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Social and Technical Aspects of Collaborative Design Web Interfaces

Aspectos Socio-técnicos das Interfaces Web para o Design Colaborativo

CÉSAR ROCHA MUNIZ

Architect and Urbanist (Faculdade de Arquitetura e Urbanismo da Universidade de São Paulo). Master of Science in Architecture and Urbanism and Doctorate student. (Escola de Engenharia de São Carlos da Universidade de São Paulo). Professor and coordinator at Curso de Arquitetura e Urbanismo das Faculdades COC – Ribeirão Preto, SP

arq.cesar.muniz@gmail.com; *cmuniz@usp.br*

AZAEL RANGEL CAMARGO

Civil Engineer and Master of Science in Architecture and Urbanism. (Escola de Engenharia de São Carlos da Universidade de São Paulo – EESC-USP). Doctor of Philosophy in *Urbanisme et Amenagement, Politiques Publiques* (Institut d'Urbanisme de Paris Université Paris Val de Marne). *Professor Associado* (MS-5) at Departamento de Arquitetura e Urbanismo - EESC-USP.

azaelrca@sc.usp.br

Abstract

Based on the Social Construction of Technology model, this work examines the collaborative design in Information Society. It comprehends some cognitive aspects of interface and discusses social and technical issues of collaborative work in different community types. Sustained by an empirical study of web interfaces, it establishes some recommendations for the construction of collaborative design interspaces and identifies some possibilities provided by Information and Communication Technologies (ICTs). It concludes that if we avoid technologically deterministic approaches, there are strong evidences that ICTs provide special support for collaborative design practices and socially relevant technology oriented to creation and transfer.

Keywords: Information and Communication Technology; Interface; World Wide Web; Design; Collaboration.

Resumo

Este trabalho aborda o design cooperativo no contexto da Sociedade da Informação e, do ponto de vista teórico-metodológico, baseia-se no modelo da Construção Social da Tecnologia. Além de contemplar alguns aspectos cognitivos da interface, discute aspectos sociais e técnicos do trabalho colaborativo segundo diferentes classes de comunidades diferenciando-o de outras formas de participação. Com base num estudo empírico de interfaces web, estabelece algumas recomendações para a construção de interespaços colaborativos de projeto e identifica possibilidades oferecidas pela Tecnologia da Informação e da Comunicação neste campo. Conclui que, se abandonarmos

abordagens tecnologicamente deterministas, existem fortes evidências que a tecnologia da Informação e da Comunicação viabiliza, de forma privilegiada, práticas colaborativas de design voltadas para a criação e transferência de tecnologias socialmente relevantes.

Palavras-chave: Tecnologia da Informação e da Comunicação; Interface; World Wide Web; Design; Colaboração.

Social Aspects of Collaborative Design Web Interfaces

Introduction

The technological convergence supports a process that puts communication and information technologies together and weakens hindrances imposed by time and space. According to Manuel Castells (2000), fragmentation, decentralization and interdependency are aspects of the contemporary society that alter work and production relations in a planetary scale. This is the context of this work. It presents some results of a research that studies the socially relevant technology design in the Information Society. In this way, it belongs to a research field that gathers two concepts rarely seen together in an integrated way: Sociology and Technology.

Bertram Bruce (2002) states that "the mutual constitution of social relations and technologies occurs because technological artifacts are enmeshed in our activities and our connections to other people" (p. 55). He also says that we cannot, in this scenario, consider that neither technology nor social relations are constructed or evolve independently. In the same way, when they analyze the relations between science, technology and innovation as social constructions, Pinch and Bijker (1989) offer a similar vision. These researchers highlight that different social groups appropriate the same technical artifact in singular ways. Therefore, to make sociology of the techniques is necessary.

Adding another level to this question, Castells (2000) declares that information is raw-material and means of production nowadays. In the same way, discussing the information web as one of the main systems of contemporary society, Milton Santos (1999) strengthens the need of studies that bypasses the material aspects of the technical nets and that also includes social features. Regarding this, he reminds that the expansion of these nets occurs propelled by economic activities. In the transnational context they are, nowadays, components of the technology that constitutes fundamental supports of competition.

Information economy strengths one of the key features of capitalist doctrine: the competition. According to Brotchi (cited by BORJA, CASTELLS, 1997), information economy relies upon three factors: connectivity, innovation and institutional flexibility. This is a movement towards cost reduction and productivity increase that alters the weight and the significance of some production system variables. Considering that competition in the capitalist system is a form of conflict, we decided to

confront it with its opposite, the collaboration. By doing so, we noted that the new media potential is equally relevant and, consequently, it deserves more investigation.

The applicable production techniques, whether manufacturing or communicating in nature, are one of the main pillars of competition. The Information Technology (IT) is not apart from this rule. According to the vision of Milton Santos and Manuel Castells, the fast growing of IT research and development poles was not limited to the military or the academic spheres as the Internet history may suggest. Since the 70's, this growth aimed at the productivity increase and, as a result, greater competition. This apparatus, however, ended up being used in contexts which were different from those they were created for. Our object of investigation settles in this scenario: The adoption of Information Technology by communities as a way to increase cooperation, which is the opposite of competition.

Cooperation or collaboration have been identified within enterprise environment as an important work configuration, particularly because of their power to generate parallel processing and to increase the innovation possibilities (ERKKO, LAAMANEN, 1985). Nevertheless, the collaboration that seeks to be socially relevant is the one that matters to us.

Information and knowledge are social constructions that have a decisive role in the decrease of inequality. Otherwise, Information and Communication Technologies (ICTs) are reshaping the way information and knowledge are produced and distributed. This happens in different ranks. These processes happen both in the distance range — from local to global — as well as in the materiality range — from concrete to virtual. As a result of the transformation of information and knowledge in merchandise, these alterations can aggravate the inequality.

In this milieu, our work-hypothesis is that ICTs can also be appropriated in order to allow design collaborative practices for the production and transference of socially relevant technologies taken here as those capable to decrease inequality. To verify this allegation, we carried out an empirical research confronting institutional discourse with practices embodied in websites that, in most times, exhibit an ideology expressed with words such as 'values', 'mission', 'purposes' and 'strategies'. We analyzed the web use not only as data-base interface, but also as institutional interface. Finally, we intend to verify by which means ICTs constitutes a qualified resource to develop cognitive environments to the socially relevant design.

Cooperation, community and design

The knowledge produced in collaborative ways has altered many design practices. Virkkunen and Kuuti (1996) in a case study carried out in the Finnish public administration reveal that, alongside a transition from collective to individual focus, the knowledge conception and expertise themselves suffered significant changes. Sanoff (1999), known by his researches and collaborative urban projects, points that participation empowers individual and collective identities.

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The gathering of individuals interested in a same problem does not necessarily establish cooperation in an adequate way. The classification of workgroup individuals as layman and experts, for instance, actually leads to a pseudo-participation form. Although implementation is collectively discussed, key objectives or even start points happen to be previously defined by technicians. We can see this is not a genuine participation process but actually a collective legitimating process of decisions already made. This distinction reveals the political dimension of participation processes. Whate, Nair and Ashcrofth (cited by Sanoff, 1999) rely upon social relations as a whole, and particularly in communication strategies adopted by the group, the main weight in the distinction amid different participation forms.

Following this criterion, we consider the distinction between cooperation and participation cannot be derived from the actor's qualification, but so, they should be derived from Political relations and adopted communication ways. Therefore, we shall use participation when there are visible stakeholder categories that distinguish the controllers — the ones who establish goals, paths and expected results — from the participants — actors whose major function is consultancy.

Although these categories cannot be completely eliminated, the very cooperation notion admits groups of individuals or single workers doing their jobs side by side following a previous division based on accorded goals and premises. Cooperation is also observable when single or grouped individuals have expert abilities. Working alongside with the possibilities of mutual interference, Fischer names it as 'asymmetry of knowledge'. He states that required know-how for some specific purpose is always unequally distributed and no actor or group has the decision power alone.

Communities

- Since Romanticism, community has a sociability form characterized by an organic and perfect bond. According to Ferdinand Tönnies (1925), the presence of a reciprocal and attaching feeling that overrules internal disputes is proper of the community. Due to this vision of community, "people remain essentially united despite the factors that separate them." (BAUMAN, 2003, p. 15). This understanding of what community is, however, is insufficient when used for the ICTs study. The following community subclasses were required during empirical investigation:

Communities of interest. To Wenger, McDermott e Snyder (cited by Horan, 2000), communities of interest are groups formed by people that share a concern, a issue or even a passion about a topic and this deepens their knowledge as a result of continued interaction.

Communities of practice. This expression defines groups concerned about some clearly defined and shared goal. The difference from communities of interest is the ascendancy that the need of reaching a given objective has over of the need of knowledge extension about a specific topic.

Communities of place. A group of people that share a territory and whose bond is originated in the share of a common history and other cultural place-related elements.

Ethic and linguistic communities. It occurs when groups are separated from their national origins but keep their original bounds built by their cultural and language share.

We see the presence of a common element in these definitions: the *habitus*, concept proposed by Pierre Bourdieu (according to ORTIZ, 1994). It describes a socialized form of subjectivity or incorporated system of dispositions or predispositions acquired socially. The *habitus* is the mortar in all these classes and it is, as well, what differentiates then.

Virtuality and community networks

We believe virtual community, when completely unattached from its physical counterpart, presents more fragile bonds than its grounded-in-concrete spaces version. The fragility measure lies in the presence of a shared symbolic capital that cannot be completely untied from these spaces. This fact is especially visible in communities of place. Even in circumstances when this dependency is not determinant, it's possible to identify a high volatility in the bonds established in exclusively virtual communities. The *habitus* does not necessarily settle in these contexts given the difficulty in embedding the shared values. The 'virtual community' expression, however, has been banalized and, for this reason, we consider that a better observation of community interspaces can clarify things.

The relationships that occur in environments assembled by a net of interfaces, machines and individuals are the pillars of the interspace concept proposed by Terry Winograd (1987, 1997). The interspace is, in synthesis, the object we seek. As we analyzed, the collaborative relations mediated by websites and two of its configurations are particularly relevant:

First, the Community Network, as defined by Artur Serra (2000), is a support structure for the social actors' mobilization in a way the collaborative organization of actors is capable of making the Participatory Social Design viable.

Second, The Intercommunity Network, a configuration derived from the Community Networks, emerges from the contextual and constitutional similarities of the communities around the globe. So, the experience exchange among them may be of mutual advantage. The Intercommunity Networks come from the possibility of a community of interest or a community of practice to be assembled by a set of Community Networks. From its very nature, which is decentralized and comprehensive, we consider that Intercommunity Networks may be a better connection between global and local realms. The social production of knowledge question in the Intercommunity Network context acquires a strategic significance for the socially relevant design.

About this matter, Horan and Wells (2005) suggest that the use of community networks built from a physical and virtual space synergy may result in improvements of the place feeling. It must boost, and not attenuate, the face-to-face interaction. The authors point the possibility of a knowledge-enhancing information community of practice. Briefly, it is a particularly interesting way to describe what we seek in

this investigation, assuming that the socially produced and shared knowledge is fundamental for the collaborative design.

Many public social inclusion programs rely on a causal relation between ICT equipment deployment and rise of the place and belonging ties. Nevertheless, as we had seen, it is not so simple to build this link considering the complexity of the social and technical phenomena involved. It's clear that the community network emergence cannot abdicate the presence and understanding of a previous linkage bundle. Depending on its net configuration, services, technical infrastructures and management policies, the community networks can be improved or weakened.

Digital place and design: the collaborative design environment

Hitherto, our reflection has been moving far away from the computer and towards the user groups organized in a complex web of intersubjective relationships. We believe it is well established that human-computer interaction composes an interdisciplinary field. As Winograd states (1997, p. 151), "we operate in an 'interspace' that is inhabited by multiple people, workstations, servers, and other devices in a complex web of interactions." Beyond multiple and complex, the collaborative design environment must be oriented toward the building of a collective discourse structured by the design problem at hand. Under this approach that Winograd calls language/action perspective, lays the need of a linguistic and conceptual shared base established beforehand. It can also be built inside the system itself. The language/action approach comprehends some aspects we've already discussed and they have many analogues in the normative and methodological structures of design.

We must note that collaborative design process has parallels in the web of dialogues formed in any work environment. It could not be otherwise but, the same way, a question remains: Can web interfaces reproduce or improve these practices? As we may see later on, interfaces designed to support collaborative environments are rare. Many of them lack the meta-information needed for the building of a collective memory of the discourse underlying a given project.

In addition to the discourse itself, there is another question related to the information volume and retrieval. Vilém Flusser (1999) points two basic information handling problems in collaborative environments: first, the mass of information that surpasses individual memory. Second, the need of human components, artifacts and adequate heuristic models required for distribution, analysis and application in design activities. We see here a parallel with the Critical System proposed by Fischer (2000).

In the design world, representation, modeling and production management tools are numerous and organized in classes like CADD (Computer Aided Design and Drafting), CAE (Computer Aided Engineering) e CAM (Computer Aided Manufacturing). Fischer, however, adds two more classes: The Critical Systems (CS) and the Expert Systems (ES). The ES is by definition a problem solving tool used in situations when inferential procedures and high human expertise are needed. The ES is

characterized by its capacity of problem solving in very restrict domains reproducing human expert procedures. For Fischer, the challenge is to transform an Expert System into Critical System by deployment of "on the fly" analysis and evaluation functions capable of overcoming the knowledge accumulated by a community of practice. (FISCHER, 2000, p.4). As we will see, our survey did not disclose the presence of web interfaces with those characteristics, even those still in embryonic stage.

When we apply the asymmetric knowledge distribution principle — according to Fischer, in a collaborative process, no one has the same quantity of relevant knowledge to the problem at hand — the effort for the farther displacement from the computer and toward the understanding of design practices is deeply required. In Fischer's words, to go beyond new wrapping in relation to old concepts and work practices and to "reinvent how we think, design, learn, and collaborate." (2000, p.6)

In this setting, the design act is situated in a context formed by an association of actors, interfaces and a variety of devices capable of information producing and its transformation into knowledge. The collaborative approach can be better understood when we use the interspace and situated action notions. They allow an important concept interlock: The net, cognitive environment and interface conceptions considered on a broader sense[i]. They base what Winograd calls Interaction Design:

> The traditional idea of 'interface' implies that we are focusing on two entities, the person and the machine, and on the space that lies between them. But beyond the interface, we operate in an 'interspace' that is inhabited by multiple people, workstations, servers, and other devices in a complex web of interactions. In designing new systems and applications, we are not simply providing better tools for working with objects in a previously existing world. We are creating new worlds. Computer systems and software are becoming media for the creation of virtualities: the worlds in which users of the software perceive, act, and respond to experiences. (WINOGRAD, 1997, p.151)

Web interfaces as a collaborative design environment

Santaella (1996) remembers that there are lots of non-intentional communication blended in both form and codes used in symbolic interchanges. In other words, new communication modes also carry new meanings. By facing it, our analysis seeks to identify significant processes that are analogous to the ideas we have just examined in the structure of websites used in collaborative design. It is limited to non-profit organizations used in collaborative design contexts.

We used approximately 30 keywords selected from a systematic derivation from the main concepts found during theoretical research. Then, we established a time frame that included only websites updated in the last 3 months. Finally, we limited the survey to .org domain only. A primary list composed by fewer than 500 URLs resulted from this procedure. Aiming to circumscribe the themes in

socially relevant collaborative design field, we manually removed websites that did not meet at least one criterion from the following groups:

- Group I: Non-profit organizations; government agencies; Non-governmental organizations and other forms of civil society organizations.
- Group II: Presence of clearly identifiable collaborative activities; clear presence of design procedures related activities; evidence of any decision processes that affects spatial features of urban fragments.

This routine has configured a 184 websites population from which we randomly picked up 33, that is an 18% sample. According to four analysis dimensions, the survey has observed a set formed by 10 variables that are largely nominal qualitative. For each one of these dimensions, guide questions were proposed to guide results assessment. In this article, we present the results obtained in two of these dimensions.

First Dimension: Interface and innovative web services

Guide-question 1. To what extent do the web interface take place just for the growth of traditional communication ways in detriment of a greater use of ICTs in innovative communication ways?

This question was analyzed by quantifying the presence of interface features called by us as web services[ii] which we consider sophisticated and innovative when they show a greater use of ICTs in information arrangement. We also sought strategies based in more technologically advanced communication ways, such as the ones which use Expert Systems or Critical Systems.

Collected information allowed us to categorize 150 instances as communication increasing strategies. Frequency analysis (Tab. 1) shows declarations classified as 'improving of existent communication channels' in the first place with 21 cases (2/3 of the total amount). Within to this category, web interfaces mainly used to attract the visitor to a more significant contact using a traditional medium as, for instance, a telephone call or a personal visit. On the other hand, in only 7 cases (less than 1/5 of the total amount), we found occurrences categorized as 'new communication forms development'. This suggests the web interface is still largely conceived as a support tool for traditional communication procedures.

Tab. 1: Action strategies frequency for improving of existent communication channels[iii]

strategy	f
existent communication channels improvement	21
strategic alliances development	18
scientific event promotion	15

technology transfer	13
specialized service providing	13
awards and incentives	13
projects funding	12
on site education	11
scientific periodic publication	9
financial resource gathering	8
new communication forms development	7
distance education	5
volunteering promotion	4
physical infrastructure providing	1
Total researched websites	33

Guide-question 2. To what extent are innovative services used in the development of interface and cognitive environments in the researched websites? How do they hinge on each other according the researched strategies?

The counting of services found in the researched websites and classification (Tab. 2) revealed that the less frequent resources are those we deem a more technically elaborated approach. Instances as 'multilingual interface', 'media repository (audio)', 'media repository (video)' are rare. All of them have only one instance among the 33 surveyed websites (relative frequency is about 1% of the total amount). No Critical System analogous was found.

Tab. 3 shows the cross-examination between 'web services' and 'strategies'. It's one of most revealing tables of this study because of the numbers it presents and also because of the absences it denounces.

Tab. 2: Interface resources (web services) frequency[iv]

web service	f	f%
media repository: text	27	15%
e-mail list or forum	25	14%
event agenda	23	13%
bookmarks and address book	23	13%
news	21	11%
portal	13	7%
media repository: image	12	7%
search engine	5	3%
training and courses	5	3%
pattern repository[v]	5	3%
data bank	4	2%
advertising	3	2%
intellectual property control	3	2%
gallery and portfolio	3	2%
e-commerce	2	1%
chat	2	1%

tools repository	2	1%
consultancy	2	1%
media repository: audio	1	1%
proxy server	1	1%
multilingual interface	1	1%
media repository: video	1	1%
total	184	100%

Some categories established before data collecting weren't found. It's the case of 'graphic virtual design environment', 'artificial intelligence systems' and 'expert agents'. Although they depend on more complex interfaces than one can find in World Wide Web, they are powerful. We must stress that the use of neural nets, as common structures found in Expert Systems, is already usual as in imagery analysis tools in more sophisticated search engines. However the survey found nothing that indicates its presence.

Tab. 3: Strategies and web interface services relationship

	existent communication channels improvement	Human resources training	new media development	strategic alliances development	distance education	on-site education	project funding	infrastructure providing	awards and incentives	specialized services providing	volunteering promotion	scientific events promotion	scientific and technical periodic publication	technology transfer	total
media repository: text	17	7	7	17	5	8	10		8	9	3	15	9	12	127
tool and program repository	2		1	1			1					2	1	2	10
address book and bookmarks	17	5	6	14	4	10	9	1	11	11	2	12	6	8	116
e-mail list or forum	16	7	6	12	5	8	10		10	9	2	13	8	10	116
events agenda	16	5	6	12	5	9	9	1	11	9	3	11	6	8	111
news	14	4	3	10	5	10	8	1	11	10	2	9	7	7	101
portal	8	5	2	11	2	6	8	1	6	5	3	7	4	5	73
media repository: image	8	2	5	7		3	3	1	3	4	2	6	1	6	51
training and courses	3	1	1	4	3	3	2		4	1	1	5	2	1	31
search engine	4	1	1	1	1	1	1		2	2		4	2	1	21
data bank	3	1	1	1	1	1	1		1	2		3	1	1	17

pattern repository	3		1	1			1		1	1		3	1	4	16
gallery and portfolio	2		1	1		2	1	1	3	1	1				13
advertising	1	1		1		1	1		2	1		1	1	1	11
intellectual property control	2		1			1			1	2		2		1	10
e-commerce	1			2	1	1	1			2			1	1	10
chat	2		2	1								1		2	8
multilingual interface	1	1		1			1		1			1	1		7
consultancy	1		1						1					1	4
media repository: video				1		1				1				1	4
proxy server	1									1		1			3
media repository: audio														1	1

Some resources, on the other hand, overcome the simple and static information retrieval. It is the case of pattern[vi] repositories that store reusable digital fragments or solutions such as API[vii]s. Classified generically in our survey as 'pattern repositories', they were found in almost half of the analyzed websites (16 instances in 33). Anyway, when we consider all possibilities, we can state the web interface is below its technological transfer potential — an essential attribute of innovative design environments. Although the 'pattern repositories' have been found in a acceptable frequency, we verified that in only four cases technology transfer strategies were coordinated with decentralized forms of use and management of the stored patterns.

As we had already presumed, popularized resources were easily found in our population. Services and tools categorized as 'e-mail list or forum', 'news', 'portal', 'media repository (text), besides 'address books', bookmarks and event tracking systems were found in almost all researched interfaces. On the other hand, we were surprised by websites such as those of Association for Computer Machinery, of Environmental Design Research Association, and of Community Design Collaborative of AIA Philadelphia. They do not have any of the most sophisticated services we were expecting. Actually, we noticed that the affinity with the design theme in most cases is clearly shown in the graphical interface refinement.

Second dimension: Community and action strategies

Guide-question 3. Which strategies have been used and how they are related to different types of community?

Tab. 4 Action Strategies frequency according to community type

	community of interest	community of place	community of practice	inter community	Sub-totals
existent communication channels improvement	17	7	16	6	46
strategic alliances development	13	6	14	7	40
scientific events promotion	13	2	14	3	32
technology transfer	9	4	11	6	30
specialized services providing	10	3	12	3	28
project funding	9	5	8	2	24
awards and incentives	12	2	10		24
on-site education	9	2	10	2	23
technical and scientific periodic publishing	7	2	8	3	20
new media development	6	2	6	3	17
training	6	4	6		16
distance education	4	1	5	1	11
volunteering promotion	3	3	2		8
physical infrastructure providing		1			1
total	118	44	122	36	320

The strategy classes effectively verified in our survey, alongside with its occurrence frequency related to the various types of target-communities are in Table 4. We noticed a resource concentration in communities of interest and in communities of practice that, altogether, sum ¾ of the total amount (Tab. 5). We also saw that the strategy classified as 'physical structure providing' was found only once. It was found in the Phinney Neighborhood Association, Seattle (US-WA), a community of place, as expected.

Few occurrences categorized as 'intercommunities' were found. It suggests that, at least in the researched population, the connection potential among different kinds of communities isn't yet completely realized. From the 33 researched websites, only 7, that is, less than 1/5, presents clear manifestation of the expected attributes. Even in these cases, we verified that the 'traditional communication channels improvement' strategies are predominant. An exception, however, can be pin pointed. It strengthens a suspicion that emerged during the theoretical research: from those 7 websites included in the 'intercommunity' category, 6 adopt strategies classified as 'technological transfer'. This

frequency is quite higher than those saw in other categories. We found in 26 communities of practices, only 11 cases of technological transfer and in communities of interest, only 9. When we studied communities of place, the proportion is similar, that is, 4 occurrences in 7 cases. This finding allows us to establish a correlation, even a weak one, between intercommunity relationships and the emergence of technological channels and mechanisms.

Tab. 5 Types of community according to their type

community type	f
community of practice	26
community of interest	25
community of place	10
intercommunity	7
total	68

Observation summary: general and particular

Looking at the broader scene formed by collected data, we found both relevant typical aspects and particular cases. They drew our attention by the connection between website structure and its general objectives.

We verified a low incidence of services that go beyond text communication. They are recurrently restricted to the traditional web standards as e-mail lists and discussion forums. We also found a high frequency of service providing and subscription used as financial funding. Collecting resources by subscription were found in 23 websites (2/3 of total amount), by donations, 17 (half the total amount), and by service providing, 12 (1/3 of total amount). Public funding was identified in only 1/8 of the surveyed websites (only 4 occurrences).

An examination of the collected textual fragments showed that, in many cases, these services cannot be considered as collaborative activities or knowledge distribution fosterers. Technically specialized service providing is common as it is in Industrial Designer Society of America and the American Design Drafting Association. Quality Certification and Accreditation as in National Association of Certified Home Inspectors are also frequent. We noticed that the main purpose of about half of the 33 visited websites are the development or promotion of professional activities.

These observations allow the proposition of the following types that describe around 1/3 of the cases.

Type 1. Websites which main purpose is to promote their maintainers' activities and interests. Despite being communities of interest and communities of practice, they do not' use the web interface as a main form of interaction among their users.

Type 2. Professional association websites focused in three main activities: recruiting new associates, promoting its activities, standardization and quality certification of technical services.

We also have seen the use of interface as an extension of knowledge production activities. These cases use strategies we have categorized as 'scientific events promotion' and 'periodic publishing'. We noticed that, in many websites, the interface is mostly a medium used before and after important events to exchange personal impressions. This is the case, for instance, of the Association for Computer Machinery, The American Institute of Architects and The Society for Technical Communication.

In face of these findings, we propose a third type:

Type 3. Websites that amplify information trade inside communities of practice and communities of interest focused in scientific research or technical development.

Finally, a last type was observed. It is a particular case of type 3. Despite the frequency is below what we consider the ideal situation based in theoretical research, some websites can actually be described as collaborative environment interfaces. In these, we found more sophisticated tools than the ones we find in traditional homepage. Even though in embryonic phase, we classified them as:

Type 4. Websites that present working or embryonic tools that provide genuinely collaborative processes.

Tab. 6: Surveyed websites typification

Type	f
Type 1	2
Type 2	10
Type 3	14
Type 4	7
Total	33

We must stress that these types cannot be seen as a set of excluding categories. In other words, a given website can be classified in more than one type. There is, for instance, a common superposition involving types 1 and 2. In Table 6, we organized the websites according the perceived main attributes.

During the research, we tried to go beyond the frequency analysis of the observed variables. We collected textual information taken directly from the visited websites. This allowed us to identify some model cases summarized in Tab. 7.

Tab. 7 Model cases according to their distinctive attributes

Initiative name	University –community relationship	Dialog structuring	Socially relevant technology transfer	Sectorial work-groups forming	Innovative technologies	Why this initiative is a model
ThinkCycle Open Collaborative Design	x	x	x	x		Website is fundamental in design activity. It presents technological innovations in many researched attributes. The use of web interface is intense.
The Drachman Institute	x		x	x		Although web interface isn't sophisticated, this initiative presents some key-elements we have discussed.
The International Digital Object Identifier Foundation					x	Website is fundamental part in activity. There isn't technology transfer, but creation of services and technology based in Expert Systems.

ThinkCycle Open Collaborative Design

ThinkCycle Open Collaborative Design (Fig. 1) is an academic initiative whose main purpose is to foster technological innovation according to open source philosophy. It aims to disseminate socially relevant innovations emphasizing the relationship between poor communities and the environment. Resulted from a workshop promoted by the Massachusetts Institute of Technology and titled Design

that Matters, this initiative has been focused on the challenges of sustainable development based in collaborative practices.

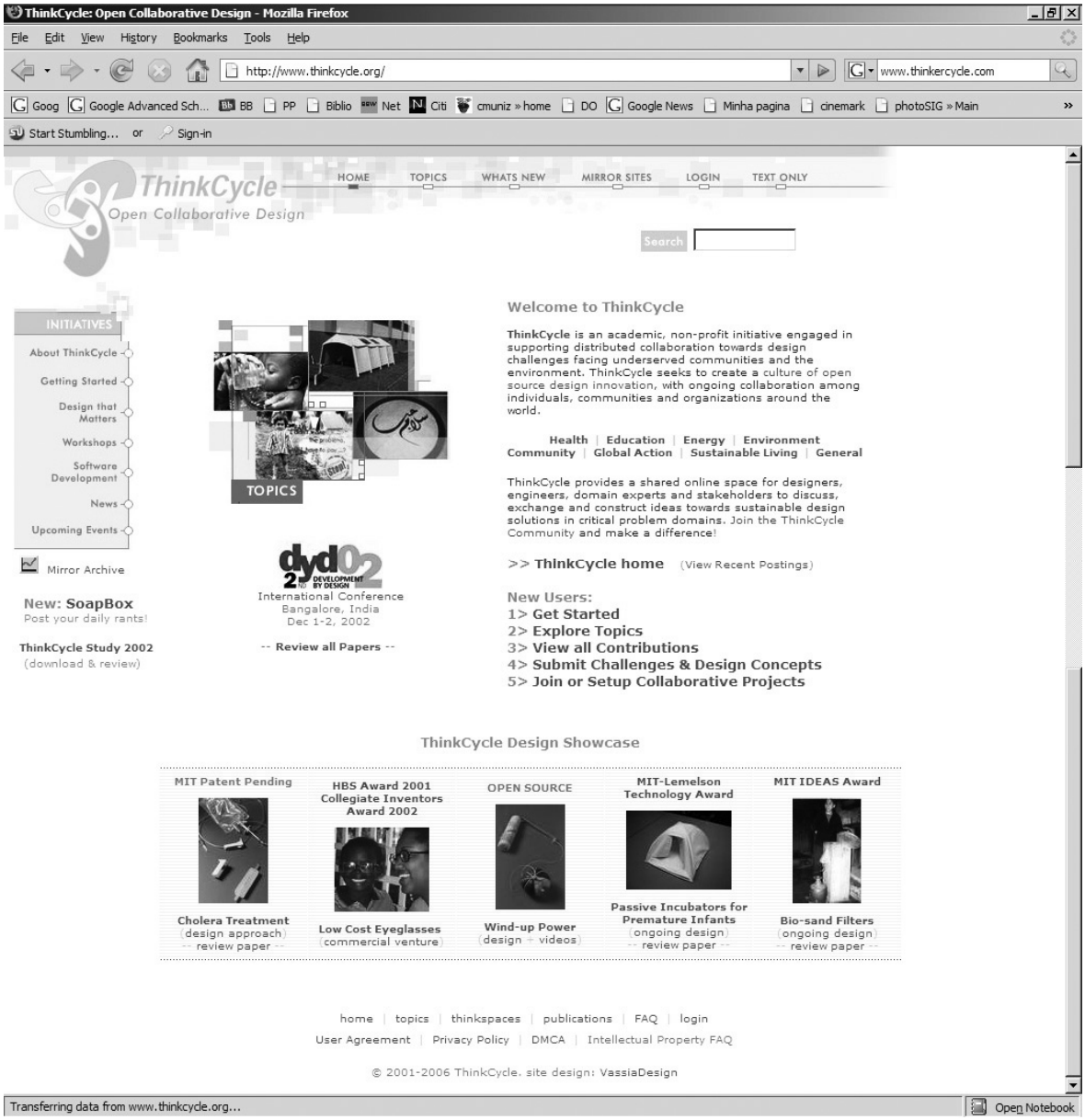

Fig 1: ThinkCycle Homepage

There are many topics in ThinkCycle. They vary from cholera treatment devices, low-cost eye glasses, aeolian electricity generation to passive incubators. The way forums were organized drew our attention. The intensive use of meta-information as well the dynamic leadership creation strategies make it a model to follow.

The Drachman Institute

The second model case also comes from university and focuses on community. As in ThinkCycle, the web interface is more than a promotion medium. An expressive group of information, some of them graphically represented, is available.

The Drachman Institute (Fig. 2), however, does not use sophisticated ICT based tools. This fact almost made us exclude the institute from the model case group. A lot of information is in plain text form, lowering the recombination potential. The website, however, allowed us to see the presence of dynamic and static hierarchy free of stakeholder organization. This fact is particularly notable if we recall the differences between collaboration and participation already discussed.

Fig. 1: Drachman Institute Home page

We also consider that this case strengthens a well-known technology transfer mechanism: the reduction in distance between the academic world and place communities.

The International Digital Object Identifier Foundation

The web interface of the Digital Object Identifier (DOI) is an identifying, copyrights and metadata management system. There are also hyperlinks for content providers and, in this regard, it is a good example of technology dissemination. DOI (Fig. 3) uses many techniques among which we highlight:

- Handle System
- Indecs Data Dictionary
- Persistent Identifiers

The general working mechanism establishes interoperable patterns. They are used for reusable object repositories creation as well authoring rights fee calculations.

The general working mechanism establishes interoperable patterns. They are used for reusable objects repositories creation as well as copyright fees calculations.

Although the DOI works mainly as a support environment and not as a design interface it is one of the rare studied cases where the website can be considered the main interface for sophisticated resources access.

Fig. 1: DOI Tools page

Conclusion

We concluded that the theoretical studies with significant indications of a deeper understanding of design collaborative practices requires investigation of social, technical, cognitive and communicative aspects of technique usage.

Elements found in the empirical research answered a set of guide questions and revealed a scenario characterized by the following aspects:

- There is a connection between inter-communitarian organization and the emergence of technology transfer mechanisms and channels.
- Most interface configurations confirm that ICTs are disseminated and have a deep penetration in diverse fields at least in the institutional communication point of view.

Types found in these configuration, however, reveal that the use of web interfaces as a building block of cognitive and communicative environments is still more a possibility than an accomplishment.

Finally, we noted that many collaborative practices are already part of the design culture. There are many possibilities for its insertion in the digital arena. We have noticed that the possibilities provided by ICTs in cognitive, interactive and collaborative environments can be used to enrich communitarian and inter-communitarian practices. We stress that empirical studies have confirmed many elements pointed out in theoretical framework. So, we believe we have found strong evidences that under a socio-technical approach, ICTs enable collaborative design practices used in socially relevant technology creation and transference.

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NOTES

[i] I.e. interface more than just a technical artifact present in human-computer interaction, but a translator of elements that composes the interspace and those transition points between technical superimposed nets.

[ii] Despite the fact we are using the same name, in this moment we are not talking about the Web Services used to describe Applications Program Interfaces present in network clients.

[iii] Meaning of the classes used in this table: *existent communication channels improvement*: any action taken to improve the contact mediated by traditional communication channels such as telephone, visiting; *strategic alliances development*: promotion of alliances with NGO or other organizations with common objectives; *scientific event promotion*: promotion of congresses, seminars and other research and development meetings; *technology transfer*: sharing and transfer of skills, knowledge, technologies; *specialized service providing*: provision of expert or specialized services related to the main goal of the researched organization; *awards and incentives*: promotion of competitions and other actions that recognize excellence in a certain field; *projects funding*: provision of material or financial resources; *on site education*: formal or technical training; *scientific periodic publication*: publication of scientific or technical periodicals; *financial resource gathering*: finding and gathering of financial resource to found projects; *new communication forms development*: creation or improvement of new communication forms, specially digitally mediated ones; *distance education*: training and education based on digital technologies that deliver information to students who are not physically on site; *volunteering promotion*: events and actions to advertise and promote volunteer opportunities; *physical infrastructure providing:* provision of key infrastructure to carry out activities or projects related to the main goal of the provider organization. For more information about how these classes were established, see MUNIZ, C. O design cooperativo na sociedade da informação : sistemas e interfaces telemáticas socialmente relevantes na cidade inteligente. Master Thesis — Departamento de Arquitetura e Urbanismo - Escola de Engenharia São Carlos da Universidade de São Paulo, 2005.

[iv] In this table, we use the term *repository* to describe any form of collect, organize and share reusable material such as tools, media or design patters. In this way, *media repository: text* refers to shareable texts related to a specific domain; *media repository: image* refers to shareable pictures, diagrams or drawings; *tool and program repository* refers to shareable hardware and software and so on.

[v] Collection of general reusable solutions to a commonly occurring problem. Commonly used in software design.

[vi] Initially proposed by Christopher Alexander in a Pattern Language (Oxford Univesity Press, 1977) the patterns were widely adopted in software engeneering fileld.

[vii] Application Programming Interface. Procedure call that communicates with a linkable library or an operating-system. Usually reusable object in software engineering.