

An Interaction Design Perspective on the Pragmatic Web: Preliminary Thoughts

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Abstract: Much research has been done and put into practice during the last years in order to increase usability and accessibility of digital artefacts. It can be observed that their usage is no longer limited to professional work contexts but diffuses into all areas of life. This introduces a new spectrum of users, who do not always act purposefully nor rationally. Some services offered in the Web are well adopted by users while others are not, especially those services that are intended to assist users the most, e.g. electronic government services. This paper draws on research literature to investigate how the vision of the Pragmatic Web can contribute to the interaction design of services that are accessible, intelligible and relevant, whereas – in contrast to the Semantic Web – the interaction happens primarily between human agents, especially those non-expert users of technology. Results of the investigation point out questions to be addressed in the interaction design within inclusive usage contexts.

Keywords: Pragmatic Web, Human Computer Interaction, Semiotics

Categories: H.1.2, H.4.3, H.5.2, H.5.3, H.5.4

1 Introduction

During the last years, digital artefacts are being used in more and more diverse configurations. Within the context of this paper a “digital artefact” is anything created by humans and accessed via computerized technology (e.g. a word processing application running on a local PC, an electronic government service accessed via a mobile device, digital interactive television). Not only professionals are interacting with digital artefacts in a purposeful manner, but people are accessing services anywhere, anytime for different purposes, be it in a work context or simply for entertainment or other leisure related activities. [Bødker 2006] has coined the term “the third wave of HCI (Human-Computer Interaction)” to characterize this broadening and intermixing of use contexts and application types.

This third wave can be best described via juxtaposition with the second wave: the third wave is about non-work contexts, non-purposeful or non-rational actions, etc. It focuses on the cultural level and expands the view from mere cognitive to emotional aspects. This shift to the third wave in the HCI discipline – although leaving open still unsolved issues of the second wave – poses many new challenges and questions regarding interaction design.

We must not forget that a great number of potential users has difficulties to access those applications or services or has no access to them at all. Reasons for this are manifold: illiteracy, no experience in using digital artefacts, or special needs not attended by the service in question, only to name a few. In the context of Brazil for example, the Brazilian Computer Society has addressed this issue when defining the fourth of five “Grand Challenges in Computer Science Research in Brazil” as “Participative and Universal Access to Knowledge for the Brazilian Citizen” [SBC 2006].

The challenge refers to technological, educational, cultural, social and economical barriers to the access and the interaction with digital artefacts, whereas “access” is not only defined in the narrower sense of accessibility but in the more comprehensive sense of legibility, that addresses the problem of how to deliver information that makes sense and is relevant to users.

With regard to applications or services accessed via the Internet, today’s HTML-based so-called Syntactic Web does not offer many mechanisms to facilitate the understanding of content apart from content formatting and structuring. For example, the Wikipedia article on “Semantic Web” contains a thumbnail of the W3C’s Semantic Web logo (http://en.wikipedia.org/wiki/Semantic_web), but apart from the logo caption, nothing indicates that the depicted image is the logo of a W3C activity related to the subject of the Wikipedia article. Furthermore, it is not clear, how the article and the activity are related (e.g. if the article is a summary of the activities key findings, if the activity is an example of an institution incidentally working on the same subject as the article’s authors, etc.)

The Semantic Web has been proposed as an extension to the current Web with the intent to introduce meaning to Web pages, processable by human or machine agents [Berners-Lee et al. 2001]. Currently, many languages exist (e.g. RDF Schema; <http://www.w3.org/TR/rdf-schema/>), or the Web Ontology Language (OWL; <http://www.w3.org/TR/owl-features/>)), that allow for knowledge modelling and meaning sharing, and that provide a basis for semantic interoperability [Shadbolt et al. 2006]. However, the augmented semantic contents to a great extent remain inaccessible or unintelligible for human agents.

[Gandon 2005] illustrates some of the problems of retrieval of semantically annotated information and proposes a mechanism to facilitating the interpretation of query results. However, he does not treat questions related to interaction design. Despite this and other efforts having been made to make the Semantic Web intelligible for humans, according to [McCool 2005, p. 86] it will never achieve widespread adoption “because it’s a complex format and requires users to sacrifice expressivity and pay enormous costs in translation and maintenance”. However, [Singh 2002] claims that the vision of the Semantic Web can be implemented via Pragmatics, a branch of Semiotics that deals with context-based meaning. The purpose of this paper is thus to investigate how the vision of the Pragmatic Web can contribute to the interaction design of services that are accessible, intelligible and relevant, whereas – in contrast to the Semantic Web – the interaction happens primarily between human agents. The paper is organized as follows: [section 2] gives an overview of relevant literature in adjacent areas, [section 3] proposes an initial approach to conduct interaction design in the Pragmatic Web, and discusses the unveiled issues, [section 4] concludes.

2 Related Work –Pragmatic Research and the Pragmatic Web

The challenges that arise with the third wave of HCI require a socio-technical view. Organizational Semiotics (OS) is a discipline that recognizes the need to approach the question of how to facilitate and promote access to digital artefacts in a way that considers technical as well as social issues [Stamper 2001]. It focuses on understanding the different properties of signs on various levels to analyse and design information systems in terms of three human information functions: expressing meanings, communicating intentions and creating knowledge.

The primary focus of this paper lies in the pragmatic aspects of digital artefacts, i.e. intentions, motivations, negotiations or, in other words, the different actions that are possible to be executed on a digital artefact and the question why and how actions are executed. Pragmatics deals with intentions, communications, conversations, negotiations, etc., i.e. with the purposeful use of signs. Important concepts with regard to Pragmatics are the “pragmatic information”, i.e. the personal knowledge and experience of each communicating partner, the shared knowledge (that is higher if the partners are from the same cultural community), and the context where the communication takes place, whereas the context is comprised of elements such as speaker, hearer, intention, purpose, theme, time, location, etc. [Liu 2000, chapter 3.2].

Besides Organizational Semiotics there exist other approaches that are suitable to investigate these questions of users acting in a broader organizational context, whereas organization is defined in a broader sense than for example the work context. [Cordeiro and Filipe 2003] compare the Language/Action Perspective (LAP), Organizational Semiotics (OS) and the Theory of Organized Activity (TOA) and propose an integration of the three approaches into a combined one.

[Cordeiro and Filipe 2003] and [Goldkuhl 2005] show that there still exist many open questions with regard to conceptualization, explanation and understanding with the help of different action oriented or pragmatic theories. Theories adapted from reference disciplines have different strengths and weaknesses. The Language/Action Perspective for example presumes that actions are purposeful, neglects tacit communication and has a focus on a professional work context [Winograd 2006].

The integration of LAP, OS and TOA proposed by [Cordeiro and Filipe 2003] starts from a TOA activity and is based on a vocabulary mapping and on drawing analogies between the respective key concepts. Within their integration model, the human within his social domain is acknowledged as the central concept. OS's information fields like family, religion or country expand the activity domain.

LAP, TOA and OS are often applied to business contexts that substantially differ from Bødker's third-wave HCI. In this context users that interact with each other might be influenced by entirely different information fields, thus in the worst case, the only implicit shared context that can be assumed is the URL accessed via the browser. Actions are not always rational; often the primary purpose of an action is entertainment or distraction.

Regarding the analysis of actions and action repertoires, depending on the theoretical frame of reference, different concepts exist. [Gibson 1977, p.177] defined, “the affordances of the environment are what it offers the animal, what it provides or furnishes, either for good or for ill”. An affordance is “something that refers to both the environment and the animal”. Affordances in the sense of Gibson are inherent

properties that simply exist. [Norman 2008] introduced the term into design in 1988, referring himself to “perceivable affordances”, i.e. properties that do not simply exist, but that have to be perceived. Since then, the term has been widely adopted by the HCI community, not always in the sense originally intended by Norman. In a later essay, he introduces the term “(social) signifier” that should replace the term “affordance”. The term “social signifier” reflects the social character of most actions that we perform and on the other hand allows accidental signifiers: “the perceivable part of an affordance is a signifier and if deliberately placed by a designer, it is a social signifier” [Norman 2008, p.19].

In OS, affordances are used in the original sense of Gibson: they are invariant repertoires of behaviour and as such constitute the perceivable reality of a human agent [Stamper 2001]. Thus, Norman's “social signifiers” can be seen as an approximation to the affordances as defined in OS.

“Actability” is a similar concept that is concerned with social actions mediated by information systems. It has been defined as “an information system's ability to perform actions, and to permit, promote and facilitate the performance of actions by users, both through the system and based on information from the system, in some business context” [Cronholm 1999, p. 1076]. [Goldkuhl 2008] provides a comparison of “actability” with “affordances” in Gibson's sense.

From the perspective of interaction design, social signifiers, affordances and actability are concepts that are concerned with a pragmatically oriented action repertoire, i.e. the different actions a human agent can perform on a digital artefact. “Social signifiers” and “actability” seem to have a closer relation to the human-computer interface, whereas “affordances” in the OS sense emphasize the social context of the human agent. Furthermore, “affordances” exist independently of the digital artefact and thus seem to be an appropriate concept to be already considered in the phase of artefact creation.

Regarding the implementation of the Pragmatic Web vision using the theoretical constructs described above, examples from literature often refer to web services. A main difference of the approaches described below and our interaction design perspective is that web services often refer to electronic and not to human agents. However, many results below can be mapped or adapted to our case.

With relation to web services, [Singh 2002] identifies challenges that cannot be addressed by merely considering the Syntactic or Semantic Web, but that require a pragmatic view of the problem. For example, web services cannot be fully described by the methods they provide; instead, a model that permits the negotiation between service provider and consumer about if and how to interact with each other would be more adequate. [Singh 2002] lists three principles of pragmatic web service design: user before provider, process before data, and interaction before representation.

Although [Singh 2002] is concerned with web services provided and consumed by electronic agents, the challenges and principles he identified can be partly matched to human agents. E.g., the principle “interaction before representation” that refers to hiding “excess” semantics when describing the interaction specifications of services clearly applies to the modelling and implementation of (inter-)action repertoires in the human-computer interface.

Another milestone in the relatively recent history of the Pragmatic Web is the paper by [Schoop et al. 2006], in which the Pragmatic Web vision is defined as “to

augment human collaboration effectively by appropriate technologies, such as systems for ontology negotiations, for ontology-based business interactions, and for pragmatic ontology-building efforts in communities of practice” [Schoop et al. 2006, p.76]. Scientific contributions in the area reveal different understandings and accentuations of the term “Pragmatic Web”.

[De Moor and van den Heuvel 2004] adopt a semiotic perspective to examine how virtual communities can pragmatically select web services. Since the purpose of their work is theory construction, it has to be examined whether and how this methodology can be adopted to our usage scenario. On the other hand, it has to be questioned, if their approach can be adapted to be applicable by communities of “non-expert”/non-technical users. Furthermore, it is not clear, how the challenges identified by [Singh 2002] are addressed.

[Liu 2008] explores the context of pragmatic web services. He describes methods of how to construct, discover and rank pragmatic web services in order to be able to use the right service at the right time. Although the author works with computational agents, some of the concepts might be mapped to human agents. For example, a pragmatic web service can be interpreted as an element of the action repertoire. For a given user, alternative candidates may exist that all yield the desired result, but that may be more or less appropriate.

[De Moor 2005] addresses the problem of modelling context in the Pragmatic Web and proposes pragmatic patterns for the meaning negotiation processes. Meanings are assigned to syntactic resources and formalized in ontologies. Meaning alignment is concerned with the compatibility of ontologies. Ontologies are modelled on the semantic and used on the pragmatic layer: agents in the Pragmatic Web select meanings and meaning representations and negotiate meanings among each other.

In our approach, we adopt the conceptual model of the Web by [de Moor 2005] with semantic resources in the Semantic Web layer and a set of pragmatic contexts in the Pragmatic Web layer. The semantic resources exist mainly in the form of ontologies, i.e. we agree with [de Moor 2005] and use a mix of large, detailed, standard ontologies and independent, domain-specific micro-ontologies. These are supplemented by potentially large folksologies, i.e. ontologies that contain an unrestricted and non-stable set of entities and that are generated by amateur users in an uncoordinated way [Spyns et al. 2006].

3 A view on interaction design in the Pragmatic Web

The previous section has shown that the Pragmatic Web is a still emerging area with different ideas and approaches, many of which build on the Syntactic Web and are concerned with (semi-)automated agents or expert human agents. The goal of this section is to explore how the concepts of the Pragmatic Web can be applied to the interaction of non-expert human agents and what design questions arise in this context. “Non-expert human agents” include users with special needs, low or no literacy skills and no or low computer skills.

Regarding non-expert human agents, the following questions arise: How can users select meanings from already existing ontologies? How can users create or adapt meanings? What are good meaning representations? How can users negotiate meanings with other users or non-human agents? These questions are interrelated and

have a common denominator: How can users benefit from more legible and more relevant information without having to worry about the conceptual aspects of the Pragmatic Web. For example, we cannot expect users to construct meanings querying and aligning different existing ontologies. End users should not be concerned with reading ontology diagrams or other representations. Required meaning negotiation processes should occur transparently to the user.

Under an actability perspective, the action repertoire of a system can be induced from the individual user's pragmatic context, i.e. it is the result of meaning selection and negotiation. In contrast to examples of actability related papers (see [Goldkuhl 2008] for further references), we cannot always presume a work-practice context and structured interaction among users. The action repertoire depends on the individual pragmatic context and can be different for different users. Moreover, the action repertoire cannot be exhaustively pre-defined and hence must be extensible to accommodate different meaning selection and negotiation processes and to enable novel ways of use. Finally, the action repertoire should not be defined on a per-system, but on a per-concept basis to ensure consistency of action repertoires for similar concepts in different systems.

3.1 An example and a preliminary case study

The following example serves to illustrate our considerations and to indicate some of the arising questions. In contrast to scenarios often found in the Semantic Web literature (e.g. [Berners-Lee et al. 2001]), this example does not include electronic agents that automatically interpret or negotiate meanings but has a focus on pragmatic aspects of interaction between human agents.

A user of a social network service (SNS) like Facebook or MySpace is confronted with various pieces of information when moving around in the network. Depending on how the user interprets these pieces of information, different actions are afforded, all of which depend on the pragmatic context of the current user. Initially, meanings and action repertoires might be limited by the current service. For example, within the context of the SNS in question, a user is defined by a user name, an optional e-mail address and a personal page with a guest book. The action repertoire associated with a user and provided by the SNS is comprised of leaving a message in the guest book, adding a user's e-mail address to one's personal address book and sending synchronous or asynchronous messages to a user using tools provided by the SNS.

In this small example the repertoire of relevant actions could already differ for two distinct users: the e-mail address would be irrelevant to a digitally illiterate or semi-literate user without an e-mail account, and thus, the action "add to address book" would not be part of her/his personal action repertoire. On the other hand, a blind or illiterate user would opt to send and receive audio instead of text messages, whereas a deaf and literate user would prefer to send video messages in sign language to a user who accepts incoming video messages in sign language. A simple implicit meaning negotiation process between a literate and an illiterate user would yield the result that "send message" means "send an audio message".

Meanings and action repertoires can be extended if the user acts outside the SNS in other systems. For example, if the user is also a member of another SNS, he might be able to perform additional actions depending on whether other users (or any other

concept) reside in only one or both SNSs. If a user is also defined by a telephone number in the other SNS and the user in question has got a Voice over IP (VoIP) account from a third provider, s/he should be able to call telephone numbers of users in the SNS via her/his VoIP account. On the other hand, if two users already share a pragmatic context, they could also share meanings of further concepts and action repertoires associated with those concepts. For example if two users are part of the same SNS, have a shared pragmatic context with regard to the “user” concept, and similar action repertoires associated with that concept, user A could share a new communication method (e.g. “send SMS”) with user B.

The above examples are inspired by the e-Cidadania (engl.: e-Citizenship) project, the goal of which is to search for methods and system designs that provide access and make sense to the users' community, thus supporting the formation of a digital culture that respects the diversity in our society. Within this project, a SNS is being developed using OS as a frame of reference and following principles of Universal Design and Participatory Design (cf. [Neris et al. 2009] and <http://www.nied.unicamp.br/ecidadania>).

Many of the pilot users have no or almost no experience in the use of computers, the Internet and SNSs, some users have low literacy levels. The pilot users can be characterized as mainly belonging to the social class of the working poor and usually access the Internet at the local telecenter. Many of the pilot users own no e-mail account; most of them do not use instant messengers or other online communication tools.

The SNS implementation is based on an off-the-shelf content management system (CMS) that has been enhanced with additional functionalities. One of the core functionalities is the possibility to record video and audio messages as a complement to text. During activities with the pilot users, it became clear that the action “making a comment” does not necessarily mean to “write a comment and optionally add an audio or video message”, but could mean just to “leave an audio or video message”. As a result, the comment form has been changed to not requiring a text body as originally designed by the CMS provider.

An example to illustrate the different perspectives of actability and affordances is the area containing the list of online users. Regarding actability, clicking the user's name permits viewing his or her profile. Seeing a user's name in the list of online users affords to start a conversation even if the system does not permit it (yet). Hence, the actability perspective permits to detect e.g. a missing functionality during the analysis phase, whereas an analysis of affordances would have defined the need for this functionality during requirements specification.

3.2 Discussion

The example and preliminary case study above and the approach to use Pragmatic Web techniques for direct interaction between human agents raise many questions. From the point of view of pragmatic interaction design, most of these questions are concerned with meanings, actions, and action repertoires. In order to structure the discussion, we use the organizational “onion” [Stamper 1993b], which describes an organization as consisting of three main layers of information systems: the informal, the formal and the technical information system (IS).

For each issue or question discussed, we indicate the implications on interaction design.

Technical IS: Storing of meanings and action repertoires. Meanings and actions should be shareable or reusable across system boundaries. Furthermore, a user potentially accesses Web based services via different channels in different environments. Thus, a purely local approach to storing would be infeasible. On the other hand, a remote centralized or distributed approach would have to be flexible and easy to use. Regarding interaction design, storing or accessing meanings and action repertoires should be as transparent as possible, and a user should not be bothered if storage is central or distributed.

Technical IS: Interoperability. The access to proposals of meanings or instantiations of action repertoires provided by different entities might require a prior registration. Thus, authentication and seamless, interoperable service execution are important aspects. E.g. two users who meet in a SNS and want to start a conversation using a tool outside the SNS they met in, should be able to do this transparently without needing to authenticate twice and without even leaving the SNS.

Formal IS: Formal representation of meanings and action repertoires. There exist various languages or notations to represent meanings. A representation of actions and action repertoires could be inspired by web service notations, bearing in mind the shortcomings described in [Section 2]. A great challenge for interaction design will be to translate the formalisms into user interfaces and processes that are meaningful to the user.

Formal IS: Creation, adaptation, and sharing of meanings and action repertoires. Based on the formal representations mentioned in the previous item, procedures have to be established to enable sharing and adaptation of meanings and action repertoires. The challenge for interaction design does not only lie in the translation of those procedures into meaningful interactions, but also in the impact this item has on the informal IS. E.g., privacy is an important issue here, since a user might want to share certain meanings only with certain users. One approach would be to share only meanings that are minimally required for the interaction with a current user. However, this approach could unnecessarily limit the evolution of other users.

Informal IS: Meaning negotiation. The example above has shown a simple case of implicit negotiation. However, if two users have to negotiate the meaning of concepts that either user selected from different semantic resources, mechanisms have to be provided that are compatible with the abilities of the end users. E.g. for a user with some digital literacy, “collaboratively creating a document” might mean “locally editing a document and sending it via e-mail to the collaborator”, whereas to a fully digitally literate user it might mean “using an online collaborating tool”. Conversation patterns like “Conversation for Possibilities” might provide a starting point for further investigations. Meaning negotiation can be complex. A challenge for interaction design is to enable meaning negotiation considering the different abilities and needs of users.

Informal IS: Changing pragmatic contexts. Users may move in different pragmatic contexts, for example work and private contexts. Meanings or actions relevant in one context might be irrelevant in other contexts or even differ. Depending on the current pragmatic context, it must be possible to select the adequate set of meanings and actions. Furthermore, different meanings and differences in the action

repertoire have to be accommodated by interaction design. E.g. compared to the work context, within the private context, an action “invite user to event” might propose a less formal invitation template and use a different channel for sending the invitation.

All layers: Theory of interaction design. The items above show that the Pragmatic Web affects interaction design on all three layers of information systems. We expect that “third-wave HCI” services that focus on concepts, meanings and associated actions pose other new requirements on interaction and interface design. Because of the greater diversity, we as HCI practitioners know our users and their use contexts less than ever. Regarding relevant meanings and action repertoires, it is not enough to rely on assumptions made by software engineers, interface designers and the like. Participation of end user representatives is crucial. Thus, we recommend an inclusive, universal and participatory approach in analogy to [Baranauskas et al 2008]. As to methods for defining meanings and action repertoires, the Semantic Analysis by [Stamper 1993a] seems promising, since ontology diagrams in this method already consider agents and affordances.

A problem that remains is the question of how to establish that connection between the formal and the informal. HCI theory has only recently begun to embrace the informal aspects of interaction design. Methods are emerging, but are not yet complete enough to analyse all phenomena, let alone design interaction comprehensively considering informal aspects.

4 Conclusion and Future Work

Based on the observation that the use of digital artefacts has significantly changed during the last years and that today users interact with those artefacts in different contexts, with different purposes and competencies, we investigated how the vision of the Pragmatic Web can contribute to the interaction design of services that must be accessible, intelligible and relevant.

Concepts currently being elaborated by the Pragmatic Web community, such as pragmatic patterns, pragmatic contexts, as well as methods and techniques from other areas, such as Organizational Semiotics, Language/Action Perspective or Socio-Instrumental Pragmatism provide promising starting points to define a frame of reference for analysing and designing accessible, intelligible and relevant services. The example and discussion from the previous section have posed many questions one of the more important ones in our research context being the question of designing interaction inclusively and universally.

Our next steps in this research include the formalization of a methodology to be adopted drawing on already existing methods from related areas. In parallel we envisage the participatory design and development of a prototype that explores our considerations from [section 3] regarding pragmatics in the inclusive usage of the Web.

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