a user is new to a site, no matter which page they are visiting (we make no assumption that a user enters a site

at the front page, although most of the time this should be so). In this instance, the site falls back on previous experiences with similar users. As the user profile shows, we can ascertain certain information about a user on first visit, specifically browser and machine or OS type. From this information we can build a (scanty!) profile and estimate of user trust. For example, a user with the latest browser running on a Macintosh has more trust than a user running Netscape 4 under Windows 95 (none of which may be true, this is, after all, an example). This kind of information is built up from previous interactions with similar users. Thus, the more users that visit a site, the better the original estimate. In this instance, the value of user trust we use is similar to the concept of *General Trust* as set out in [10]. Note that, in an instance where there is no prior information (similar machine and/or browser) we fall back even further and use the concept of *Basic Trust* from [10]. In both cases, this estimate becomes our new user trust value. Subsequent uses of this value correspond to the concept of *Situational Trust*, especially when a user-page interaction takes place.

As may be expected, when we have a history of the user, we have already been able to estimate their trust. In this case, we are using the equivalent of *Situational Trust*. It is worthwhile taking a little time to discuss this concept further.

In [10] agents enter into essentially a cooperative situation and use trust as a means of determining whether or not to cooperate, with whom, and so on. While trust is not the only consideration in such matters, it is an important one and one which allows comparisons to be made between similarly competent agents. In any case, there was a requirement for maintaining an estimate of a *Cooperation Threshold*, a further means of deciding cooperation – if trust was below this threshold, ordinarily cooperation would not take place.

This arrangement is still viable in our trust reasoning web site, but in this, the site is attempting to reason with the other agent's (the user of the site) inherently subjective trust measures. Using these, the site attempts to ascertain the user's likelihood of continuing to interact with the site. Using this estimate, the site can take measures to attempt to increase trust if possible. This consideration estimates situational trust and cooperation threshold and compares the two to enable the site to make decisions based on the results. We provide a simple worked example of these considerations here.

5.3.1 Working with Subjective Trust – A Worked Example

In this example, we are assuming that the site is in the second state in the above discussion. In other words, it has a browsing history and is capable of using this to provide better measures of trust.

In [10], Situational Trust is estimated thus:

$$T_x(y, \alpha) = U_x(\alpha) \times I_x(\alpha) \times \hat{T}_x(y)$$

Where:

$T_x(y, \alpha)$ is trust of x in y in situation α (in other words, at this current page, where in our case, y is the site, and x the user).

$U_x(\alpha)$ is the estimate of utility x has from situation α (browsing this site at this page)

$I_x(\alpha)$ is the estimate of importance to x of this situation

$\hat{T}_x(y)$ is the estimate of user trust in y in general, which is in itself constructed from the history of past interactions in possibly similar situations. For a discussion of how agents estimate this, see [10].

It is as yet unclear to us how to estimate utility and importance in the web interaction, although this is something we are working on. One solution is to give each page an estimate of its own importance/utility values, which change according to the page's content. For example, a page used to get payment details is significantly more important than a simple introduction page, while a help page may well be seen as more important than an item description page. These settings are ultimately under the control of the site architect.

On this thread, we note that visiting certain pages on a site affects the trust value accordingly. For example, payment pages can increase $T_x(y)$, with the assumption that trust is higher if the user wants to buy from us. Company details or shipping policy pages may decrease or leave alone the value (asking for more details in an interaction may represent lack of confidence, or it may represent prudence...)

Cooperation Threshold is less important in this scheme than it may first appear, and indeed need only be worked out once. The explanation for this is relatively straightforward – if the user is here, they are cooperating in some way (they are browsing). They may at any time be above or below the cooperation threshold, but if they are still here they're still cooperating, and we can use this to allow us to build trust again. In other words, the Cooperation Threshold measure allows the site the opportunity to correct its behaviour as trust fluctuates. For the sake of completeness, however, Cooperation Threshold is determined as:

$$C_{-} T_x(y, \alpha) = (R_x(\alpha) / C_x(y, \alpha)) \times I_x(\alpha)$$

Where:

$R_x(\alpha)$ is the perceived risk involved in the (browsing session) situation for x

$C_x(y, \alpha)$ is x 's estimate of y 's competence in this situation (the browsing session)

$I_x(\alpha)$ is the situation's importance to x . In this instance, it's the importance of the browsing session as opposed to the importance of the specific page.

We are only moderately happy with this estimate, but have reduced its importance by calculating it once per browsing session. Further work is investigating a web site specific cooperation threshold measure, which includes judgements about page importance, and so forth.

In the worked example, consider a user x who has visited this site before. In this instance, the value of $T_x(y)$ (where y is the site) is increased slightly as the user has chosen to return. The user visits a help page, whose importance value is assigned as +0.75 (all measures are between -1 and +1) and utility as +0.5 (ideally, we'd design sites whose utilities were always +1!). Previous history gives a trust level of +0.45, calculated thusly:

When the user arrived, their initial profile was compared with other similar profiles, to arrive at a Basic Trust of +0.20. Subsequent interactions have served to increase this level – three purchases have been made (which increase trust by a specific level, dependent on price paid, etc., say in this instance +0.05 per transaction), the user has returned to the site twice before (also increasing trust, say be +0.05 again)) and the level is now estimated at 0.45.

The Situational Trust value for this page is estimated then at $0.45 \times 0.75 \times 0.5$, or **0.17**. This sounds quite small, but in reality it is higher than in previous interactions. We determine that visiting the help page is at best a neutral choice and trust is not affected by this decision. The cooperation threshold is estimated at (Risk/Competence) \times Importance, with values set up by the site architect at $(0.5/0.6) \times 0.9$ (we always overestimate importance, since an underestimate leads to an artificially low threshold, and the site will not behave properly to correct faults). Final value is thus **0.27**.

In this instance, the cooperation threshold is greater than the situational trust. Were this an agent considering cooperation with another, no cooperation would occur. It is, however, simply a site trying to estimate the level of trust a user has in it. As mentioned above, in this circumstance the cooperation threshold is of little importance other than informing each page how well it is doing with regard to keeping the user at the site. Here, the page can see that trust is lower than cooperation threshold and thus that it needs to try to build more trust as possible. The remainder of this section describes some of the things that a page can do to try to increase user trust. In addition, following all the rules given in section 4 can do no harm in this respect.

If the page constructs itself accordingly and the user continues to click through the site, we can increase the amount of trust by a value specified in the page itself (this related to the importance of the page as specified by the site architect). In this case, for example, we might increase general trust by 0.05 (a less important

page would perhaps increase this by 0.01, for example). Should the user go straight from the site, or to a page which represents less trust (company credit details, or instructions on how to return products, for example) we would decrease trust by the same amount. This revised trust value is now used in subsequent calculations for this user, and the site can continue to adapt accordingly.

Adaptation to increase trust is a relatively straightforward exercise. Most of the work to be done is given in the design guidelines in section 4. Other aspects are to maintain a sensible personality, not shifting too much to different styles during a session (a latency is applied to this kind of adaptation) – for more information, see section 5.4.

Other means of facilitating trust are being investigated at the time of writing. Specifically, we are interested in how to apply methods that work in societies, such as reputation management, referrals, available sanctions and third party certification. Methods such as TRUSTe and Verisign are steps in that direction but we believe will ultimately fail because of their own lack of consumer trust. It may be, therefore, that governmental regulation of trust management is one aspect which would work, although we do not advocate this approach.

5.4 Personality – Adapting a Page

This user profile is passed from page to page as the user browses. It is the responsibility of each page to use the profile in a manner relevant to the page and create a representation to the user accordingly. As an example, consider information about a specific book. A dominant representation of the book would use active

the history of those before to further reinforce the site’s inference regarding user personality and trust levels. To do this, we give the user browsing choices which we use in personality inference. For example, a page can include links to the same information (the same page) but worded differently. The wording will reflect the personality of the page that is created when the link is clicked. We can create dominant and submissive links to the same page, in other words, which, when one is chosen, reflect the user’s personality (or at least, the personality the user wants the site to portray). At each stage, the click throughs are evaluated and our confidence in our estimate of user’s personality updated. Depending on this level of confidence, each page adapts itself accordingly. It is important to note here that, while pages may display information differently, in all instances the information is the same – nothing is omitted from one page representation to another.

Representing personality in a web page follows Nass and Reeves’ suggestions [15]. Information content is not changed, but presentation is altered. Thus, colours used, language style, and page layout are all affected by the personality of the page being displayed. In addition, we follow our own rules for trust facilitation (see sections 4 and 5.3). The end result is a web page that not only reflects user personality but *because of this*, increases user trust. Each page, when our surmise is correct about the required personality (user keeps selecting links with similar personality) can increase the trust level we estimate the user has in the site. As discussed in section 5.3, there are in fact other cues we can use to alter the trust value.

6. A SIMPLE PROTOTYPE SITE ARCHITECTURE

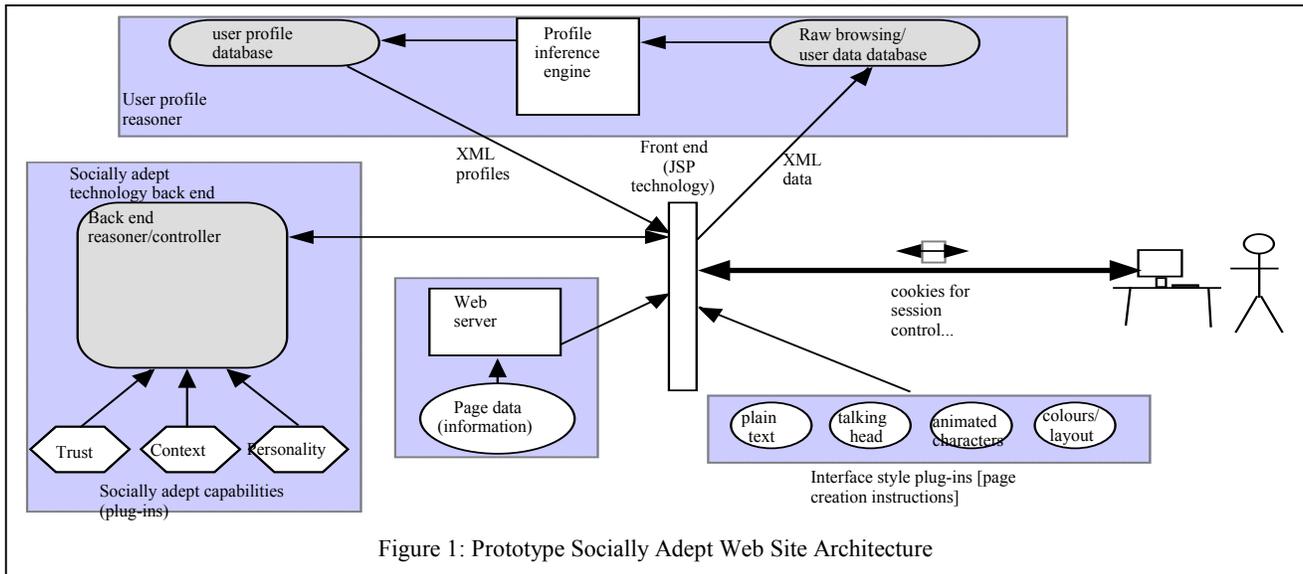


Figure 1: Prototype Socially Adept Web Site Architecture

verbs and terminology to describe the book to the (dominant) user (“This book is X,” “Buy this book,” “View similar books.”), while a submissive representation is more passive (“If you wish to buy this book...” “You might want to see similar books.”). We conjecture that presenting information in such a manner ensures trust facilitation. Each successive page in the interaction builds on

In order to test some of our hypotheses regarding trust facilitation and personality representation in adaptive web sites we have developed and implemented several simple testbeds for our work. These testbeds take the form of nascent web sites, implemented using Sun’s JSP architecture, each of which builds on those

coming before it in order to produce a working prototype. We expect to be able to give demonstrations of the final working prototype at the workshop.

The prototype has several aspects, as shown in figure 1. The main components are: web page construction data, user profile generator, socially adept back end reasoner, web page creator. Each of these components plays a critical part in the generation of each web page.

In the site, when a user clicks on a link, the page agent corresponding to that link is woken and given the user profile and other relevant information (such as where the user clicked from). This information is passed to the back end to generate appropriate trust and personality values for the page, which are passed back. Using these, the agent gets relevant page creation instructions from the available plug ins (such as text, animated characters, etc.), each of which contain instructions for how to construct pages in their own style. The personality is added by the page agent. The constructed page is passed back to the browser for display to the user which the page agent updates user profile and history information and saves this in the user profile database. The process is repeated every time the user clicks on a link to the site. Usual turnaround time is comparable to most web sites, with any delays offset by the clear benefits from adaptation to the user.

7. FURTHER WORK

This is a work in progress, and much of what has been documented here is in a state of flux. However, some aspects of the work are clearly amenable to extension and correction. One of the most important aspects here is that of each page being able to reason with more data than it currently has available. In future we will be extending the site architecture so that aspects of morality, ethics and other societal phenomena can be taken into account. Our ultimate goal is a 'socially adept' web page system (see [12] for more details on social adeptness) where each page truly is able to enter into a dialogue with the user, bearing in mind that in truth the site is in dialogue, and the pages are the means of that dialogue for the site, while the user's click throughs are their communication.

Additional further work is concentrating on adapting the trust formalisation to better reflect the web browsing experience. As mentioned above, we are looking closely at adapting cooperation threshold and trust formulae in this respect.

Our current architecture is a working prototype only. In the longer term, a fully working version of the architecture will be made available on the web for use and experimentation from any interested parties.

8. CONCLUSIONS

We have presented a web site architecture which uses the concept of page as agent. In this architecture, each page is able to reason

about specific societal aspects of dialogue and interaction between page (web site) and user. Initial work has concentrated on construction of pages with personality, and which can reason about user trust in web site. Initial results with a prototype architecture are promising, and a working demonstration version of the site will be available at the workshop for evaluation.

We believe this is the first truly adaptable web site, and that it is the first E-Commerce web site which pays more than lip service to the concept of user trust in a site. Specifically, the site pays attention to estimates of user trust and adapts accordingly in order to facilitate and if possible increase the amount of trust a browsing user has in the site, with the ultimate aim of encouraging user purchases and users to return to the site.

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