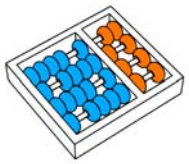
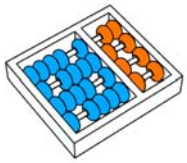


Roberto Pereira

Authority Network and Support to Social Interaction on the Web: a culturally informed approach

Rede de Autoridades e Apoio às Interações Sociais na Web: uma abordagem culturalmente informada

CAMPINAS
2012



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Roberto Pereira

"Authority Network and Support to Social Interaction on the Web: a culturally informed approach"

Supervisor/*Orientador(a)*: **Profa. Dra. Maria Cecília Calani Baranauskas**
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"*Rede de Autoridades e Apoio às Interações Sociais na Web: uma abordagem culturalmente informada*"

PhD Thesis presented to the Post Graduate Program of the Institute of Computing of the University of Campinas to obtain a PhD degree in Computer Science.

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Instituto de Computação
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Rede de Autoridades e Apoio às Interações Sociais na Web: uma Abordagem Culturalmente Informada

Roberto Pereira[1]

12 de Dezembro de 2012

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Resumo

O advento da Web 2.0 tornou possível o desenvolvimento de aplicações mais ricas e inovadoras em termos de interatividade. Nos chamados software social, ou aplicações sociais, usuários criam, compartilham e recomendam informação, e interagem entre si em escala e velocidade até então inéditas. Embora tenha ocorrido uma popularização desse tipo de sistemas, ainda há pouco conhecimento sobre como projetar sistemas que façam sentido aos seus usuários e que não desencadeiem efeitos negativos no ambiente social em que eles são disponibilizados. Problemas de sobrecarga, falta de qualidade e de credibilidade da informação, e impactos negativos em valores como privacidade, confiança e reputação são comumente reportados no contexto de software social. Nesses sistemas, a diversidade de usuários e de seus contextos socioculturais atinge dimensões e introduzem dificuldades com as quais os designers não estão acostumados a lidar. Isso demonstra que projetar aplicações no contexto de uma sociedade mediada por tecnologias da informação e comunicação é uma tarefa cada vez mais complexa, demandando uma visão de design socialmente responsável que considere de forma explícita os valores e a cultura das diferentes partes interessadas. Lidar com aspectos emocionais e afetivos, culturais e de valores, é um dos desafios que caracterizam um novo momento na área de IHC que requer que as técnicas e teorias utilizadas para apoiar o design de sistemas sejam repensadas, trazendo cultura e valores humanos para o centro do processo de design, e desenvolvendo novos artefatos, métodos e exemplos para apoiar o design em suas diferentes atividades.

Esta tese de doutorado propõe uma abordagem culturalmente informada e orientada a valores para o design de software social, e demonstra a utilização dessa abordagem para apoiar o design de um sistema no qual a autoridade de seus participantes é um fator chave. A abordagem, denominada VCIA (*Value-oriented and Culturally Informed Approach*), articula teorias de diferentes áreas e fornece um conjunto de artefatos e métodos criados/adaptados para apoiar diferentes atividades de design. O software social, denominado TNR (Todos Nós em Rede), está sendo projetado para favorecer a constituição de uma rede de autoridades entre professores da área de Educação Especial.

Abstract

The Web 2.0 advent has made it possible the development of richer and innovative applications in terms of interactivity. In the so-called social software, or social applications, users create, recommend and share information, and interact with each other at scales and speeds never seen before. Although there was a popularization of such systems, there is still little knowledge about how to design systems that make sense to their users and do not trigger negative effects on the social environment in which they are introduced. Social software has suffered from problems of information overload, lack of quality and credibility, and has negatively impacted on values such as privacy, trust and reputation. In social software, the diversity of users and their sociocultural contexts reaches dimensions and introduces difficulties that designers are not used to deal with. This demonstrates that designing applications in the context of a society mediated by information and communication technologies is an increasingly complex task, requiring a socially responsible view for design that explicitly considers the values and culture of the different stakeholders. Dealing with aspects related to emotion, culture, and values, is one of the challenges that characterize a new moment in the IHC area that requires techniques and theories used to support the design of interactive systems to be rethought. It also requires putting culture and human values at the center of the design process and creating new artifacts, methods and examples for supporting the design in its different activities.

This thesis proposes a value-oriented and culturally informed approach (VCIA) for the design of social software, and demonstrates the use of this approach to support the design of a system in which the authority of its participants is a key factor. VCIA articulates theories from different areas and provides a set of methods and artifacts created/adapted to support different design activities. The social software, named TNR (Portuguese acronym for All of Us Networked), is being designed to promote the constitution of a network of authorities among teachers from the Special Education area.

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À Deus.

"*It is not enough to teach a man a specialty.*
Through it he may become a kind of useful machine but not a harmoniously developed personality.
It is essential that the student acquire an understanding of and a lively feeling for values.
He must acquire a vivid sense of the beautiful and of the morally good.
Otherwise he—with his specialized knowledge—more closely resembles a well-trained dog
than a harmoniously developed person."

Albert **Einstein** ("Education for Independent Thought", The New York Times, 1952).

Sumário

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Lista de Abreviaturas e Siglas

ACM	Association for Computing Machinery
AEE	Atendimento Educacional Especializado
BBC	Building Blocks of Culture
BJET	British Journal of Educational Technology
CA	Cognitive Authority
CARF	Culturally Aware Requirements Framework
HCI	Human-computer Interaction
HCII	International Conference on Human-Computer Interaction
ICT	Information and Communication Technology
IHC	Interação Humano-Computador
LIBRAS	Linguagem Brasileira de Sinais
LMS	Learning Management System
OS	Organizational Semiotics
PAM	Problem Articulation Method
SAC	Socially Aware Computing
SES	Specialized Educational Services
SID	Stakeholder Identification Diagram
TIC	Tecnologias da Informação e Comunicação
TNR	Todos Nós em Rede
TVDi	Televisão digital interativa
VCIA	Value-oriented and Culturally Informed Approach
VCT	Value Comparison Table
VF4SS	Valuation Framing for Software Social
VIF	Value Identification Frame
VP	Value Pie
VSD	Value Sensitive Design

Capítulo 1

Introdução

Toda tecnologia desencadeia impactos (positivos e/ou negativos) no ambiente em que ela é inserida e nas pessoas que vivem nesse ambiente, ainda que estas não a utilizem diretamente. Sistemas interativos são uma realidade na vida das pessoas, sendo utilizados por meio de diferentes dispositivos, para diferentes propósitos, em contextos distintos, com consequências imprevisíveis e de longo alcance. Para Hall (1959), artefatos tecnológicos são capazes de desencadear mudanças profundas em uma sociedade com o menor esforço possível. Nesse sentido, na medida em que sistemas interativos têm estado presentes em todos os lugares, objetos, e aspectos da vida das pessoas, a tarefa de projetá-los tem assumido novas dimensões em termos de complexidade e tem requerido um entendimento maior acerca das responsabilidades ética e social daqueles que os criam.

As aplicações desenvolvidas após o advento da Web 2.0 são exemplos de como as Tecnologias da Informação e Comunicação (TIC) têm deixado os limites dos escritórios e locais de trabalho para permear todos os aspectos da vida pessoal e coletiva. O termo Web 2.0 refere-se a uma plataforma para aplicações, explorando conteúdos gerados pelos usuários de formas sofisticadas e poderosas. Ao possibilitar o desenvolvimento de aplicações mais interativas e complexas, a Web 2.0 tornou-se um fator decisivo para o surgimento de sistemas como: *Twitter*®, *Youtube*®, *Flickr*®, *Facebook*®, entre outros, nos quais grandes massas de usuários interagem, se comunicam, criam, compartilham e organizam conteúdos. Estes sistemas, que demonstram a "força do coletivo", as oportunidades e o conhecimento que podem ser gerados pelo trabalho em conjunto e pela interação em massa (Silva e Pereira, 2008), foram popularmente denominados de Software Social.

Software social tem comumente sido citado por suas oportunidades e desafios para a academia, instituições governamentais e organizações privadas. Esse tipo de sistema tem sido amplamente adotado, alcançando números surpreendentes em termos de quantidade de usuários, informação produzida e compartilhada pelos mesmos, e tempo gasto interagindo com/por meio deles. Software social, e aplicações Web em geral, estão globalmente

disponíveis, ultrapassando fronteiras geográficas, sociais e culturais. A relação de clientes com seus fornecedores, o papel dos usuários como produtores e consumidores de informação, e a mobilização social apoiada por esses sistemas são alguns dos exemplos das mudanças possibilitadas pelo software social.

Apesar da aceitação e da popularização de software social, os problemas de sobrecarga, credibilidade e qualidade da informação produzida e das interações mantidas nesses sistemas, são desafios tanto para os projetistas quanto para os usuários. Implicações relacionadas à cultura e valores das diferentes partes interessadas envolvidas, como privacidade, confiança, reputação e segurança têm sido comumente relatados pela mídia (Mui, 2011; Winter, 2010). Em termos gerais, isso ocorre porque não se tem conhecimento e experiências suficientes sobre como apoiar de forma eficiente as interações sociais por meio de sistemas computacionais, como entender o mundo social e como desenvolver sistemas que façam sentido para seus usuários, refletindo um entendimento do modo como eles interagem e vivem.

Nesse sentido, o ciclo de desenvolvimento de software que a Ciência da Computação tem tradicionalmente entendido como melhores práticas de Engenharia de Software (especificação, design, construção, testes etc.) precisa ser repensado para considerar, de forma explícita e transversal, questões culturais, destacando-se os valores das pessoas que serão direta e/ou indiretamente afetadas pelo desenvolvimento, disponibilização e utilização desse artefato tecnológico. Do mesmo modo, conceitos e práticas tradicionais da área de Interação Humano-Computador (IHC), tais como usabilidade e acessibilidade, necessitam ser postos em perspectiva e abordados como valores técnicos cruciais em qualquer projeto de tecnologia. De fato, embora os benefícios potenciais dos sistemas sociais sejam evidentes, eles podem ser excludentes sem uma ação de pesquisa e desenvolvimento de recursos que ampliem o acesso de pessoas que não o têm hoje. Aplicações como *Facebook*®, *Google Maps*® e as demais citadas anteriormente, são exemplos de ambientes nos quais pessoas com necessidade especiais, em geral, não conseguem participar facilmente.

No que diz respeito aos problemas da sobrecarga, credibilidade e qualidade da informação, a teoria da Autoridade Cognitiva (Wilson, 1983) tem sido utilizada para explicar a forma como as pessoas julgam e identificam a qualidade e a relevância da informação na Web, bem como a reputação e a especialidade (*expertise*) dos usuários/instituições que a produzem e/ou disponibilizam (Rieh e Belkin, 2000; Rieh, 2005). Outros autores também têm investigado o uso da teoria em sistemas de tagging (Russell, 2005) para favorecer o reconhecimento e a identificação de autoridades no conhecimento em questão; e outros têm estendido essa proposta utilizando conceitos da teoria de redes para favorecer a interação entre os usuários (Pereira e da Silva, 2008) e para melhorar o processo de recuperação de informação (Côgo *et al.*, 2012).

A teoria da Autoridade Cognitiva é uma teoria da epistemologia social relacionada ao reconhecimento das competências de indivíduos/objetos/instituições e tem se apresentado como uma teoria compatível com a natureza democrática, aberta e rápida da Web. Entretanto, essa teoria precisa ser revisitada tanto pela ótica de software social — uma vez que ela foi formulada e discutida em um contexto muito diferente do atual, quanto pela ótica de valores e cultura — uma vez que a concessão, o reconhecimento e a influência da autoridade cognitiva possuem ligações diretas com valores culturais, como confiança e reputação. É impossível saber como projetar sistemas que utilizem efetivamente o conceito de autoridade cognitiva se não considerarmos os valores e a cultura dos diferentes stakeholders de forma integrada e explícita. Como citado anteriormente, tanto "valores" quanto "cultura" são conceitos que se apresentam como desafios para o design de sistemas interativos.

De fato, diversos autores, tais como Bannon (2011), Bødker (2006), Harisson *et al.* (2007) e Sellen *et al.* (2009), argumentam que nosso relacionamento com a tecnologia tem se transformado nos últimos anos. Essas mudanças são profundas a ponto de exigirem uma revisão/mudança na área de IHC, em suas teorias, métodos e práticas. Para Sellen *et al.* (2009), mesmo os termos "interação", "humano" e "computador" deveriam ser revisitados, exigindo uma compreensão mais profunda sobre o que significa ser humano, o que é e onde está o computador/interface, e como é a interação na era digital.

Winograd (1997) já afirmava que a tarefa de projetar sistemas interativos vai além da construção de uma interface para englobar todo o "interespaço" no qual as pessoas vivem. Segundo o autor, há uma interligação complexa entre a tecnologia, os aspectos cognitivos das pessoas e a comunicação social, que requer uma mudança de foco no sentido de ver além da "maquinaria" para ver e entender também a vida das pessoas que a utilizarão. Essa mudança de foco chama a atenção para fatores relevantes, como os emocionais, afetivos e culturais, que se tornam difíceis de quantificar e mesmo de identificar.

Os fatores citados anteriormente têm apontado para um novo "momento" na área de IHC. Alguns autores falam em termos de um terceiro paradigma (Harrison *et al.*, 2007) no qual devem ser considerados o estabelecimento e a multiplicidade de significados em interações situadas; outros falam em termos de uma terceira onda (Bødker, 2006) na qual novos elementos da vida humana precisam ser considerados e na qual o foco está nos aspectos culturais e na expansão do cognitivo para o emocional.

Diferentes iniciativas também têm sido realizadas para identificar e inspirar os rumos da pesquisa em IHC. Em 2007, pesquisadores da academia e da indústria de diversos países e com diferentes bases de conhecimento se reuniram para discutir a área de IHC em 2020 (Sellen *et al.*, 2009). Os participantes foram unânimes em apontar para a necessidade de se manter valores humanos no centro da área de IHC. Recentemente, em 2012, a comunidade

brasileira de pesquisa em IHC apresentou uma iniciativa para prospectar grandes desafios de pesquisa em IHC no contexto brasileiro para os próximos 10 anos (Baranauskas *et al.*, 2012). No evento, realizado no XI Simpósio Brasileiro de Fatores Humanos em Sistemas Computacionais (IHC 2012), cinco grupos temáticos surgiram e foram discutidos como potenciais geradores de desafios: "Valores Humanos" está entre deles.

Entretanto, cultura, valores, fatores emocionais e afetivos, são aspectos tradicionalmente deixados às margens das abordagens de construção de tecnologias. Segundo Bødker (2006), embora novas técnicas e tecnologias tenham sido produzidas em uma tentativa de mover esses aspectos para o centro das abordagens, elas normalmente são apresentadas de forma isolada tanto nas teorias quanto nas soluções técnicas. De fato, Buchdid e Baranauskas (2012) mostram indícios de que, embora reconhecidos como importantes e críticos, esses aspectos não têm aparecido de forma significativa em algumas das principais conferências internacionais (CHI e INTERACT) e na conferência nacional de IHC. Além disso, os currículos em Ciência da Computação e Tecnologia da Informação tradicionalmente não direcionam grandes esforços no sentido de habilitar os estudantes a lidar com questões sociais envolvidas no design de tecnologias. Deste modo, à medida que a necessidade de se trazer à tona a questão de valores e cultura tem se tornado mais evidente, o despreparo dos profissionais de tecnologia e a inabilidade dos métodos e abordagens atuais de apoiá-los nessa questão têm se tornado mais visível.

Esta tese de doutorado investiga o design de software social sob a ótica da cultura e de valores humanos e técnicos. A pesquisa aqui descrita está situada no panorama atual da área de IHC que requer novas teorias, métodos e artefatos para apoiar o design de aplicações para uma sociedade mediada pelas TICs, estando também relacionada ao contexto do Desafio número 4 de pesquisa em Computação no Brasil: Acesso participativo e universal do cidadão brasileiro ao conhecimento (Baranauskas e Souza, 2006). O objetivo desta tese é a concepção de uma abordagem para o design de software social que apoie os projetistas a considerarem valores e cultura de forma explícita e articulada durante as atividades de design; a utilização dessa abordagem é ilustrada no apoio ao design de um software social que favoreça a constituição de uma rede de autoridades.

O termo "abordagem" é utilizado aqui como referência a um conjunto de passos na direção de um propósito específico e ao modo particular de conduzir esses passos[1]. Portanto, esta abordagem: i) articula diferentes teorias, tais como Semiótica Organizacional (Liu, 2000), Blocos Básicos da Cultura (Hall, 1959) e Teoria de Valores (Schwartz, 2005); ii) propõe

[1] Utilizamos o termo "Abordagem" no sentido da palavra correspondente inglesa "Approach": "2 a: *the taking of preliminary steps toward a particular purpose <experimenting with new lines of ~> b: a particular manner of taking such steps <a highly individual ~ to language>*" *http://www.britannica.com/bps/dictionary?query=approach&header_go=*

artefatos e métodos para apoiar diferentes atividades de design; e iii) instancia um processo de Design Socialmente Consciente[2] (Baranauskas, 2009; Baranauskas e Bonacin, 2008) para envolver valores e cultura de forma explícita nas diferentes atividades de design: da clarificação de problema à avaliação do sistema projetado. Esta abordagem foi denominada VCIA: *Value-oriented and Culturally Informed Approach*.

O sistema de rede social projetado para favorecer a constituição de uma rede de autoridades está situado no contexto do projeto Proesp/CAPES[3] "Redes Sociais e Autonomia Profissional: Novos Rumos para Formação Continuada à Distância de Professores de AEE". Denominado "Todos Nós em Rede" (TNR), esse sistema foi tanto o contexto de trabalho que inspirou a concepção da abordagem quanto o sistema computacional que tem se beneficiado diretamente de sua criação. A abordagem VCIA e seus artefatos foram experimentados e avaliados também em outros contextos de design que colaboraram para a sua análise e aperfeiçoamento, e que demonstraram os benefícios de se considerar nas atividades de design a cultura e os valores das diferentes partes interessadas.

1.1. Objetivos específicos e Metodologia

Como objetivos específicos desta tese destacam-se:

- Clarificar e entender o conceito de Software Social, suas características e dinâmicas, bem como os desafios e oportunidades de pesquisa no contexto deste tipo de sistemas;
- Identificar elementos básicos que, quando articulados, possibilitam projetar um software social orientado a valores;
- Conceber um esquema de organização para os valores identificados;
- Criar uma abordagem que auxilie projetistas de sistemas sociais a envolverem e articularem cultura e valores em seus projetos;
- Criar ou adaptar artefatos e métodos que apoiem a utilização da abordagem concebida;
- Analisar a adequabilidade da abordagem concebida para apoiar o design de sistemas computacionais.

A pesquisa aqui descrita é composta por investigações teóricas, análises empíricas e informadas e estudos de caso aplicados em dois níveis que se relacionam: um nível conceitual, que corresponde à concepção da abordagem para apoiar o design de software

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[2] Tradução livre do autor para "*Socially Aware Computing*".

[3] *http://www.nied.unicamp.br/tnr*

social, e um nível aplicado, que corresponde ao design do sistema TNR para apoiar a constituição de uma rede de autoridades.

A metodologia de trabalho no nível conceitual envolve: i) a revisão e análise da literatura em software social, web social, valores e cultura, design de sistemas computacionais e Semiótica Organizacional; ii) a análise de sistemas sociais já existentes; e iii) a criação/adaptação de artefatos e métodos para apoiar diferentes fases de design.

No nível prático, a metodologia de trabalho considera: i) a utilização dos artefatos e métodos para avaliar sistemas sociais existentes; ii) a experimentação da abordagem por designers e estudantes em diferentes contextos; iii) o envolvimento de potenciais usuários em diferentes etapas do processo de design; e iv) a utilização da abordagem para apoiar o design de um sistema computacional alinhado à cultura e aos valores identificados nas práticas com os usuários envolvidos que propicie a constituição de uma rede de autoridades.

1.2. Organização da Tese

A Figura 1.1 ilustra a organização desta tese em 4 capítulos centrais que abordam de forma construtiva cada um dos 4 temas principais desta pesquisa: software social, valores, cultura e autoridade. Estes capítulos são construídos sobre resultados que foram produzidos no decorrer da pesquisa e que foram apresentados, analisados e discutidos de forma mais detalhada em vários artigos (retângulos situados na parte inferior da Figura 1.1.). Alguns desses trabalhos podem ser úteis para o leitor que desejar ter acesso a discussões e exemplos adicionais — ver Tabela 1.1.

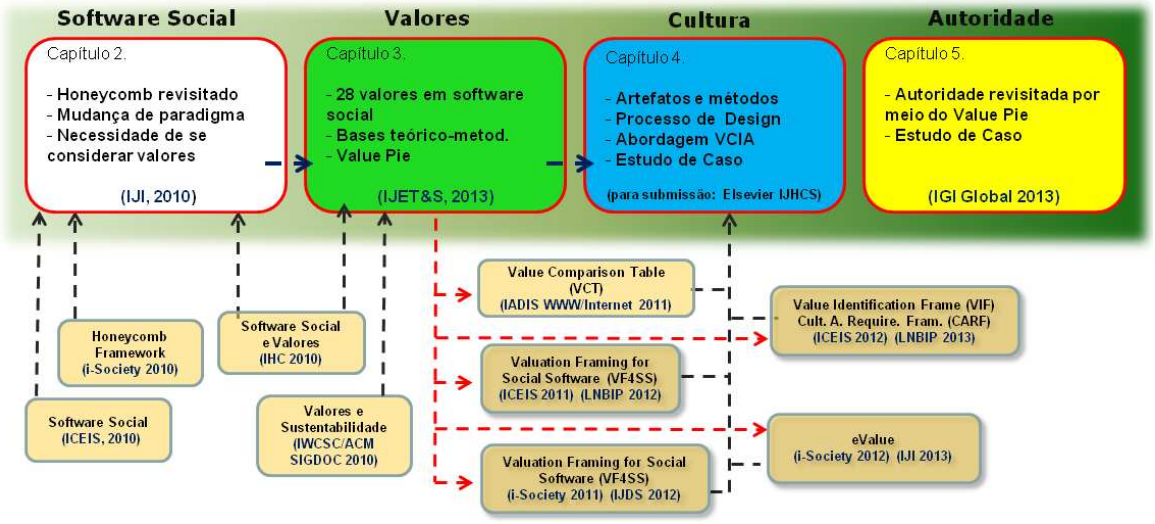

Figura 1.1. Organização da Tese.

O **capítulo 2** apresenta a revisão de literatura relevante sobre software social, apresentando-o não apenas como um conceito que representa um conjunto de tecnologias, mas que, além disso, representa um movimento que trouxe (e requer) mudanças de paradigma na forma como entendemos e desenvolvemos tecnologias. Este capítulo indica a necessidade de se considerar uma abordagem capaz de trazer a tona e de envolver de forma explícita aspectos culturais e valores para o entendimento e o design de software social[4].

O **capítulo 3** estende a revisão de literatura com o objetivo de identificar, discutir e exemplificar um conjunto de 28 elementos abordados como valores informais, formais e técnicos no contexto de software social. Neste capítulo, a teoria dos Blocos Básicos da Cultura (Hall, 1959), Semiótica Organizacional (Liu, 2000) e Teoria de Valores (Schwartz, 2005) são articuladas para a criação de um esquema conceitual, denominado *Value Pie*, que organiza os valores identificados e que é a base para dos demais artefatos criados no contexto dessa tese[5].

O **capítulo 4** apresenta a abordagem VCIA, criada para apoiar o envolvimento de valores e de cultura de forma explícita e integrada durante todo o processo de design de sistemas interativos. Neste capítulo, as bases teórico-metodológicas da pesquisa são apresentadas e articuladas, os artefatos e seus métodos de uso criados/adaptados para apoiar os diferentes estágios de design são apresentados e explicados e a abordagem é ilustrada no contexto prático de design do sistema TNR[6].

O **capítulo 5** apresenta a teoria da Autoridade Cognitiva (Wilson, 1983) e a revisita sob a ótica de cultura e valores no contexto de software social. Neste capítulo, o *Value Pie* é utilizado para discutir o conceito de "autoridade cognitiva" como um valor em três dimensões diferentes: formalidade, cultura e interdependência. As discussões são situadas no contexto prático do sistema TNR, mostrando as decisões de design tomadas para que o sistema possibilite a constituição de uma rede de autoridades[7].

Finalmente, o **capítulo 6** apresenta as conclusões desta pesquisa e indica uma agenda para trabalhos futuros.

1.3. Material de Complementar

Os capítulos desta tese são construídos sobre resultados que foram produzidos no decorrer da pesquisa e que foram apresentados, analisados e discutidos de forma mais detalhada em

[4] Artigo publicado em revista internacional.
[5] Artigo aceito para publicação em revista internacional. Previsão para publicação: Janeiro de 2013.
[6] Artigo a ser submetido para revista internacional.
[7] Artigo aceito para publicação como capítulo de livro a ser publicado pela editora IGI Global. Previsão de publicação: Junho de 2013.

vários artigos. Alguns desses trabalhos podem ser úteis para o leitor que desejar ter acesso a discussões e exemplos adicionais — ver Tabela 1.1.

A coluna "Referência" da Tabela 1.1 apresenta a referência completa do artigo publicado; a coluna "Seção" indica a ordem do artigo na seção de Anexos desta tese; a coluna "Descrição" apresenta uma breve explicação sobre o conteúdo do artigo; e a coluna "Revisão de Literatura" indica se o artigo apresenta conteúdos relacionados a software social ("S.S."), valores ("Valor.") e cultura ("Cult.").

Tabela 1.1. Artigos publicados em conferências e revistas.

Referência	Seção	Descrição	Revisão de Literatura		
			S.S.	Valo	Cult
Pereira, R., Baranauskas, M.C.C., Silva, S.R.P. A Framework - Informed Discussion on Social Software: Why Some Social Software Fail and Others do Not?. *In: 12th International Conference on Enterprise Information Systems (ICEIS 2010)*, Funchal, 2010, pp.149-154.	Anexo 1	Este artigo apresenta discussões iniciais sobre software social utilizando um *framework* conceitual como base (o *Honeycomb Framework*). Um sistema Web para apoiar a avaliação cooperativa de usabilidade foi analisado por meio do *framework* para identificar as decisões de design que podem ter contribuído para que o sistema não tenha conseguido manter a participação contínua de seus usuários.	X		
Pereira, R., Baranauskas, M.C.C., Silva, S.R.P. Softwares Sociais: Uma Visão Orientada a Valores. *In: IX Simposio Brasileiro de Fatores Humanos Sistemas Computacionais (IHC'10)*, 2010, pp. 149-158.	Anexo 2	Este artigo discute sobre software social e comunidades *online*; apresenta 27 elementos classificados como valores pessoais, sociais e técnicos por meio da Cebola Semiótica; apresenta considerações sobre o sistema *ChatRoullete*® e detalha um estudo de caso no qual o sistema *Vila na Rede*® é interpretado de acordo com os valores apresentados.	X	X	
Pereira, R., Lima, M., Baranauskas, M.C.C. Sustainability as a Value in Technology Design. *In: IWCSC/ACM SIGDOC'2010*, 2010.		Neste artigo, o conceito de "sustentabilidade" é discutido como um valor no contexto do design de sistemas computacionais. Este trabalho demonstra que existe um subconjunto dos valores sugeridos em (Pereira *et al.*, 2010b) que fazem sentido em outros contextos além de software social.		X	
Pereira, R., Baranauskas, M.C.C. Valuation Framing for Social Software: A Culturally Aware Artifact. *In: Proceedings of 13th International Conference on Enterprise Information Systems (ICEIS 2011)*, 2011. pp.135-144.	Anexo 3	Este artigo apresenta discussões em torno de valores e cultura no design de sistemas interativos e propõe uma adaptação do artefato *Valuation Framing* da Semiótica Organizacional para o contexto de software social: o *Valuation Framing* para Software Social (VF4SS). Este artefato foi utilizado para apoiar a análise de 6 protótipos distintos de sistemas projetados para apoiar a colaboração intercultural. Os protótipos foram projetados por 16 designers no contexto de uma	X	X	X

Pereira, R. and Baranauskas, M.C.C. Seeing Social Software Analysis and Evaluation through the Lenses of Culture. *In: R. Zhang et al. (Eds.): ICEIS 2011, Springer Lecture Notes in Business Information Processing (LNBIP 102)*, 2012, pp. 374-387.					
Pereira, R., *et al.* Interaction Design of Social Software: Clarifying requirements through a culturally aware artifact. *In: International Conference on Information Society (i-Society 2011)*, 2011, pp. 310-315. Pereira, R., *et al.*, Towards a Culturally Aware Design for Social Software. *International Journal of Digital Society*, Vol. 3 (1), 2012, pp. 590-599.	Anexo 4	Este artigo estende as discussões sobre valores e cultura para as atividades de análise e identificação de requisitos. O trabalho está situado no contexto do sistema TNR e demonstra como o VF4SS pode contribuir com a identificação e organização de requisitos relacionados à cultura e aos valores dos diferentes *stakeholders*. Um conjunto de passos para a utilização do artefato é sugerido. O artigo recebeu o ***Best Paper Award*** da conferência e foi publicado em versão estendida em revista.	X	X	X
Pereira, R., Baranauskas, M.C.C., Almeida, L.D. The Value of Value Identification in Web Applications. *In: Proceedings of IADIS International Conference on WWW/Internet (ICWI 2011)*, 2011, pp.37-44.	Anexo 5	Neste artigo, discute-se sobre o impacto potencial das aplicações *Web* nos valores e na cultura dos usuários e propõe-se um artefato para apoiar designers na análise e comparação de diferentes aplicações com relação ao modo como elas foram projetadas para apoiar valores: o *Value Comparison Table*. O artigo apresenta um estudo de caso no qual 4 aplicações distintas foram comparadas: *Yahoo*! *Respostas*®, *ACBP-Sakai*®, *LeMill*® e *Vila na Rede*®.	X	X	X
Pereira, R., Buchdid S.B., Baranauskas, M.C.C. Keeping Values in Mind: Artifacts for a Value-Oriented and Culturally Informed Design. *In: Proceedings of 14th International Conference on Enterprise Information Systems (ICEIS 2012)*, 2012, pp. 25-34.	Anexo 6	Este artigo apresenta dois novos artefatos criados para i) tornar explícito os valores dos diferentes *stakeholders* envolvidos no design de um sistema computacional (o *Value Identification Frame* — VIF), e ii) identificar e organizar requisitos relacionados à cultura e aos valores desses *stakeholders* (o *Culturally Aware Requirements Framework* — CARF). A criação desses artefatos foi motivada pelas vantagens trazidas pelo uso do VF4SS para a identificação de requisitos e pela necessidade de se oferecer artefatos específicos para essa atividade. O artigo apresenta um estudo de caso no qual os artefatos foram utilizados para apoiar 38 alunos de um curso de graduação em Ciência da Computação no design de 8 aplicações diferentes destinadas a promover a interação social por meio da TV digital interativa. Os resultados reforçaram as contribuições do conjunto de valores em software social e indicaram a viabilidade dos artefatos propostos. O estudo de caso também demonstra a instanciação da abordagem VCIA de forma completa,		X	X

		com outros artefatos e técnicas sugeridos. O artigo recebeu o ***Best Student Paper Award*** da conferência na área de IHC e foi convidado para publicação em versão estendida como capítulo de livro da série *Springer LNBIP*.			
Pereira, R., Buchdid S.B., Miranda, L.C., Baranauskas, M.C.C. Considering Values and Cultural Aspects in the Evaluation of Interactive Systems Prototypes. *In: Proceedings of International Conference on Information Society (i-Society 2012)*, 2012, pp. 395-400.	Anexo 7	Este artigo discute sobre a avaliação de sistemas interativos no contexto do novo "momento" em IHC (terceiro paradigma, terceira onda) e propõe um artefato novo criado para apoiar a avaliação de sistemas interativos sob a ótica de valores e cultura. O artefato também foi experimentado no estudo de caso para design de aplicações para a TV digital interativa e seus resultados demonstraram a viabilidade do artefato cobrir aspectos que, segundo a literatura, não são considerados por métodos de avaliação tradicionais (*e.g.*, Inspeção Heurística). Os resultados também demonstraram que é necessário utilizar artefatos e métodos para lidar com valores em todos os estágios de design. Uma versão estendida do artigo foi convidada para ser publicada em revista internacional.		X	X

Capítulo 2

A Discussion on Social Software: Concept, Building Blocks and Challenges[8]

"*There is no absolute knowledge, and those who claim it, whether they are scientists or dogmatists, open the door to tragedy.*"
(J. **Bronowski**, "The Ascent of Man", 1974)

The possibility of developing more interactive and innovative applications led to an explosion in the amount of systems available on the web in which users interact with each other and have a primary role as producers of content — the so-called social software. However, despite their popularity, few of these systems keep an effective participation of users, promoting a continuous and productive interaction. This paper examines the concept of social software and analyzes the social software honeycomb, a framework to help in understanding this kind of system. Based on the analysis of an inclusive social network and on literature review, we revisit that framework. We argue that values should be considered in the context of social software and the framework should be extended and theoretically grounded in order to address the several challenges imposed by the "social".

[8] Pereira, R., Baranauskas, M.C.C. & Silva, S.R.P. A Discussion on Social Software: Concept, Building Blocks and Challenges. *International Journal for Infonomics (IJI)*. ISSN 1742 4712. Vol3(4), pp.533-542. 2010.

2.1. Introduction

New applications allowing mass collaboration, communication and interactivity were developed with the Web 2.0 advent, encouraging the creation of technologies such as social networks, social search, social categorization (folksonomies), among others (Bryant, 2006). These technologies, developed for supporting a "social web", are called social software, and are based on applications that enable mass interaction, communication and interaction.

Applications such as *Youtube*®, *Second Life*®, *Delicious*®, *Twitter*®, *Flickr*®, *Facebook*®, among others, invite millions of users to communicate, interact, create, share and organize information. These systems show the "power of the collective", the opportunities and knowledge that can be generated through collaborative work and mass interaction. According to Webb (2004), the goal of social software is to deal with groups, with ordinary interaction among people. This scenario is a bit different from the groupwork, which usually takes place in a formal setting; here, the interaction occurs in an unprecedented scale and intensity, leading to a situation in which issues related to human-computer interaction are extended to issues related to human-computer-human interaction in social situations.

Despite the popularity and the growing in the number of users of the social software, just a small fraction of systems is really successful. To Webb (2004), the main particularity of social software is in the design process, because human factors and group dynamics introduce design difficulties that are not obvious without considering the human psychology and nature. Moreover, as Silva and Pereira (2008) argue, due to the recent emergence and popularization of social software it is still necessary to understand the impacts that this new range of applications cause, both in social and technological aspects. Likewise, it is necessary to study the new challenges raised by this kind of interactive software; due its social aspects, its requirements are constantly changing, because the quantity and variety of users are very different from those found in conventional software.

Indeed, despite the lack of formal metrics to determine whether a social software has succeeded or not, the number of users and their level of activities offer significant evidences. Without users there will be no information or other kind of knowledge to be analyzed. Thus, being completely dependent on their users, the success of social software heavily depends on how users feel when using them, on their interface features and on their interaction mechanisms. Users need to feel confident, guided, rewarded and motivated to use the application because, otherwise, there is no reason for using such systems to produce or organize information or to interact with each other.

Although the concept of social software is relatively new, discussions around the design of collaborative systems have received attention from academy since more than two decades. In Winograd and Flores (1987), the authors discuss the impact of computer systems on the

social relations of their users, emphasizing that this impact must be taken into account when designing a system. Ackerman (2000) says that at the stage of design, the biggest challenge is social instead of technological. The author emphasizes that systems do not fully meet the requirements of sharing information, the social policy of groups, responsibilities, among others, because we do not have knowledge on how to develop systems that fully support the social world. These statements are also valid for the social software design process, because it seems that the differences between both the concepts of social software and collaborative systems (in their more general form) are in the number and diversity of users, in the amount of information created and shared by them, and in the possibilities users have of interacting with each other and with the system.

In an attempt to build a functional framework for understanding the nature and structure of social software, Smith (2007) proposed a framework he named "social software honeycomb" to illustrate a list of seven elements that compose a functional definition of it. Smith's framework is grounded on the evolution of a discussion informally developed among professionals and researchers who were interested in understanding the new dynamics, challenges, opportunities and implications of the so-called social software. Although a good starting point for analysis, the framework needs further improvements and theoretically grounded discussions to help in understanding, designing and evaluating social software.

This paper revisits some definitions and discusses the social software concept. It also sheds light on Smith's social software honeycomb (2007), discussing it, pointing out its limitations, suggesting improvements and theories for grounding it. These theories, such as Organizational Semiotics (Liu, 2000), help in understanding and dealing with the social world. To analyze the framework, we apply it to an inclusive social network: *Vila na Rede* (Almeida *et al.*, 2009). As a result, we show aspects, such as collaboration and emotion, which the framework is not able to address. Furthermore, trough a literature review, we identify additional elements that, according to researchers and practitioners, afford the social aspect of social software and can be determinant of their success. The empiric analysis of the *Vila na Rede* system and the literature review provide the basis of a new set of elements — which we call the social software building blocks.

The paper is organized as follows: section 2.2 discusses several definitions literature brings to the term "social software" to clarify the meanings behind it, and describes the framework from its origin to its conception as the social software honeycomb; section 2.3 presents the *Vila na Rede* system and presents an analysis about its resources, features and the participation of users, discussing the elements considered by the system; section 2.4 revisits the framework and proposes new elements to it; section 2.5 suggests three changes in social software regarding their elements and design process; section 2.6 presents our conclusions and directions for future research.

2.2. Social Software: Literature Review

The term "social software" is used in many different contexts, and different technologies are underlying it. Inspired by Lazar and Preece's (2003) discussion on online communities, we can say that social software is usually a subjective matter: it is easy to understand and recognize, but it is unstable to define and even more complicated to measure.

One of the first definitions for the term (and one of the most broadly discussed) was given by Shirkly (2005) as "software that supports group interaction". Klamma *et al.* (2007) in the context of educational technologies assume, generally, social software as "tools and environments that support activities in digital social networks", while Smith (2008), presents it as "software that allows people to connect through a computer-mediated communication".

In a more detailed view, Chatti *et al.* (2007) define social software as tools for augmenting human social and collaborative abilities and as a medium for facilitating social connection and information interchange. Kolko *et al.* (2007) go beyond web applications and consider mobile devices as social devices, "in the degree to which they mediate social relationships, social networks and manage the circulation of culture that sustains such networks".

Many authors argue that social software is a poorly defined concept (Chatti *et al.*, 2007; Klamma *et al.*, 2007; Kolko *et al.*, 2007). In part, it is because technologies, tools and social concepts are mixed and not clearly explained. Several systems such as *Wikipedia*®, *Facebook*®, *Youtube*® and *MySpace*® are broadly accepted as social software. In the same way, Wikis, Blogs and Social Networks are also included in this category. *Wikipedia*® is a Wiki, but is it considered social software because it uses Wiki technology or because of the way it is used? Therefore, we can notice that the classification criteria vary not only according to the technologies used and the features implemented, but also with pragmatic aspects of usefulness and applicability.

Other point commonly mentioned (McLoughlin e Lee, 2007; Dron, 2007) is that the Internet has always comprised a network of individuals connected through social technologies. Some of them, such as e-mail, chats and forums are long ago available. However, McLoughlin and Lee (2007) argue that "current social software tools not only support social interaction, feedback, conversation and networking", but they also have features of flexibility and modularity enabling collaborative "remixability". Remixability is defined by the authors as "a transformative process in which the information and media organized and shared by individuals can be recombined and built on to create new forms, concepts, ideas, mashups and services".

According to Dron (2007), one useful way to distinguish social software from earlier forms of mediated communication is in comparing some of its key features. For instance,

compared with chat rooms, discussion forums, mailing lists, etc., social software scales very well, gaining strength from large numbers of users. That is, while the examples above tend to become overloaded once a certain number of participants has been exceeded, usually, social software can offer additional benefits, such as organization or collective knowledge emergence. Dron still points out that social software is "organic and self-organizing", underpinned by dynamics that parallel natural processes; "evolutionary", replicating the successful and diminishing the unsuccessful; "stigmergic", signs left in the environment communicate something to others who leave further signs; that "emergent structure" is formed from bottom-up control rather than top-down design.

It is necessary, however, to distinguish between social technologies and social software. Social technologies correspond to technologies such as, social network system, wiki system, social bookmarking system, etc., that allow the instantiation of the social software (*Facebook*®, *Wikipedia*®, *Delicious*® to cite a few). But it is the way an application is instantiated and the way it is used by its users that will really bring social software to life. Indeed, as Boyd (2007) argues, when we talk about social software we are not just talking about a specific set of technologies in which the main focus is on people. Rather, we are talking about a movement in which there are three significant changes: the **first** is the way technology is developed, *e.g.*, the perpetual beta instead of locked-down versions; the **second** is the way participation is widespread, *e.g.*, the network effect and organic growth; and the **third** is the way people behave, *e.g.*, the focus is on connecting people and watching the subject and shared interests emerging instead of creating pre-defined groups.

In this context, we see social software as systems that allow people, in their particularities and differences, to communicate (interact, collaborate, share ideas and information), mediating and facilitating any kind of social relationship; systems whose usefulness is dependent on and whose structure is shaped by the active participation, interaction and production of content by their users.

2.2.1. The Honycomb Framework

Based on an idea from Morville (2000) for a framework to show the facets of user experience, Smith (2007) proposed a framework to illustrate a list of seven elements that give a functional definition to social software (see Figure 2.1).

The first appearance of the social software elements is found in Stewart Butterfield's discussions in 2003 (Butterfield, 2003), when he argued that social software "is software that people use to interact with other people, employing some combination of the following five devices: Identity, Presence, Relationships, Conversations and Groups". To the author, the key idea behind social software is that "by using technology we can reinvigorate interest and participation in the democratic process". In 2004, Webb extended Butterfield's list adding

two other elements he judged important to social software: Reputation and Sharing (Webb, 2004). In 2007, Smith created the social software honeycomb aiming to provide a basis for understanding the functioning of social software and, consequently, for determining the elements that should be considered when designing them (Smith, 2007). Each honeycomb element can be basically understood as follows:

Figure 2.1. The Social Software Honeycomb

- **Identity**: a unique identifier of a user within the system — something that represents his/her "me". The "self" of individuals; the expression of elements of a person's personality and individuality (who is the person over the space and time). For instance: a user's profile.
- **Presence**: are resources that allow knowing whether certain identity is online, sharing the same space at the same time. For instance: the user is online in the system.
- **Relationship**: it is a way to determine how users of the system can relate\are related to each other. For instance: at *Facebook*® the relationship is friendship, at *Twitter*® it marked by followers and at *Delicious*® by fans.
- **Reputation**: it is a way of knowing the status of a user in the system, either a collective opinion from other users or a statistical measure of the system. For instance: who is trustworthy, who produces good information, who are the top collaborators, etc.
- **Groups**: it refers to the possibility of forming communities of users who share common interests, preferences, ideas, opinions, and so on. For instance: a group of people who study the social web.
- **Conversation**: it refers to resources for communication among users (synchronous and/or asynchronous). For instance: instant messages, emails, forums, etc.
- **Sharing**: it refers to the possibility of sharing objects that are significant, important, useful or of users' interest. For instance: documents, photos, music, posts, etc.

The identity appears at the centre of the framework because, according to Smith (2007), it is the most basic requirement of any social system. One may understand from this structure that not all software has all of these elements. Actually, according to examples shown by Smith, we found out that systems usually have three or more of such elements, but have a main focus on only one or two of them. For instance, considering the *Youtube*® system under the framework perspective (see Figure 2.2), we could say it focuses on the "sharing" element: the main purpose of users in the system is to share videos—posting and watching videos. Additionally, the system implements the elements of "identity": users have their profile with favorite videos and added videos; "conversation": users comment and respond to comments about the videos; "groups": the system provides resources for the formation of groups and channels in which users can join and participate; and "reputation": the system implements a collaborative scheme of reputation over the comments posted in videos and the videos themselves in order to identify and avoid spam and promote the best ones.

Figure 2.2. The *Youtube*® elements

Although a good starting point in defining a conceptual framework to assist in the understanding of social software, the framework elements are far from being exhaustive and complete. Following, we explore the framework by analyzing the *Vila na Rede* system. This analysis identifies the elements considered by the system, explains aspects of how these elements were implemented, and shows which points are not being covered by the framework

2.3. *Vila na Rede*: an Inclusive Social Network

Vila na Rede[9] is an Inclusive Social Network built for and with Brazilian citizens. The system is a result of a project which aimed at studying and proposing solutions to the challenges of interaction and user interface design on systems related to the exercise of citizenship,

[9] *http://www.vilanarede.org.br*

contributing to the promotion of a digital culture in society. The *Vila na Rede* was conceived to be a "social network system that provides users with a welcoming environment in which they feel comfortable and can identify themselves with; a system that makes sense to the users" (Almeida *et al.*, 2009).

The main difference of *Vila na Rede* when compared to other social network systems is that it was conceived with and for users with low exposition to the digital culture, considering their limitations and abilities, resulting in a system that is part of their social context of life. The system was designed taking into account what Baranauskas (2009) calls Socially Aware Computing: "the theory, artifacts and methods we need to articulate to actually make the design socially responsible, participatory and universal as process and product".

The *Vila na Rede* system (see Figure 2.3) is an environment in which its users can announce products and services, ideas, or events, communicating with each other (synchronous and/or asynchronously) by using different media (audio, video, image) that are transversal to the system. The content produced in the system remains open (unless users choose to keep it private), making it possible for anyone to browse and access information regardless of registration. However, for posting, commenting or collaborating with others, previous registration is required.

Figure 2.3. The *Vila na Rede* System

The main features offered to the users are: i) users can publish and browse announcements of products, services, events and ideas. ii) They can use multimedia resources embedded in the system in their announcements: a user can take a picture and have that picture directly on the announcement; make short movies to show their things or to explain something using LIBRAS (Brazilian Sign Language) — and/or upload files with images or videos. iii) All announcements can be commented and the user who creates it can choose if his/her announcement will be publicly available or not. iv) Users can collaborate with others by adding information\media in someone else's announcement. v) There is a meta-communication mechanism that uses multiple media for supporting users in using the system. vi) It is possible to select or choose all announcements which contain audio to create a playlist. vii) Users can see who is online in the system and chat with other users using text, webcam, sending files, etc. viii) The system allows users to adjust the interface according to their preferences (*i.e.*, graphic layout) or needs (*i.e.*, content size). ix) There is a feature called Virtual Presenter who reads the content posted by the users in the system and allows (not/partially) literate or visually impaired users to access the information. The system also shows data about visitants, new registered users, comments on advertisements, and so on. See Figure 2.4 for some examples.

Figure 2.4. *Vila na Rede*'s features

Looking at Figure 2.4, the detail "1" indicates the resource developed for supporting users in taking their pictures. They do not need to have knowledge about how to

organize/search files in an operating system in order to post a picture: it is enough to have a webcam. The system already captures the image and displays it for the user to choose whether to post that picture or capture another. The detail "2" refers to the meta-communication feature in multiple media (audio, video, pictures or LIBRAS) that explains how the system can be used, the resources available for use and their functionalities, and that supports users in a contextualized way at the moment they are performing a task. The Virtual Presenter who reads the content of announcements to users is also viewed in this feature. Detail "3" marks an interface component that triggers the meta-communication function of the feature "online users". Whenever a user clicks on the "i", an explanation about the related feature is presented. Detail "4" shows the features that allow users to adjust (tailor) the interface according to their preferences (*e.g.*, change the menu, text size, color contrast, etc.), and detail "5" marks a feature that enables users to navigate on the screen without using the scrollbar. This feature was created due to a difficulty that users who were not familiarized with computer systems had in using the browsers' scrollbar.

According to the features presented, in the following section we identify the elements of the Honeycomb framework that are being considered in the *Vila na Rede* system.

2.3.1. The honeycomb elements analyzed in the *Vila na Rede*

The most important aspect of *Vila na Rede* is its simplicity, its attention to the diversity of competencies (*e.g.*, literacy) and limitations of its prospective users, their specific needs, including affective and emotional aspects. Considering the Honeycomb framework to evaluate the system (see Figure 2.5), we can see it focuses on the conversation and sharing elements (in dark gray color), also implementing the elements of identity and presence (in light gray color). The elements not explicitly considered appear in blank.

The conversation and sharing elements are visible mainly through the announcements posted by the users. Users effectively interact, communicate and collaborate with each other, sharing not only products, services, events or ideas, but also their culture, preferences, interests, expectations and their context of life. Conversation is also considered via the resource of chat, in which a user can talk directly to other users who are online in the system.

The element of identity is explicitly implemented through a resource of users' profile, which shows information about who the user is, how to contact him/her, who are their "godfather" in the system (the user who supports or invited them to use the system), etc. Moreover, the way the elements of conversation and sharing are implemented reinforces the creation of a virtual identity in the system, because the awareness of what users say and post, with whom they interact, and what they are doing, influence the perception of them about themselves and of other users about them. Finally, the element of presence is perceptible

through a mechanism that shows the users who are online in the system allowing the synchronous communication among them.

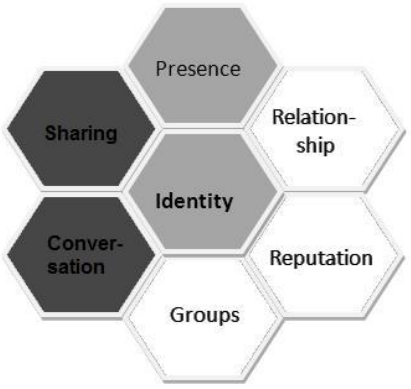

Figure 2.5. *Vila na Rede*'s elements

It is important to notice that although the elements of reputation, groups and relationship are not being explicitly considered in the system, they can be perceived in users' participation and history. Reputation is something built from users' comments, announcements and collaboration; and a reputation of a user is recognized by others according to the quality of his/her participation in the system. In this case, despite the absence of a resource for representing reputation explicitly, this element emerges from users' interaction, implicitly influencing the future interactions among them and the way they want to be seen in the system. Similarly, the element of relationship is not made explicit; nevertheless it can be identified through a graphical feature that shows who are talking to whom in a given instant of time, and groups can be identified mainly through the comments and the collaboration of users in each others' announcements.

Vila na Rede was designed with users involvement during the whole system development process, and the need for these elements were not identified. Consequently, there was no reason to overload users with resources they do not need or that do not make sense to them..

2.4. Discussion

In the previous section we applied the Honeycomb framework to analyze the *Vila na Rede* system. Here, we do the opposite and use the system as a way of evaluating the framework.

The first point we want to highlight is related to the framework usefulness. In the way it was conceived by Smith (2007), the framework brings a set of elements commonly found in systems that connect people, such as Learning Management System (LMS), collaborative systems or social network sites. It is useful in remembering a designer, or evaluator, what

resources are interesting to consider when designing\evaluating a system which is intended to be social. However, it does not allow identifying other important elements (*e.g.*, collaboration) nor to understand if a specific application characterizes social software. Considering the definition of social software presented in section 2.2, the framework does not draw attention to key issues such as users' diversity, needs, or other social aspects. Therefore, just implementing some of (or all) the framework elements does not imply that the system is social or supports, mediates, facilitates social relationship. On the other hand, as shown in the *Vila na Rede* analysis, a system can be social even not explicitly considering half of the framework elements.

Indeed, if we consider a LMS system like *Moodle*® and try to identify which elements it implements, probably, we will recognize most (if not all) the elements. However, researchers on educational technologies such as Chen *et al.* (2007), Dalsgaard (2006) and Roberts and McInnerney (2007), are convinced that LMSs are not capable to support learners in an interactive and effective learning process. There are several different arguments justifying such statement but one is strongly mentioned: LMSs focus on content instead of on people. Nevertheless, Dalsgaard (2006) points out LMSs' efficiency regarding administrative issues. According to him, these systems can support the management of courses and their activities, favoring their centralization and organization in a top-down format. Indeed, its focus is on courses and activities, and the other elements such as group (*e.g.*, a class), relationship (*e.g.*, colleagues) and conversation (*e.g.*, forums) are all implemented in order to support the system goal: managing these courses and activities. In a system where the focus is on people, *e.g.*, a social network, identity is the core element.

Consequently, classifying LMSs as successful or unsuccessful is a subjective matter that depends on the purpose and expectative of their users: LMSs can be an excellent option for managing contents and activities while fail in providing a social experience that could lead to effective learning from a constructivist perspective. Thus, choosing the right elements and the right way of implementing them is a key-point, because this will influence the interaction of users with the system and with users themselves.

Actually, for being able to help designers and evaluators in understanding social software and in projecting it, the framework needs to be theoretically grounded and expanded with new elements. For Norman (2008), people learn social skills, but machines, systems or other technological artifact need those skills being designed into them. This means that it is not enough to choose some elements, implement them, build a system and deliver it to users hoping they will like and use it. It is not enough to group people together and tell them to share their knowledge and collaborate; people need to see a clear benefit in using a system or carrying out a task, otherwise they will not spend their time doing it. But understanding these

social requirements is possible only if designers could see the system through the lenses of its users and their cultural particularities.

In this sense, as Neris *et al.* (2008) highlight, we need to know users in their abilities, formalizing the interaction requirements and investigating solutions of interaction/interface for the diversity. Systems should reflect an understanding on how people actually live and work in their organizations, communities, groups and other forms of collective life, otherwise, as Ackerman (2000) asserts, the produced systems will be useless, distorting the collaboration, communication and other social activities.

According to the discussion exposed in this section, following we present additional elements to the framework identified in the analysis through the *Vila na Rede* system and reinforced by literature review; in the next section we present a paradigm-shift in the way these elements should be understood

2.4.1. New elements in discussion

For the literature review, we selected three journals and three conferences according to their tradition and importance in the areas of Computer Science (focusing on HCI) and Education (due to the growing discussion about the design of technologies for supporting teaching and learning promoted by social interaction). The selected journals were: Computers & Education journal and the British Journal of Educational Technology (BJET) due to their tradition and impact factor, and Journal of Educational Technology & Society, by explicitly considering the aspect of "Society" and having special issues devoted to the topic of social software. The International Conference on Human-Computer Interaction (HCII), Conference on Human-Computer Interaction (IFIP TC13-INTERACT) and Conference on Human Factors in Computing Systems (ACM CHI) were selected in order to consider the three most important and comprehensive international conferences in the field of HCI.

Initially, the investigation considered all the scientific papers published over the past 5 years at the conferences previously mentioned and over the past 10 years at the selected journals that were found based on the following keywords: web 2.0, social web, social software, social network and life-long learning. Also, papers published in other journals and conferences indexed with the same terms were considered. From this investigation, we identified 43 papers relevant to our research, and from these papers we reached some new elements. Following, we present the elements that agree with our findings in the analysis of the *Vila na Rede* system.

Object: in further discussions about Smith's framework, Wal (2008) suggested new elements, such as "object" and "collaboration", and agrees with Zangestrom (2005) that an important element missing is the Object. Knorr-Cetina (1997) addresses the individual and the object as central elements in a process of social interaction (an object-centred sociality):

objects around which discussions occur, the focus is maintained, the talks begin, among other social interactions. Actually, the social object being built/modified is determining which elements should be considered and how they should be considered (*e.g.*, in *Youtube*® the object is video, in *Delicious*® it is bookmark, and in *Vila na Rede*® it is an announcement). Depending on the object, the elements needed to support it and the way these elements should be technically implemented will vary significantly. In Smith's framework the "object" is not made explicit; it is behind the scene, as the thing people "share" in the social software.

Collaboration: this element refers to resources that allow users cooperate with each other; working together on the same object. For instance: users cooperatively create, edit and evaluate an article in a Wiki (Roberts e McInnerney, 2007).

Emotion and Affection: it is related to feelings, people sensations such as welfare, pleasure, fun, engagement, boredom, disappointment and other aspects related to users' experience. For instance: users' fear of suffering discrimination because of information published in their profile (Norman, 2008; Sellen *et al.*, 2009).

Neris *et al.* (2008) emphasize that what makes the design of social software so complex is surely the heterogeneity of users who can interact with the system and through the system in their social contexts. Thus, the framework needs to help in understanding what maintains the collaboration, the participation and the effective interaction among users, because in a social software there should be a symmetric relation in the sharing of the object, regarding who gets the benefits of the task. People have a natural tendency to collaborate, participate and interact, because it is a way to define their space, to build their identity in face of others and the world. However, users must have some benefit, feeling motivated and compensated for investing their time and effort interacting with others and producing content in these systems. Consequently, the framework needs to draw attention to the users' affective, emotional and cultural aspects. These aspects were considered in *Vila na Rede* since its design, but the original Smith's framework would not be able to represent them through combination of its elements.

Adaptability: it refers to features that allow users to modify a system according to its context of use; flexibility to adapt the system's interface to situations of use that have changed or are unexpected. For instance, users can add/remove shortcuts to the system most frequently used features (Dron, 2007; Neris *et al.*, 2008). Regarding this element, the *Vila na Rede* system also indicates that a system should be adaptable (tailored) to the users diversity (skills, preferences, limitations, age, experience, etc.), and this is another point not covered by the honeycomb framework.

Usability: this concept refers to interfaces that are consistent, controllable and predictable, easy to use and satisfactory. The system cannot require users a high level of expertise in the use of computers (Lazar e Preece, 2003).

Accessibility: is the capability of supporting a heterogeneous set of users with distinct skills, preferences, needs, and motor and cognitive limitations (Santana *et al.*, 2009). For instance: the system provides alternative registration for users that do not have an e-mail account; the system has a feature that reads the content of an announcement for the users.

The Honeycomb framework does not address the usability and accessibility concepts which are critical in social software. If users could not use or have difficulties in using a poor designed system, probably they would not use it. In this context, it does not matter if a system implements the framework's elements in several ways, if it not accessible and usable, it will fail in being social.

During our literature review we verified that the concept of accessibility is almost absent from discussion. Isaias *et al.* (2009) and Tsai *et al.* (2011) discuss the need of providing easy access and favoring the participation of people, but their arguments are not related to the development of accessible systems or technologies; the only research in which we identified an explicit concern regarding accessibility was Hernandéz-Ramos (2006). The author analyzed 25 awarded research projects in technology for education and identified that the most impactful projects were not those developed using the top technologies, but those that had a clear purpose and were developed in order to solve a specific problem for the widest possible audience.

This negligence with accessibility reveals more than an additional element to the framework; it represents a lack regarding the development of technologies and solutions for the diversity, which can be accessed by everyone. Accessibility is especially important in systems related to the exercise of citizenship, where the technology cannot discriminate or deprive citizens of their rights. In this sense, if we understand accessibility as a right of people instead of a technology's attribute, naturally, we will see that this negligence points to something that we must be mindful: human values.

Despite the limitations presented in this section, the Honeycomb framework was a good starting point in understanding social software. Its expansion with new elements, some of them suggested in this section (object, collaboration, adaptability, usability, accessibility and affective and emotional aspects) and its application within theoretical grounded basis can make it more adequate to the social software context. However, we reinforce that this framework usefulness to the design and evaluation of social software should address the view of a Socially Aware Computing (2009). Otherwise, the fulfillment of users' social demands will be missing.

2.5. The Paradigm Shift

If we are to develop social software according to Baranauskas' approach (2009; Baranauskas e Bonacin, 2008) we need to change the way we understand the elements that compose them and the way we design these systems. Here, we can highlight three points.

First, we must be aware that every innovation brings negative and positive impact to the environment in which it is introduced. In this context, we need to move from a perspective of technical (or functional) elements only, to a perspective in which technical, formal and informal (social) aspects are intertwined in each element. **Second**, we must understand that culture influences the way the innovation will be valued by its direct and indirect users regarding its impact. In this sense, the elements that compose social software must be understood as values: values of different nature and with different relationships instead of functional elements codified in a software. **Third**, we need discard our view of a design process in which technological innovations are produced and delivered for people using them even without a clear perception of their utility and potential impact, and adopt one that favors the understanding of the social world and that sees people, organizations, process, rules and norms as part of a whole information system.

Regarding the first point, human operate on three distinct levels: the informal, formal and technical (Hall, 1959). Each is present in any situation but one will prevail at any instant in time. In the Organizational Semiotics (OS) theory (Liu, 2000) an organization and its information system are considered a social system in which human behaviors are organized by a system of norms. The Semiotics Onion (Stamper, 2000) is an artifact of the OS that represents these three levels (see Figure 2.6): the informal, where the organizational culture, customs and values are reflected as beliefs, habits and individual behavior patterns of its members; the formal in which rules and procedures are created to replace meanings and intentions; and the technical that represents the computer system situated within the formal level. Therefore, any technological artifact is embedded in a formal system which, in turn, exists in the context of an informal one.

The structure represented by the Semiotics Onion calls attention to the need for i) considering elements that are manifested in each of the three levels and ii) approaching the elements from each level in a connected way. For instance, in the previous section we evidenced the existence of elements in the context of social software that are manifested in the informal (emotion and affection), formal (collaboration) and technical level (accessibility).

Neglecting elements placed in any level prevents designers from understanding the elements and their relationships in a general way. On the other hand, if we are to consider these elements, we must approach and deal with them in the three levels simultaneously. For instance, identity is an element related to personal (informal) aspects of users that are

reflected on/by the social world. However, this element also has a formal aspect, such as a formal definition of what it means or a set of norms and rules that model its components; this formal aspect can support understanding the way this element is established in people or organization's culture and in creating a technical representation of it as a feature in a computer system, *e.g.*, a user's profile.

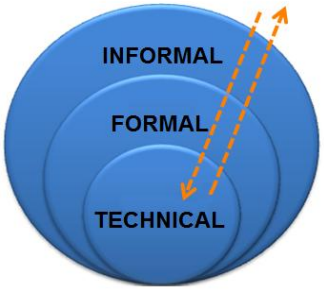

Figure 2.6. The semiotics onion

The Values Theory (Schwartz, 2009) defines values as desirable, trans-situational goals that vary in importance and that serves as guiding principles in people's lives. In 2007, researchers from academia and industry from different countries and with different knowledge bases (*e.g.*, computing, design and social sciences) met in Seville, Spain, to discuss the area of HCI in 2020 (Sellen *et al.*, 2009). Among the main questions raised at this meeting one was strongly mentioned: the need of keeping human values in the core of HCI.

Each culture develops specific values (Hall, 1959) that influences the way people will see a technological innovation. In this sense, as technology left the context of offices and workplaces to pervade every aspect of people's personal and social lives, a broad set of factors that range from emotional and affective aspects, sociability and human values, to issues of scalability, security and performance are now in play. This new and complex scenario brings us challenges that were not faced before. Therefore, regarding the second point we highlight the need of approaching the elements involved in the context of social software in terms of values: informal, formal and technical values that are situational, interconnected and bound to cultural aspects. These values should be discussed and charted according to the way they are supported, promoted or inhibited by technologies (Sellen *et al.*, 2009) and also according to way they are related to each other. As discussed in the previous section when suggesting accessibility as a new element, identity, groups, collaboration, adaptability should all be considered in terms of values. Privacy, security, autonomy, reciprocity, portability, etc., are other possible candidates because they also seem to be important to users and, therefore, critical in the context of social software.

The third point refers to an understanding of the design of social software from a social perspective (see Figure 2.6): "as a movement that starts in the society, crosses the informal

and formal layers of signs, towards the construction of a technical system, returning back and impacting the society" (2009). In summary, to design systems that effectively meet users' demands, accessible, and that reflect the values of the people they are intended for, we need a new Science of Design aligning system development with social practices with the end user.

2.6. Conclusion

The process of designing social software is highly complex because we must consider human factors, group dynamics, social, psychological and cultural aspects to understand how to design a system that effectively satisfies the needs of its users and that really meets the demands imposed by the social context. In this paper we have focused on social software design and understanding. First, we reviewed some definitions to the social software term and presented a constructed meaning for it. Further, we introduced the Honeycomb framework and, based on an analysis of an inclusive social network and grounded on a literature review, we revisited this framework discussing its elements and suggesting new ways on it.

The main points we highlighted in this paper were the need for considering elements manifested in the informal, formal and technical levels of information; the perception of these elements as values bound to cultural aspects of people, groups, organizations and their environments; and the view of social software design from a social perspective. As a challenge, we point out the need for developing theories, methods and artifacts that support designers in placing values at the core of the design of any technological artifact. Theories and concepts such as Organizational Semiotics (Liu, 2000), Socially Aware Computing (Baranauskas, 2009), Object-Centred Sociality (Knorr-Cetina, 1997) and Values Theory (Schwartz, 2009) motivated our discussion in this paper and are good candidate for grounding future investigations.

Capítulo 3

Social Software and Educational Technology: Informal, Formal and Technical Values[10]

"*Values emerge from the tools that we build and how we choose to use them. Yet, in most of the current practice in designing computer technology and the related infrastructure of cyberspace, little is said about values.*"
(B. **Friedman**, "Value Sensitive Design", 1996).

Social software is a growing reality worldwide and several authors are discussing its use to promote social interaction in learning contexts. Although problems regarding privacy, reputation, and identity are commonly reported in social software, an explicit concern regarding peoples' values is not a common practice in its design and adoption, in part, due to the lack of research in this subject. The issue of values becomes even more critical as social software crosses the boundaries of people's cultures to pervade every aspect of their lives, from personal relationships to work, from play to education. In this paper we shed light on this scenario by presenting an informed discussion about values in the context of social software. An organization of 28 suggested values is presented in the Value Pie, as a way of informing the design of social software. Our discussion is grounded on Organizational Semiotics and the Building Blocks of Culture.

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[10] Pereira, R., Baranauskas, M.C.C. & Silva, S.R.P. Social Software and Educational Technology: Informal, Formal and Technical Values. *International Journal of Educational Technology & Society (ET&S)*, 16(1), 4-14. 2013.

3.1. Introduction

The Web 2.0 was a milestone in the development of rich and innovative web systems in terms of interactivity, enabling the emergence of the so-called social software (*e.g.*, social networks, wikis, and social bookmarking). Social software is frequently cited as determinant of transformations that are changing the way people relate to digital technology (Pereira *et al.*, 2010a). *Twitter*®, *Facebook*® and *Youtube*® are examples of how information and communication technology (ICT) has pervaded every aspect of people's personal and social life. This kind of system is used not only at home, but also in workplaces, public organizations, and schools for several purposes, via different devices and with far-reaching consequences.

Sellen *et al.* (2009) assert that we now live with technology, not just use it. What this means is that a broad set of factors that range from emotion, affect, sociability and human values, to issues of scalability, security and performance, have changed the interaction between people and computers. In fact, interactions have assumed new dimensions and cannot be addressed only as being task-oriented. The concepts we mentioned above, such as human values, motivation, pragmatics, emotion, and affect, that were traditionally left on the margin of approaches to computer systems development, need to be moved to the centre in order to develop systems aligned with the new demands of a society mediated by ICT (Harrison *et al.*, 2007).

Authors such as Chatti *et al.* (2007), Dalsgaard (2006), Dron (2007), and Klamma *et al.* (2007), discuss the adoption and use of social software to promote social interaction for both informal learning and distance learning — traditionally centered on Learning Management Systems (LMS). Although these authors have different approaches, and focus on different aspects of the integration between informal and formal learning, they are congruent in suggesting social software as a technical solution for this issue. However, as social software remains a quite unexplored topic by the research community, the understanding of such a complex integration still demands further investigation.

The concept of social software, and the changes and challenges it brings, are being discussed in the literature and through informal discussions in forums and blogs since mid 2004. In Pereira *et al.* (2010a), we presented a review and compilation of discussions indicating the need for a paradigm shift in the way we understand and design social software. As social software, and web applications in general, are available worldwide, we argue that the various elements should be understood as values bounded to cultural aspects of people, groups, organizations, and their environments, which are manifested in the informal, formal, and technical levels of information. As a challenge, we pointed out the need for studies,

investigations, and theories to support understanding and placing values at the core of the analysis and design of social software.

According to Rokeach (1973), the value concept seems to be able to unify the apparently diverse interests of the sciences concerned with human behavior. Boyd (2007) asserts that social software is all about the new in web applications, but the new is more related to people's behavior than to the technology itself. Social software introduces many complex issues that pervade every aspect of people's lives, representing opportunities and challenges, benefits and drawbacks, democracy and exclusion. Therefore, taking into account values in social software design is among the most complex scenarios we are facing nowadays. If we consider the design of the systems previously cited, there is little concern for human values such as privacy, reputation, autonomy, among other cultural aspects (*e.g.*, beliefs, behavioral patterns). An evidence of such negligence of the social aspects of these applications, users have been inadvertently serving as beta testers of applications as well as subjects of implicit behavioral experiments to identify the viability of a resource or product. Privacy policies and agreement terms are constantly changed and updated, many times without users' awareness. Products which were not approved in their beta tests are removed/discontinued disregarding possible effects on users. Accessibility issues are usually neglected, making it difficult or even preventing the access of people that do not fit the myth of the "average user".

Other evidences of implications related to values (or to the lack there of) in social software design have been widely reported by media, and can be easily perceived. Solove (2007) was one of the first authors to devote attention to the possible negative effects of social software on people's privacy and reputation. However, as Sellen *et al.* (2009) highlight, human values, in all their diversity, should be seen according to the way they are supported, promoted, or inhibited by technologies. Specifically, in the context of social software, little is known about values. What these values look like, their roles, the way they can be promoted or inhibited, and the possible means to deal with them still demands investigation.

In this paper we shed light on these challenges by presenting a literature review on values in social software and educational technology, suggesting 28 elements that we approach as interactive values. Grounded on theories such as Organizational Semiotics (Liu, 2000), the Building Blocks of Culture (Hall, 1959), and Values Theory (Schwartz, 2005), we propose the Value Pie: an informed scheme that presents values as bounded to culture and manifested in the informal, formal, and technical layers of information systems.

The paper is organized as follows. First, we present a discussion on values in technology design (section 3.2). Second, we suggest, describe, and exemplify 28 values identified through a literature review on social software and educational technology (section 3.3). Third, we propose the Value Pie and exemplify our discussion in the context of informal and formal learning (section 3.4). Finally, we present our final remarks.

3.2. Values in Design

Friedman *et al.* (2006) define values as something that is important to a person or group of people. In the Values Theory, Schwartz (2005) defines values as desirable, trans-situational goals that vary in importance and that serve as principles that guide people's lives. In this theory, values are understood as beliefs tinged with emotions, as motivational constructs that transcend specific situations and actions, serving as standards or criteria to guide the selection of actions, policies, people, and events.

For Knobel and Bowker (2011), values often play out in information technologies as disaster needing management, because conversations and analysis of the values in technologies generally occur after their design and launch. Consequently, most users are faced with undecipherable and sometimes strange decisions previously made on their behalf, often not to their benefit. Friedman (1996) argues that the cost to disseminate a technology is insignificant when compared to the cost of developing it, so that the values embedded in its implementations are deep, systematic, and easily disseminated. According to the author, although the negligence of moral values in any organization is disturbing, it is particularly damaging in the design of computer technology, because, unlike people with whom we can disagree and negotiate values and their meanings, we can hardly do the same with technology. Therefore, when designing computer technology it is necessary to see human values from an ethical point of view.

In the context of educational technology, researchers such as Chatti *et al.* (2007), Chen *et al.* (2009), Dalsgaard (2006), and Roberts and McInnerney (2007), are convinced that systems such as LMS are not capable of supporting learners in an interactive and effective learning process. The authors highlight the inability of educational technologies to promote a continuous social interaction, due to their focus on content instead of people, and the lack of resources to motivate users' participation and interaction outside the limits of a formal course or institution. On the one hand, Dalsgaard (2006) points out the efficiency of such systems regarding administrative issues, its organization in a top-down format, and the management of courses and their activities. On the other hand, Chati *et al.* (2007) criticize the one-size-fits-all model adopted by LMS. These authors understand learning as a social process and argue that educational technologies usually treat learning just as "courses delivery", "learning objects", and "learning resources", carrying to the virtual environment the procedures, structure, and activities already existent in traditional learning models in institutions. The cited authors are unanimous in suggesting social software as an interesting alternative to promote learning in informal contexts, as well as to foster social interaction and users' motivation in combination with educational technologies.

Although the previously cited works have pointed out the viability of using social software to promote the integration of informal and formal learning, they are usually concerned with technical issues and/or formal procedures and practices of teaching/learning, not approaching informal learning directly. There is a lack of research that takes into account the impacts of this integration on the values of the stakeholders involved. Understanding the way values are intertwined with the informal, formal, and technical aspects of learning is key to produce educational technologies capable of integrating these aspects.

Some works have explicitly focused on values in technology design. Cockton (2005) proposes a framework to support what he named a Value-Centred Design, which suggests some activities and artifacts to support designers in the understanding of technology design as a process of delivering value. Adopting a different perspective, during the last decade Friedman (1996) has been working on an approach she named Value-Sensitive Design, which is intended to support the concern with human values in the design of computer systems, especially the ethical ones. Sellen *et al.* (2007) assert that presently the biggest challenge in the design of technology is the explicit consideration of values. Their assertion reinforces the choir of Miller *et al.* (2007), Knobel and Bowker (2011) and Bannon (2011) who argue for studies, methods, artifacts, and examples to support designers in understanding values in technology design.

3.3. A survey on Values in Social Software and Educational Technology Design

Values are bound to culture (Hall, 1959; Schwartz, 2005). They are intertwined with each other and vary in meaning, importance, and priority according to the culture being analyzed and across time and space. In the context of computer systems, depending on the way the system is designed, it may afford behaviors that are intrinsically related to individuals and the complex cultural context in which they are using it.

Hall (1959) understands culture as a form of communication and, in an attempt to formalize its basic constructs, he proposed 10 areas, or culture building blocks, he named Primary Messages Systems (PMS): Interaction, Association, Learning, Play, Protection, Exploitation, Temporality, Territoriality, Subsistence and Bisexuality — in Liu (2000) approached as "Classification". Each area is biologically rooted, and any culture can be seen as an evolution of human behaviors and interactions mapped by a combination of them. For him, all cultures develop values with regard to these 10 areas. For instance, values in "Association" refer to the way people organize and structure themselves in society; the groups they form, the kind of relationship they develop and maintain, etc. "Family" is a

manifestation of the aspect of "Association" in a given culture, and its role, structure, and relative importance in society can be understood as values developed in/by that culture. Values in "Classification" refer to preferred style of dressing, jobs, sports, and so on, of men and women. In the same way, values in "Learning" may be related to valued abilities, knowledge and professions; the relative importance of experience, expertise, meritocracy, and others.

In Pereira *et al.* (2010a) — *chapter 2*, we presented analyses of existing social software as well as a review and organization of some discussions about the subject. In that work, we identified and suggested 13 elements we called the social software building blocks, drawing attention to the need for leaving a technically-centered perspective in favor of one that encompasses and articulates informal, formal, and technical aspects involved in social software.

In this paper, we revisit and expand our literature review on social software and educational technology in order to identify, discuss, and exemplify what we are calling informal, formal, and technical values. For the literature review, we selected three journals and three conferences according to their tradition and importance in the areas of Human-Computer Interaction (HCI) and Educational Technology (due to the growing discussion about the design of technology to support teaching and learning that promote social interaction). The International Journal of Educational Technology & Society, the Computers & Education Journal and the British Journal of Educational Technology were selected based on their tradition, scope, and societal reach. The International Conference on Human-Computer Interaction (HCII), the Conference on Human-Computer Interaction (IFIP TC13-INTERACT), and the Conference on Human Factors in Computing Systems (ACM CHI) were selected in order to consider three of the most important and comprehensive international conferences in the field of HCI.

Initially, the investigation considered all the scientific papers published from 2005 to 2010 at the conferences, and the scientific papers published in the same period in the journals, based on the following keywords: web 2.0, social web, social software, social network, values and life-long learning. Additionally, for the International Journal of Educational Technology & Society, the search was expanded to encompass papers published from 2000 to 2011. Papers published in other journals and conferences which were referenced by the selected papers were also considered — see Table 3.1. This initial survey resulted in a total of 2,300 papers. In the first stage, 161 papers were selected based on title and abstract. In the second stage, a detailed analysis of the pre-selected papers resulted in the identification of 65 papers relevant to our interest in values, elements, success factors, and guidelines for designing social software and educational technology that promotes social interaction.

Regarding the literature on learning technologies, Klamma *et al.* (2007) discuss the necessary characteristics of collaborative adaptive learning platforms; McLoughlin & Lee (2007) present 12 examples of pedagogical innovations using social software in 4 countries; Dron (2007) proposes 10 principles to the design of educational social software; Roberts & McInnerney (2007) point out seven problems of online group learning and suggest their solutions. These authors consider social software within formal learning contexts where teachers and students have an explicit relationship with an educational institution. They usually focus on technical aspects of social software and formal aspects of learning. The nature of social software is informal. Thus, it may support informal learning through social interaction taking advantage of its ability to deal with users' experience attributes, such as pleasure, motivation, and creative involvement.

Table 3.1. Literature Review

NAME		PERIOD	PAPERS	
			Selected	Relevant
HCII	International Conference on Human-Computer Interaction	2005, 2007, 2009	29	3
IFIP-INTERACT	Conference on Human-Computer Interaction	2005, 2007, 2009	4	1
ACM-CHI	Conference on Human Factors in Computing Systems	2006 - 2010	19	3
ET&S	International Journal of Educational Technology & Society	2000 - 2011	53	16
C&E	Computers & Education	2005 - 2010	9	3
BJET	British Journal of Educational Technology	2005 - 2010	6	2
	Other journals and conferences	-	41	37
		Total	161	65

Grounded in the relevant papers and in our previous work, we identified 28 elements that represent critical aspects and could be seen as values in systems intended to promote social interaction. Table 3.2 presents these values, their description, including a formal definition of them by Britannica (2011) — *in italic*, and the most meaningful references whose discussions allowed their identification.

Table 3.2. Values in social software

VALUE	DESCRIPTION	REFERENCES
Accessibility	"*Providing access; capable of being reached; also being within reach; easy to communicate or deal with*" Capability of supporting, satisfactorily, a heterogeneous set of users with distinct skills, preferences, needs, perceptual and learning disabilities, and motor and cognitive limitations. Example: the system is fully readable by a screen-reader application.	(Hernández-Ramos, 2006) (Almeida *et al.*, 2009)
Adaptability	"*Capable of being or becoming adapted*" Possibility of modifying a system according to its context of use; flexibility of being adapted to different contexts; situations of use that have changed or are unexpected. Example: users can create contact lists and configure the information they want to share with each other.	(Dron, 2007) (Neris *et al.*, 2007)
Aesthetic, Appearance	"*External show; outward aspect; outward indication; a sense impression or aspect of a thing*" Characteristics related to attractiveness, beauty, care with the image, and the way things are displayed and presented. Example: standardized interfaces with significant and well designed graphic elements.	(Lazar & Preece, 2003) (Norman, 2008)

Autonomy	"*The quality or state of being self-governing; especially the right of self-government*" Users' ability to decide, plan, and act in a way they believe help them reach their goals. Ability to control the technology and use it to their advantage. Example: features that make the system self-explanatory for novice users.	(Bannon, 2011) (Friedman, 1996)
Availability	"*The quality or state of being available*"; Available: "*present or ready for immediate use*" Refers to the capability of the system, feature, or functionality of being available for use at any time and without interruption. Example: the system is available 24/7.	(Isaias *et al.*, 2009)
Awareness	"*Watchful, wary; having or showing realization, perception, or knowledge*" Individual and/or collective perceptions about who is available in the system; who is doing what; what is happening and what happened, etc. Example: users are notified about the news existent since their last logon.	(Chatti *et al.*, 2007) (Glahn *et al.*, 2009)
Collaboration	"*To work jointly with others or together especially in an intellectual endeavor*" Possibility for cooperating; working together on the same object. Example: users jointly create, edit, and evaluate an article in a Wiki.	(Knobel & Bowker, 2011) (Vavoula *et al.*, 2009)
Conversation	"*Oral exchange of sentiments, observations, opinions, or ideas*" Possibility of two or more users establishing direct communication (synchronous and/or asynchronous). Example: comments, chat.	(Tsai *et al.*, 2008) (Vavoula & Sharples, 2009)
Emotion and Affection	"*A conscious mental reaction (as anger or fear) subjectively experienced as strong feeling usually directed toward a specific object and typically accompanied by physiological and behavioral changes in the body*" Feelings, people's sensations such as welfare, pleasure, fun, engagement, boredom, disappointment, and other aspects related to the user's experience. Example: users' fear of suffering discrimination because of information published on their profile; features that allow users to express their affective state.	(Brandtzaeg & Heim, 2009) (Norman, 2008) (Almeida *et al.*, 2009)
Groups	"*A number of individuals assembled together or having some unifying relationship*" A set of individuals with characteristics, situations, interests, or purposes in common. Example: a group of people interested in the use of social software in education.	(Roberts and McInnerney, 2007) (Tsai *et al.*, 2008)
Identity	"*The distinguishing character or personality of an individual*" The "self" of individuals; the expression of elements of a person's personality and individuality (who the person is over space and time). Example: the representation of a person's profile, their activities, personal information, etc.	(Boyd & Elisson, 2007) (Knorr-Cetina, 1997) (Pereira *et al.*, 2010a)
Informed consent	"*Consent to surgery by a patient or to participation in a medical experiment by a subject after achieving an understanding of what is involved*" Users' awareness about the possible impacts of their actions. Refers to informing and garnering people's agreement about what is produced from their interaction with the system and with other users. Example: a user agrees to make his/her profile public even after the system alerting about the risks of such a decision.	(Friedman *et al.*, 2006) (Miller *et al.*, 2007)
Meta-communication	Meta: "*occurring later than or in succession to; situated behind or beyond; later or more highly organized or specialized form of*". Communication: "*an act or instance of transmitting; a process by which information is exchanged between individuals through a common system of symbols, signs, or behavior*" Features that make the system self-explanatory; that allow the user to understand how the system works, the reason it was designed in that way, what can be done through the available resources/features, and what are the possible impacts of using them. Example: the system has explanations and offers tips recorded in video and sign language that guide the user regarding privacy settings.	(Hayashi & Baranauskas, 2010)
Norms, rules and policies	Norm: "*a principle of right action binding upon the members of a group and serving to guide, control, or regulate proper and acceptable behavior*" Formal aspects that govern, regulate, and determine how individuals behave, think, make judgments, and perceive the world. Example: the system's terms and conditions of use.	(Neris *et al.*, 2007) (Lazar & Preece, 2003)
Object	"*Something mental or physical toward which thought, feeling, or action is directed*" Artifacts around which social interactions occur (*e.g.*, the talks, the focus, the collaboration, etc.). Example: videos on *Youtube* , short messages on *Twitter*, comments, sharing on *Facebook*.	(Knorr-Cetina, 1997) (Pereira *et al.*, 2010a)
Ownership and property	"*The state, relation, or fact of being an owner*" The right to possess an object or information, and the right over the actions that can be executed over/with/through this object. Example: a user creates a document, changes it, and shares and transfers its ownership to another user.	(Friedman, 1996) (Sellen *et al.*, 2009)
Portability	"*The quality or state of being portable".* Portable*: "usable on many computers with little or no modification*" Possibility of using the system, its features and functionalities, through different devices and on different platforms. Ex: access through mobile phone, compatibility with different browsers.	(Isaias *et al.*, 2009) (Sellen *et al.*, 2009)
Presence	"*The fact or condition of being present*" Refers to a person being (or not) in a certain place at a certain time. Example: the user is online in the system.	McLoughlin & Lee, 2007 (Pereira *et al.*, 2010a)

Privacy	"*The quality or state of being apart from company or observation; the right to freedom from unauthorized intrusion*" A claim, entitlement, or right of users to determine what information about them will be available and who has access to that information. Example: the system allows users to show his/her list of friends only to people who are already part of it.	(Cotler & Rizzo, 2010) (Glahn *et al.*, 2009) (Karat *et al.*, 2008)
Reciprocity	"*The quality or state of being reciprocal; mutual dependence, action, or influence; a mutual exchange of privileges*" Feeling of mutual benefit; reward for performing a task or for employing some effort to achieve a goal. Example: users that provide high quality contents appear in the "top contributors' users".	(Chen *et al.*, 2009) (Glahn *et al.*, 2009) (Klamma *et al.*, 2007)
Relationship	"*The state of being related or interrelated; a specific instance or type of kinship; a state of affairs existing between those having relations or dealings*" Some kind of link or social tie between two or more individuals. Example: followers, fans, friends.	(Boyd & Elisson, 2007) (Karat *et al.*, 2008)
Reputation	"*Overall quality or character as seen or judged by people in general; recognition by other people of some characteristic or ability*" The perception or collective opinion about an individual constructed by others. Example: the user is an expert in a specific area; the user is known for sending spam and undesirable content.	(Bannon, 2011) (Solove, 2007)
Scalability	"*Capable of being scaled; capable of being easily expanded or upgraded on demand*" Capability to support a growing number of users and deal with a growing amount of information. Example: the system is able to support thousands of simultaneous accesses and communications without presenting problems.	(Boyd, 2007) (Dron, 2007) (Isaias *et al.*, 2009)
Security	"*The quality or state of being secure; freedom from danger; freedom from fear or anxiety; freedom from the prospect of being laid off*" Refers to how well the system protects the information it contains, whether from external attacks or possible technical failures. Example: the users' information will not be lost or shared in an unwanted way.	(Karat *et al.*, 2008) (Santana *et al.*, 2009)
Sharing	"*To divide and distribute in shares; to partake of, use, experience, occupy, or enjoy with others; to have in common*" Possibility for users to make objects or information in their possession available to other users. Example: publication of photos in a social networking system.	(Chatti *et al.*, 2007) (Chen *et al.*, 2009) (Pereira *et al.*, 2010a)
Trust	"*Assured reliance on the character, ability, strength, or truth of someone or something; one in which confidence is placed*" Extent to which another individual, a system, or other artifact, behaves as expected by the users. Example: The system shares only the information approved by the users.	(Dron, 2007) (Karat *et al.*, 2008)
Usability	"*Capable of being used; convenient and practicable for use*" Refers to interfaces that are consistent, controllable and predictable, easy to use and satisfactory. Example: users do not need to remember system-generated codes in order to accomplish a task.	(Lazar & Preece, 2003) (Tsai *et al.*, 2008)
Visibility	"*The quality or state of being visible; capability of being readily noticed; capability of affording an unobstructed view*" Possibility for users to be seen, found, or exist in a given context. Example: the system allows users to search and browse other users' profiles.	(Cotler & Rizzo, 2010) (Roberts and McInnerney, 2007)

The list presented in Table 3.2 adds to the previously cited findings by considering not only technical and formal issues involved in the context of social software and educational technologies, but also the informal ones. It also includes values particularly relevant to educational technologies. For instance, "meta-communication" has shown to be effective for promoting users' autonomy (Hayashi & Baranauskas, 2010). "Informed consent" seems to be important in dealing with conflicts between privacy and visibility favoring security (Friedman *et al.*, 2006). Social conventions, rules, procedures, laws etc., are different "norms" that govern how society works and must be explicitly considered. "Accessibility" issues must be a main concern in the design and adoption of any technology. "Emotional and affective" aspects involved in educational technology development, adoption, and use also need to receive attention. The concern with these values seems to be even more critical when we consider informal learning, where there is no formal assistance and guidance; where users need to be autonomous, aware of their possibilities, and the consequences of their actions; where users need to be motivated, confident, and rewarded for their efforts using the

technology and interacting with each other. If these values are neglected, we run the risk of importing to educational technologies the problems widely reported in social software (*e.g.*, privacy, reputation, exclusion) without fully taking advantage of its use to encourage the integration between formal and informal learning.

We must highlight, however, that the 28 values do not constitute a definitive or exhaustive list. Indeed, as Friedman *et al.* (2006) argue, perhaps no list could be, at least in such a broad and complex area. For example, more abstract values such as solidarity, well being, involvement, motivation, satisfaction, and aspects of user's experience are represented by the value "Emotion and affection". Some values may be decomposed (*e.g.*, "collaboration" encompasses "cooperation", "security" encompasses "safety") or are transversal to the others (*e.g.*, "norms"). Our main concern when creating this list was to find a balance between making it as comprehensive and diverse as possible without having it be overly complex or detailed.

3.4. An Organized Scheme for Values

We previously suggested the importance of taking values into account when discussing informal and formal learning. According to Hall (1959), humans operate at three different levels: informal, formal, and technical. In the learning context, for example, people may learn from observing other people and imitating them (informal); from other's explicit feedback, suggestions, and instructions (formal); or from books, guidelines, and other materials that explain and justify things in a coherently outlined form (technical). A given culture may emphasize technical learning while another may be heavily informal. As Hall asserts, we can identify all the three levels in almost any learning situation, but one will always be emphasized.

It is possible to perceive the three levels in action when the adoption of social software to foster educational practices is being considered. There are several informal issues at play, mainly the emotional and affective ones such as students' motivations and teachers' openness to change. There are also formal issues that must be understood and followed, such as the laws, the teaching program, and the students' minimum age. And there are technical issues, which range from choosing the right social software (that respects the formal issues and is in conformity with the informal ones) to the physical structure (space, internet access, network security).

These three levels are also related to the values. For instance, "autonomy" and "identity" are clearly informal issues, while "norms, rules and policies" are clearly formal, and "scalability" and "portability" clearly technical. In this sense, the Organizational Semiotics

theory (Liu, 2000) proposes the Semiotic Onion to explain how these levels exist in the context of organizations and information systems. The informal represents the organizational culture, customs, and values that are reflected as beliefs, habits, and individual behavior patterns of its members. The formal corresponds to aspects that are well established and accepted, becoming social conventions, norms, or laws. In this level, rules and procedures are created to replace meanings and intentions. Finally, the technical, situated at the core of the onion, represents aspects that are so formalized that they can be technically approached and supported. In a social perspective to the design of computing systems, Baranauskas (2009) and Baranauskas & Bonacin (2008) draw attention to the need for considering the three levels in an integrated and interrelated way in order to produce systems that make sense to their users, not causing negative impacts on them and the environment in which they will be used.

Aiming at situating the values at the three levels in which humans operate and in accordance to Hall's (1959) areas of culture, we draw on the Semiotic Onion (Liu, 2000) and Schwartz's Circular Model of Values (2005) to conceive the Value Pie — see Figure 3.1. The Value Pie is divided into 10 slices, each one corresponding to an area of culture, and is composed by three layers: the external layer refers to the informal level, the middle layer refers to the formal level, and the internal layer refers to the technical level. Values placed at the informal level usually have a personal or ethical nature; values situated at the formal level are collective or social values where there is a social rule or system of norms; and values placed in the technical level can be understood as quality attributes or special features of technology.

These values have an interactive nature and each level must not be approached in isolation. For instance, "autonomy" (informal level) may be restricted/promoted depending on the existing "norms and rules" (formal) and on "accessibility" issues (technical). Moreover, Hall (1959) explains that although one level always dominates and although we deal with them separately, the levels are simultaneously present in everything. For instance, based on Schwartz's Circular Model of Values (2005) one may relate "privacy" to aspects of safety, harmony, and stability of the self, which are usually treated as informal concepts. Everyone has his/her own informal understanding of what privacy is and what it means. However, there are social protocols, conventions, rules, and laws that are formally established to define the meaning, limits, and guarantees of an individual's privacy. Finally, there are also some facets of privacy that are so formally accepted that they can be technically supported, such as a curtain to cover a window or a feature for restricting the visibility of personal data in a social network website.

On the other hand, values placed in a same slice tend to have a natural congruence because they are developed in the same area of culture. For instance, all values developed in

"Association" have some individual-individual/individual-object (Knorr-Cetina, 1997) association in their nature. "Group" is an association. "Relationship" is a kind of association. "Conversation" usually occurs when there are individuals associated in some way. "Trust" is built on and may reinforce association while the lack of trust may destroy it. Mapping it to a learning context, we can say that the existence of an explicit relationship between two or more individuals (*e.g.*, personal contacts) may favor the emergence of a group (*e.g.*, users interested in games), which may promote conversation among the participants (*e.g.*, forum, chats), and which, in turn, may reinforce trust among the users (*e.g.*, sharing ideas).

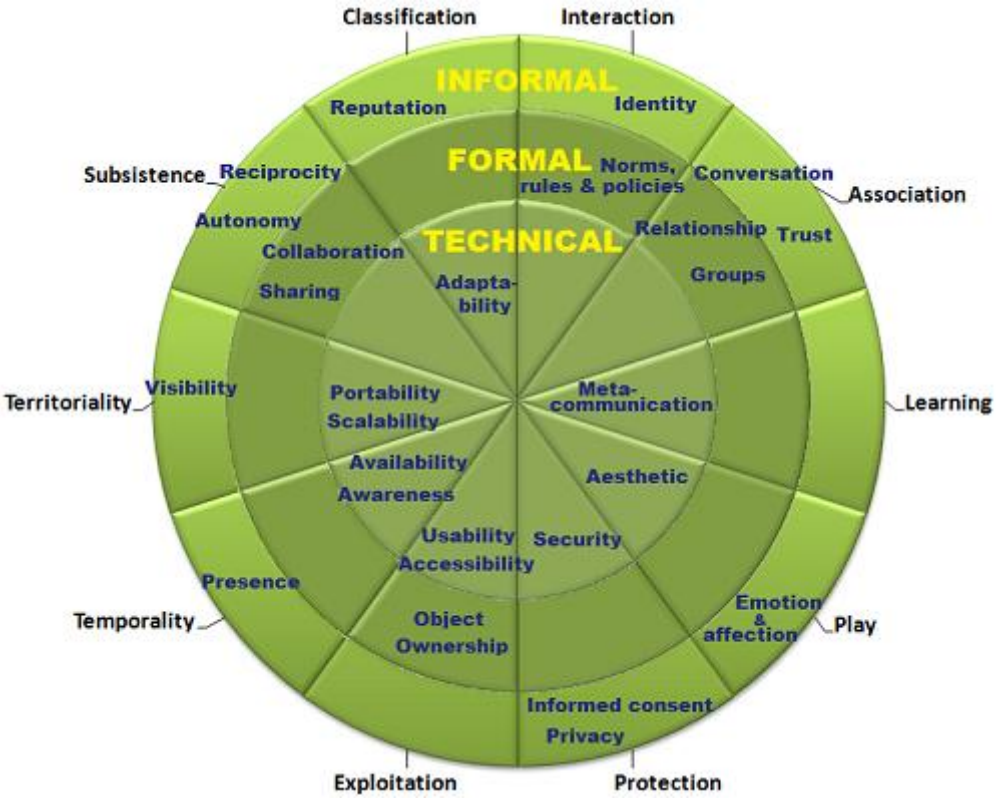

Figure 3.1. The Value Pie

The Value Pie is not intended to be a classification scheme in which the elements are assigned to one and only one class within a system of mutually exclusive and non-overlapping classes (Jacob, 2004). Values may be developed at the intersection of multiple areas. For instance, "privacy" is developed at the intersection of "Protection-Territoriality". It appears in the "Protection" area because while the aspect of space changes (physical, personal) the aspect of protecting the space remains. Other values, such as "identity" and "norms", are transversal to the 10 areas. For instance, one may see "identity" as the sum of an individual's aspects, values, and behavioral patterns, related to the 10 areas (*e.g.*, his/her

position in a social group, his/her job, preferences in playing and learning). The value of "norms", on the other hand, is present in the formal aspect of all the other areas, *e.g.*, learning institutions and their rules ("Learning"), geographical limits and registry of property ("Territoriality"), time zone ("Temporality"), age defining adulthood ("Classification"), etc. The values of "identity" and "norms" appear in the "Interaction" area because it is also transversal to the other areas. For Hall (1959), interaction is at the center of culture and the other areas grow from it: interacting with the environment is to be alive, failing to do so is to be dead; everything people do involves interaction with someone/something else. In this sense, the Value Pie aims at organizing values according to their dominant PMS, and the unfilled spaces may indicate opportunities for reflection and for challenging designers and analysts.

3.5. Conclusion

Usually related to informal contexts, social software has been regarded as bringing both opportunities and challenges to the academy as well as to governmental institutions and private organizations. Researchers of educational technologies were among the first to consider its use in formal settings, evidencing the need for making explicit the values involved in such a complex context.

Although recognized as important, there are few initiatives relating values to technology. In social software, there is even a lack of theoretically grounded approaches for investigating it. In this paper, we presented a survey of social software and educational technology in order to identify elements that should be considered by designers and practitioners when designing or adopting these systems for different usage contexts. As a result, 28 elements were identified and approached as values. Grounded in theories from different areas, we conceived the Value Pie: an informed organization scheme that presents values as bound to culture and manifested in the informal, formal, and technical layers of information systems. The list of values and the Value Pie are a first step in the direction of a value oriented and culturally informed approach to the design of technology intended to promote learning through social interaction. By drawing attention to the diversity of values and their interactive nature, they may be helpful in guiding designers, analysts, and practitioners to consider values when designing their systems.

Capítulo 4

A Value-Oriented and Culturally Informed Approach to Design[11]

"*We understand systems design from a social perspective, as a movement that starts in the society, crosses the informal and formal layers of signs, towards the construction of a technical system, returning back and impacting the society. This science demands new methods, artifacts, objects to think with…*"

(M.C.C. **Baranauskas**, "Socially Aware Computing", 2009)

Cultural aspects, such as values, beliefs and behavioral patterns influence the way technology is understood and used, and the impact it may cause on the environment and on people. Although there is influential literature devoted to the subject of values and culture in design, there is still a lack of principled and light-weighted artifacts and methods to support designers in this task. In this paper we present the VCIA: a value-oriented and culturally informed approach created to support the explicit involvement of values and culture in an integrated way throughout the design of computer systems. The approach is grounded on the Organizational Semiotics theory and the Building Blocks of Culture, and inspired by the Socially Aware Computing approach. It involves a set of artifacts and methods articulated to support the design process in its different stages and activities: from the identification of stakeholders and their values to the organization of requirements and the evaluation of the designed solution. In this paper we present the VCIA, its theoretical and methodological basis, the artifacts that compose it, and examples where the artifacts were instantiated in a practical context related to the design of a social network system. The examples and results of the approach usage indicated its suitability for dealing with values and culture in design.

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4.1. Introduction

Every time a technology is introduced in an environment it causes positive and/or negative impacts on it. We are surrounded by both positive and negative examples of what these impacts look like: from privacy protection to security issues, from digital exclusion to peoples' autonomy, from services availability to excessive techno-dependency, just to name a few. Interactive systems are a growing reality worldwide, and people use them for different purposes, through different devices, and in quite different and complex contexts.

Bødker (2006) asserts that technology has spread from the context of workplaces to our homes, everyday lives and culture. Considering recent advents such as the ubiquitous computing, Sellen *et al.* (2009) highlight that people are not just using technology but living with it. The authors recognized values as a critical issue when designing technologies for the digital age, and pointed out transformations that are changing the way people relate through and with technology.

Winograd (1997) had already argued that the design role "goes beyond the construction of an interface to encompass all the interspace in which people live", requiring a shift from seeing the machinery to seeing the lives of people using it. The author suggests the existence of a complex interplay among technology, individual psychology and social communication, in a way it demands attention to relevant factors that become hard to quantify and even identify — values and other cultural aspects (*e.g.*, beliefs, behavioral patterns) are surely among them.

Some authors have suggested the emergence of a new moment in the Human-Computer Interaction (HCI) field. Harrison *et al.* (2007) discuss a third paradigm that, differently from the first and second ones (oriented to issues of ergonomics and cognitive factors, respectively), must deal with the establishment and multiplicity of meaning in situated interactions. Bødker (2006), in turn, speaks in terms of a third wave in HCI where new elements of human life are included, such as culture, emotion and experience, and where the focus is on the cultural level and on an expansion of the cognitive to the emotional.

These new elements were traditionally left on the margin of approaches to technology design, but now are being moved to the centre. However, as Bødker (2006) points out, although new techniques and technologies have been developed, they are most often presented in theoretical isolation, and as an isolated technical solution. In this sense, Sellen *et al.* (2009) assert that HCI experts must broaden the field's scope and adopt new methods to be useful in the 21st-century sociotechnical environments, and Bannon (2011) claims a reformulation of the HCI discipline, exploring new forms of living with/through

technologies that give primacy to human actors, their values, and their activities. Considering all these different issues and speaking in terms of either waves or paradigms, the fact is that we are passing through a new moment in the HCI field that requires its theories, methods, practices, artifacts and tools to be revisited.

From the core areas of Computer Science listed by ACM[12], HCI is the area that must deal with issues that are universal and transversal to the other areas and, in parallel, consider specific aspects (social, cultural, economic, political, geographic) of the environment in which its application occurs. It highlights the inherent complexity that characterizes the area and that requires a multidisciplinary vision. Nevertheless, curricula in Computer Science and Information Technology traditionally do not favor students to deal with social issues in technology design. Moreover, although there is a crescent appeal for works that discuss and address issues related to values and culture in design, several authors, such as Bannon (2011), Bødker (2006), Miller *et al.* (2007), and Sellen *et al.* (2007), emphasize the need for developing and publishing studies to support designers and evaluators to deal with the complexity and different requirements that current technologies demand. More than including issues regarding values and cultural aspects in the agenda, we need to facilitate their consideration by professionals that are not familiar with social sciences.

In this paper we present the VCIA: a value-oriented and culturally informed approach to design that articulates different theories and offers artifacts and methods to deal with values and culture in an articulated and explicit way. This approach is grounded on Organizational Semiotics theory (Liu, 2000) and the Building Blocks of Culture (Hall, 1959), and is inspired by the Socially Aware Computing approach to design (Baranauskas, 2009; Baranauskas and Bonacin, 2008). It encompasses different design stages: from the problem clarification and the organization of requirements to the evaluation of prototypes and the final solution. We have experienced this approach in different design contexts and it has shown promising for supporting design activities in the HCI new moment.

Although there are works in literature devoted to the study of values and cultural aspects in technology design and adoption, *e.g.*, Del Gado and Nielsen (1996), Friedman (2006), Marcus (2001), Noiwana and Norciob (2006), Isomursu *et al.* (2011), to our knowledge, no informed approach or method is explicitly concerned with supporting the understanding and involvement of both values and their cultural nature. Moreover, as Schikhof *et al.* (2010) show, there is a lack of solutions, explanations and examples of how to deal with these issues in an explicit way. Our research adds to the existing literature by integrating both culture and values, articulating different theories, and offering a set of artifacts and methods to support

[12] Association for Computing Machinery: *http://www.acm.org/education/curricula-recommendations*

designers. The discussion and examples presented in this paper may also inspire researchers and practitioners in other contexts.

This paper is organized as follows: Section 4.2 presents the relevant literature on values and culture in design. Section 4.3 introduces and articulates the theoretical and methodological foundation of our work, and Section 4.4 presents and discusses the VCIA. Section 4.5 instantiates the VCIA in a practical setting related to the design of an inclusive social network for Brazilian teachers of the special education field. Section 4.6 discusses our findings. Finally, Section 4.7 presents our conclusion and directions for future research.

4.2. Relevant Literature

For Rokeach (1973), the value concept seems to be able to unify the apparently diverse interests of the sciences concerned with human behavior. In the Values Theory, Schwartz (2005) defines values as desirable, trans-situational goals that vary in importance and that serve as principles that guide people's lives, and in the context of technology design, Friedman *et al.* (2006) understand values as something that is important to a person individually or a group of people.

Bannon (2011) provides interesting examples of the need for values consideration in the context of "Ambient Assisted Living". He mentions how often designers and even researchers conduct their researches and develop their products hoping they will support elderly people living independently, having a better quality of life at home instead in an institution, and not becoming a burden on other people or on the state as they grow older. Nevertheless, although much of this work aims at empowering older people through independent living, they are more engaged in providing 24/7 remote monitoring than in adding to these people dignity, or empowering themselves to remain autonomous.

According to Norman (2008), every product has a social component and correctly identifying it determines whether the interaction with that product will be sociable or not. People learn social skills, but machines, systems or any other technological artifact, need such skills being designed into them. In this same sense, Friedman (1996) argues that designers necessarily communicate values through the technology they produce. For her, although the neglect of moral values in any organization is disturbing, it is particularly damaging in the design of computer technology, because, unlike people with whom we can disagree and negotiate about values and their meanings, we can hardly do the same with technology.

Evidences of implications related to values (or their lack) in the design of computer systems are present everywhere. However, they are usually too subtle to notice until some social rule is violated, a behavioral pattern is broken, or any conflict of interest arises. Indeed, as Knobel and Bowker (2011) point out, because conversations and analysis about values in

technology generally occur after design and launch, values often arise as a disaster needing management. Consequently, most users are faced with undecipherable design decisions that do not make sense to them, and that were already made on their behalf and often not to their benefit.

Sellen *et al.* (2009) highlight that human values, in all their diversity, should be charted according to the way they are promoted or inhibited by technologies. In Bannon's example (2011), the real needs, concerns and values of the people involved are not in fact central but secondary. Thinking on technology development or medical assistance before understanding the different stakeholders and their values may prevent the understanding of more basic issues, such as people's need to be in contact with family, friends and neighbors in a natural way; the need to manage their privacy and to keep control over themselves, etc.

For Friedman (1996), values emerge from the tools we build and how we choose to use them. Technology itself does not have values — people do have, but depending on the way a technology is designed it will afford behaviors that are intrinsically related to individuals and the complex cultural context in which they are using it. Individuals will interpret and behave over/through the technology influenced by their cultural systems (*e.g.*, values, beliefs, behavior patterns). Their behavior may be in dis/agreement with their values and/or the values of other people. This, in turn, will promote or inhibit certain values over others.

4.2.1. Values in Design

Some works have explicitly focused on values in technology design. Cockton (2005) proposes a framework to support what he named a Value-Centred Design, suggesting some activities and artifacts to support designers in the development of value-centred systems. According to him, the focus of his framework is on the understanding of technology design as a process of delivering value. In a different perspective, since 1996 Friedman has been working on an approach she named Value-Sensitive Design (VSD). This approach is intended to support the concern with values in the design of computer systems, especially the ethical ones.

Other authors have reported experiences in design activities where the concern with values was made explicit. Schikhof *et al.* (2010) explored the role of monitoring systems in small-scale housing for older people with dementia. The authors incorporated principles of VSD in a human centered design process, pointing out to the lack of explanations in HCI to support the understanding of how to focus on human values and to identify those that are critical and must be considered in a design context.

Isomursu *et al.* (2011) proposed a method based on Schwartz's circular model (Schwartz, 2005) for modeling the subjective value perceived by users of new technology. The model was experienced in the context of value analysis in the adoption of a technology-supported attendance control system (*e.g.*, smart cards, mobile phone, web portal) in a primary school.

The results showed the importance of thinking of values since the design stage. The authors concluded that if values were considered in an explicit way when the system was designed, it could have resulted in a product that would better meet the target users' values.

Although there are some initiatives for favoring the consideration of values in technology design, Le Dantec (2009) and Isomursu *et al.* (2011) claim that usually the existing models and approaches, such as Schwartz's circular model, end up restricting the analysis to a set of preconceived values rather than encouraging designers to inquiring about other values that may appear and that are relevant to a particular usage context. Isomursu *et al.* (2011) also highlight that models which consider global values and do not account for their cultural nature, if followed strictly, may prevent the identification and understanding of some important and culturally specific values areas.

4.2.2. Culture in Design

Studies in culture have challenged works, theories and methods used in HCI regarding the universality of their application. Some authors have dealt with the subject of culture in technology design, specially investigating cultural factors in usability evaluation (del Gado and Nielsen, 1996; Winschiers and Fendler, 2007), and the study of current HCI design methods from a cultural perspective (Maunder *et al.*, 2007; Salgado *et al.*, 2011; Yeo, 2000). Research related to Internationalization/Globalization (Marcus, 2000) in HCI have the premises of not making assumptions based on a single place, but they often do not approach culture and values in an explicit way.

Hofstede (1991) investigated cultural differences and proposed a framework with five cultural dimensions (Power Distance Index, Individualism, Masculinity, Uncertainty Avoidance Index, Long-Term Orientation Index). His work was conducted in the context of an international technology company, and has been used by several works intended to deal with cross-cultural issues in HCI. However, it does not favor the identification of other aspects than the dimensions already suggested by the framework (*e.g.*, the ones related to play, fun).

El-Shinnawy and Vinze (1997) examined the impact of technology and culture and their interaction on the process and outcomes of group decision making. Their findings indicated that group decisions are a function of the medium of communication and the cultural setting in which the decision is taken, confirming the importance of considering cultural aspects when studying a group process. According to the authors, technology affects group decision making, and the extent of the impact varies according to the group's cultural norms.

Noiwana and Norciob (2006) investigated the effects of animated graphic colors on attention and perceived usability of users from different cultures and concluded that culture causes influences on users' overall performance, overall retention, and overall self-reports on

usability. Swigger *et al.* (2004) investigated how cultural factors affect the performance of distributed collaborative learning teams, and identified that the cultural composition of teams is a significant predictor of their performance on programming projects.

Situated in the context of persuasive computing, Vasalou *et al.* (2010) investigated social networks sites focusing on how designers motivate users to create content and to keep coming back to the website. In this study, the authors identified that experience with the website and culture have effect on users' motivations, the way they use the website and the time they invest on it.

Noiwana and Norciob (2006) argue that although HCI researchers recognize culture as an important factor, the cultural studies in HCI are still insubstantial. They mention that recommendations of interface design for international users are mainly based on collective knowledge, personal experiences, and few case studies. In fact, as Sellen *et al.* (2007) highlight, despite the recent efforts there is still a need for developing and publishing studies to support the design of technology for the digital age.

4.2.3. Value Sensitive Design (VSD)

From the previously cited works that address issues related to values and culture in technology design, the VSD has been perhaps the most influential. According to Friedman *et al.* (2006), VSD is a theoretically grounded approach to the design of technology that accounts for human values throughout the design process. It involves an integrative and iterative tripartite methodology that consists of conceptual, empirical, and technical investigations, encouraging moral discussions in relation to the development of products and services (Miller *et al.*, 2007).

In short, conceptual investigations involve identifying the direct and indirect stakeholders affected by the solution to be designed and questioning about how they could be affected. Designers must investigate what values are implicated, the trade-offs among competing values, and define their scope and meaning. Empirical investigations should be necessary depending on the questions that may arise. In some situations, analyses have to be informed by empirical investigations in the environment in which the solution is/will be situated, considering aspects of human activity that can be observed, measured, or documented: quantitative and qualitative methods used in social science research can be used here. Technical investigations focus on both how existing technological solutions support/hinder human values and the proactive design of systems to support the values identified in the conceptual investigation. While the focus of empirical investigations is on the individuals, their groups, and those that use or are otherwise affected by the technology, the focus of technical investigations is on the technology itself (Friedman *et al.*, 2006). The authors suggest a practical guide to use the VSD:

1. Start with a value, technology, or context of use.
2. Identify direct and indirect stakeholders.
3. Identify benefits and harms for each stakeholder group.
4. Map benefits and harms onto corresponding values.
5. Conduct a conceptual investigation of key values.
6. Identify potential value conflicts.

On the one hand, our work adds to the VSD in artifacts and methods that may support some of its different activities, like, for instance, the identification of stakeholders and their values, the analysis of existing technical solutions, the organization of requirements related to values, and the mapping of possible impact of these requirements in the stakeholders. On the other hand, it differs substantially from VSD by explicitly addressing the cultural nature of values and by integrating the proposed artifacts and methods into a well-defined design process.

4.3. Theoretical and Methodological Foundation

In this section we present the main theories that ground our approach. We draw on Hall's (1959) Building Blocks of Culture (BBC) for understanding and representing culture and its connection to values. We draw on the Organizational Semiotics (OS) theory (Liu, 2000) to create and adapt the artifacts and methods for considering values and cultural aspects at different systems design stages. Finally, we draw on the Socially Aware Computing (SAC) approach (Baranauskas, 2009; Baranauskas and Bonacin, 2008) to integrate our artifacts and methods into a design process able to account for values and culture throughout the design activities.

4.3.1. The Building Blocks of Culture

When talking about culture, Hall (1977) believes it is more important to look at the way things are put together than at theories or specific analysis and descriptions. Hall (1959) recognizes culture as a term that has received different meanings, and uses it to refer to the way of life of people, their learned behavioral patterns, attitudes, values, material things. To him, culture is related to the very different ways of organizing life, of thinking, and of conceiving underlying assumptions about the family, the state, the economic system, and even of the mankind.

The natural act of thinking is strongly modified by culture. In many different ways, it influences on what people pay attention to and what they ignore, the way they behave and

the way they interpret other's behavior, what they value and what they do not (Hall, 1977). Values are learned and determined by culture (Hall, 1959; Rokeach, 1979; Schwartz, 2005). In this sense, if we are to approach values in technology design, we must pay attention to their cultural nature and complexity.

Hall (1959) approaches culture as a form of communication giving emphasis to the nonverbal. What people are able to communicate in a verbal way would be only part of an entire complex system, and probably the most obvious one. Aiming to formalize the characterization, analysis and comparison between different cultures, he proposes 10 Primary Messages Systems (PMS), or areas, named the basic building blocks of culture: Interaction, Association, Learning, Play, Defense, Exploitation, Temporality, Territoriality, Subsistence and Bisexuality. Each area: i) is rooted in a biologic activity widely shared with other living forms; ii) is capable of analysis in its own terms (without the need for direct references to the other areas); and paradoxically, iii) has direct relationships, interacts, and is reflected in the rest of culture (in all the other areas). In this sense, any culture may be seen as an evolution of human behaviors and interactions mapped by a combination of them.

Cultures develop values with regard to the ten areas (Hall, 1959). For instance, values in "Defense" are related to the rules, strategies and mechanisms developed in order to protect the space (physical, personal), the objects used to guarantee protection, the kind of medical therapy adopted/preferred, etc. — religions may be understood as a way to protect the society from itself by inhibiting potentially harmful behaviors. Values in "Play" are related to the kind of sporting activities preferred in a society, the importance given to leisure and the day of the week used to rest, preferred places for playing, and so on. Values in "Exploitation" are related to the preferred tools, objects, instruments, and procedures for working, playing, learning, protecting, eating, etc.

Values may also be developed in the intersection of different areas. For instance, according to the definition by Britannica[13], identity is "the distinguishing character or personality of an individual". The value of "identity" in a society may be understood as a value developed in the intersection of all the ten areas. It refers to the "self" of individuals; the expression of elements of a person's personality and individuality: who the person is over space and time in its widest sense. The conception and importance of "identity" vary according to the culture being considered. Table 4.1 presents the ten areas of culture and an explanation for each one.

[13] *http://www.britannica.com/bps/dictionary?query=identity*

Table 4.1. The Hall's (1959) building blocks of culture

PMS	DESCRIPTION
Interaction	To be alive means to interact with the environment. Everything people do involves interaction with something/someone else: people, systems, objects, animals, etc. Speaking and writing are highly developed forms of interaction. All the other following areas have interaction in their nature. As Hall asserts, interaction is at the center of the universe of culture and everything grows from it. The value of "identity" is clearly related to this area, once it is also transversal to all the others.
Association	Association begins when two cells have joined: all living things organize their life in some pattern of association. This area refers to the different ways that society and its components are organized and structured. Governmental and social structures may vary strongly according to the culture, not only in nature, form and function, but also in importance. "Association" is clearly related to "Learning" (*e.g.*, classroom, teacher-students), "Play" (*e.g.*, teams, clubs), and "Defense" (*e.g.*, army, military alliances). Values related to groups, personal relationships, partnerships, etc., are developed in this area.
Learning	Learning is one of the basic activities present since the beginning of life. It has an important role in the course of man evolution. People reared in different cultures learn to learn differently. As Hall asserts, education and educational systems are strongly tied to emotion and as characteristic of a culture as its language. Learning is related to the other areas in several aspects: "Territoriality" (*e.g.*, places for learning, position in the classroom), "Temporality" (*e.g.*, specific period for learning, course duration), and "Classification" (*e.g.*, levels of instructions, kinds of knowledge). Values in this area are related to valued kind of abilities, knowledge and professions; the relative importance of experience, expertise, meritocracy, and others.
Play	Funny, emotion and pleasure are terms related to this area. Although its role in the evolution of species is not well understood yet, "Play" is clearly linked to the other areas: in "Learning" it is considered a catalyst; in relationships ("Association") a desirable characteristic; in "Subsistence", a highly motivational factor, etc. Values developed in this area are strongly related to emotion and affection (*e.g.*, welfare, solidarity, motivation). Hall declares that if one controls the humor of a people, s/he is able to control almost everything else.
Protection	Originally named "Defense", we adopted the modification proposed in the OS theory (Liu, 2000). Protection is a specialized activity of vital importance. People must defend themselves not only against hostile forces in nature, but also against those within human society and internal forces of the individual. Cultures have different mechanisms and strategies of protection: medicine, army and religion are some examples. The content of religion ("Learning"), its organization ("Association") and hierarchy ("Classification"), places for praying ("Territoriality"), and the way it is integrated with the rest of life vary from culture to culture. The value of "privacy" is developed at the intersection of "Protection-Territoriality" areas; it is more visible here because while the aspect of space changes (physical, personal) the aspect of protecting the space remains.
Exploitation	Hall argues that it is impossible to think about a culture with no language and no materials. This area is related to the use of materials in order to explore the world. Materials in an environment are strongly related to the other aspects of a culture, for instance: there are tools and artifacts for cooking (*e.g.*, cutlery), protecting (*e.g.*, guns, weapons), playing (*e.g.*, game artifacts), learning (*e.g.*, books, notepad), etc. Values in this area are related to the right and possibility of access (*e.g.*, accessibility), the valued kind of materials and objects, the property/ownership, etc.
Temporality	Life and time are connected in several forms, such as cycles, periods and rhythms (*e.g.*, gestation, breath rate, heartbeat), and measures (*e.g.*, hours, days). The ways people deal with time and the roles of time in society vary across cultures and make it clear its relationship with the other areas. For instance, there are specific times and duration for almost every activity, from learning and playing to cooking and praying; the holydays, workdays and daytime are specific times. Values in this area are related to how people understand and give importance to each moment, phase and stage of life (*e.g.*, childhood, aging, vacations,), the availability of resources ("Subsistence"), and so on.

Territoriality	It refers to the possession, use and protection of space. Having a territory is essential to life; the lack of a territory is one of the most precarious conditions of life. There are physical (*e.g.*, country, house) as well as social (*e.g.*, social position, hierarchy) and personal spaces (*e.g.*, personal data, office desk). The way space is understood, used and valued may vary strongly according to the culture. It is also easy to see how space is intertwined with the other areas: every interaction occurs in an environment (place); there are places for learning, playing, resting, working; places to protect and to be protected; the relationship between the social hierarchy and the position at a table, etc. Values developed in this area are related to the role and importance people attribute to their different spaces.
Classification	Originally named "bisexuality" to indicate the differences in terms of form and function of genders, we adopted the name suggested by the OS theory (Liu, 2000) in order to comprise the differences in terms of socio-economic conditions, age, abilities, etc. Cultures have different forms of distinction and classification, and give different importance to each one. For instance, there are specific places ("Territoriality"), jobs ("Subsistence") and sports ("Play") for man and woman; there are divisions according to the age (*e.g.*, childhood, adulthood, old age); there are classifications according to the economic conditions of both people and countries (*e.g.*, poverty line, developing/developed countries). Values in this area are related to the way the society classify itself; to the preferred and valued kind of materials and behaviors expected to belong/be followed by people from different classes (*e.g.*, behaviors exhibited by males in one culture may be classified as feminine in another).
Subsistence	This area includes from people's food habits to the economy of a country. Professions, supply chains, deals, natural resources, are all aspects developed in this area and that vary strongly according to the culture, being influenced not only by the other areas (*e.g.*, territoriality, temporality, learning) but also by geographical and climatic conditions. Values in this area are related to the valued kinds of work; to the way the society plans and approaches retirement; shares its resources and duties; collaborates for common and individual achievements, etc.

4.3.2. The Organizational Semiotics Theory

Besides the attempt to structure and organize the study of culture, perhaps one of the most important contributions of Hall's works is the introduction of the notions of informal, formal and technical levels in which humans operate and understand the world (Hall, 1959). According to him, each level is present in any situation, but one will always dominate in a given instant of time and we deal with them separately. Sometimes, the shifts (and boundaries) between these levels are subtle and rapid, but understanding them is the basic requirement to understand the process of change.

The OS theory (Liu, 2000) proposes a structure named "Semiotic Onion" to explain how these levels exist in the context of organizations and information systems: the key idea is that any technical artifact is embedded in a formal system, which in turn, exists in the context of an informal one — see Figure 4.1. The informal represents the organizational culture, customs and values that are reflected as beliefs, habits and individual behavior patterns of its members. The formal corresponds to aspects that are well established and accepted, becoming social conventions, norms or laws; in this level, rules and procedures are created to replace meanings and intentions. Finally, the technical situated in the core of the onion represents aspects that are so formalized that can be technically approached and supported.

The OS theory considers an organization and its information system as a social system in which human behaviors are organized by a system of norms (Liu, 2000). For Stamper *et al.* (2000), these norms govern how members think, behave, make judgments and perceive the

world, being directly influenced by culture and values. The OS explores the use of signs and their effects on social practices, and provides a set of methods (*e.g.*, Problem Articulation Method, Norm Analysis Method) and artifacts (*e.g.*, Stakeholders Identification Diagram, Semiotic Ladder, Ontology Charts) to deal with information and information systems in a balanced way, taking into account technological issues as well as human and social aspects of information resources, products and functions.

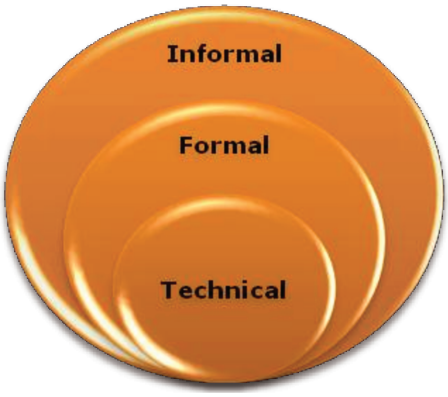

Figure 4.1. The Semiotic Onion

From the OS methods, the Problem Articulation Method (PAM) helps those involved in the design of an innovation to cope with tasks of analysis and specification of all kinds and at all levels (Kolkman, 1993). It is an organized way for articulating and solving complex issues that are characterized by ambiguity and change. Several artifacts were developed to support PAM activities. An artifact from the PAM is the Semiotic Framework, also called Semiotic Ladder (Liu, 2000). It supports the identification and organization of requirements according to six different layers of signs: Physical World, Empirics, Syntatics, Semantics, Pragmatics, and Social World. The three first layers are directly related to the information technology platform, the basis of a system. The other three represent the human information functions, the characteristics of the human/social organization. These layers allow designers to see information (*i.e.*, signs) from different perspectives, based on the different functions one can apply on this information. The interested reader may consult (Liu, 2000) for an overview and examples on the OS theory, and (Baranauskas *et al.*, 2005; Baranauskas and Bonacin, 2008; Baranauskas, 2009) for examples of the use of the OS and its methods and artifacts in design activities.

4.3.3. The Socially Aware Computing

In HCI, design is usually understood as a practical and creative activity intended to result in a product that favors its users to achieve their goals (Preece *et al.*, 2002). In this view, design

activities depend on established requirements, and the design product is built iteratively through a design-evaluation-redesign cycle using prototypes and involving users. This means that, before starting the development of a product, it is necessary to understand its purpose and the expectations around it; and when developing the product, users should be involved. Different approaches may be used to support product understanding and user involvement at different levels.

Baranauskas and Bonacin (2008) acknowledge the practical and creative character of design and give emphasis to its constructive and reflective nature. The authors understand design as a social process that focuses on both problem setting and problem solving. They articulate ideas inspired by OS (Liu, 2000) and propose a framework that considers a dialogue with design materials and, mainly, among individuals in their different roles (*e.g.*, designer, developer, user, other stakeholders) to conduct work in interactive system design. Their framework is also inspired by Participatory Design (Schuler and Namioka, 1993) and supported by different artifacts that aim to encourage and maintain the interaction among users and designers in a social process in which different views of design are contrasted and negotiated. These artifacts serve as communication and mediation tools in the design of interactive systems taking into account the Hall's levels (1959) represented by the Semiotic Onion (informal, formal, technical). This work forms the basis of the SAC approach (Baranauskas, 2009) which represents a social perspective to the design of computer systems.

Baranauskas and Bonacin (2008) point out that design processes usually occur centered in technical aspects, giving little (or no) attention to the formal and informal aspects of organizations and the society, *i.e.*, it is focused on the core of the Semiotic Onion (Figure 4.1). Consequently, positive and negative effects on the formal and informal layers of the organization, as well as on society, are completely undefined and unanticipated. A technically centered perspective prevents designers from a wider sense-making of the problem being handled, the solution being designed, the stakeholders involved and the complex social world in which they live, including their culture and values. In this sense, Baranauskas (2009) argue that any design process must be understood as a movement that begins from outside to inside the Semiotic Onion, crossing the informal and formal layers of signs towards the construction of the technical system, because this movement favors the identification, articulation and formalization of relevant aspects of the social world. Therefore, when the movement returns, the technical system will impact on the formal and informal layers and on the society in an informed way, reflecting an understanding of the social world, making sense to users and potentially promoting acceptance and adoption.

Figure 4.2 illustrates the SAC approach to design. The dashed ellipse indicates the design process in action. It starts at the social world, crossing the informal layer where activities are conducted to clarify the problem (*e.g.*, identify the stakeholders, their cultural differences,

interests and expectations), elaborate solution proposals, discuss their main dis/advantages, and choose the most viable one. Design progresses from the informal to formal where activities support: i) the elicitation of requirements; ii) the decision-making informed by the knowledge produced during the problem clarification; and iii) the solution modeling and analysis. The design process continues towards the construction of a technical solution through activities that support the construction of interactive prototypes, the codification, experimentation of design alternatives, and the analysis and inspection.

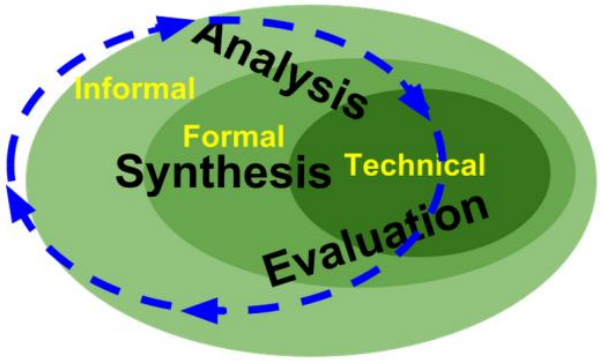

Figure 4.2. The Socially Aware Computing approach to design

The approach considers three main design stages: Analysis, Synthesis and Evaluation, in a non-linear order, indicating that understanding and describing a problem, finding a solution, and implementing it, do not occur in fixed, predefined sequences, but in an interactive, iterative and incremental process. The stage of **Analysis** happens mainly when designers are clarifying the problem and conceiving a solution, but also when they are defining, organizing and evaluating requirements as well as investigating existing solutions, technical possibilities, restrictions, and so on. The stage of **Synthesis** occurs mainly when the results of discussions are documented, converted into requirements or project decisions, but also when the problem is being clarified and technical alternatives are being considered. The stage of **Evaluation**, in turn, is clearly visible during the inspection of prototypes and the justification of design decisions, but also occurs when models are validated, decision are made to solve conflicts, and when expectations, values, meanings and intentions are being shared and confronted. Therefore, all the stages encompass different activities, are supported by different artifacts and methods, and cross the informal, formal and technical layers, although they are more centered in one of them.

As the ellipse indicates, the process does not finish in the technical level, but continues crossing back the formal and informal layers. This means the design product will trigger changes that may require updating the modeling, making/reviewing agreements, justifying design decisions, as well as cause impact on established processes, formal norms and laws.

Therefore, it also impacts on the shared understanding about the problem and solution, its importance to the different stakeholders, and so on. The process will progress iteratively and incrementally as much as necessary.

Baranauskas' approach has been applied in design contexts of high diversity in terms of users (*e.g.*, skills, knowledge, age, gender, special needs, literacy, intentions, values, beliefs) and for creating different design products. For example: inclusive social networks (Baranauskas and Neris, 2007); applications (Piccolo *et al.*, 2007) and physical devices (Miranda *et al.*, 2010) for the interactive digital television; systems for supporting problem solving and decision making in a manufacturing organization (Baranauskas and Bonacin, 2008); and accessible technologies (Santana *et al.*, 2008). Practical results have indicated the approach's usefulness to support design activities in both academic and industrial settings.

4.4. The VCIA Approach

The VCIA is a value-oriented and culturally informed approach to the design of computer systems that involves a set of artifacts and underlying theories and methods articulated to support the explicit considerations of values and culture in different design stages. To conceive the VCIA, we instantiated the SAC approach (Baranauskas, 2009; Baranauskas and Bonacin, 2008) and filled it with artifacts we created/adapted to serve to specific purposes. The artifacts and their usage methods were created/adapted on the grounds of OS theory (Liu, 2000) and the BBC (Hall, 1959) — see Figure 4.3.

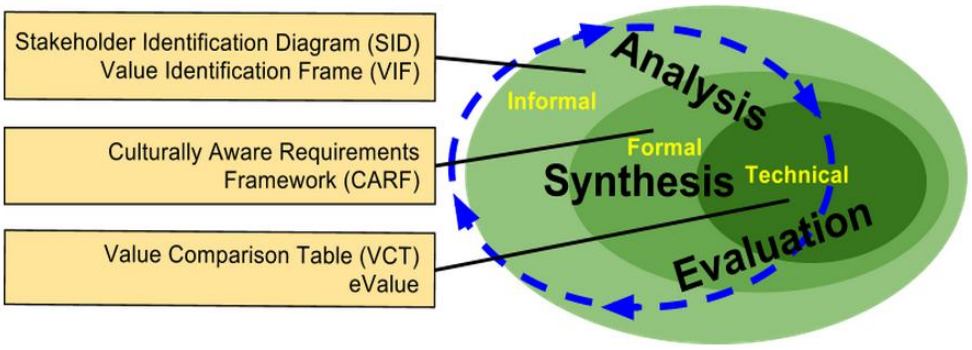

Figure 4.3. The Design Model for VCIA

The VCIA understands that every innovation brings negative and/or positive impact to the environment in which it is introduced (Hall, 1959). There are people in that environment who suffer this impact, trigger others, and confer values upon such an innovation (Kolkman, 1993). In order to design solutions that make sense to people, meet their demands, respect their values, culture and other social requirements and, ultimately, do not produce side

effects that harm them, it is necessary to understand the way the different stakeholders would value and react to the proposed innovation, seeing the world through their lenses in their cultural particularities.

Considering the design model in Figure 4.3, the rectangles show the artifacts created/adapted to support the design process. They are linked to the layer of the onion in which they contribute the most, suggesting a feasible but flexible order of use. In the stage of Analysis, the Stakeholder Identification Diagram (SID) and the Value Identification Frame (VIF) are two artifacts to support the identification of stakeholders and their values, making them explicit since the early stages of the problem clarification.

In the stage of Synthesis, the Culturally Aware Requirements Framework (CARF) supports designers to identify and organize requirements related to the values and culture of the different stakeholders involved in the design context. These requirements will guide designers in the prototyping and implementation of their solution.

Once an increment of the solution has been produced, the Evaluation stage takes place. The eValue artifact supports designers to evaluate whether the solution was designed accordingly, *i.e.*, whether design decisions are reflecting the understanding about the values and the culture of the different stakeholders. The Value Comparison Table (VCT), on the other hand, supports designers in the comparison between different design alternatives; it may also be used in the Analysis stage, when designers are investigating existing/related solutions.

The design process has not a pre-defined number of iterations, but continues as far as the problem and its solution need to be improved. The artifacts inserted into the model force designers to keep values and cultural aspects in mind, dealing with them in an explicit way during all the design activities.

Following, we present the artifacts in details and explain how they can support designers at the different stages. In the next section, we situate our discussion in the design of a social network for teachers of the Special Education area.

4.4.1. The Stakeholder Identification Diagram (SID)

The SID is an artifact from OS (Liu, 2000) widely used to support the identification of all the stakeholders direct/indirectly affected by the problem being discussed and/or its solution — see Figure 4.4. The project/solution to be designed is represented by the core of the artifact ("Operation") and the stakeholders are distributed into different categories: from the actors directly involved in the design ("Contribution") and the sources of information ("Source") to the partners and competitors ("Market"), and the people who may not use the solution, but may be affected by it ("Community"). The more close to the core layer the stakeholder is, the more direct is the impact and influence it causes/suffers.

The identification of stakeholders is one of the first activities to be conducted in a design process. The SID forces designers to think beyond the obvious classes of stakeholders (*e.g.*, user, client, manager), paying attention to different levels of involvement, interests and expectations. The basic assumption of SID is: different stakeholders bring different perspectives to the innovation being designed, having different interests, views, needs, values and culture, suffering and/or causing different impacts on the project. The analysts' work is to map these different stakeholders making them explicit. Its **input** is the problem being clarified, and its **output** is a map of the different stakeholders involved in the project. For practical matters, when the number of stakeholder is too high designers may discuss and highlight the most important ones in each layer.

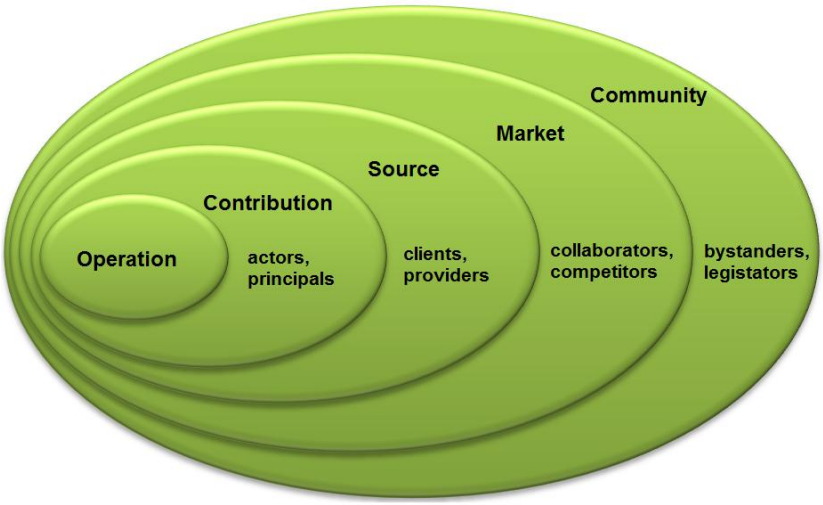

Figure 4.4. The Stakeholder Identification Diagram. Adapted from Kolkman (1993)

4.4.2. The Value Identification Frame (VIF)

Once stakeholders have been identified, designers should think about the values they are bringing to the design context. The VIF was created to help designers in this task. Its basic principles are: each stakeholder has a set of values that may cause/suffer impact with the introduction of the innovation being designed; the analyst's work is to map what values each stakeholder brings to the project and have to be considered in the design — see Figure 4.5. The VIF's **input** is the list of stakeholders identified through the SID artifact; and its **output** is a list of the values each different stakeholder brings to the project.

The artifact is inspired on the SID. Its header has a space in which designers can put the name of the project — corresponding to the SID's core layer, and a list of values to serve as a start point for the activity. The VIF has also four blocks related to the other layers of SID. Each block has two columns: in the first one, designers put the stakeholders identified in the

respective layer; in the second one, they indicate what values each stakeholder is bringing to the project and must be taken into account. Because the SID leads designers to think about all the stakeholders direct/indirectly involved in the system being designed, by preserving its structure, the VIF leads designers to think of the values of all the different stakeholders making them explicit.

Project	<Project's name>
Values	<List of suggested values>
CONTRIBUTION	
Stakeholder	**Values**
Stakeholder A	Values related to the Stakeholder A
Stakeholder B	Values related to the Stakeholder B
SOURCE	
Stakeholder	**Values**
Stakeholder C	Values related to the Stakeholder C
(...)	(...)
MARKET	
Stakeholder	**Values**
(...)	(...)
(...)	(...)
COMMUNITY	
Stakeholder	**Values**
(...)	(...)
(...)	(...)

Figure 4.5. The Value Identification Frame

4.4.3. The Culturally Aware Requirements Framework (CARF)

After the identification and mapping of stakeholders and their values, it is necessary to specify the way these values will be handled in the project. The CARF artifact was created to support designers in the identification and organization of requirements that are related to cultural aspects of the different stakeholders and their values — see Figure 4.6.

The CARF's basic assumptions are: values are culturally developed according to BBC (Hall, 1959). Depending on the way the innovation is designed, it will impact on different aspects of these areas, promoting/inhibiting the values of different stakeholders. The analysts' work is to identify requirements for the project according to the 10 areas that are related to the values of the different stakeholders, defining priorities among these requirements, and dealing with possible conflicts.

The artifact's **inputs** are: the BBC; the stakeholders identified through the SID; and the values mapped for each stakeholder through the VIF. The output is a ranked list of requirements that are related to the stakeholders and their values.

In the artifact, the column "AREAS (PMS)" presents the BBC (Hall, 1959); the column "P" indicates the priority for each requirement (*e.g.*, "3"–High, "2"–Average; "1"–Low); the column "Requirements" describes the requirements related to each area of culture and values; the column "Values" makes it explicit the values related to each requirement; and the column "Stakeholders" indicates the stakeholders whose values may be affected by the requirement. In practical terms, designers will insert into the artifact: i) the stakeholders identified through the SID and ii) their values mapped through the VIF, reasoning, making questions and trying to identify, in each area, the requirements that are related to the values of these stakeholders. Finally, they will assign a priority to the requirement and mark an "X" in the column of each stakeholder that may be affected by it.

AREAS (PMS)	P	Requirements	Values	Stakeholders			
				A	B	C	D
Interaction	#	<requirement 01>	<value>	X			X
	#	<requirement 02>	<value>		X		X
Association	#	<requirement 03>	<value>	X	X	X	
Learning							
(...)							
Subsistence							

Figure 4.6. The Culturally Aware Requirements Framework

The CARF is not intended to replace other existing techniques/artifacts for eliciting requirements, but it leads designers to pay attention to values and culture in an explicit, organized and informed way. For practical matters, when the number of stakeholders is too high and listing all the values of all the stakeholders become an onerous task, we suggest designers to consider at least the most representative stakeholders from each layer of SID (*e.g.*, the highlighted ones). This assures that the different forces of information are being represented, reducing the risk of neglecting important issues related to values and culture in the project.

Once a common understanding about the project and its solution has been achieved among participants, designers may begin the prototyping activities. The BrainDraw technique

may be conducted to stimulate the creation of different proposals for implementing the solution. BrainDraw is a technique from Participatory Design (Schuler and Namioka, 1993) that structures a graphic and cyclic brainstorming intended to result in several design alternatives for the solution interface (Rocha and Baranauskas, 2003). Its main goal is to achieve a consensus among participants for a solution proposal, considering and consolidating different ideas and perspectives. Design guidelines and patterns may also support the conception of interface proposals. Interactive prototypes may be built based on the results, so that the design product can be experimented and analyzed before complete implementation.

4.4.4. The Value Comparison Table (VCT)

When designers start discussing a new problem, or are looking for inspiration, it may be useful to analyze existing applications. The VCT was created to support designers in identifying and comparing the way values are being technically promoted or inhibited in different applications through the way they were designed — see Figure 4.7.

AREAS (PMS)	VALUES	APPLICATIONS		
		A	B	C
Interaction	Identity			
	Norms			
Association	Conversation			
	Groups			
	Relationship			
	Trust			
Learning	Meta-communication			
Play	Aesthetics			
	Emotion and Affection			
Protection	Informed consent			
	Privacy			
	Security			
Exploitation	Accessibility			
	Object			
	Property (ownership)			
	Usability			
Temporality	Availability			
	Awareness			
	Presence			
Territoriality	Portability			
	Scalability			
	Visibility			
Subsistence	Autonomy			
	Collaboration			
	Reciprocity			
	Sharing			
Classification	Adaptability			
	Reputation			

Figure 4.7. The Value Comparison Table

The basic assumptions of VCT are: every system allows users to interact with it and through it, for different purposes and by means of different interface and interaction

resources. Depending on the behavior favored or inhibited by the system, it will impact either positively or negatively on users' values related to cultural aspects that pervade everyday life: from the way they learn and play to the way they manage time and space; from the way they interact and associate to the way they work and subsist in the world. The analysts' work is to explore each system, questioning and analyzing how they reflect values.

In the artifact, the column "AREAS (PMS)" presents the BBC (Hall, 1959); the column "Values" serves to indicate the values being considered in the analysis; and in the section "Applications", each column corresponds to a different application being analyzed. The artifact's **inputs** are the BBC, a list of values, and the applications to be analyzed. The **output** is a map of the way different applications are reflecting values. In this map, each cell presents reasoning about a given value in a specific application. Each line makes it possible for designers to identify the pros and cons of each application regarding a given value, and to highlight which ones can inspire them when designing a new solution, or alert them about what they have to avoid. Additionally, each column provides a picture of the values perceived in a given application, the way they are being supported, and designers' impressions about them.

The values we suggested in the VCT were identified through literature review and analysis of existing systems in the context of social software (Pereira *et al.*, 2010b). If the VCT is used after the identification of stakeholders and their values, the values mapped through the VIF may serve as the input to the "Values" column, and designers may investigate and compare how other existing applications are supporting those values. Otherwise, designers may use any other list of values they find important to the design context — *e.g.*, the list of human values with ethical considerations from Friedman *et al.* (2006). Designers may even leave the "Values" column to be filled as the analysis progresses.

4.4.5. The eValue

Once designers have identified the stakeholders and their values, specified the requirements for dealing with those different values, and produced a first version of their solution (*e.g.*, the first prototype), they have to analyze and evaluate whether their design decisions were made accordingly. The eValue is intended to support this kind of evaluation — see Figure 4.8. The analysts' work is to explore the designed solution, questioning and analyzing the way it communicates values and affects users' cultural aspects, comparing to the documentation produced (*e.g.*, values in VIF, requirements in CARF), taking notes, and proposing design alternatives.

As in the VCT, the column "Areas (PMS)" presents the BBC (Hall, 1959); the "Values" column indicates the values being considered in the evaluation; the "I" column serves to indicate whether the value in its corresponding line was identified in the application being

evaluated (*e.g.*, "I" – Identified, "N" - Neglected); the "Application" column describes the way the application is reflecting each value. For instance, regarding the "Accessibility" value, evaluators should verify whether the application being analyzed is supporting the value, what features are supporting it, whether they are enough to make the application accessible, etc. Finally, in the "Notes" column evaluators may register important information regarding the value, highlighting both positive and negative points, benefits and drawbacks, warnings and ideas. The artifact's **input** are the BBC, the list of values identified through the VIF (and other values designers may find out important to consider), and the application to be evaluated. The **output** is a map of what values are being reflected by/on/through the analyzed application and the way it is done. It also presents evaluators' reasoning about each value, pointing out pending questions, critical issues, ideas and possible improvements that may guide a redesign activity, or at least, serve as a reflection list.

AREAS (PMS)	VALUES	I	APPLICATION	NOTES
Interaction	Identity	<I>	<analyst's evaluation>	<comments>
	Norms			
Association	Conversation			
	Groups			
	Relationship			
	Trust			
Learning	Meta-communication			
Play	Aesthetics			
	Emotion and Affection			
Protection	Informed consent			
	Privacy			
	Security			
Exploitation	Accessibility			
	Object			
	Property (ownership)			
	Usability			
Temporality	Availability			
	Awareness			
	Presence			
Territoriality	Portability			
	Scalability			
	Visibility			
Subsistence	Autonomy			
	Collaboration			
	Reciprocity			
	Sharing			
Classification	Adaptability			
	Reputation			

Figure 4.8. The structure of the eValue artifact

4.5. VCIA in Practice: Designing an Inclusive Social Network

All the artifacts have been experienced and evaluated in different design contexts, *e.g.*, social applications for the Interactive Digital Television (Pereira *et al.*, 2012a; 2012b); applications for supporting cross-cultural collaboration (Pereira and Baranauskas, 2011); inclusive social network (Pereira *et al.*, 2011a, 2011b). In this section, we instantiate the artifacts in the design context of a social network for Brazilian teachers of the Special Education field — teachers who work with students that have some type of disability.

In the last years, the Brazilian public policies for inclusion of disabled students in regular schools created the Specialized Educational Services area (SES), in which teachers accomplish activities with students in multifunctional resources rooms, *i.e.*, rooms in traditional schools equipped with specialized resources (MEC, 2009). In order to qualify professionals in this field, teachers from all over the country started specialization courses within e-learning environments. However, these courses have a limited period and, after that, teachers lose part of the support they have for accomplishing their daily activities.

In this context, researchers from Education and Computer Science are working in a research project intended to investigate the importance and usefulness of a social network system for connecting and supporting teachers from all over the country in their day-by-day work in a continuing education process. This network has as premises the teacher´s autonomy, self-regulation and the construction of knowledge about issues related to SES by the discussion of problems (cases) from their professional practices.

Brazil is the fifth largest country in territory and population, having a very heterogeneous population in terms of ethnicity, social and economical conditions (IBGE, 2010). Usually, teachers are not used to computer technologies, and may have some kind of impairment themselves (*e.g.*, visual); they also have their customs, preferences, procedures, values, etc., that must be taken into account. On the other hand, researchers also have their interests, expectations and values. Therefore, it is critical to consider the different stakeholders and the values they are bringing to the design context, dealing with them in an explicit way.

Design activities are following Baranauskas' SAC model presented in Section 4.3.3. Participatory activities with a group of 28 teachers — called the SES sowers, from different regions of the country, are being conducted in order to ally design activities with social practices with representatives from the target audience. A first increment of the social network is available and is being experienced by the group of teachers: the TNR System (TNR is the Portuguese acronym for "All of Us Networked"). Following, we show the artifacts instantiated in design activities that led to the first increment of the system.

4.5.1. The Analysis stage

According to the exposed in the previous section, there are three stakeholders clearly involved in the design context: SES teachers, researchers from the Education field, and researchers from Computer Science. It is interesting to note that these stakeholders are representing the three layers of the Semiotic Onion: SES teachers, represented by the sowers, bring the knowledge about the problem domain, the way things occur in practice, the habits, preferences, etc., representing the **informal** layer. Researchers from Education bring the knowledge about the rules, laws and methods defined by the Ministry of Education, representing the **formal** layer. Researchers from Computer Science bring the **technical** knowledge necessary to understand and design a computer system to support SES teachers. Other stakeholders are the students, their families, the school principal, teachers of the regular education, and so on.

The SID shows the different stakeholders involved in the project — see Figure 4.9. For instance, the students with special needs are being represented in the "Source" layer because they are source of information to the system, while the other students are represented in the "Community" layer, because although they are not direct target of the system, they may suffer/exercise influence on the case discussed by the teacher.

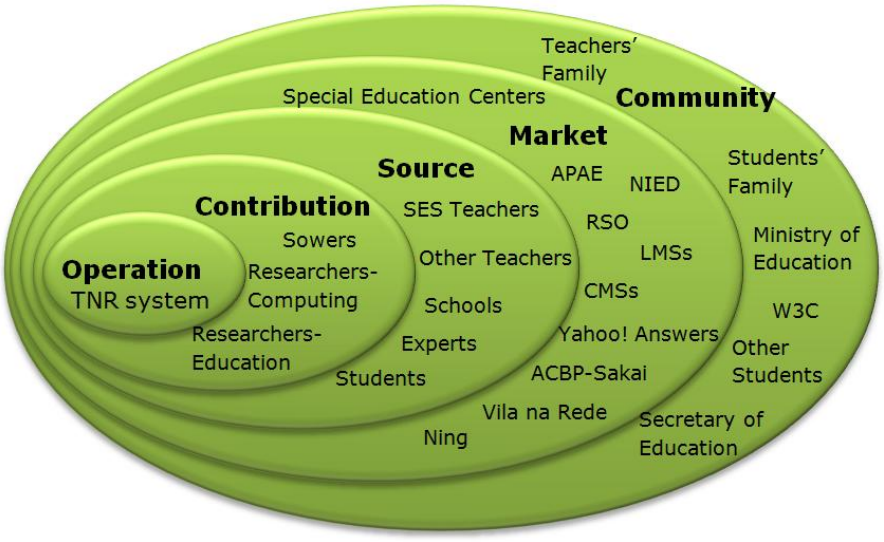

Figure 4.9. Stakeholders in the TNR context

The artifact helps us to see stakeholders that could go unnoticed, and that would be identified only when some problem arises. For instance, in the "Source" layer are the "Other Teachers" — representing the teachers who not work in the SES but teach the students in regular classes, and the "Experts" —specialists in different kinds of special needs who will be

invited to participate of the social network, sharing their knowledge with the SES teachers. In the "Market" layer the "Special Education Centers" — schools for students with special needs only, and several existing platforms and applications that could be used in the project (*e.g.*, *Ning*®, *Yahoo! Answers*®) were identified. In the "Community" layer, the "Ministry of Education" is an important stakeholder, once it is responsible to define and manage the rules and policies for the SES and the entire education system in Brazil. The "Teachers' Family" stakeholder is also important: SES teachers that are not used to computer technologies usually ask for help to their family. Some of these stakeholders would not have been easily identified if we were thinking only in terms of direct and indirect stakeholders.

Once stakeholders have been identified, it is important to think about their values, making them explicit. Figure 4.10 shows the VIF with some examples. Because the TNR system is intended to be a social network, the list of values in the context of social applications (Pereira *et al.*, 2010b) was used as starting point. As it occurs in any iterative model, the artifacts are not filled in a straightforward style, but may be incrementally modified and updated as long as the design progresses.

Project	TNR
Values	Accessibility, Adaptability, Aesthetics, Autonomy, Availability, Awareness, Collaboration, Conversation, Emotion and Affection, Groups, Identity, Informed consent, Meta-communication, Norms, Object, Portability, Presence, Privacy, Property (ownership), Reciprocity, Relationship, Reputation, Scalability, Security, Sharing, Trust, Usability, Visibility.
Stakeholder	**Values**
CONTRIBUTION	
Sowers	Awareness, Collaboration, Conversation, Identity, Informed consent, Meta-communication, Presence, Property (ownership), Reciprocity, Relationship, Reputation, Security, Trust, Usability.
Researcher Education	Accessibility, Autonomy, Collaboration, Conversation, Identity, Norms, Privacy, Relationship, Reputation, Usability.
SOURCE	
Experts	Accessibility, Autonomy, Awareness, Collaboration, Identity, Informed consent, Norms, Privacy, Reputation, Security, Sharing, Trust, Usability, Visibility.
MARKET	
Special Education Centers	Availability, Collaboration, Groups, Norms, Reputation, Security.
COMMUNITY	
Student's Family	Conversation, Emotion and Affection, Identity, Informed consent, Privacy, Trust.
(...)	(...)

Figure 4.10. Stakeholders and Values in the TNR context

In order to know the prospective users, understand their values, needs, expectations and what are (if any) the existing solutions that could already support them, some participatory activities were conducted with the teachers. In the first one, they explored four different

systems: *Yahoo! Answers*® (S1), *ACBP-Sakai*® (S2), *LeMill*® (S3) and *Vila na Rede*® (S4). For each system, a fictitious case (*i.e.*, a problem situation) was posted and participants were asked to come to a solution for it. After about a month interacting with and through the system, they gave their feedback by: i) interacting through the system in order to solve the case; ii) answering an evaluation questionnaire, pointing out features they liked, disliked, missed etc.; and iii) participating in a semi-structured interview. The materials produced in the scenarios were used to clarify the problem context and contributed to know better the teachers and understand some of the values they were bringing to the project.

The VCT was used to compare the different applications used by the teachers regarding the way they are supporting values — see Figure 4.11. The comparison supported the conclusion that no application would be able to support SES teachers in an effective way and that a new one should be designed. On the other hand, it also provided interesting examples that should inspire the design of features for a new system. For instance, designers found out that teachers liked the way the systems *ACBP-Sakai*® and *Vila na Rede*® were supporting the value of conversation and marked them as design examples for this value — see the highlighted sections in Figure 4.11.

AREAS (PMS)	VALUES	APPLICATIONS			
		Yahoo! Answer®	ACBP-Sakai®	LeMill®	Vila na Rede®
(...)	(...)	(...)	(...)	(...)	(...)
Association	Conversation	Users can post just one answer per question in a scheme similar to a forum. Users can send email and instant messages if allowed in their privacy settings.	There is a chat for supporting conversation in groups; an area for collaborative editing and the possibility of leaving comments when a specific kind of information is inserted in the system. The artifacts are used in a collaborative way.	The conversation takes place only through asynchronous messages. There are comments in objects and forums in communities.	Users can communicate through different tools such as chat, comments and posts. It is possible to use media (pictures, videos, audio) with synchronous as well as asynchronous communication.
	Groups	The system organizes the questions into pre-defined categories. There is no feature for creating groups by users. Implicit groups may be seen in users that answer questions into the same categories.	Groups are created by the system administrator. A user can belong to only one group a time.	There are features for users to create their own communities. Any user can create and enter to participate in a community.	There is no feature for creating groups by users. Implicit groups may be seen in users that collaborate in the same announcements.
	(...)	(...)	(...)	(...)	(...)
(...)	(...)	(...)	(...)	(...)	(...)

Figure 4.11. Comparison of Values and Features through the VCT

4.5.2. The Synthesis stage

Once stakeholders and their values have been identified and mapped, and existing solutions were analyzed, all the material produced was considered to the identification and clarification of requirements to the project. Figure 4.12 shows the CARF artifact filled with some

requirements: at least one requirement for each BBC, its priority (from 1 to 3), the values and the stakeholders related to each requirement. The information into the brackets indicates whether the requirement was identified in a scenario conducted with the teachers [S1, S2, S3, S4] or it is a project's target.

The CARF illustrates several important issues related to teachers' culture and values. For instance, in the "Protection" area, they do not have an explicit concern regarding the value of privacy — they think it is good to share their opinion and information, and do not see any problem in making them available. On the other hand, teachers are very concerned about security issues, and the lack of concern about privacy changes when they become aware of the importance of privacy and its possible impacts on their life, on the students and their families. The value of "Informed Consent" is identified here as a possible balance to a tension between privacy and visibility, favoring security. Informed consent refers to users' awareness about the possible impacts of their actions; it refers to informing and garnering people's agreement about what is produced from their interaction with the system and with other users. Hence, the system must support this value, guiding users regarding privacy and security issues.

AREAS (PMS)	P	REQUIREMENTS	VALUES	STAKEHOLDER					
				A	B	C	D	E	F
Interaction	3	User profile with personal information (e.g., picture, about, professional activity). [S1,S2,S3,S4]	Identity	x			x		
Association	3	The system should provide features for synchronous and asynchronous conversation. [S1,S2,S3,S4]	Conversation	x		x			
	1	The system should allow users to indicate other users s/he wants to receive information from. [S1,S2,S3,S4]	Relationship	x	x	x	x		
Learning	2	The system must offer additional information/explanation about how to use its features. [S1,S2,S4]	Meta-communication	x		x			
Play	2	The system must have a minimalist design. [S1,S2,S3,S4]	Aesthetic	x	x	x	x		
Protection	3	Only registered users will have the right to see the materials available in the system. [S1,S3,S4]	Security	x	x		x	x	x
	3	The system must guide users regarding privacy and security issues. [S1]	Informed Consent	x	x				x
Exploitation	3	Every content produced and shared into the system will have its author as its owner and responsible for the actions that will be taken over it. [S1,S2,S3,S4]	Property (ownership)	x			x		
	3	The system must be accessible. [Project]	Accessibility	x	x	x	x		
Temporality	3	The section must not have limit to expire. [S2]	Availability	x			x		
Territoriality	2	It is necessary to provide features for searching and filtering information and users. [S3]	Object	x			x		
Classification	1	The user must be able to adapt the order in which contents are presented. [S3,S4]	Adaptability	x			x		
Subsistence	3	The system must favor the autonomy of users [Project]	Autonomy		x	x			
	2	It must be possible for the user to upload materials that support the discussion of the cases (e.g., pictures, articles, links). [S1,S2,S3]	Sharing	x			x	x	x

Figure 4.12. Requirements organized through the CARF.

In Figure 4.12, the letters in the Stakeholders column represent: A – Teachers (the sowers), B – Researchers from Education, C- Researchers com Computer Science, D – Experts, E- Special Education Centers, F – Students' family. In the "Temporality" area, it was identified that teachers usually take a long time to write and post a message because they are not used to typing in the computers, they are afraid of doing something wrong, or just because they like to read the text several times before posting it to be sure it is well written. Therefore, a requirement related to the technical value of "Availability" is that the section must not have a pre-defined time to expire while the user is logged into the system.

Other interesting example is related to the "Exploitation" area and the way teachers see and understand values such as collaboration, sharing, property and identity. Teachers value collaboration in problem-solving situations. They believe that a better solution can be built based on the solution proposed by different people working together, sharing efforts and exchanging ideas. However, they give much importance to the individual contribution and to its acknowledgement; for them, nobody but who created a content (*e.g.*, post, comment, file) has the right to modify it (*e.g.*, updated, deleted). Hence, the system must allow users to cooperate in problem-solving situations, preserving their individual participation and managing users' rights and permissions.

The CARF in Figure 4.12 also illustrates requirements related to the project and its aims. In the "Exploitation" area, "Accessibility" is an important value for researchers from Education and Computer Science. It was not a concern manifested by the teachers, but it affects them directly. Autonomy is another value directly related to teachers, but that is brought mainly by the researchers from Education. Teachers are used to adopt a narrow range of activities and approaches to the different cases they deal with; researchers hope that by exchanging ideas and experiences, teachers may become more proactive and creative in their day-by-day work, developing and adopting new practices and activities. Furthermore, it is also desired that they become more autonomous in the use of computer technology as they get experienced to the system.

If these requirements are seen in isolation, they are only specifying functionalities, restrictions or quality attributes for the system. However, when they are interpreted through the lenses of culture and the values, they reveal important issues that are usually too subtle to be identified in a superficial analysis. These issues make the difference in the design rationale, supporting designers in making and explaining their choices.

All the material produced in the previous activities (including the requirements for the system) was synthesized and discussed by the researchers and the teachers in another participatory activity. Using a technique inspired by the BrainDraw (Rocha and Baranauskas, 2003), two groups, each one composed by three teachers, one researcher from Education

and one from Computer Science, created their proposals for the system interface. Figure 4.13 shows the activity and some examples of the proposals elaborated by the participants.

The discussions and the prototypes produced in the participatory activity were used to inspire and guide the design and implementation of the first increment of the TNR system. In this first increment, users are able to create and share contents (text, audio, video, slides), leave comments, create their profile, vote in pools, interact to each other through asynchronous messages, follow other users, favorite contents, and like comments. In Figure 4.14, the detail "I. TNR System" shows the home page of the TNR system, while the detail "II. Prototype" illustrates one of the prototypes produced in the participatory activity.

The main structure and the distribution of the elements on the layout were based on the prototypes produced (*e.g.*, three columns, tabs, blocks). The labels used in the system were also chosen to make sense to users. For instance, the term "Library" is common to teachers and is used to represent the repository where they can upload contents related to different kinds of disabilities they deal with — see detail "1" in Figure 4.14.

Figure 4.13. Prototypes produced in Participatory Activities.

The TNR system is intended to connect SES teachers from each part of Brazil. During the BrainDraw activity, participants used a map to indicate the presence of users in the system according to their geographical location. This idea is representing aspects of time

("Temporality") and space ("Territoriality") through a visualization form that makes part of their identity (the country's map). The idea was well accepted by all the participants and inspired designers in a way to start engaging the use of the system: to support the value of "Identity" it was created a tab named "SES Sowers" (see detail "2" in Figure 4.14) with a Brazil's map indicating the location of sowers and their names. Teachers were invited to introduce themselves leaving a comment bellow the map and they attended to the invitation as soon as they started using the system.

Identity is also supported in the system by a user profile in which users can share personal information (*e.g.*, about, contact, birthday), interests and pictures. In the profile, teachers can indicate a user name that will appear in every contribution they make in the system, and that will serve as a link to their profile. A personal area named "I in the TNR" was created to show in a single place all the content the user created in the system.

The detail "3" in Figure 4.14 illustrates the information presented to users every time they create a new content in the system: "*Remember not to share any material protected by copyright, or that may cause any kind of embarrassment, harm your privacy and/or the privacy of other people (e.g., the students)*". This kind of information is intended to remember users regarding the possible effects of their actions, helping to avoid undesired side effects generated from their behavior.

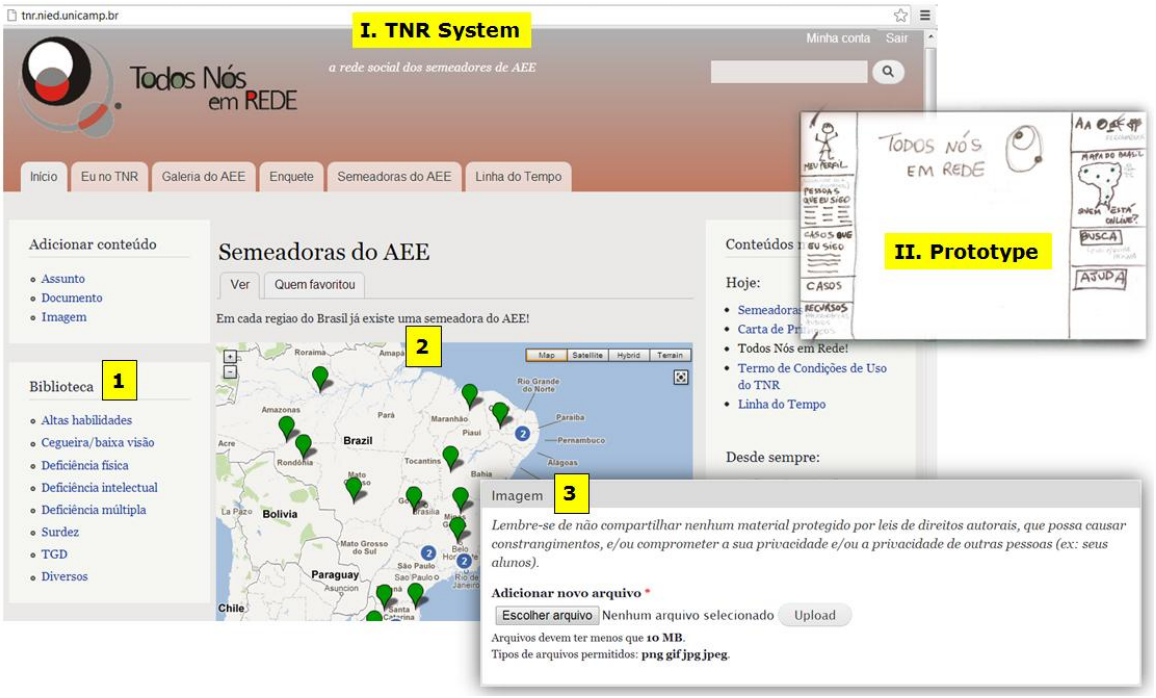

Figure 4.14. Screenshot of the TNR Homepage

4.5.3. The Evaluation stage

As we explained in the previous section, the stages evolve in a natural but not straightforward order. The evaluation stage is clearly perceived once the first increment was developed and inspection techniques are applied, although evaluation activities have been conducted since the analysis and synthesis stages, where the different systems were used and compared, teachers gave their feedback and evaluated them, and so on.

At this stage, different evaluation techniques may be applied (*e.g.*, usability and accessibility inspection methods). Figure 4.15 shows the eValue partially filled for evaluating the way the TNR system is supporting values. It shows a designer reasoning about the way the system is supporting meta-communication and sharing, and the notes/suggestions to be take into account for the system's next release. Meta-communication and sharing are values in the design context because they are directly related to teachers' autonomy, confidence, reciprocity and other emotional and affective aspects.

AREAS (PMS)	VALUES	I	TNR	NOTES
Learning	Meta-communication	I	1. There are tips, explanations and alerts that guide users regarding the possible action to be conducted and their possible consequences. 2. The label "Add content" is not clear. There are different kinds of contents, for different purposes, and visible in different areas (e.g., the "Library"). Besides, there will be the "Case", which will be a kind of content... The user will have difficult to understand and interact with different areas that seem to have a generic purpose.	1. The idea is useful; be sure it is transversal to all the system and its different features. 2. The "Library" is a section apart, where users can upload content. The "Case" will be another section where users will post their real cases. The "Add content" is representing the "other" contents that are neither a case nor a material to the library; it is informal conversations about unspecified subjects and with unforeseen intentions — similar to a "coffee room" or "teachers' room". Renaming this area may avoid confusions and mistakes.
		(...)	(...)	(...)
Subsistence	Sharing	I	In the "Library", the comments and files are not a practical way of sharing materials. Users are uploading files and leaving comments about other subjects (e.g., a personal conversation). It is not possible to search for the files attached to the comments, what makes difficult to find the desired material.	This feature must be redesigned. Today, there is no difference between the comment and file sharing functionalities and users get confused. In the "Library", the focus must be on the material being shared instead of the comment created by the user. A search feature that indexes the files uploaded and their comments is mandatory.
(...)		(...)	(...)	(...)

Figure 4.15. Detail of the eValue artifact for the TNR system. In column "I", the letter "I" means "Identified" and the letter "N" means "Neglected"

According to Figure 4.15, both values were identified in the system but have some aspects to be reconsidered. Meta-communication was identified through tips and information that the system shows to instruct and guide users (*e.g.*, advices on privacy). However, the designer pointed out the label "Add content" as a possible source of confusions and mistakes to users. If the term is considered in isolation, no significant problem may occur but users taking more time to find the desired option. Nevertheless, it may incite users to behave in a way different to the expected by the system designers, mixing informal and formal

conversations and materials, resulting in a great amount of content difficult to be organized and with little value to users.

The TNR is expected to address three different kinds of conversation among users. The **informal conversation** is related to any interaction users have to each other for any purposes: from greetings to share news, pictures, movies, and everything else they want to share with their colleagues and friends — this feature is being represented by the "Add content" label. The **formal conversation** is strictly related to their SES practices, where users can share any material they find out useful and want to recommend to others — all the conversation is centered on these materials and is being supported by the "Library" feature. The **technical conversation** is centered on the real cases teachers have and are dealing with. All the conversation is directed to the clarification and resolution of a specific problem that one of them is facing in his/her school. The feature for supporting the discussion of cases is not available for use in the first increment.

The label "Add content" it too generic. It serves to indicate everything the users create in the system and puts everything in the same place. However, it is different from teachers' cultural context. For instance, there is a specific place ("Territoriality") where informal conversations occur (*e.g.*, the coffee room/teachers' room); there are libraries where materials are organized and stored, and there are formal meetings where teachers exchange information with each other; finally, there are also the multifunctional resources rooms where teachers conduct activities strictly related to the cases they are working on. There is also a specific time and duration ("Temporality") to stay in each environment *e.g.*, the break-time is fifteen minutes long at the teachers' room. In this sense, it must be understood that teachers talk about different subjects in different places during different times. Ignoring these cultural clues may lead to the design of a system that teachers do not identify themselves with, and they will hardly be able to verbally explain why.

Designer's observation to the "sharing" value follows the same line. The "Library" is divided into eight main topics: high abilities, blindness, deafness, intellectual disability, physical disability, multiple disabilities, global development disorders, and miscellaneous. Users may leave comments and attach files to them in order to share resources related to each topic. However, it was identified that users started using the feature for talking to each other about informal issues as well as about their cases. While using the feature to discuss a specific case was a desired situation (once there is no feature to support it in this version), using it for informal discussions led to an overload of useless messages that harmed the feature. As the designer highlighted in the eValue (Figure 4.15), in this feature the focus is on the comments instead of on the files to be shared. Therefore, users tend to develop their conversations and, eventually, attach a file to them, instead of sharing the file and starting talking about it. The redesign activity must consider these points.

Other important points were also cited in the eValue, such as accessibility features and mechanisms to indicate users' presence. However, they were not pointed out as problems by the designer because they were already specified and will be available in the systems' next version.

4.6. Discussion

In this section, we highlight important points related to the artifacts, the examples presented in the previous section, and the VCIA's conception.

Regarding the artifacts and the examples presented in this paper, the work of Schikhof *et al.* (2010) emphasize a lack of practical guides and examples to explain how to deal with values in design contexts. In section 5 we instantiated each artifact in a practical context, exemplifying their usage and contribution from the identification of stakeholders to the evaluation of the system's first increment. These examples are intended to guide and inspire designers in other contexts.

Participatory Design is considered an effective approach to involve and consider values in design (Friedman et al., 2006). It naturally favors the identification of stakeholders, their values, and other cultural issues that may cause influences in the solution to be designed and its adoption. For designing the TNR system, several participatory activities were conducted in order to clarify the problem and propose a solution for it. However, as the examples presented in the previous section show, artifacts specially planned to support such activities are useful and necessary to help designers in bringing values and culture to the center of the design process, keeping them in mind during all the design stages.

Working with multidisciplinary teams and involving representatives from the target audience, although a desired scenario is not always viable or possible. The artifacts are even more important in contexts where designers must see the design problem and the envisaged solutions through the lenses of the different stakeholders involved. If no guidance, no example and no artifact are provided, designers will not know how to do and how to proceed to know stakeholders' culture and effectively deal with values.

As we showed in the 4.5.3 subsection, even though representatives from the target audience were involved and values were considered since the early design stages, pending issues and problematic design decisions were found in the evaluation through the eValue. These examples draw attention to the importance of dealing with values and culture in an explicit way throughout the design stages.

On the other hand, the artifacts that compose VCIA may also be used to support a problem clarification and solution proposal and evaluation regardless the design process adopted. They may be used to support activities in other methodologies, such as the VSD

(*e.g.*, identifying stakeholders and mapping their values) and used in isolation (*e.g.*, the eValue for conducting a value-oriented evaluation, the VCT for comparing different existing applications). Although we recommend designers to use the artifacts in an integrated way, it may be necessary to adapt the artifacts and their usage methods according to the design context.

Other specific artifacts have been produced to support designers as a complement to the artifacts presented in this section: i) a set of questions and examples for each BBC; ii) a table with the 28 values presented in the VCT and eValue, with a description, examples and references to each value; and iii) an organization scheme named Value Pie that presents these values according to the three levels of the Semiotic Onion and the BBC. Templates for all the artifacts cited in this paper are available for download[14].

In the VCT and eValue we included a list of 28 values. Although some authors have criticized schemes that classify and suggest values, designers not used to social issues may experience difficulties if no starting point is offered to them. The values we suggested in the artifacts were identified through literature review and analysis of existing systems in the context of social applications. They encompass informal, formal and technical issues, and have been experienced to support activities in different design contexts (Pereira *et al.*, 2010b; 2011a; 2011b; 2012a). Furthermore, as we suggested, designers can choose other lists and schemes, and fill in the artifacts according to their preferences and to the design context.

We highlight three main points in VCIA's nature. **First**, it considers values and culture in an integrated and articulated way. A value cannot be understood outside of its cultural context. While a value indicate something that is important and needs to be taken into account, the cultural context explain why such value is important, helping designers to understand the possible implications related to its promotion/negligence, and other issues that are direct or indirectly related to it. As we exposed in Section 4.2, there are important works on both culture and values in technology design. However, although some of them recognize the relation between culture and values, they approach them in isolation. To our knowledge, no existing approach supports the involvement of both culture and values in an explicit and integrated way throughout the design process.

Second, it address a gap identified in the literature which claims for theoretically grounded artifacts and methods for supporting designers who have little (or no) experience with social subjects to account for culture and values. On one hand, the artifacts interact with each other providing inputs and outputs that suggest a natural order of use; on the other hand, they are independent and able to be used in isolation for specific purposes according to designers needs. Each artifact is intended to incite designers to think beyond obvious issues,

[14] *http://www.nied.unicamp.br/ecoweb/products/artifacts*

expanding and clarifying their understating regarding the problem domain and the solution to be designed. They look for a balance between offering guidance to designers and favoring their critical and creative thinking.

Third, it integrates all the artifacts in a design process that articulates informal, formal and technical aspects of information systems, favoring their usage for identifying and dealing with culture and values during the different design stages and activities. By drawing on the SAC approach, VCIA favors the articulation of the artifacts with other techniques and artifacts (*e.g.*, BrainDraw, Design Patterns, UML diagrams) applied to move from informal discussions to the design of technical solutions in a socially responsible way.

The VCIA is intended to disseminate the concern with values in technology design in academic as well as industrial settings. We hope it to serve as a basis for other researchers and designers to build on it, adapt and create new artifacts and methods, and share new examples of its application.

4.7. Conclusion

Culture and values are critical issues in the design of solutions for a society mediated by information and communication technologies. Understanding and effectively dealing with them play a critical role in the design of solutions that make sense to people and do not produce side effects that harm society. This new and complex context requires us to deal with new challenges, opportunities, and consequences that are very different from all we have experienced before.

In this paper we presented the VCIA: a value-oriented and culturally aware approach to design intended to support the explicit involvement of values and culture throughout the design of interactive systems. The VCIA is an effort to address the gap pointed out in the literature regarding the lack of practical methods, artifacts, tools and even practical examples for supporting designers and researchers placed in academic as well as industrial settings to account for values in the solutions they produce.

The approach has key points that were presented and explained in the paper: it recognizes the cultural nature of values and induces designers to think of them in an integrated way; it offers a set of artifacts and methods that support different design activities: from the problem clarification to the evaluation of the designed product; and it integrates all the artifacts and methods in a iterative and incremental design model that favors a socially responsible design.

In this paper we presented the theories that ground our approach (*e.g.*, Organizational Semiotics theory, Building Blocks of Culture, Socially Aware Computing), the artifacts created/adapted to support designers at different design stages (*e.g.*, Stakeholder

Identification Diagram, Value Identification Frame, Value Comparison Table), and examples that show the artifacts instantiated in a practical design context.

The VCIA is showed to be a promising approach to support the explicit involvement of values and culture in an integrated way in design activities. The discussions and examples presented in this paper demonstrate the importance of keeping values and culture in mind during all the design stages. They also serve as a guide to inspire designers who may want to use VCIA or some of its artifacts in other contexts.

Capítulo 5

Cognitive Authority revisited in Web Social Interaction[15]

"*We must learn to understand the 'out-of-wareness' aspects of communication. We must never assume we are fully aware of what we communicate to someone else. There exists in the world today tremendous distortions in meaning as men try to communicate to each other. The job of achieving understanding and insight into mental process of others is much more difficult and the situation more serious than most of us care to admit.*"
(E. T. **Hall**, "The Silent Language", 1959)

Social software is a growing reality worldwide, while the design of systems that promote and keep users participation and reflect a respect to users' culture and values is still a challenging task. In this chapter, we revisit the concept of Cognitive Authority as a means for supporting better social interactions; for this, we draw on the Value Pie: an artifact that favors an analysis through the lenses of values and culture in social software. In order to situate our discussion in a practical setting, we present a case study related to the design of a social software intended to support the constitution of a network of authorities. The case study shows examples of how values and cultural aspects influence the way a computational feature must be designed in the system.

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[15] Artigo aceito para publicação como capítulo no livro "Frameworks of IT Prosumption for Business System Development", a ser publicado pela editora IGI Global e editado pela Prof.ª Dr.ª Malgorzata Pankowska, University of Economics, Katowice-Poland. Previsão de publicação: Junho de 2013.

5.1. Introduction

Social Software has been regarded as bringing both opportunities and challenges to academy as well as to governmental institutions and private organizations. They have been widely adopted, reaching impressive numbers in terms of users, information produced/shared, and the time users expend on them. There are almost no geographical-cultural-social frontiers in social software adoption.

The impact brought by social software is easily perceived. Users have assumed an important and clear role, regarding not only the production and consumption of content (prosumption), but also regarding the dissemination and the creation of the application itself. Without users, social software is useless, having no value at all. *Facebook*®, *Twitter*® and *Youtube*® are well-known examples of applications that have influenced the way people interact and live: from personal relationships to professional activities; from learning and play to scientific investigations. Their role during the unrests in countries like Tunisia and Egypt (Economist, 2011) illustrates the impact of Information and Communication Technology (ICT) in the modern society.

However, in spite of the acceptance and popularity of some social software, social implications related to values and cultures are being widely reported and can be easily perceived. Winter (2010) draws attention to the value of privacy in Web applications. Using *Facebook*® as an example, he states that privacy issues go from what the application does with users' data to what it allows other applications to do. In another interesting example, Mui (2011) reports how pedophiles were using *Wikipedia*® as a medium to both disseminate their ideas and enter in schools, easily reaching the students. Besides the impact on values such as identity, privacy, reputation and security, other issues related to users' participation (motivation, engagement) and the quality of the content produced by them have also demanded attention. These issues are commonly cited by those concerned with ethical issues, as well as by those interested in improving the quality of contents produced by users and the quality of contacts/interactions they experience with each other via the system.

As we have already highlighted (Pereira *et al.*, 2010a; 2011b; 2012a; 2013), part of the difficulties in promoting and maintaining users' participation in social software and part of the negative side effects they trigger on users are due to the lack of understanding and attention to values and cultural aspects, in their widest sense. Traditionally, social software (and web applications in general) have been produced and delivered for people's use even without a clear perception of their utility and potential impact. For instance, users have been inadvertently serving as beta testers of applications as well as subjects of implicit behavioral experiments to identify the viability of a resource or product. Privacy policies and terms of

use are constantly changed and updated, many times without users' awareness. Users are often unaware of the actual consequences of their actions when interacting with/via the application (*e.g.*, sharing pictures, leaving comments, recommending information). Accessibility issues are often neglected, making it difficult or even preventing the access of people that do not fit the myth of the "average user". These examples show negligence with the "social" aspects in social software and indicate some important points that must be addressed.

In this chapter, we argue that we must consider the culture and values of people if we want to create applications that make sense to them and are truly social. As social software is all about users interacting with each other, we revisit the concept of Cognitive Authority proposed by Wilson (1983) as a mean for supporting better social interactions in such systems. This concept, however, needs to be understood in the light of a society mediated by ICT, and through the lenses of culture and values in social software. We re-exam this concept, and present examples and discussion from a context of a social network where authority as well as identity and confidence are values that must be taken into account.

5.2. Background

In this section we introduce the Cognitive Authority theory and present the bases we are using to revisit it in the context of values, culture and social software.

5.2.1. The Cognitive Authority Theory

Different meanings for the term "authority" are found in disciplines such as Philosophy, Politics, Religion, and Information Science. Originally introduced in social sciences, the term Cognitive Authority (CA) was proposed to explain the kind of authority that influences people's thoughts and beliefs (Wilson, 1983). Differently from "administrative authority" in which people have the power to tell others what to do or how to behave, CA determines "who knows what about what"; it is related to the influence caused by someone in the way of thinking of an individual, because this individual judges him worthy of credit and trust.

The theory of CA has origin in the social epistemology that tries to explain the reasons that lead people to seek for information (*e.g.*, opinion, advices, help), and to let themselves be led by others. Wilson (1983) summarizes his answer to the first inquiry in a single word: "need"; and to the second: "people resort to whom they judge to know something that themselves do not know".

Some important considerations on CA are pointed out by Wilson (1983):

- It involves at least two people (nobody can be an authority only for himself) and it does not imply reciprocity.

- It is limited to spheres: people who are considered an authority in a specific subject may have no influence at all on another.
- It has degrees: authority is not a logical variable that determines whether people have or have not authority. The influence of what a person says might be plausible to be heard and counted as reliable, or strong enough to settle any question. Degrees may change over time.
- It is a matter of value that someone attributes to someone else's words, beliefs, actions, and behaviors, being justified by both direct (*e.g.*, training, formal education) and indirect bases (*e.g.*, trust, credibility).
- CA is extended to institutions and objects (*e.g.*, books, publishing houses, dictionaries).

CA is closely related to expertise. However, Wilson (1983) argues that although expertise refers to a specific and well-developed knowledge/ability, it may not warrant the recognition of authority — there is expertise without authority. CA is the possession of useful knowledge about the world, valued and recognized by someone else. Cognitive authorities are those who people turn for information, but also for advice. Although cognitive authorities cannot tell others what to think, they can influence in any other attitude or belief and, according to Wilson, this can extend to any sort of question: moral, religious, technical, philosophical, etc.

There is also an explicit relationship between the concepts of CA and reputation. According to the definition provided by Britannica (2011), reputation is the "overall quality or character as seen or judged by people in general; recognition by other people of some characteristic or ability". Therefore, we may approach CA as a kind of reputation that indicates a special knowledge about the world.

The CA theory has been used mainly in the Information Science area to understand the way people judge and evaluate information quality on the Web (Rieh and Belkin, 2000; Rieh, 2005). Other works have also proposed its combination with social networks and tagging techniques in order to improve the quality and relevance in information retrieval (Pereira and Silva, 2008), and in algorithms to rank the information retrieved (Côgo *et al.*, 2012).

In social software, where the interaction among people has assumed new dimensions and importance, the cognitive authority theory may inspire the constitution of networks of authorities for supporting better social interactions. These networks can favor security, reputation, and trust among users and in the information produced by them. The design of systems able to support the constitution of networks of authorities demand a re-examination of CA mapping it to the social software context, as discussed in the next sections.

5.2.2. The Value Pie

The Value Pie (VP) is a culturally informed conceptual scheme that organizes values identified in the context of social software (Pereira *et al.*, 2013) — see Figure 5.1.

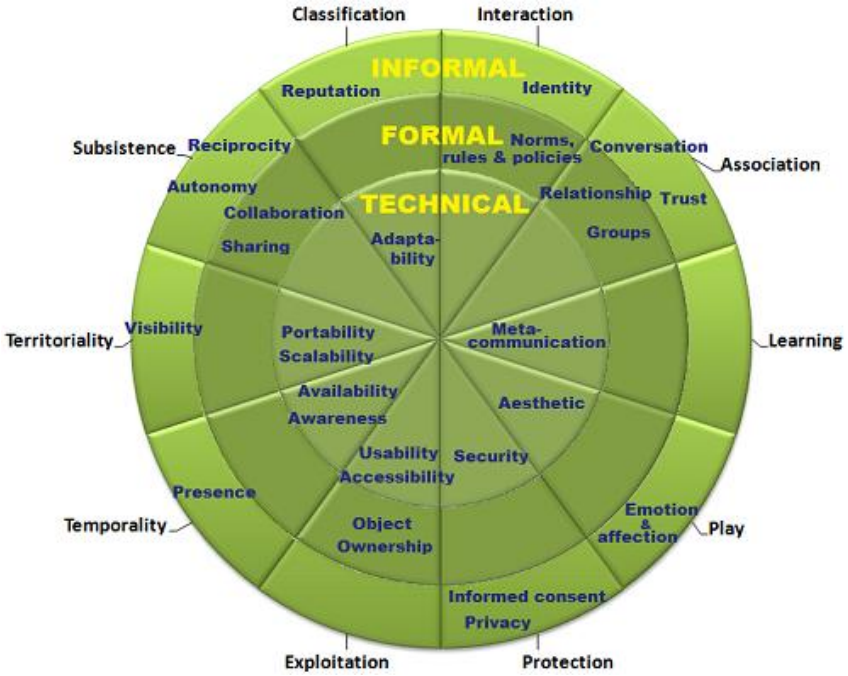

Figure 5.1. The Value Pie (Pereira *et al.*, 2013)

The VP was built on the grounds of Organization Semiotics theory (Liu, 2000) and the Building Blocks of Culture (Hall, 1959). It is formed by three layers that organize values according to their formality, and is divided into ten slices that recognize the cultural nature of values. The three layers (informal, formal and technical) represent the different levels in which humans operate and understand the world (Hall, 1959), and are structured according to the way they are perceived in the context of information systems (Liu, 2000). The ten slices represent cultural patterns of behavior in which values are developed, and that allow the mapping and comparison between different cultures (Hall, 1959; 1977). The values organized through the VP were identified through an extensive literature review and analysis of existing social applications (Pereira *et al.*, 2010a; 2010b; 2013) in order to show aspects that must be considered when designing, evaluating and using them.

The VP allows the organization and discussion of values from three different dimensions. The **first** dimension is Formality. Values are manifested in one of the three levels (informal, formal, technical) but have aspects to be considered in all the three simultaneously. Values manifested in the informal level usually have a personal or ethical nature; values manifested

in the formal level are collective or social values where there is a social rule or system of norms; and values placed in the technical level can be understood as quality attributes or special features of technology. Norms are the bridge between the informal and the technical and are present in the formal aspect of each value; they regulate and influence people's behavior, specify rules and policies, and determine the way technical features work. If social norms are not understood in their cultural settings, they tend to be automated by technical features that do not make sense to users and do not afford the behaviors they are used to in their social world.

For instance, "reputation" is manifested in the informal level because of its subjective nature and identification, *i.e.*, it lies on people opinion about other people, institution or object. At the same time, it has formal aspects — reputation is always about a specific issue and has a social rule that supports people's judgment, *e.g.*, reputation of being an expert, trustworthy, sustainable; and technical aspects, such as the mechanisms used to represent reputation, *e.g.*, certificates, awards, places and procedures specific for VIP persons, and so on.

As Baranauskas (2009) argues, the three levels must be considered for a socially aware design of computing systems. Otherwise, important values may go unnoticed, being identified only when some problem arises (*e.g.*, the need for adaptability), and important aspects of values may be misunderstood, or neglected, making no sense to users (*e.g.*, a reputation feature that causes embarrassment instead of motivation).

The **second** dimension is Culture. Values are developed in different cultures according to basic behavioral patterns: from the way people associate and protect to the way they learn and play, from the way they interact and subsist in the world to the way they understand time and space. Considering the areas related to each value contributes to a better understanding about the significance of the value for a given culture, as well as for the culture itself in the widest sense. Humans tend to interpret the world according to their cultural lenses. Therefore, ignoring the cultural nature of values results in a narrowed comprehension about them and their role in stakeholders' culture; it may even mislead the design process, resulting in solutions that do not make sense to stakeholders, do not meet their demands and that, possibly, trigger undesired side effects on them.

According to Hall (1959), the areas interact with each other, and cultures have developed values according to the areas. In fact, although values have a clear relationship to an area, they usually illustrate some aspect in which the area interacts with other area. For instance, "Sharing" is defined by Britannica (2011) as "to divide and distribute in shares; to partake of, use, experience, occupy, or enjoy with others; to have in common". The first thing to recognize is that even the informal understanding of what "sharing" is and what it means may vary across different cultures. Sharing may be understood as a value developed in the

"Subsistence" area, once it includes aspects that are important to people's survival and progress: from people's food habits to the economy of a country (Hall, 1959). It also shows the way the value is reflected/related to other areas: sharing always involves something more — time (temporality), space (territoriality), objects (exploitation); it occurs between at least two individuals (association); and for a specific purpose, *e.g.*, reciprocity (subsistence), exchanging experiences (learning), having fun (play), etc. Indeed, what is shared, who shares, the way (when, where, how, why) the sharing happens, and the cultural importance given to the act of sharing, are important issues that must be understood when dealing with this value.

The **third** dimension is Interplay. Schwartz (2005) draws attention to the interactive nature of values according to their underlying motivational principles. The VP reinforces the interactive nature of values, but considering the relationships according to values' cultural nature: it assumes that values developed in the same area of culture, *i.e.*, values placed in the same slice in Figure 5.1, have a natural relationship to each other. Because all the ten areas interact with each other and values may be developed in the intersection of them, designers must also pay attention to the values developed in related areas. There are at least three kinds of relationships: dependence, congruence, and conflict. Dependence means that a value is so strongly related to other values that it cannot be approached in a direct way, *i.e.*, it depends on others values to be considered; congruence means that by promoting a specific value other related values are endorsed, and conflict means that promoting a specific value compromises the related ones (the inverse is also true).

For instance, "Autonomy" is defined by the Encyclopedia Britannica (2011) as "the quality or state of being self-governing; especially the right of self-government". It is related to users' ability to decide, plan, and act in a way they believe help them to reach their goals; the ability to control the technology and use it to their advantage (Friedman, 1996). There are values directly related to the informal, formal and technical aspects of autonomy, such as identity, norms, accessibility and security. Autonomy depends on the value of identity to exist in the informal layer and is congruent with it — promoting autonomy contributes positively to the value of identity, while neglecting it harms identity. Autonomy is also congruent to norms and accessibility, but may conflict with security — promoting the value of security tends to restrict/limit users' autonomy (and vice-versa).

Because formality, culture and interplay are quite different perspectives, all the three must be considered in order to have a comprehensive and consistent view of values. In the next section, the CA concept is approached as a value in the social software context and is revisited according to VP's three dimensions.

5.3. Cognitive Authority revisited in the Value Pie

The CA theory was published by Wilson (1983) in his book "Second-Hand Knowledge: an Inquiry into Cognitive Authority", where the author devotes an entire chapter to discuss CA in the context of information retrieval. Issues, such as reputation, ownership, trust, and information quality are discussed. However, discussions were situated in a context where the printed word and the libraries dominated the knowledge landscape, the one-way media (*e.g.*, television, newspapers) dominated the dissemination of information, and people were used to keep in touch with a small set of individuals. In the last three decades, this scenario has passed through profound changes, and social software is, perhaps, one of the most evident examples.

In social software, users have assumed the role of information prosumers, producing and accessing a huge amount of information every day. There is also a wide range of applications and devices that allow users to interact with information and with each other in different ways. The speed and spread of information are higher and harder to control, and its storage is usually permanent. These changes are clear and indicate the need for revisiting the CA theory according to the changes of a society mediated by ICT. The VP makes it possible to revisit CA taking these changes into account — see Figure 5.2.

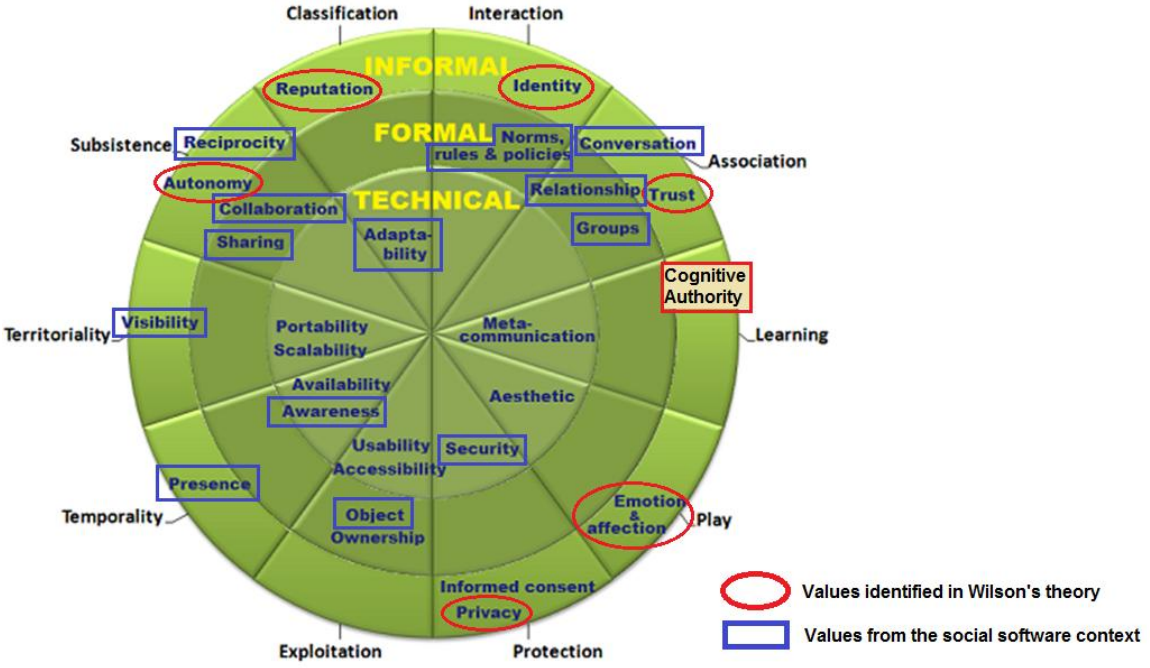

Figure 5.2. Cognitive Authority in the Value Pie

5.3.1. Formality

Humans recognize CA at the informal, formal and technical levels and deal with it in several different ways. **Technical** CA is the most easily accepted and the less controversial one. Thermometers, clocks, measuring tapes, maps, dictionaries, are examples of CA justified and supported by technical bases. This authority is the most easily verified and validated; people hardly disagree with it, unless they find clear indications of errors (even in these cases, they tend to look for a second-opinion from another technical device).

Formal CA is usually based on social and organizational norms of a specific cultural context. Professions (*e.g.*, doctor, lawyer, journalist), hierarquical/social positions (*e.g.*, parents, teacher, priest), formal achievements (*e.g.*, graduation, awards, nominations), institutions (*e.g.*, publisher house, currency exchange houses, meteorology centers) are all examples of formal bases that justify and influence the recognition of CA. This authority is usually respected by individuals who share the same social context, and may be verified and validated by comparing it to different authorities regarding the same specific criteria. Formal CA has little value (or no value at all) outside the cultural context in which it is recognized.

Informal CA is the most controversial one. It is strongly subjective, questionable and hard to justify/explain; and the most difficult to change, invalidate, or challenge. Nobody can tell who is an authority to another person; the person decides it through his/her personal criteria. Informal CA is present when people look for opinion, advice, and help; when they are dealing with unfamiliar subjects/situations and look for someone's support; when they are making choices and need to decide among different options, etc. Informal CA is all about the social strategies people develop and use to deal with other people and situations that they do not have direct experiences with, needing to rely on others. When CA is supported by informal bases such as trust, affinity, beliefs and affection, others can disagree about its legitimacy, but nobody can invalidate it directly or deny its influence.

In the social software context, although formal and technical mechanisms have been developed in order to support trust, security, privacy, reputation, information quality, and so on, they usually fail in understanding and supporting the informal aspects of such values. CA is represented at VP's informal level because informal CA is what must be understood and considered in social software for better supporting social interactions. The formal and technical levels appear here as a mean of offering bases for people to identify and recognize authorities by interacting with them and their information.

In social software people interact with other people and with information in an informal way, but supported by formal rules and technical features. Supporting informal CA in social software means favoring people to keep in touch with the people they trust, believe, like, want to share knowledge and opinion. It also means to offer them useful evidences of CA for the cases they do not have personal experiences to do so. Differently from the CA

proposed by Wilson (1983), the CA in social software should not be focused only on the ones who people turn for information and advices, but also on the ones people recommend, share, collaborate and interact with in different situations. It represents a relationship where reciprocity plays a critical role.

5.3.2. Culture

The notion of CA as a kind of reputation that indicates a special knowledge about the world indicates its direct relationship with two areas of culture: Learning and Classification.

Hall (1959) points out "Learning" as one of the most basic activities present since the beginning of life, and asserts that education and educational systems are as characteristic of a culture as its language. Values in learning can be related to appreciated kind of abilities, knowledge and professions; the relative importance of experience, expertise, meritocracy, and others. CA is clearly related to this area because in every situation where there is CA, there is also some kind and level of knowledge involved.

Classification, on the other hand, is related to the differences in gender, socio-economic conditions, age, abilities, etc. (Liu, 2000). Values in classification are related to the way society separates and organizes its members. CA is related to this area because it is a kind of classification that distinguishes people that influence someone's thoughts from those who do not. Therefore, CA may be understood as an informal value developed in the intersection of classification and learning areas.

CA is represented in VP's learning area because its key characteristic is not the classification of people, but the recognition of those who possess some kind of special knowledge about the world. What is considered a special knowledge about the world is heavily dependent on culture, while who deserves the recognition is a subjective decision. As we argued, there are bases and indications but there is no social rule that defines who is a CA for someone.

The way CA is related to the other areas allows us to see important aspects to be considered when dealing with it in the social software context. Space (Territoriality) and time (Temporality) are fundamental for any kind of interaction, and their notions have been profoundly modified. Social software, and web applications in general, are worldwide available and people can keep in touch with other people regardless of their geographical localization and the different time zones. The reach and lifetime of information are now much longer than they were used to be three decades ago. In the same way, groups and social relationships (Association) have also assumed new dimensions: groups are not defined predominantly by subject or localization, but by affinity, beliefs, purposes, and other affective aspects. On the other hand, different social relationships have been made explicit and

represented by similar technical features that do not consider their differences (*e.g.*, acquaintances, friends, fans, followers and colleagues in social networks).

Through social software, the number of authorities one individual can have and keep in touch with is much higher than it was plausible to imagine before. A network of authorities would make it possible to find authorities in any subject, identify the ones who granted the authority, the information produced and shared by them, and so on. However, while individuals gain in number and diversity of authorities, they lose in direct bases (*e.g.*, personal experience) to justify and validate the CA of someone else, depending on others to do so. In the past, one of the main challenges was to know/find a CA in a given subject; in social software, it is to decide about its legitimacy. Therefore, it is necessary to provide people with bases that may support their decision about CA legitimacy on the web. The information produced and shared, past interactions, public opinions and recommendations, analysis of profile and social network contacts may provide useful information in such cases. However, designers must be aware of the possible implications the technical means designed for supporting CA judgment may have on security, trust, privacy and other ethical values.

5.3.3. Interplay

The interplay between CA and other values, such as identity, reputation, privacy, autonomy, trust and affective aspects is explicitly pointed out in Wilson's theory (1983). The ellipses in Figure 2 highlight these values into the VP. The relationship between CA and reputation was discussed previously. CA depends on identity — there is identity without CA, but there is no CA without an identity to receive it. Trust as well as affection is the most powerful base that supports CA and put it beyond discussion. Privacy and autonomy are clearly related to CA in critical situations where trust and security are involved — they can be seen as reasons why people resort to their CA instead of to any other person.

Note that all the values pointed out in Wilson's theory are placed at the informal layer of VP and are related to different areas of culture. On the one hand, it shows that CA is intertwined with different cultural aspects and reinforces its informal nature. On the other hand, it draws attention to other aspects that must be considered when bringing CA to the social software context — see the rectangles in Figure 5.2. For instance, reciprocity, collaboration and sharing are values that provide users direct bases for justifying CA; at the same time, CA may promote them through the values of autonomy, security, and trust in users' interaction. The same happens with conversation, relationship and groups: CA reinforces relationships, favors the emergence of groups and the establishment of direct interaction among users that, in turn, provide additional bases for CA recognition and maintenance.

Awareness, visibility and presence are related to space and time issues, and are congruent with CA. They may provide useful information about CA (*e.g.*, who is doing what, who is available) favoring interaction among users. On the other hand, as Côgo *et al.* (2012) indicate, CA contributes to deal with the information overload generated by the high amount of users and the information they produce. In the same line, CA may favor different levels of adaptability in social software (*e.g.*, information retrieval, management of groups, privacy configurations).

5.3.4. Highlights

In the previous sections, we analyzed CA through the three dimensions provided by the VP: formality, culture and interplay. Here, we summarize the most important points that must be kept in mind when designing computing systems intended to support CA.

- In social software, identity and object are central values. Depending on the system's purpose, the kind of objects it is focused, the possible actions and interactions users can carry out, CA may impact on different values and assume different levels of importance. For instance, in a social software for sharing recreational contents, CA is identified in users with similar tastes/preferences that may produce/recommend interesting contents. In a health-care system, on the other hand, CA is strongly related to expertise and knowledge, and its relationship with trust and security assumes a critical importance that transcends the system itself and affects direct and indirect stakeholders.
- Reciprocity and collaboration are values as important as trust in social software. Because social software is all about interaction between users and their objects, they form a triad necessary to promote and maintain users' participation. CA as a value in social software depends on these three values working in consonance.
- CA must be understood and approached as a value culturally defined and intertwined with other values. It requires considering values and culture during all the stages of design. Understanding culture is necessary to understand the way people recognize their CA, when they resort to them, and how they do it. Considering its relationship to other values draws attention to the possible applications and implications of CA in the solution being designed as well as in users' social world.
- CA must be discussed in the three levels: informal, where it is primarily manifested and where its impacts are perceived; formal, where there are the social rules, norms and conventions that govern CA, and the bases that justify and explain it; and technical, where the norms are translated into technical features designed to support CA identification, justification and use.

5.4. Network of Authorities: a Case Study

In this section, we present a case study related to the design of a social network for Brazilian teachers of the Special Education Services (SES) — teachers who work with students that have some type of disability. This social network is intended to support teachers in their day-by-day work in a continuing education process, favoring the constitution of a network of authorities for promoting social interaction, information and experience exchange, and the construction of knowledge by the discussion of real cases they face in their activities.

The system is being designed in an iterative and incremental style according to Baranauskas' design model (2009; Baranauskas and Bonacin, 2008), involving representatives from the target audience (28 teachers from different regions of the country), as well as researchers from Computer Science and Education. Several activities were conducted in order to design the first increment of the system: teachers explored and evaluated existing solutions and gave their feedback through evaluation questionnaires and interviews; a participatory workshop was conducted to create the first prototypes for the system; all the material produced was analyzed and discussed with the participants in order to evolve towards the design of a final product. Additionally, several artifacts were used during the different design activities in order to understand the values and cultural aspects of the different stakeholders involved. For instance, the VF4SS artifact was used to organize the information related to users, their values and culture — this activity was discussed in (Pereira *et al.*, 2011b). From the VF4SS, the information was mapped to the CARF artifact (Pereira *et al.*, 2012a) as requirements to the system. These requirements were discussed with the participants and used to guide the BrainDraw activity that resulted in the first prototypes for the system.

The system was named TNR by the teachers (Portuguese acronym for "All of Us Networked"). In its first increment (see Figure 5.3), users are able to create their profile, create and share contents (*e.g.*, text, audio, video, slides) — see detail "1" in Figure 5.3, leave comments, vote in pools, and interact with each other through asynchronous messages. A "Library" was also designed for users to share materials related to different kinds of disability (*e.g.*, deafness, blindness) — see detail "2".

Different features were designed to support the constitution of a network of authorities in the system. For instance, users can "follow" other users, mark "like" to comments and "favorite" contents to indicate their interests in a specific content/comment, or their appreciation for the other user. The detail "3" in Figure 5.3 indicates a feature named "SES' Gallery" that presents the most "followed" users ("3.1"), the most "liked" comments ("3.2"), and the most "favorite" contents ("3.3") in the TNR system.

Figure 5.3. Screenshot of the TNR System

According to the VP, CA is related to several other values that must be taken into account when designing a social software. In the TNR system, identity, object, trust, collaboration and reciprocity were identified to be important to teachers. Therefore, the features for supporting these values must be designed to contribute to CA. For instance, Figure 5.4 illustrates a message in which the user (a researcher from Education field) created a message (*i.e.*, an object) and shared a file to be discussed with the teachers. In the message, the user invited others to participate, leaving comments and suggestions to the formulation of a "Principles Letter" that will guide users' behavior in the system.

The detail "1" in Figure 5.4 illustrates users' identity. It is being represented by the user's picture, user name, and a link to his/her profile (see the highlight in Figure 5.4) — these elements are present in all the contents and comments users create in the system (indicating "ownership"). At the user's profile, it is possible to see his/her public personal information and all the content s/he created in the system. It is also possible to send a private message, and to start following him/her — see detail "1.1"

Detail "2" in Figure 5.4 indicates the link for users to add the message to their favorite list. Detail "3" indicates a tab in which all the users that added the content to their favorite list are listed. Detail "5" shows the number of readings for the message; detail "6" shows the file attached to the message and detail "4" indicates the link for liking a comment. Users' names and pictures were hidden to their privacy.

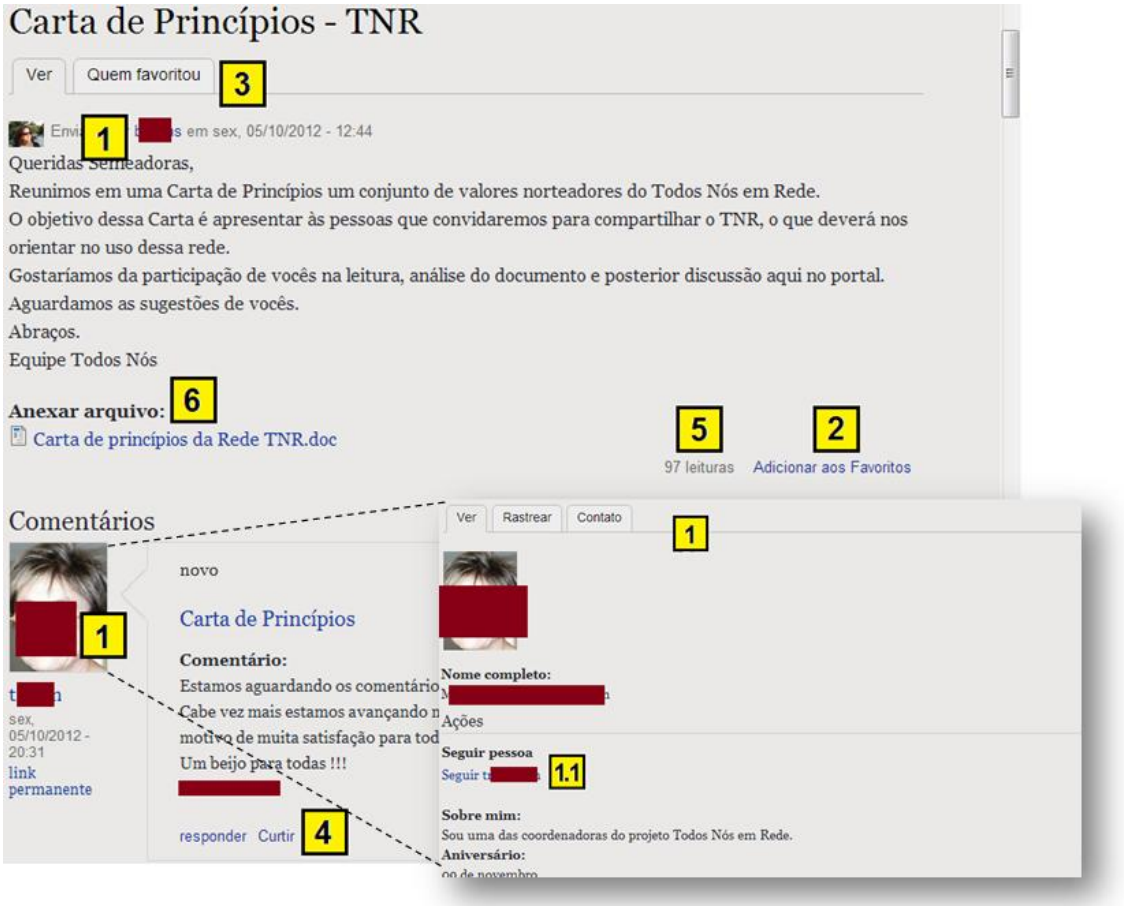

Figure 5.4. Screenshot of a message and a comment in the TNR system

In this increment, the "object" is any content that users create and share in the system. Collaboration occurs when users interact with each other leaving comments (ideas, opinions, suggestions) and sharing materials. Trust is built as much as users know and interact with each other, and is reinforced by security (*e.g.*, authentication mechanisms) and the usage terms. Finally, reciprocity depends on users' behavior and actions in the system, being favored by the non-hierarchical structure and the explicit recognition of users' participation (*e.g.*, being "followed").

At this moment (December 2012), the system is not open to public access. It has being used by 38 active users (teachers and researchers) that are working collaboratively and in a participatory way to define the usage terms, norms and values of the system. In the next increment, registration will be available through invitation by registered members.

5.5. Discussion

Understanding teachers' culture and values are determinant to the way a system is designed. It is not enough to consider the different values presented in the VP and to think about the way of supporting them. Designers must see the world through the stakeholders' lenses, understanding the role and importance each stakeholder gives to each value.

For instance, teachers are not concerned about **privacy**. It happens because teachers think of privacy in the sense of sharing their opinions and knowledge: they believe it is important to express their opinion about a given problem because it can help someone facing a similar situation. However, when they become aware of the possible impacts a social software can cause on their privacy (or on the privacy of others), they relate it to **security** issues and think that the system must prevent the participation of bad-intentioned users. On the other hand, they tend to **trust** in the contacts of their contacts, and would interact with unknown people if they could see their relationships. Using teachers'[16] words: "*If I follow someone, it is because I like what the person writes… and it is a signal that the person may follow other interesting people*" [Teacher 1]. "*I would give credibility to friends of friends; of course that being a friend of Professor [omitted] has a great weight*" [Teacher 2]. Therefore, users will be able to know who follows whom, and users invited to use the system will have an explicit indication at their profiles about who invited them. The system's terms and conditions of use also aim at avoiding harmful behavior.

Ownership was identified as a critical value for teachers. Although they like to work in groups exchanging ideas and sharing materials, they do not conceive the idea of someone but the author modifying a contribution made in the system. A collaborative editor, in this case, would trigger conflicts between the participants. Therefore, a cooperative feature where users contribute to each other but that identifies and keeps the individual contribution seems to be more adequate to them. According to Teacher 1, "*I understand that a contribution must only be edited by its authors. I think it is interesting a space for discussion, but respecting and keeping the contribution of each member. The interventions/editions in texts created by other people may not be well-accepted*". In the TNR, users are able to create discussions, leave comments and attach files to any content available in the system. Keeping the individual participation allows the identification of who did what in the system, and favors the recognition of users' contribution as well as the start of new interactions — this is key to promote the feeling of **reciprocity** in teachers.

The concern with ownership has also a clear relation to **identity**. Every interaction, content, comment, etc., contributes to construct teachers' identity in the system. Teachers

[16] Translations were made by the authors.

also want a space where they can put their personal information, pictures, experiences, etc. (*e.g.*, user profile), and the possibility of seeing information about other users. For teachers, if they do not know the other user, his/her profile can give important indications about the user's experience, knowledge, affiliation, and participation in the system, influencing the trust and serving as bases to CA recognition. Using teachers' words: "*I am not used to ask for help without, at least, knowing the person's profile, her references, readings… I am quite suspicious*" [Teacher 3]. "*I would pay attention to the participation of the person, his/her comments and answers, but I would be very critical… I would take into account the person's name and occupation*." [Teacher 4].

Although teachers give importance to **reputation** issues and think it is useful to have features for helping them to identify the quality and relevance of the contributions made by other users, they think that every contribution is important and can bring benefits. When discussing a real case, they believe that there is not a best individual solution, but that the best one is constructed upon all the individual contributions. Using teachers' words: "*I don't like the idea of choosing the 'best contribution', because it can generate a discomfort with the other participants. However, I think it is very interesting to have the possibility of identifying the quality of the contributions, although not defining the best one*." [Teacher 6]. "*It is very interesting to know the opinion of the other participants, but it must be only an indication of quality because not always the best contribution is the one we selected*." [Teacher 2]. "*I think it is very useful to know the quality of the contributions, because I consider quality as something extremely important*" [Teacher 4]. "*I am interested in knowing the opinion of other users, mainly the ones I like*" [Teacher 5]. It indicates that a mechanism for supporting the identification of quality and relevance must be essentially positive, *i.e.*, the presence of recognition must differentiate the contribution from the others, while the absence of recognition must not signify a bad indication. The features for liking comments and adding contents to a favorite list are intended to promote the best contributions according to users' opinion, without penalizing the ones that were not chosen by them.

The relationship between trust and **CA** is strong for teachers. When they need information, advices or help, they tend to resort to people they trust, like, feel comfortable with, and are directly connected. Using teachers' words: "*I look for the most intelligent ones! [laughs]… first I resort to my contacts. It would be very good to have direct contact to Professor [omitted], because the people that are our references (models) always influence our actions even not knowing it*" [teacher 1]. "*Here, at my school, I would look for my manager, because of her experience. I would also look for my books and on the internet; but I always look for an experienced person, because someone who already faced a similar problem always has good suggestions*" [teacher 5]. "*If I'm dealing with a new subject I look for people, books, internet, magazines… I would look for colleagues, teachers and friends…*" [teacher 6]. The feature for following users is intended to support CA in the technical level, making it easier for teachers to see the contributions made by their contacts, and to identify who follows whom in the system.

There are other features being designed to support social interactions in the TNR system: a module for the discussion of real cases, the possibility of inviting other users to participate in a discussion, the visualization of who is following a given user, online chat, and others. These features are also intended to reinforce the value of CA as well as to be benefited by it. For instance, the system is expected to have about five thousand users; therefore, the amount of users and information tends to be very high. In this sense, CA may be used to filter as well as recommend information and people to users when they need to find information about a specific subject or are looking for help.

At this moment, there are 76 "following" relationships between the 38 users in the TNR system. The top five users received 40 (53%) of such relationships: user1 has 14 followers, user2 has 8, users3 has 7, user4 has 7, and user5 has 4 followers. These users are among the ones teachers interacted with the most and received support for accomplishing their tasks in the previous activities (*e.g.*, using different systems, discussing fictitious cases, answering questionnaires). From these users, user1 is a Computer Science researcher who supported teachers in their difficulties; user3 and user4 are Education researchers who are reference in Inclusive Education and who have interacted with teachers during the previous activities; and user2 and user5 are teachers whose participation was explicitly praised by the other teachers during interviews because of its quality and relevance. Although we cannot assume the top followed users will represent CA when the system becomes open, it shows that, at least for the group of teachers using the system, the act of following someone indicates CA and makes sense to them.

5.6. Conclusion

In this chapter, we introduced the concept of Cognitive Authority as a mean for supporting better social interactions and revisited it using the Value Pie: an artifact grounded on Organizational Semiotics, Building Blocks of Culture and Values Theory, that allowed the discussion of the concept through the lenses of values and culture in social software.

Revisiting Cognitive Authority, we pointed out changes in the way people interact that have implications in time, space and association issues. In this sense, we showed the need for approaching it as a value in three different dimensions: formality, culture, and interplay. Formality concerns the informal, formal, and technical levels in which values are manifested and must be understood; culture is related to the cultural nature of values and interplay is related to the way they are intertwined with each other. We argue that all these three dimensions must be considered in order to obtain a wide understanding about Cognitive Authority and values in the design of social software.

In order to situate our discussion in a practical setting, we mapped it to the design context of a social network system intended to support the constitution of a network of authorities. This system is being designed in a participatory style to support Brazilian teachers of the Special Education field in their day-by-day work. Cognitive Authority, autonomy and accessibility are critical values that have been considered since the beginning of design activities.

The case study shows that it is not enough just to consider the values suggested in the Value Pie when designing social software. Depending on stakeholders' cultures, values will assume different importance and meaning, and will require quite different technical features for supporting them. The case study provided examples of how some details in the way stakeholders interact and understand their context may determine the way a computational feature must be designed. If the cultural nature of values and their relationships are neglected, the produced system tends not to make sense to users, distorting and complicating the social activities people conduct in their social life.

Finally, the Value Pie has been used to inspire the creation of different artifacts intended to support designers in different design activities. These artifacts and their usage methods compose what we are naming a value-oriented and culturally informed approach (VCIA) to design.

Capítulo 6

Conclusão

Embora software social seja um tipo de sistema interativo de grande popularidade atualmente, ainda há pouco conhecimento sobre como projetar sistemas que façam sentido aos seus usuários e que não desencadeiem efeitos negativos no ambiente social em que eles são disponibilizados. Esses sistemas têm apresentado problemas de sobrecarga, falta de qualidade e de credibilidade da informação, e têm produzido impactos negativos em valores como privacidade, confiança e reputação. O conceito de autoridade cognitiva tem sido considerado como uma possibilidade para lidar com tais problemas. Entretanto, os trabalhos existentes normalmente transportam para o contexto de software social o conceito de autoridade cognitiva tal como foi proposto há 3 décadas quando a rede mundial de computadores ainda não existia. As mudanças em termos de valores e de aspectos culturais de uma sociedade mediada pelas tecnologias de informação e comunicação que precisam ser entendidas para o design de sistemas adequados ao panorama atual não têm sido consideradas.

A dificuldade de se revisitar o conceito de autoridade cognitiva no contexto atual e de se projetar sistemas que façam sentido aos seus usuários se deve, em parte, à falta de artefatos e métodos que apoiem os designers nessa tarefa. A falta de familiaridade dos profissionais de tecnologia em lidar com questões sociais também é um fator de dificuldade adicional. De fato, lidar com aspectos emocionais e afetivos, culturais e de valores é um dos desafios que caracterizam um novo momento até mesmo na área de IHC. Este momento requer que as técnicas e teorias utilizadas para apoiar o design de sistemas interativos sejam repensadas, que cultura e valores humanos sejam colocados no centro do processo de design, e que sejam desenvolvidos e disponibilizados novos artefatos, métodos e exemplos para apoiar o design em suas diferentes atividades. Além de vários trabalhos na literatura indicarem para a necessidade de se considerar cultura e valores humanos como aspectos chave em IHC,

diferentes iniciativas têm apontado que essa necessidade é um desafio de pesquisa para a área na próxima década.

No contexto mencionado acima, esta tese de doutorado investigou o design de software social sob a ótica da cultura e de valores humanos e técnicos, demonstrando a necessidade de uma mudança de paradigma na forma como software social é entendido e projetado. Esta pesquisa articulou um arcabouço teórico-metodológico que possibilitou a criação/adaptação de artefatos e métodos para favorecer o envolvimento explícito de valores e de aspectos culturais durante todo o processo de design. Esses artefatos e seus métodos de uso foram instanciados em um processo de design socialmente consciente, originando a abordagem VCIA. A abordagem foi exemplificada e discutida no contexto de design de um software social projetado para favorecer a constituição de uma rede de autoridades e o seu arcabouço teórico foi utilizado para revisitar o conceito de Autoridade Cognitiva como um valor no contexto de software social.

6.1. Principais Contribuições desta Tese

As contribuições desta tese podem ser agrupadas em quatro temas distintos, porém inter-relacionados: software social, valores e cultura, processo de design, e autoridade cognitiva. Software social é o contexto de pesquisa desta tese e autoridade cognitiva é o conceito considerado para apoiar as interações sociais na Web. Entretanto, ambos os conceitos precisaram ser discutidos e entendidos no contexto de uma sociedade mediada pelas tecnologias de informação e comunicação, seus aspectos culturais e de valores, requerendo uma abordagem de design que apoiasse os projetistas nessa tarefa. Esta tese buscou articular esses diferentes temas na construção de um sistema computacional para apoiar a formação continuada de professores da área de Educação Especial.

6.1.1. Software Social

Nos dois primeiros anos da pesquisa, diversos trabalhos foram desenvolvidos e publicados no intuito de entender software social, suas características, dinâmicas e diferenças quando comparados aos sistemas ditos convencionais. Diferentes sistemas foram analisados, tentativas de explicar e definir software social foram confrontadas, oportunidades e desafios relacionados ao design e uso desses sistemas foram apontados, e diferentes teorias foram utilizadas e articuladas para apoiar as discussões desenvolvidas.

O capítulo 2 desta tese constrói sobre esses trabalhos e contribui ao oferecer: i) uma discussão organizada sobre software social; ii) um mapeamento da discussão para um contexto prático de análise de uma rede social inclusiva; iii) a indicação da necessidade de uma mudança de paradigma no modo como esses sistemas devem ser projetados e

entendidos; e iv) sugerir bases teóricas para apoiar essa mudança. O capítulo 3 contribui ao oferecer uma lista composta por 28 elementos-chave em software social, resultante das atividades de revisão de literatura e análise de sistemas existentes. Esta lista se diferencia pela diversidade dos elementos que considera, inova ao propor que esses elementos sejam entendidos como valores pessoais, sociais e técnicos, e contribui ao mostrar que é necessário considerar esses diferentes valores de forma integrada e transversal às atividades de design.

6.1.2. Valores e Cultura

Problemas desencadeados pela disponibilização e uso de software social (*e.g.*, com relação a privacidade, reputação, segurança) são comumente reportados pela mídia. Ao discutir software social sob a ótica de valores, esta tese chama a atenção para questões importantes relacionadas tanto ao design desses sistemas, seus atributos técnicos e de qualidade, quanto aos impactos desencadeados pelos mesmos no mundo social. Como mencionado, considerar valores no design de tecnologias é visto como um desafio e uma necessidade para a área de IHC.

Valores fazem sentindo em um contexto cultural. Entretanto, embora existam trabalhos importantes sobre valores e cultura na literatura, não foram encontradas iniciativas que articulassem esses conceitos de forma explícita. Reconhecer a natureza cultural de valores favorece a identificação daqueles que são importantes em um determinado contexto, e possibilita um entendimento maior acerca do seu significado e papel em uma sociedade. Esta tese se diferencia dos trabalhos existentes ao discutir a relação de valores e cultura de forma explícita, e contribui ao articular bases teóricas que trazem essa discussão para o espaço de design de sistemas interativos.

Os exemplos e discussões apresentados no decorrer dos capítulos contribuem para conscientizar sobre a importância de se considerar valores e cultura no design. O capítulo 3 apresenta um esquema, denominado *Value Pie*, criado para ajudar a explicar a natureza cultural e interativa de valores e o modo como eles se manifestam no contexto de sistemas de informação. O capítulo 4 apresenta, de forma mais detalhada, as bases teóricas que fundamentam o artefato, contribuindo para uma discussão organizada e informada de valores no contexto de software social.

6.1.3. Processo de Design

Como já mencionado, os profissionais de Ciência da Computação e Tecnologia da Informação normalmente não possuem uma formação que propicie um entendimento sócio-técnico acerca do design de soluções computacionais. Nesse sentido, a falta de técnicas, e mesmo de exemplos que possam servir como base, é uma das principais dificuldades para se considerar valores e cultura de forma efetiva durante todo o processo de design.

A abordagem construída nesta tese, denominada VCIA, favorece a consideração de aspectos culturais e valores durante os diferentes estágios de design: da identificação das partes interessadas e de seus valores, à organização de requisitos, comparação entre diferentes soluções de design e avaliação do sistema projetado. Esta abordagem se diferencia dos trabalhos encontrados na literatura por considerar valores e cultura de forma explícita e integrada, contribui com métodos e artefatos criados/adaptados para apoiar designers em suas atividades, e inova ao articulá-los em um processo de design socialmente consciente.

O capítulo 4 apresenta a abordagem e a exemplifica no contexto de design de uma rede social online que deve favorecer a constituição de uma rede de autoridades — o sistema TNR. Além desse exemplo, os artefatos e seus métodos de uso foram experimentados por diferentes grupos de designers em diferentes contextos de design, tais como sistemas para apoio à colaboração intercultural e aplicações para a TV digital interativa.

6.1.4. Autoridade Cognitiva

No que diz respeito à Teoria de Autoridade Cognitiva, esta tese oferece contribuições tanto ao revisitá-la sob a ótica de cultura e valores no contexto de software social, quanto ao utilizar o artefato *Value Pie* para fundamentar as discussões apresentadas. Ao revisitar a teoria, demonstra-se a necessidade de considerar autoridade cognitiva como um valor influenciado pela cultura dos indivíduos, que possui relação direta com outros valores, e que precisa ser entendido em diferentes níveis de formalidade para fazer sentido no panorama atual; ao utilizar o *Value Pie* para fundamentar as discussões, apresenta-se um exemplo de como o artefato pode apoiar o entendimento de valores no contexto de software social, influenciando decisões de design.

O capítulo 5 apresenta as discussões desenvolvidas em torno de autoridade cognitiva em software social, mapeando as discussões para o contexto de design do sistema TNR. Essas discussões evidenciam a necessidade de se considerar valores e aspectos culturais nas atividades de design para se entender como projetar um sistema capaz de apoiar a constituição de uma rede de autoridades.

6.2. Considerações sobre o Trabalho

A pesquisa que originou esta tese foi desenvolvida com base em investigações teóricas, análises empíricas e informadas, estudos de caso aplicados. Os capítulos aqui apresentados são um recorte sobre todo o trabalho desenvolvido e visam apresentar de forma organizada as principais contribuições produzidas. A Tabela 1.1, apresentada no Capítulo 1, serve como um índice para os trabalhos que não foram incluídos no corpo desta tese, mas que estão disponíveis como documentos anexos. O leitor está convidado a consultá-los.

Com relação às contribuições, resultados e limitações desta tese, alguns pontos importantes merecem ser destacados:

- Há pelo menos três diferenças significativas entre esta pesquisa e os demais trabalhos encontrados na literatura que abordam valores ou cultura, como Friedman *et al.* (2006) e Yeoh (2000): 1. Considera-se, além de valores humanos, valores técnicos que são diretamente ligados a atributos de qualidade da inovação sendo projetada (*e.g.*, acessibilidade, disponibilidade, usabilidade). 2. Valores e cultura são abordados de forma inter-relacionada e teoricamente embasada (*e.g.*, valores estão relacionados a diferentes aspectos de uma cultura; a cultura influencia no entendimento, papel e importância dada a valores). 3. Artefatos foram criados/adaptados e articulados em um processo de design para apoiar o envolvimento de valores e de aspectos culturais em diferentes atividades de design, conforme apresentado principalmente no capítulo 4.
- A lista de 28 valores identificados no contexto de software social, proposta e utilizada como apoio nos artefatos construídos, não representa uma lista definitiva e não pretende ser exaustiva. Nos estudos de caso realizados com mais de 50 designers, a sugestão de uma lista de valores foi importante por servir como guia, apoio e ponto de partida para as atividades de design. Devido à falta de familiaridade com a questão de valores, designers tendem a discutir apenas os problemas mais óbvios, e podem se sentir perdidos, sem saber o que fazer ou como proceder se nenhum ponto de partida for oferecido.
- Embora a sugestão de uma lista de valores ofereça contribuições, se utilizada de forma isolada ela pode restringir a análise e discussão em torno dos valores sugeridos, desfavorecendo aqueles que emergem do próprio contexto de design. Os artefatos criados para apoiar as atividades de design foram pensados para incentivar a investigação e discussão de valores além daqueles sugeridos e independentemente do contexto de design. Por exemplo, ao assumir que valores são ligados à cultura dos stakeholders, os artefatos convidam a estudar e entender as diferenças culturais das partes interessadas e, consequentemente, a identificar e entender seus valores. A lista de valores utilizada nos estudos de caso foi positivamente avaliada pelos designers e não foram encontrados novos valores para ser incluídos na lista, indicando a sua abrangência e relevância.
- Os artefatos foram construídos para não exigir dos designers formação específica em ciências sociais. Além da lista de valores, foram criadas tabelas explicativas sobre as áreas da cultura, sugestões de perguntas a serem consideradas em cada área, exemplos, etc., que foram embutidos nos artefatos de modo a facilitar as atividades de design. Embora alguma dificuldade inicial no entendimento e uso dos artefatos seja esperada, os estudos de caso demonstraram que os artefatos criados fazem sentido para designers e contribuem efetivamente para suas atividades.

- A abordagem VCIA sugere uma ordem natural de uso dos artefatos em um processo de design que em sua natureza favorece a identificação e envolvimento de valores e do contexto cultural das partes interessadas. Os estudos de caso demonstraram que é preciso apoiar os designers em todo o processo de design de modo que valores e cultura sejam considerados de forma explícita e efetiva nas diferentes atividades. Se utilizados apenas nos estágios finais de design, aspectos importantes que passaram despercebidos durante a clarificação do problema e proposta de solução podem exigir um esforço muito grande de redesign. Se utilizados apenas nos estágios iniciais de clarificação do problema, não há garantias de que a solução projetada esteja realmente refletindo uma compreensão dos valores das partes interessadas envolvidas.
- Embora a abordagem sugira uma ordem natural de uso dos artefatos, essa ordem é flexível e pode ser adaptada às necessidades do projeto sendo trabalhado. Os artefatos podem ser utilizados de forma isolada para apoiar atividades específicas (*e.g.*, comparar diferentes aplicações, avaliar um sistema existente, mapear os valores das partes interessadas envolvidas) independentemente do processo de design utilizado. De fato, não foram identificados indícios de que os artefatos não pudessem ser utilizados para apoiar outros processos e modelos de desenvolvimento de software.
- O estudo de caso apresentado nos capítulos 4 e 5 situa a pesquisa no contexto de design do sistema TNR, cujo objetivo é apoiar professores da área de Educação Especial em suas atividades práticas e favorecer a constituição de uma rede de autoridades. Esse contexto de design se beneficiou de alguns resultados desta pesquisa e, ao mesmo tempo, contribuiu para o seu desenvolvimento. Devido às diferenças temporais entre o andamento das atividades de design do sistema e a evolução da pesquisa desta tese, alguns dos artefatos foram criados depois que o primeiro incremento do sistema já estava sendo utilizado por um grupo de usuários. Por exemplo, o VF4SS foi o primeiro artefato adaptado para trabalhar com a questão de valores. Esse artefato foi utilizado para apoiar atividades de design no contexto do sistema TNR e, também, para apoiar 16 designers no projeto de 5 aplicações para favorecer a colaboração intercultural. Com a evolução da pesquisa, o VF4SS originou dois artefatos mais específicos: VIF e CARF. Portanto, esses artefatos foram preenchidos de acordo o conteúdo do VF4SS utilizado inicialmente, mas são exemplificados na seção de estudo para demonstrar como eles seriam utilizados e quais as contribuições que eles trariam para o contexto de design. Ambos os artefatos foram experimentados por um grupo de 38 alunos de graduação no projeto de 8 aplicações para a TV digital interativa no contexto brasileiro.
- Ainda com relação ao estudo de caso, as análises apresentadas nos capítulos 4 e 5 sugerem que os artefatos têm contribuído para o design de um sistema que faça sentido para seus

usuários e que seja apropriado pelos mesmos. Entretanto, é preciso destacar dois fatores que influenciam nos resultados apontados e que são particulares ao estudo de caso.

- O primeiro está relacionado novamente ao tempo do projeto TNR e o tempo da tese. Como o sistema ainda está em fase de desenvolvimento e alguns recursos essenciais ainda não foram disponibilizados aos usuários, não foi conduzida uma avaliação formal, com a participação dos usuários, que possibilitasse identificar os pontos positivos e negativos das decisões de design tomadas. Uma avaliação com os usuários reforçaria as contribuições apresentadas e poderia indicar questões que ainda não foram percebidas. Por outro lado, os retornos obtidos informalmente (por email) quando o sistema foi disponibilizado para uso, indicam que o sistema está sendo bem recebido pelos usuários e revelam aspectos emocionais e afetivos que estão envolvidos no design do sistema. Alguns exemplos, nas palavras das professoras que estão utilizando o sistema: "*Adorei as novidades! Vou dá uma espiadinha. Até breve.*" [usuário 1]; "*Achei tudo fantástico... Pretendo explorar aos poucos...*" [usuário 2]; "*Uau!! Incrivel... parabéns, vou aproveitar as novidades da rede.*" [usuário 3]; "*Parabénss!!! Como sempre vcs e suas ideias maravilhosas!!!*" [usuário 4]; "*Já visitei e gostei mt das novidades. Saudades de vcs.*" [usuário 5].
- O segundo diz respeito ao modelo de design utilizado no estudo de caso. O sistema está sendo desenvolvido no contexto de um projeto de pesquisa multidisciplinar no qual o meta-modelo de design proposto por Baranauskas (2009; Baranauskas e Bonacin, 2008) está sendo utilizado e representantes do público-alvo estão envolvidos desde o início das atividades. Portanto, este não é um cenário convencional, uma vez que a preocupação com os valores dos diferentes stakeholders envolvidos é um aspecto intrínseco do projeto. Deste modo, se por um lado esse contexto de design favorece o entendimento do problema e a utilização dos artefatos, por outro, ele torna difícil de apontar com clareza quais contribuições os artefatos trouxeram para o design que não teriam sido obtidas caso eles não tivessem sido utilizados.

  Entretanto, devido a fatores que variam do despreparo das equipes envolvidas até às limitações impostas pelo contexto do problema, sabe-se que o cenário mencionado acima não é a realidade da maioria dos projetos desenvolvidos. Designers precisam de artefatos e métodos que os apoiem a enxergar o mundo através das lentes das diferentes partes interessadas direta e indiretamente envolvidas no problema de design. Como os estudos de caso apresentados nos anexos desta tese demonstram, são nesses casos que as contribuições da abordagem VCIA são mais evidentes.

• O conceito de autoridade cognitiva revisitado mostra como é preciso entender esse conceito para que ele faça sentido no panorama atual. As discussões apresentadas servem também para ilustrar como as bases teórico-metodológicas articuladas nesta pesquisa possibilitam a discussão de um conceito sob a luz de cultura e valores humanos na era

digital. Embora uma análise do sistema TNR com um maior número de usuários seja necessária para se determinar a constituição de uma rede de autoridades e explicar suas dinâmicas, o estudo de caso demonstrou indícios de que o modo como o sistema está sendo projetado tem se mostrado propício para a constituição desta rede.

6.3. Trabalhos Futuros

Esta pesquisa abre diferentes oportunidades de trabalho tanto no contexto aplicado relacionado ao design do sistema TNR quanto no contexto da abordagem VCIA, software social, e autoridade cognitiva.

O design dos próximos incrementos do sistema TNR é uma evolução natural desta pesquisa. Outros recursos importantes para a constituição da rede de autoridades serão disponibilizados e o sistema será aberto para novos usuários por meio de convite de usuários já cadastrados. Deste modo, espera-se ter um contexto real para o desenvolvimento de trabalhos de análise de redes sociais, do reconhecimento e do papel da autoridade cognitiva no sistema e de valores em software social.

Embora esta tese tenha discutido o design de software social, a abordagem foi criada para ser utilizada independentemente do domínio do problema. Deste modo, a sua utilização em outros contextos de design também é uma continuação importante para reforçar os resultados obtidos, aperfeiçoar os artefatos e seus métodos, e produzir exemplos que possam inspirar designers em contextos semelhantes.

Durante os diferentes estudos de caso realizados, foram utilizados modelos dos artefatos em papel e em formato digital. Como esses estudos visavam analisar as contribuições dos artefatos e de seus métodos de uso em um contexto prático de design, a interferência de um sistema computacional poderia tanto trazer facilidades práticas quanto inserir dificuldades adicionais que prejudicariam a análise dos artefatos e do retorno dos designers. Atualmente, os modelos dos artefatos estão publicamente disponíveis em uma página que apresenta e explica a abordagem VCIA de forma sintetizada[17]. Como próximos passos, uma ferramenta computacional para apoiar o uso dos artefatos já foi especificada (ver Anexo 9) e sua implementação será um complemento desta pesquisa que contribuirá para facilitar o uso dos artefatos e disseminar a abordagem criada.

Stamper (2000) apresenta diferentes taxonomias para normas e sugere que valores estão relacionados a normas avaliativas: um tipo específico que influencia no comportamento dos indivíduos (normas comportamentais). Há na literatura uma ampla gama de trabalhos importantes que investigam e aplicam normas comportamentais na modelagem de sistemas

[17] *www.nied.unicamp.br/ecoweb/products/artifacts*

interativos. Entretanto, o entendimento de como as normas avaliativas influenciam as normas comportamentais, e de como elas podem ser representadas formalmente ainda é uma questão que demanda investigação. Este é um tópico de pesquisa importante que pode trazer contribuições efetivas sobre o papel e as dinâmicas de valores no contexto de sistemas de informação.

6.4. Comentários Finais

No panorama atual em que se tem discutido os rumos da área de IHC e se tem evidenciado a necessidade de se repensar as teorias, métodos e práticas adotados para apoiar o design de soluções computacionais, a preocupação com aspectos relacionados à cultura e valores é uma tendência e um desafio.

De fato, é preciso entender e reconhecer que esses aspectos influenciam diretamente na forma como um sistema interativo é percebido, entendido e utilizado. A falta de atenção a valores e de compreensão do contexto cultural tem levado à criação de produtos que não atendem às demandas de seus usuários, não fazem sentido e que, muitas vezes, desencadeiam impactos indesejados no ambiente em que são disponibilizados. Também é preciso entender que existem fatores significativos que não podem ser clarificados por meio de uma entrevista com potenciais usuários ou de alguns estudos de campo, e que precisam ser trazidos à tona por meio de análises informadas e explicitamente preocupadas com valores e com sua natureza cultural.

Nesse sentido, enquanto designers de tecnologias, nós temos a responsabilidade ética de garantir que as soluções que projetamos não desencadeiem efeitos indesejados no ambiente em que elas são inseridas e nas diferentes partes interessadas envolvidas. Enquanto pesquisadores, nós devemos assumir o compromisso de investigar e criar métodos, artefatos e ferramentas que apoiem designers em contextos industriais e acadêmicos nessa tarefa. Este foi o norte que orientou esta tese.

Finalmente, tão importante quanto o entendimento e o respeito para com cultura e valores no design de tecnologia é a preocupação com os valores que comunicamos por meio dos problemas que trabalhamos e da ciência que produzimos. Enquanto grandes investimentos em termos de tempo, recursos financeiros e humanos têm sido direcionados para a pesquisa de novas tecnologias, algumas das quais sem aplicação no curto e médio prazo, ainda há problemas sociais críticos que demandam um esforço conjunto de diferentes áreas de pesquisa e que devem ser priorizados. Isso não significa impor restrições ao desenvolvimento científico, mas reconhecer que existem questões que devem ser tratadas em caráter de urgência e que demandam um compromisso ético com valores de natureza moral e universal.

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Anexo 1 – A Framework - Informed Discussion on Social Software: Why Some Social Software Fail and Others do Not?[18]

[18] Pereira, R., Baranauskas, M.C.C., Silva, S.R.P. A Framework - Informed Discussion on Social Software: Why Some Social Software Fail and Others do Not?. *In: 12th International Conference on Enterprise Information Systems (ICEIS 2010)*, Funchal, 2010, pp.149-154.

A FRAMEWORK—INFORMED DISCUSSION ON SOCIAL SOFTWARE

Why some social software fail and others do not?

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Abstract: The possibility of developing more interactive and innovative applications led to an explosion in the amount of systems available on the web in which users interact with each other and have a primary role as producers of content—the so-called social software. Despite the popularity of such systems, few of them keep an effective participation of its users, promoting a continuous and productive interaction. This paper aims at starting a discussion about the factors that contribute for the success of certain systems in keeping their users attention while others fail. To achieve this goal, we present a discussion informed by a conceptual framework. To situate the discussion in a practical context, we illustrate with an analysis of a collaborative system for usability evaluation on the web.

1 INTRODUCTION

The Web 2.0 advent incited the development of new applications characterized by mass collaboration, communication and interactivity. The emergence of the "new web" encouraged the creation of technologies such as social networks, social search, social categorization (folksonomies), collaborative editing, publishing and sharing, among others (Bryant, 2006). These technologies, developed for supporting a "social web" are called social software. We can exemplify with the YouTube, the Flickr, the Orkut, the Second Life, the Delicious, the Twitter, among others, in which millions of users interact, communicate, create, share and organize information. These systems show the "power of the collective", the opportunities and knowledge that can be generated through the collaborative work and through the mass interaction. According to Webb (2004), the goal of social software is to deal with groups, with the interaction among people. And in this context, the interaction will occur in an unprecedented scale and intensity, leading to a situation in which issues related to human-computer interaction are extended to issues related to human-computer-human interaction.

Despite the popularity and the growing in the number of users of the social software cited above, just a small fraction of systems is really successful. Therefore, Zengestrom (2005) raises a discussion on **why some social software work and others do not**. That is, what are the factors responsible for the success of some [social] systems and for the failure or abandonment of others? To understand these factors and, then, trying to give an answer, it is necessary to consider that designing systems for the social web is a complex challenge in which several points need to be addressed.

The main particularity of social software is in the design process, because human factors and group dynamics introduce design difficulties that are not obvious without considering the human psychology and nature (Webb, 2004). Moreover, due to the recent emergence and popularization of social software it is still necessary to understand what are the impacts that this new range of applications could

cause (or cause) both in the social and the technological aspects.

Despite the lack of formal metrics to determine whether a social software succeed or not, the number of users and their level of activities offer significant evidences. **If there are no users there will be nor information neither other kind of knowledge to be analyzed**. Thus, being completely dependent on their users, the success of social software depends heavily on how users feel when using them, on their interface features and on their interaction mechanisms (Pereira and Silva, 2008). Users need to feel confident, guided, rewarded and motivated to use the application because, otherwise, there is no reason for using such systems to produce or organize information or to interact with each other.

Although the concept of social software is relatively new, discussions around the design of collaborative systems are receiving attention from academy since more than two decades. In Winograd and Flores (1987), the authors discuss about the impact of computer systems on the social relations of their users, emphasizing that this impact must be taken into account when designing a system. Ackerman (2000) says that when designing a collaborative system the biggest challenge is social instead of technological. The author emphasizes that systems do not fully meet the requirements of sharing information, the social policy of groups, responsibilities, among others, because we do not have knowledge on how to develop systems that fully support the social world. Neris *et al*. (2008) point the challenge created by the users' diversity of skills, in general, saying that to address this challenge it is necessary to know users in their skills, formalizing interaction requirements and studying solutions of interface\interaction for the diversity. Systems should reflect understandings about how people actually live and work in their organizations, communities, groups and other forms of collective life. Otherwise, as Ackerman (2000) argues, produced systems will be useless, inefficiently automating and distorting the collaboration, and other social activities.

This paper sheds ligh on the discussion about why some systems work and others do not. Given the inherent complexity in any attempt of finding a synthesized answer, the discussion will be generated around an analysis of a collaborative system for usability evaluation on the web. This analysis considers a functional framework proposed by Smith (2007)—the **social software honeycomb**, to explain how social software works and, thus, to determine which elements should be considered when designing them. The paper is organized as follows: section 2 presents the social software framework elements; section 3 describes the *TesteUsabilidade* system and presents an analysis about its resources and the participation of its users, discussing the elements considered by the system; section 4 revisits the framework. Finally, section 5 presentes our conclusions and directions for future research.

2 THE SOCIAL SOFTWARE BUILDING BLOCKS

Smith (2007) proposed a framework to illustrate a list of seven elements that give a functional definition for social software (see Figure 1). These "social software building blocks" are: identity, presence, relationships, conversations, groups, reputation and sharing—an overview about the discussions that led to the honeycomb framework can be found in (Pereira, Baranauskas and Silva, 2010). Each element can be basically understood as follows:

Figure 1: Social software honeycomb (Smith, 2007).

Identity: a unique identifier of a user within the system. Something that represents his/her "me". **Presence**: resources that allow knowing whether certain identity is online, sharing the same space at the same time. **Relationship**: a way to determine how users of the system can relate\are related to others. **Reputation**: a way of knowing the status of a user in the system. **Groups**: the possibility to form communities of users who share common interests, ideas or opinions. **Conversation**: resources for communication (synchronous and/or asynchronous). **Sharing**: refers to the possibility of users sharing objects that are significant, important to them.

The identity appears at the centre of the framework because, according to Smith (2007), it is the most basic requirement of any social system. One may understand from this structure that not all software has all of these elements. Actually, systems usually have three or more of such elements, but

have a main focus on only one or two of them. To illustrate, consider Figure 2 which presents the elements implemented by the systems: *Youtube*, *Delicious* and *Orkut*, which are examples of systems with a great number of active users. The dark gray hexagons correspond to the core element in which the system is focused. The light gray hexagons correspond to the other elements that are implemented by the system and which work as a complement to the core element. Those that are not explicitly considered in each system appear in blank.

Considering the *YouTube* system (Figure 2 (a)), it is possible to see that it focuses on the "sharing" element: the main purpose of users in the system is to share videos—posting and watching videos. Additionally, the system implements the elements of "identity": each user has his/her profile with favourite videos and added videos; "conversation": users comment and respond to comments about the videos; "groups": the system provides resources for the formation of groups and channels in which users can join and participate; and "reputation": the system implements a collaborative scheme of reputation over the comments posted in videos in order to identify and avoid spam.

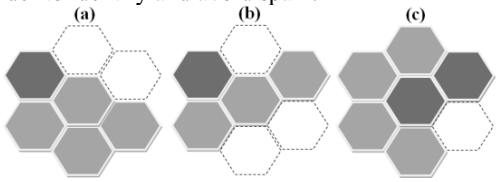

Figure 2: (a) *Youtube*, (b) *Delicious*, (c) *Orkut*.

As we mentioned earlier, the elements presented in this section are far from being exhaustive and complete. However, they are good starting points in defining a conceptual framework to assist in the understanding of social software. The framework makes it possible to examine these systems and to understand how people use them to meet their personal and social goals. Following, we describe the *TesteUsabilidade* (2007) system and present an analysis based on the social software framework.

3 A HONEYCOMB ANALYSIS OF THE *TESTEUSABILIDADE*

TesteUsabilidade (2007) is a collaborative system to create a space for evaluating the usability of any application or page available on the web. According to its creators, it is a collaborative system that aims at offering a free, simple, online and fast resource for the Hallway Testing (Olson, 1996), in which people are randomly allocated to test a product.

Basically, the system allows its users to register their websites to be evaluated by other users, receiving feedback, responding to comments, evaluating these comments and, consequently, also acting as evaluator into the system. Thus, the main intention is the provision of a social environment in which users help each other to improve the quality of their products, and enabling the exchange of knowledge related to the design and evaluation of websites. There are no methods or pre-defined rules to guide the evaluations. The system provides an internal page with some tips about how to evaluate; however, evaluations of websites are basically a message containing users' perceptions, their views and considerations in unstructured natural language.

Despite being an interesting initiative, the *TesteUsabilidade* system did not succeed. In the next subsection, we present data showing the system stagnation. Like every social software which depends on users' participation and collaboration for achieving success, something is missing to encourage the participation of users and to improve the quality of the evaluations they accomplish.

We do not intend to discuss here the advantages or disadvantages about the method applied by the system. We will focus at two main questions: How to encourage users to evaluate more? And how can websites have more chances of being evaluated? The next subsection gives us a picture of users' participation in the system and the next one applies Smith's framework to it.

3.1 Users' Participation

The system was available on the web in the middle of 2008. Data collected on May, 17, 2008, presented a total of 195 registered users, 153 comments and 147 websites registered to be evaluated. At October, 14, 2009, it presented 516 registered users, 386 comments and 324 websites. By that time, just 54% of the websites were commented and just 28% of the comments were replied. When comparing the data obtained from the two periods, it indicates that the data roughly doubled. However, a small portion of users is responsible for the most part of the evaluations, and a small portion of websites receives the most part of the evaluations—the long tail phenomenon (Anderson, 2006). Despite the finding of low users activity over a period of about three semesters, what allows us to say that it does not maintain a constant participation of its users, the

most ten active users remained practically the same in this interval.

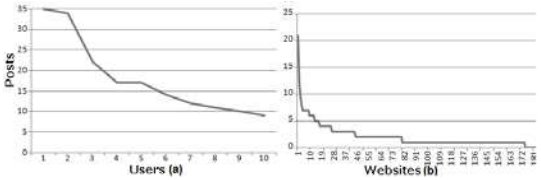

Figure 3: Long tail: (a) users; (b) websites.

The graph in Figure 3 (a) shows the curve of the number of posts created by the ten most active users in the system. We noticed that only 2% of users were responsible for exactly 47% of the evaluations. The user with the highest number of reviews conducted 36 evaluations while the user in the 10th position conducted 9; in 2008, the values were 25 and 3 evaluations, respectively—there was no change in the first seven positions of the ranking. On the other hand, the graph of Figure 3 (b) shows the concentration of evaluations in a small portion of websites, while more than a half had never been evaluated. In the graph, the "X" axis is the amount of websites, while the "Y" axis is the number of evaluations each website received. The difference in the distribution of comments by the websites may be explained by what Barabàsi (2003) calls "the rich get richer": the tendency of nodes that have a high number of connections in receiving more connections. However, a forgotten website tends to stay there, until someone decides to be the first to comment on it. Nonetheless, the time waiting for an evaluation is relative and, sometimes, the website's owner may wait months for a single feedback. When (if) this feedback comes, it can be no longer required or expected and, in those cases, a late help leads to an evaluation being wasted. Currently, the best chance that a website has for receiving its first evaluation is when it remains among the users' most recent added websites. After that, its chances tend to decrease and it starts to count on the "lucky" to get its first evaluation.

Klamma *et al.* (2007) discuss about incentive mechanisms inspired by Social Exchange Theory. Grounded in their experiments, a feature that can help in soften the problems shown above is to allow users, when registering a website for evaluation, explicitly requesting an evaluation to some members of the community. Ex: user "A" asks user "B" to evaluate his website. Thus, there are more chances of "A" having his website evaluated and, besides, there is the possibility of "A" expressing his interest in receiving a feedback from user "B", whether "A" considers this user as an expert or just because "A" think s/he may assist and attend to his request. Furthermore, user "B" will have reasons that encourage s/he to, at least, give an opinion about the website. The participation of users is being driven by the request of another, which may be a factor for them to feel recognized, excited to participate more, and mainly, to make evaluations of better quality—even more if there is a ranking of the users most requested for evaluating websites. This strategy can help in two issues: encouraging the participation of users and conducting useful evaluations. We would see the elements of "conversation", "relationships" and "reputation" present in this strategy.

3.2 The System Building Blocks

Perhaps, one of the most interesting (and important) contributions of *TesteUsabilidade* is allowing users to read the usability evaluations conducted by other users, generating an exchange of experience and even of knowledge. Furthermore, it is possible that the user who posts a website to be evaluated reply the comments received keeping an interaction with the evaluators. This opened mode of displaying evaluations makes it possible to see some posts in which: i) suggestions are taken into account; ii) there is an effective communication; and iii) websites are evaluated again after being restructured.

Figure 4: *TesteUsabilidade's* elements.

Figure 4 illustrates the elements considered by the system. The focus is in the "conversation" that is implemented using the resources of comments and responses to the evaluation of websites. The element "identity" is considered as the user's profile that exposes personal information relating to the user participation. The element of "reputation" is represented in a scheme by assigning a grade to evaluations accomplished by users and which are publicly available at their profiles. The "sharing" element must be addressed separately. The system does not allow an effective share of objects: users do not have resources to share photos, documents, etc. One can interpret that the websites, or their evaluations, are the objects being shared. However, considering the semantics of the word "sharing" (*To give part of what one has to somebody else to use or*

consume; To have in common), it becomes clear that this element is not implemented by the system, because the object remains exclusively of its owner. The other elements of "presence", "relationship" and "groups" are not considered by the system.

Once identified the elements in the system, it is also necessary to question whether these elements were actually chosen and implemented properly to meet the goals of the system. As shown by usage data, the system has no sufficient elements for supporting users' participation. The interaction starts around the object with focus on the element of "conversation", but it seems that users do not feel motivated to start new interactions after a few experiences. In this case, the addition of new elements (e.g., relationships), could improve the process of interaction. Currently, the "conversation" is maintained through messages/replies in a scheme similar to a forum. The system already considers the elements of "identity" and "reputation" and it facilitates the insertion of the "relationship" element, which tends to keep users more engaged with the system and focus on the activities of other users.

The "conversation" element also should be more explored. Users do not have a resource for direct interaction with other users being restricted only to the posting of evaluation messages. If in this process users have doubts, need help or want to keep an effective and direct contact with other users, they need to look for resources external to the system. The initiative of implementing the element of "reputation", even relevant, loses much of its impact due to the absence of other elements such as "relationships" and even "groups": a reputation has importance as a status, and a status has value when it can be displayed, admired, used as a distinction form. But in the way it is implemented, it becomes only one indicator related to the history of ratings of each user (this example shows how the elements influence each other).

4 REVISITING THE HONEYCOMB FRAMEWORK

After seeing examples of social software which got success, as well as a system that, despite considering some of the social software framework elements, not kept the participation of its users, some questions remain: What is the main difference among these systems, taking both as social software? What have they as singular characteristics that are crucial for their acceptance and for keeping the attention of their users?

First of all, the framework elements are far from exhaustive and complete. Zangestrom (2005) asserts that an important element missing in Smith's original framework is the **Object**—the social object being built/modified is determining which elements should be considered and how they should be considered (e.g., in *Youtube* the object is videos, in *Flickr* it is photos). In Smith's framework the "object" is not made explicit; it is behind the scene, as the thing people "share" in the social software.

It is necessary to understand what maintains the collaboration, the participation and the effective interaction among users. Knorr-Cetina (1997) addresses the individual and the object as central elements in a process of social interaction (an object-centred sociality), discussing objects around which the discussions occur, the focus is maintained, among other social interactions. In this context, we can say that systems should have a well defined object of interaction, since these objects are generally complex, open and questionable. They are in constant process of being materially defined, constantly acquiring new properties and modifying the existing ones. Besides, it should be a symmetric relation in the sharing of the object regarding who gets the benefits of the task. In the *TesteUsabilidade* this relation is asymmetric as the site owner is the person who gets the most benefit of the participation (not the person doing the evaluation task). With these assumptions a new question arises: how the elements of the framework are implemented in a system so that the object of interaction is put into focus, generating discussions, acquiring new properties, being challenging and motivating?

When designing social software, depending on the combination and the focus given to each element, the environment can be quite completely different impacting, consequently, in how it will be understood by its users. The question here is to choose the right elements and the right way for implementing them. To combine and implement the framework elements we need a socio-technical approach, or what Baranauskas (2009) defines as Socially Aware Computing: "*the theory, artifacts and methods we need to articulate to actually make the design socially responsible, participatory and universal as process and product*".

In summary, to design a system that can be accessed by everyone, keeps its users attention and produces useful contents, we need a new Science of Design, aligning system development with social practices with the end user. Further work in

revisiting the honeycomb framework is now being conducted inspired by Organizational Semiotics (Baranauskas and Bonacin, 2008).

5 CONCLUSION

The process of designing social software is highly complex because we must consider human factors, group dynamics, social and psychological aspects to understand how to design a system that effectively satisfy the needs of their users and that really meet the demands imposed by the "social". In this paper we aimed at putting focus on possible factors that influence the success (or failure) of social software systems which depend on the effective participation of users. The paper discussed elements necessary for the functioning of social software and briefly suggested theories that can guide and give basis for understanding how to design successful systems. We observed that the object of interaction and the symmetry of interests in the shared object are decisive factors in determining how a system should be designed, which elements should be considered and how these elements should be implemented to provide an effective, productive and continuous interaction. Moreover, the process of designing social software needs to address the view of a Socially Aware Computing, otherwise, it seems to be impossible the development of systems that completely satisfies the users requirements, needs, and expectations to fulfil social demands.

In the same way as the discussion on the shared object need to be expanded, the discussion presented in this paper is a just starting point in defining a conceptual framework to help in the understanding and design of social software. With this framework, it is possible to analyze these systems and to infer why people use (or do not use) them to meet their personal and social goals. The next steps of our approach involve expanding the framework proposed by Smith (2007) where some elements should be added and other must be reconsidered and strongly discussed (Object, Awareness, Emotional and Affective aspects, Personalisation to name a few others). Additionally, discussion around the theories we mentioned in this paper (Socially Aware Computing, Organizational Semiotics and Object-Centred Sociality) are being considered as theoretical referential.

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Anexo 2 – Softwares Sociais: Uma Visao Orientada a Valores[19]

[19] Pereira, R., Baranauskas, M.C.C., Silva, S.R.P. Softwares Sociais: Uma Visao Orientada a Valores. *In: IX Simposio Brasileiro de Fatores Humanos Sistemas Computacionais (IHC'10)*, 2010, pp. 149-158.

Softwares Sociais: Uma Visão Orientada a Valores

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ABSTRACT
Social software have been triggering transformations that are changing the way people relate, use and are affected by technology. The opportunities and challenges brought by this kind of interactive systems require traditional methods of design and evaluation to be rethought and new concepts, such as human and technical values, be considered in computing systems. This paper presents a discussion on the concept of social software and places this kind of system in the context of human and technical values. As main contribution, it presents a set composed of 27 personal, social and technical values identified through an extensive literature review for supporting social software analysis.

RESUMO
Os softwares sociais tem sido desencadeadores de transformações que estão alterando o modo como as pessoas se relacionam, utilizam e são afetadas pela tecnologia. As oportunidades e os desafios trazidos por esse tipo de software interativo exigem que os métodos tradicionais de design e avaliação sejam repensados e que novos conceitos, como valores humanos e técnicos, sejam considerados em sistemas computacionais. Este artigo apresenta uma discussão sobre o conceito de software social e coloca esse tipo de sistema no contexto de valores humanos e técnicos. Como principal contribuição, propõe-se um conjunto composto por 27 valores pessoais, sociais e técnicos para apoiar a análise de softwares sociais.

Palavras-chave
Software social, valores, *web* social

INTRODUÇÃO

A *Web* 2.0 foi um marco no desenvolvimento de aplicações caracterizadas pela colaboração, comunicação e interatividade entre os usuários de forma e em escala inéditas [32]. A possibilidade de desenvolver aplicações mais ricas e inovadoras em termos de interatividade, permitiu o surgimento dos chamados **Softwares Sociais** (*e.g.*, *Youtube*, *Orkut*, *Flickr*, *Delicious*, *Twitter*) e colaborou para uma mudança de paradigma: mais do que interligar documentos, páginas ou recursos, a *Web* hoje interliga pessoas, organizações e conceitos, dando origem à chamada ***Web* Social**.

Dentre as principais características dos softwares sociais podemos citar a necessidade de uma massa crítica de usuários e uma grande quantidade de conteúdo produzido por eles [14]. Nos softwares sociais, milhões de usuários interagem, se comunicam, criam, compartilham e organizam conteúdos, demonstrando a "força do coletivo", as oportunidades e o conhecimento que podem ser gerados pelo trabalho conjunto e pela interação em massa [32]. Porém, por ser totalmente dependente dos usuários, o êxito desses sistemas depende fortemente de aspectos da Interação Humano-Computador (IHC) relacionados, por exemplo, com fatores emocionais, sócio-culturais e técnicos, incluindo a forma como os recursos de interface são empregados.

Os softwares sociais representam um grande desafio para a comunidade de pesquisa não apenas em IHC, Sistemas Colaborativos ou Engenharia de Software, mas também em Banco de Dados, Redes de Computadores, entre outras áreas ligadas à infraestrutura, abrangendo também disciplinas que vão além da computação (*e.g.*, Sociologia, Psicologia, Antropologia, Direito, Comunicação, etc.). Como mencionado no *workshop* realizado em Sevilha, na Espanha, para discutir como seria IHC em 2020 [30], nós agora vivemos com a tecnologia, não apenas a usamos. Isso implica na existência de um amplo conjunto de fatores que abrange desde aspectos emocionais e afetivos, de sociabilidade, valores humanos, até questões de segurança, escalabilidade e desempenho. Deste modo, para que seja possível desenvolver tecnologias que realmente atendam às necessidades dos usuários, considerando suas diversidades e limitações, é preciso compreender as novas formas de interação e de relações sociais. É preciso considerar a interação das pessoas com a tecnologia, entre as próprias pessoas, com seus objetos do dia-a-dia e também com o ambiente, compreendendo os valores envolvidos nessas interações.

Nesse sentido, Harrison *et al.* [13] apresentam discussões que apontam para a 3ª onda em IHC. Comparada às 1ª e 2ª ondas, nas quais havia uma orientação para as questões de ergonomia e fatores cognitivos respectivamente; a 3ª onda trata da multiplicidade e do estabelecimento de sentido. Nela os artefatos e seus contextos estão mutuamente definindo e sendo sujeitos de diferentes interpretações. Essa visão de multiplicidade é ainda mais pertinente no contexto das aplicações sociais, nas quais os requisitos

estão em constante mudança devido à variedade de usuários, seus valores e dispositivos de interação.

Efetivamente, os softwares sociais representam parte das transformações que têm redefinido nosso relacionamento com a tecnologia (*e.g.*, o aumento da hiperconectividade; o fim do efêmero; o aumento do envolvimento criativo; o aumento da dependência da tecnologia) [30]. Essas transformações provocam questões que a área de IHC não tinha que se preocupar antes, pois o relacionamento dos usuários com a computação agora vai além de estarem sentados na frente do computador preparando *slides* ou digitando textos. Por exemplo, quais técnicas de interação e que tipos de interface são adequados para apoiar a interação e a comunicação em massa? Como auxiliar as pessoas a gerenciar a sobrecarga de informação a que são expostas? Quais **valores** as aplicações devem favorecer e quais elas devem inibir? Como desenvolver sistemas que atendam efetivamente a essas demandas?

Harrison *et al.* [13], assim como Sellen *et al.* [30], enfatizam a necessidade de se desenvolver e publicar estudos que auxiliem projetistas e avaliadores a lidarem com a complexidade e com os requisitos diferenciados que as aplicações sociais apresentam. Neste artigo, investigamos o conceito de software social e discutimos esse tipo de sistema do ponto de vista dos valores envolvidos (*e.g.*, confiança, reputação, autonomia, colaboração, etc.). Para isso, apresentamos uma discussão teórica sobre o termo software social e sua definição. Com o objetivo de ampliar a discussão em torno de valores em softwares sociais, propomos um conjunto de 27 elementos identificados na literatura; os classificamos em termos de valores pessoais, sociais e técnicos; e demonstramos, por meio de exemplos, como esse conjunto pode auxiliar a compreender e identificar os valores envolvidos em softwares sociais. Finalizamos o artigo com uma agenda de pesquisa na área de software social e suas aplicações.

SOFTWARES SOCIAIS: REVISÃO DE LITERATURA

Embora o conceito de software social seja relativamente novo, discussões em torno do design de sistemas colaborativos vêm recebendo atenção da academia há mais de duas décadas. Winograd e Flores [38] discutem sobre os impactos dos sistemas nos relacionamentos sociais de seus usuários e enfatizam que esses impactos devem ser levados em conta ao se projetar um sistema. Ackerman [1] também defende que o grande desafio ao se projetar um sistema é de caráter social e não tecnológico. Para o autor, os sistemas atuais não atendem satisfatoriamente os requisitos de compartilhamento de informação, de políticas sociais de grupos, responsabilidades, entre outros, porque não possuímos conhecimento sobre como desenvolver sistemas que suportem eficientemente o mundo social. Neste mesmo contexto, ao abordar questões sobre o design de sistemas colaborativos, de Souza [34] afirma que a qualidade da comunicação e das ações que os usuários experimentarão ao utilizar um sistema é determinada pelos seus designers, porque a forma como um sistema é projetado estabelece as percepções dos usuários sobre si, sobre os outros, bem como as reações individuais e coletivas a essas percepções.

Neris *et al.* [23], por sua vez, sugerem que a diversidade de habilidades dos usuários está entre os fatores que tornam o design desses sistemas tão complexos. Os autores apontam a necessidade de conhecer os usuários em suas habilidades, formalizando os requisitos de interação e investigando soluções de interação/interface para a diversidade. Os sistemas devem refletir uma compreensão sobre o modo como as pessoas realmente vivem e trabalham em suas organizações, comunidades, grupos, e outras formas de vida coletiva. Caso contrário, como Ackerman [1] argumenta, os sistemas produzidos serão inúteis, distorcendo e automatizando de forma ineficiente a colaboração, comunicação e outras atividades sociais.

Essas considerações sobre sistemas colaborativos também são válidas para o contexto de softwares sociais. De fato, como exposto por Dron [10], a grande diferença entre ambos os conceitos parece estar no número e na diversidade dos usuários, na quantidade de informação criada e compartilhada pelos mesmos, e nas possibilidades de interação com o sistema e com outros usuários.

Discussões sobre o termo Software Social

O termo "software social" é utilizado em muitos contextos e diferentes tecnologias são cobertas pelo mesmo. Inspirados na discussão de Lazar e Preece [18] sobre comunidades *online*, podemos dizer que o conceito de software social normalmente é subjetivo: ele é fácil de entender e reconhecer, mas é instável de definir e ainda mais complicado de se medir.

Uma das primeiras definições para o termo, e uma das mais amplamente discutidas, foi apresentada por Shirkly [31] como "softwares que suportam a interação em grupo". Klamma *et al.* [16] consideram, genericamente, softwares sociais como "ferramentas e ambientes que suportam atividades em redes sociais digitais", e Smith [33], como "softwares que permitem às pessoas se conectarem por meio de uma comunicação mediada por computador". Nessa mesma linha, para Chatti *et al.* [7] softwares sociais são ferramentas para aumentar as habilidades sociais e colaborativas das pessoas e um meio de facilitar a conexão social e a troca de informação.

Autores, como Klamma [16] e Smith [33] argumentam que software social é um termo pobremente definido. Em partes, isso ocorre porque tecnologias, ferramentas e conceitos sociais são misturados e não são claramente explicados. Sistemas, tais como a *Wikipédia*, o *Facebook* e o *Youtube* são amplamente aceitos como sociais. Do mesmo modo, *Wikis* e *Blogs* também são incluídos nessa categoria. A *Wikipédia* é um *Wiki*, mas ela é considerada um software social por causa da tecnologia *Wiki* ou pela forma como ela é utilizada por seus usuários? Deste modo, percebe-se que os critérios de classificação variam não

somente de acordo com as tecnologias usadas, mas também com aspectos pragmáticos de utilidade e aplicabilidade.

Outro ponto comumente mencionado é que a *Internet* sempre incorporou uma rede de indivíduos conectados por meio de tecnologias sociais. Algumas delas, como o *e-mail*, *chats* e fóruns de discussão estão disponíveis há muito tempo [10, 31]. Entretanto, como McLoughlin e Lee [21] argumentam, as ferramentas de software sociais atuais não apóiam apenas a interação social, a conversação, o *feedback* e os relacionamentos, mas elas também oferecem recursos que possibilitam o que os autores chamam de "remixabilidade": um processo pelo qual a informação e mídia produzida, organizada e compartilhada pelos indivíduos pode ser recombinada e construída de modo a criar novas formas, conceitos, idéias e serviços.

Para Boyd [4], independentemente das críticas de que o termo software social não representa nenhuma evolução tecnológica; de que muitas tecnologias sociais já existem há muito tempo; ou de que uma nova definição é realmente necessária para separar as antigas pesquisas, produtos e práticas dos atuais, o termo software social referencia um conjunto de tecnologias desenvolvidas após a explosão da *Web* (chamada de *pos-web-bust era*). Software social pode ser compreendido como um movimento, e não simplesmente como uma categoria de tecnologias nas quais as pessoas são o foco principal. Um movimento no qual houve mudanças significativas na forma como a tecnologia é desenvolvida (*e.g.*, o perpétuo *beta*), no modo como a participação é disseminada e no modo como as pessoas se comportam. Neste artigo, compreendemos softwares sociais como sistemas que permitem às pessoas, em suas particularidades e diversidades, se comunicarem (interagirem, colaborarem, compartilharem idéias e informações), mediando e facilitando qualquer forma de relacionamento social; sistemas cuja utilidade seja dependente e a estrutura moldada pela efetiva participação, interação e produção de conteúdo por parte dos usuários.

Pesquisas em Softwares Sociais

Compreender, projetar, desenvolver e avaliar softwares sociais está entre os grandes desafios atuais para a comunidade de pesquisa em computação, pois envolve (e exige) equipes multidisciplinares e interação direta com outras grandes áreas. Na seção anterior mencionamos a complexidade das questões que esses sistemas envolvem e a necessidade de discuti-las sob a luz dos valores humanos de uma sociedade em transformação, onde os usuários não são só consumidores, mas também são criadores; onde a tecnologia deve permitir um envolvimento criativo e considerar os aspectos emocionais da experiência do usuário; onde o compartilhar via *Web* pode acontecer a qualquer momento, em qualquer lugar e a partir de sistemas computadorizados embutidos em diferentes objetos.

Diversos trabalhos, tais como [10, 13, 23, 30], enfatizam a necessidade de se desenvolver estudos que auxiliem projetistas e avaliadores a lidarem com a complexidade e com os requisitos diferenciados que as aplicações sociais apresentam. Entretanto, ainda faltam propostas, discussões, resultados e validações sobre como compreender, projetar e avaliar softwares sociais. Podemos citar alguns trabalhos como esforços nessa direção.

Thompson e Kemp [36] demonstram que os métodos tradicionais de avaliação de usabilidade, como a Inspeção Heurística, não consideram os aspectos tecnológicos e os relacionados à experiência dos usuários presentes nos softwares sociais. Os autores se fundamentam em trabalhos prévios de outros pesquisadores e realizam experimentos identificando que aspectos relacionados à experiência do usuário (como o envolvimento criativo) ou à *Web* 2.0 (como a qualidade dos conteúdos publicados pelos usuários), apesar de serem fundamentais para definir o sucesso de uma aplicação não são freqüentemente considerados. Como um resultado da pesquisa, os autores sugerem um conjunto de heurísticas complementares.

Smith [33] apresenta um *framework* conceitual chamado *Honeycomb Framework*. Esse *framework* é composto por elementos que foram identificados por pesquisadores e profissionais interessados no design e avaliação de softwares sociais (*e.g.*, identidade, grupos, reputação). De acordo com seus criadores, os softwares sociais possuem um conjunto de elementos comuns que são combinados e implementados para produzir ambientes distintos. Em [25], documentamos o surgimento do *framework* e as principais discussões que ajudaram a evoluí-lo; utilizamos esse *framework* para a avaliação de um software social; e apontamos aspectos, como os relacionados à sociabilidade, que o mesmo não é capaz de identificar. Como contribuição, sugerimos que novos elementos (*e.g.*, colaboração, objeto) sejam adicionados ao *framework* de modo a considerar tais aspectos.

Lazar e Preece [18] abordam fatores de sucesso e questões de sociabilidade em comunidades *online*. Para eles, o sucesso de sistemas cuja participação das pessoas é primordial é favorecido pela combinação de softwares bem projetados (usabilidade) com políticas sociais cuidadosamente elaboradas (sociabilidade). Nesse mesmo contexto, de Souza e Preece [9] propõem um *framework* para compreender e analisar comunidades *online*. As autoras apresentam quatro componentes-chave das comunidades *online* que formam a base do *framework*: pessoas, propósitos, políticas e software; e apontam dois fatores de qualidade: usabilidade (relacionado ao software) e sociabilidade (relacionado aos demais componentes). De Souza e Preece argumentam que avaliar a usabilidade e sociabilidade de comunidades *online* requer abordagens diferentes daquelas aplicadas para avaliar softwares utilizados por apenas um usuário, e que uma vez que sejam moldados são relativamente estáveis. Mudanças pequenas na sociabilidade (e.g., na moderação) ou de usabilidade (*e.g.*, a forma como uma política é descrita e apresentada na tela) podem causar efeitos profundos. Assim, o *framework*

proposto visa apoiar avaliadores, designers, moderadores e usuários a identificar e compreender problemas de sociabilidade e usabilidade em comunidades *online* ou outro software que permita interação social *online*. De acordo com nossa revisão de literatura, podemos considerar comunidades *online* como sendo comunidades constituídas e mediadas por softwares sociais, de modo que as discussões em torno desse tópico também são pertinentes aos softwares sociais de uma forma geral.

VALORES EM SISTEMAS COMPUTACIONAIS

No contexto de sistemas computacionais, Friedman [11] considera que o custo para disseminar uma tecnologia é insignificante quando comparado ao custo para desenvolvê-la, de modo que os valores embutidos nas suas implementações são profundos e sistemáticos e, portanto, facilmente difundidos. Friedman *et al.* [12] definem **valor** como algo que uma pessoa, ou grupo de pessoas, considera importante na vida. E, segundo Friedman [11], embora a falta de atenção aos valores morais em qualquer organização seja perturbador, isso é particularmente prejudicial no projeto de tecnologias computacionais, pois, diferentemente das pessoas com as quais podemos discordar sobre valores e seus significados, dificilmente podemos fazer o mesmo com a tecnologia. Por isso, ao projetar tecnologias computacionais é preciso enxergar os valores humanos de um ponto de vista ético.

Para Norman [24], todo produto possui um componente social e identificá-lo corretamente determina se a interação com tal produto será sociável ou não. As pessoas aprendem as habilidades sociais, porém as máquinas, os sistemas, ou qualquer outro artefato tecnológico, precisam que essas habilidades sejam projetadas dentro deles. Nesse sentido, Sellen *et al.* [3] destacam que os valores humanos, em toda a sua diversidade, deveriam ser classificados de acordo com o modo como eles são apoiados, incentivados ou inibidos pelas tecnologias. Especificamente no contexto de softwares sociais, é preciso questionar quais impactos esse tipo de software causa sobre a vida das pessoas, tanto no aspecto pessoal quanto no social, cultural, econômico ou político. Como os autores expõem, as pessoas não apenas usam a tecnologia, mas vivem com ela. Por exemplo, quando olhamos para um sistema como o *ChatRoulette*[1] quais valores humanos esse sistema reflete? Quais valores são exaltados, influenciados, ou inibidos pelo sistema?

O *ChatRoulette* é um sistema que conecta aleatoriamente dois usuários e os coloca para conversar transmitindo som e imagem. O único requisito para a utilização do sistema é possuir uma *Webcam*, não sendo necessário o cadastro ou o aceite de alguma política de uso. Como normalmente há muitos usuários conectados, a diversidade de perfis é muito grande, o que incentiva o usuário a "girar a roleta" para selecionar um novo parceiro. Pelo mesmo motivo, torna-se improvável que dois usuários se reencontrem após o contato inicial. Em pouco tempo de uso da ferramenta é possível identificar que os usuários realizam o julgamento do outro com extrema rapidez — praticamente no momento em que a imagem é carregada já se solicita um novo contato. Também se percebe que tanto conteúdos pornográficos quanto usuários com cartazes dizendo não à pornografia são frequentes.

Deste modo, em uma primeira análise é possível dizer que o sistema reflete favorecer interações efêmeras, uma vez que não exige cadastro ou outra informação que identifique os usuários ou que comprometa de forma explícita sua **privacidade**. O sistema também mantém o **controle** do usuário sobre o conteúdo que está sendo transmitido (imagem, som e texto) — embora não exista controle sobre o conteúdo que se está recebendo. Ele também apresenta suas funcionalidades de forma simples e prática. Essa sensação de efemeridade e de proteção à privacidade (real ou imaginária) colabora para que os usuários troquem de parceiro muito rapidamente. Não há a preocupação com os impactos que a "rejeição da imagem" do outro possa causar, tampouco há a construção de **laços sociais** originados de uma interação contínua. Por outro lado, esse julgamento instantâneo promove a **criatividade** dos usuários na tentativa de manter a atenção do outro por um tempo superior ao chamado "piscar de olhos"; assim como a facilidade de uso e o controle sobre o que se está transmitindo pelo sistema promovem um sentimento de **autonomia** no usuário.

Com este exemplo, não pretendemos discutir o sistema de um ponto de vista ético, mas demonstrar que o mesmo carrega valores embutidos e que a forma como ele é projetado reflete esses valores, promovendo-os (privacidade, autonomia) ou inibindo-os (reciprocidade, confiança, relacionamento). Além disso, percebe-se que os valores são interativos e que nem sempre é claro como encontrar um equilíbrio quando há conflitos entre os mesmos. Muitas vezes é preciso restringir alguns valores em função de outros (em sistemas críticos o valor de autonomia pode ser restringido em função da priorização do bem-estar e da segurança). Porém, este exemplo também evidencia que é necessário considerar o relacionamento entre valores morais, éticos, sociais e técnicos, levando em conta quem são os usuários, o contexto de uso e as tecnologias envolvidas.

Friedman *et al.* [12] apresentam uma abordagem, denominada *Value Sensitive Design* (VSD), que visa considerar valores no design de sistemas computacionais. Os autores propõem uma metodologia que envolve investigações conceituais, empíricas e técnicas, e apresentam sugestões práticas para a sua aplicação. Exemplos: 1) começar com um valor, uma tecnologia ou um contexto de uso; 2) identificar os *stakeholders* diretos e indiretos; 3) identificar os possíveis benefícios e prejuízos para cada grupo de *stakeholder*; 4) mapear os benefícios e

[1] http://www.chatroulette.com

prejuízos em valores correspondentes; 5) conduzir uma investigação conceitual dos valores-chave identificados; e 6) identificar potenciais conflitos de valores. Os autores sugerem ainda uma lista com 12 valores de importância ética para orientar o processo de investigação (*e.g.*, bem-estar, privacidade, confiança, cortesia etc.).

Cotler e Rizzo [8] basearam-se nas diretrizes de VSD para avaliar redes sociais *online* do ponto de vista de valores humanos. Os autores destacam que as redes sociais, em geral, promovem o valor de visibilidade e falham tanto em proporcionar privacidade aos usuários quanto em deixá-los cientes das ações que eles executam e das possíveis implicações dessas ações. Nesse contexto de avaliação de sistemas, Le Dantec *et al.* [19] apontam que a metodologia VSD privilegia valores de importância ética já conhecidos e especificados desfavorecendo o processo de descoberta de novos valores (*e.g.*, valores técnicos). Para os autores, é necessário realizar investigações empíricas antes de aplicar a metodologia, de modo a favorecer a descoberta de novos valores.

Na próxima seção, apresentamos um conjunto de 27 valores resultante de uma investigação da literatura sobre softwares sociais. Apresentamos esses valores classificados de acordo com os níveis da Cebola Semiótica [35] e demonstramos que eles podem ser compreendidos como um conjunto abrangente para guiar uma análise de softwares sociais orientada a valores.

Valores em Softwares Sociais

A identificação dos valores relacionados ao contexto de softwares sociais foi realizada por meio de uma revisão da literatura. Foram selecionadas três revistas e três conferências de acordo com sua tradição e importância nas áreas de Computação (com maior foco em IHC) e Educação (devido a crescente discussão sobre o design de tecnologias para o apoio ao ensino-aprendizagem que promovam a interação social). As Revistas *Computers & Education* e *British Journal of Educational Technology* (BJET) foram selecionadas devido a sua tradição e fator de impacto, enquanto a revista *Educational Technology & Society*, foi selecionada por abordar explicitamente o aspecto de "Sociedade" e por possuir edições especiais dedicadas ao tema de software social. As conferências *International Conference on Human-Computer Interaction* (HCII), *Conference on Human-Computer Interaction* (IFIP TC13-INTERACT) e *Conference on Human Factors in Computing Systems* (ACM CHI) foram selecionadas de modo a considerar três das mais importantes e abrangentes conferências internacionais na área de IHC.

Inicialmente, a pesquisa considerou todos os artigos científicos publicados nas revistas e nas conferências citadas nos últimos 5 anos, bem como artigos publicados nos últimos 10 anos nas revistas selecionadas e categorizados com os seguintes termos: *Web* 2.0, social *Web*, social software, social *network* e *life-long learning*. Para outras revistas e conferências também foram efetuadas pesquisas sobre os artigos publicados utilizando os mesmos termos. Esse levantamento inicial resultou em uma quantidade superior a 2.000 artigos. Na primeira etapa foram pré-selecionados, de acordo com sua relevância, 136 artigos científicos. Na segunda etapa, uma análise detalhada dos artigos pré-selecionados determinou um conjunto final composto por 43 artigos.

Para classificar os valores identificados na revisão da literatura construímos o seguinte mapeamento: de Souza e Preece [9] sugerem que, pessoas, propósitos, políticas e software são componentes-chave de comunidades *online*, e que usabilidade e sociabilidade são fatores qualitativos que impactam em seu sucesso. Preece [27] utiliza o termo sociabilidade para se referir às interações sociais de uma forma geral, e usabilidade como referência ao que ocorre no nível de interface de software. Na teoria da **Semiótica Organizacional** (SO) [20], uma organização e seu sistema de informação são considerados como um sistema social no qual os comportamentos humanos são organizados por um sistema de normas. Assim, qualquer artefato tecnológico (*e.g.*, um software social) está embutido em um sistema formal que, por sua vez, existe no contexto de um sistema informal. A **Cebola Semiótica** [35] é um artefato da SO que representa esses três níveis: o **informal** — onde a cultura organizacional, costumes e valores são refletidos como crenças, hábitos e padrões de comportamento individual de seus membros; o **formal** — no qual regras e procedimentos são criados para substituir significados e intenções; e o **técnico** — que representa o sistema computacional situado dentro do nível formal [23]. Deste modo, podemos mapear os componentes-chave de de Souza e Preece [9] para os níveis da Cebola Semiótica, de modo que: Pessoas e Propósitos sejam relacionados ao nível Informal; Políticas ao nível Formal; e Software ao nível Técnico (ver Figura 1).

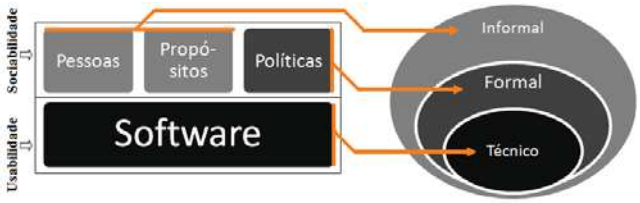

Figura 1. Mapeamento dos componentes-chave de comunidades *Online* para os níveis da Cebola Semiótica.

O mapeamento ilustrado pela Figura 1 mostra uma co-relação dos componentes-chave de comunidades *online* com os três níveis da cebola semiótica. Como o contexto de software social abrange o contexto de comunidades *online*, isso indica que um esforço em identificar e classificar componentes (valores) relacionados a softwares sociais deve considerar questões de aspectos informais, formais e técnicos de forma sistêmica. Esse mapeamento nos permite representar uma quantidade maior de componentes. Por exemplo: i) além de usabilidade, acessibilidade e estética também são fatores qualitativos que impactam no sucesso de um software social; ii) o conceito de sociabilidade

precisa ser decomposto (e.g., conversação, relacionamento) e aspectos individuais precisam ser considerados de forma explícita. Assim, classificamos os valores identificados em nossa análise de literatura de acordo os níveis da Cebola Semiótica e os abordamos como valores **pessoais** (nível informal), **sociais** ou coletivos (nível formal), e **técnicos** (nível técnico). A Tabela 1 descreve esses valores e a Figura 2 ilustra a sua classificação.

Tabela 1. Valores pessoais, sociais e técnicos.

Valor	Descrição	Ref.
Autonomia	Capacidade de uma pessoa decidir, planejar e agir do modo que ela acredita auxiliá-la a alcançar seus objetivos. Capacidade de controlar a tecnologia e usá-la a seu favor.	[12, 12, 29]
Confiança	Extensão até a qual o sistema, ou outros indivíduos, se comportam da maneira esperada por determinada pessoa. Ex: o sistema compartilha apenas as informações solicitadas pelo usuário.	[7, 10, 12, 15]
Consentimento Informado	Situação de ciência de um indivíduo sobre as ações possíveis de serem executadas e os impactos dessas ações. Ex: o indivíduo concorda em executar um programa mesmo depois do aviso do sistema operacional sobre os riscos de tal operação.	[11, 12]
Emoção e Afeto	Sentimentos, sensações de um indivíduo, tais como bem-estar, prazer, diversão, tranqüilidade, envolvimento, aborrecimento, decepção. Ex: medo do usuário em sofrer perseguição por causa de informações expostas no sistema.	[6, 24, 29, 30]
Identidade	O "eu" (*self*) do indivíduo; a expressão de elementos da personalidade e da individualidade de uma pessoa. Ex: representação do perfil de uma pessoa, suas atividades, informações pessoais, etc.	[4, 5, 17, 28, 37]
Presença	Diz respeito à pessoa estar (ou não) em determinado lugar, em um determinado tempo. Ex: usuário está *on-line* no sistema.	[25, 31]
Privacidade	Uma exigência ou direito de um indivíduo em determinar quais informações a seu respeito podem ser expostas e quem pode ter acesso a elas. Ex: mostrar a lista de amigos de um indivíduo apenas para as pessoas que já fazem parte dela.	[5, 8, 15, 30]
Reciprocidade	Sentimento de recompensa ou benefício mútuo com o executar de uma tarefa ou emprego de algum esforço. Ex: o usuário colabora com um conteúdo de qualidade e recebe acesso a conteúdos extras de outros usuários.	[16, 26, 27]
Reputação	Percepção construída de um indivíduo pelos outros. Ex: o indivíduo *expert* em uma área específica; indivíduo conhecido por enviar *spams*.	[12, 14, 29]
Visibilidade	Possibilidade de um indivíduo poder ser encontrado, visto, de existir em um determinado contexto. Ex: um usuário com muitos contatos em uma rede social está mais visível que outro que não possui contatos.	[8, 28]
Normas, Regras e Políticas	Aspectos formais que regem, regulamentam e determinam como os indivíduos se comportam, pensam, fazem julgamentos e percebem o mundo. Ex: termos e condições de uso do sistema.	[10, 27, 35]
Colaboração	Possibilidade de cooperar, trabalhar em conjunto sobre um mesmo objeto. Ex: os usuários criam, editam e avaliam um artigo em conjunto.	[5, 9, 37]
Compartilhamento	Possibilidade de um indivíduo disponibilizar a outro(s) individuo(s) objetos ou informações de sua posse. Ex: publicação de fotos em uma de rede social.	[4, 7, 26]
Conversação	Possibilidade de dois indivíduos, ou um grupo de indivíduos, estabelecerem comunicação direta (síncrona e/ou assíncrona). Ex: comentários, chat.	[25, 37]
Grupos	Conjunto de indivíduos com alguma característica, situação, propósito ou interesse em comum. Ex: grupo de pessoas interessadas em Semiótica.	[28, 37]
Objeto	Artefato em torno do qual as interações sociais ocorrem (e.g, as discussões surgem, o foco é mantido, as conversas se iniciam, a colaboração acontece etc.).	[17, 25, 26]
Relacionamento	Algum tipo de ligação, laço social, entre dois ou mais indivíduos. Ex: amizade, seguidores, fãs, etc.	[15, 29, 31, 35]
Propriedade (posse)	Direito de posse sobre um objeto ou informação, e sobre as ações que podem ser executadas sobre esse objeto. Ex: o usuário cria um documento, o modifica, compartilha, transfere para outro usuário, etc.	[12, 30]
Acessibilidade	Capacidade de atender, de forma satisfatória, a um conjunto heterogêneo de usuários, com habilidades, preferências, necessidades, e limitações motoras e cognitivas distintas. Ex: o sistema oferece meios alternativos de cadastro que não exige que o usuário possua uma conta de *e-mail*.	[29]
Adaptabilidade	Possibilidade de alterar uma aplicação de acordo com o seu contexto de uso; flexibilidade de um sistema em ser adaptado a diferentes contextos, situações de uso não previstas ou que sofreram alterações. Ex: o usuário pode adicionar/remover atalhos para as funcionalidades mais usadas de um sistema.	[5, 7, 10, 23, 29]
Aparência (estética)	Característica relacionada à atratividade, beleza, cuidado com a imagem e o modo como as coisas são exibidas, apresentadas. Ex: interfaces padronizadas com elementos gráficos bem projetados.	[3, 24]
Awareness	Percepção individual e coletiva sobre quem está disponível; quem está fazendo o quê, o que aconteceu e o que está acontecendo etc. Ex: usuário é informado das novidades que existem desde seu último acesso.	[7, 8]
Disponibilidade	Refere-se ao sistema, recurso ou funcionalidade, estar disponível para uso a qualquer momento e sem interrupções.	[14]
Escalabilidade	Capacidade de suportar um crescente número de usuários e de lidar com uma crescente quantidade de informação. Ex: o sistema é capaz de suportar milhões de acessos e de comunicações simultâneas sem apresentar problemas.	[4, 10, 14]
Portabilidade	Possibilidade de utilizar o sistema, seus recursos e funcionalidades, por meio de diferentes dispositivos e em diferentes plataformas. Ex: acesso pelo celular; compatibilidade com diferentes browsers.	[14, 30]
Segurança	Diz respeito ao quão bem o sistema protege a informação que contém, seja de ataques externos, seja de possíveis falhas técnicas. Ex: as informações pessoais de um indivíduo não serão perdidas nem compartilhadas de forma não desejada.	[15, 29]
Usabilidade	Refere-se a interfaces consistentes, controláveis e previsíveis, de uso fácil e satisfatório.	[12, 18, 29, 37]

A Tabela 1 apresenta os valores, uma descrição e as referências mais significativas cujas discussões permitiram a identificação desses valores. É válido mencionar que, assim como as listas, fatores de sucesso e elementos, tais como [6] [10] [12] [14] e [18], os 27 valores pessoais, sociais e técnicos listados e descritos na tabela acima não formam uma lista exaustiva e definitiva. Valores mais

abstratos, tais como, solidariedade, bem-estar, envolvimento, satisfação e outros aspectos relacionados à experiência do usuário estão sendo representados pelo valor "Emoção e afeto". Também não se pode garantir que os aspectos sociais (e.g., a sociabilidade decomposta em outros valores) e técnicos estão todos cobertos pelos valores citados. De fato, os valores selecionados visam fornecer uma lista tão diversa e abrangente quanto possível, sem torná-la demasiadamente complexa ou detalhada.

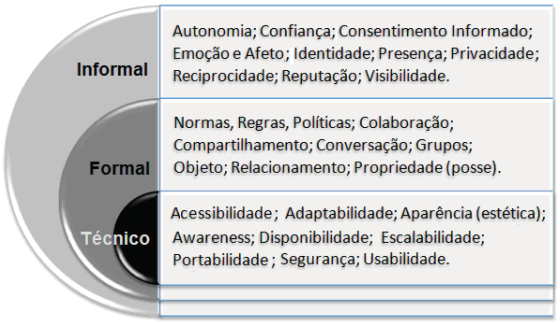

Figura 2. A classificação dos valores em três níveis.

O objetivo da Tabela 1 e da classificação dos valores ilustrada pela Figura 2 é servir como uma heurística para a sugestão de valores que devem ser considerados durante uma investigação. Essa lista se diferencia das demais previamente citadas em dois pontos: na quantidade e na diversidade de valores identificados. Além de essa lista mostrar um conjunto maior de valores envolvidos no contexto de softwares sociais, ela chama a atenção tanto para aspectos pessoais, éticos e sociais, quanto para aspectos técnicos que possam exercer algum tipo de influência ou impacto nos sistemas, em seus usuários e na sociedade de uma forma geral.

Para situar as discussões deste artigo em um contexto prático, apresentamos na próxima seção a análise baseada em valores de uma rede social inclusiva.

ESTUDO DE CASO

O sistema Vila na Rede[2] é uma rede social inclusiva [3] construída para e com cidadãos brasileiros. O sistema é resultado de um projeto que visa estudar e propor soluções para os desafios de design de interação e interface de usuário no contexto de sistemas para o exercício da cidadania, contribuindo para a promoção de uma cultura digital na sociedade. O Vila na Rede foi concebido para ser uma rede social que proporcione um ambiente útil, acessível e agradável aos usuários, no qual eles se sintam confortáveis e com o qual possam se identificar; um sistema que faça sentido aos usuários [2].

O sistema permite que seus usuários se comuniquem (de forma síncrona e/ou assíncrona), criem conteúdos, utilizem diversas mídias, colaborem com outros usuários na criação de conteúdos, troquem ideias, opiniões etc. A principal diferença do sistema Vila na Rede quando comparado a outros sistemas de redes sociais é que ele foi pensado para a diversidade de usuários presente na população brasileira considerando suas limitações e habilidades (usuários sem experiência no uso de computadores, idosos, pessoas com deficiências, usuários não letrados, etc.). Além de participarem da construção do sistema, por meio de suas interações e conteúdos produzidos, os usuários são os responsáveis por manter a continuidade e a utilidade do sistema. Portanto, as características do Vila na Rede de apoiar a interação social e a diversidade, possibilitar a auto-expressão, depender do comportamento e das ações dos usuários para oferecer benefícios e ter sido desenvolvido com a participação dos usuários, nos permitem classificá-lo como um software social.

Utilizando como guia a metodologia sugerida por Friedman *et al.* [20] (ver Seção 3), o primeiro passo de nossa análise envolve escolher possíveis valores como ponto de partida. Pela descrição do sistema e de seus propósitos já é possível identificar valores dos três níveis: informal (autonomia, emoção e afeto), formal (conversação, colaboração), e técnico (usabilidade e acessibilidade). Na sequência, identificam-se os *stakeholders* diretos (os usuários do sistema: cidadãos brasileiros, em sua maioria pessoas com baixa exposição à tecnologia) e indiretos (a sociedade brasileira no seu contexto geral). Os próximos passos são: i) tendo em mente os valores inicialmente escolhidos, especificar os benefícios e prejuízos que o sistema pode causar, ou trazer, para os *stakeholders*; ii) mapear cada benefício e prejuízo aos valores que eles impactam. Alguns deles são listados a seguir:

1) O sistema foi desenvolvido levando em conta as limitações e diversidade dos usuários, portanto, ele colabora para a criação de uma cultura digital e para a inclusão desses usuários. Aqui estão envolvidos os valores de autonomia, emoção e afeto, identidade, acessibilidade e usabilidade. 2) O sistema possibilita que os usuários conheçam novas pessoas e mantenham contato de forma prática com pessoas que convivem em um mesmo espaço geográfico (*e.g.*, bairro) ou compartilham de um mesmo contexto (*e.g.* trabalham em cooperativas). Aqui identificamos os valores de identidade, conversação, relacionamento, grupos e visibilidade. 3) Os usuários têm a oportunidade de se ajudarem, seja a criar e divulgar conteúdos ou a utilizar o próprio sistema. Os valores que podem ser relacionados a este item são: objeto, colaboração, reciprocidade, emoção e afeto (solidariedade) e confiança. 4) Ao utilizarem um sistema de rede social os usuários estão expostos à ação de indivíduos que podem obter informações pessoais e utilizá-las para fins indesejáveis. Aqui identificamos os valores de identidade, visibilidade, privacidade, consentimento informado, segurança e reputação.

Depois de feito o mapeamento é necessário realizar uma investigação conceitual dos valores identificados. A tabela

[2] http://www.vilanarede.org.br

1 é um ponto de partida para essa etapa. Finalmente, é preciso identificar os potenciais conflitos entre os valores levantados. Uma vez identificados os conflitos e tendo claro seu impacto, uma investigação técnica pode ser realizada para determinar como o sistema deve ser construído (ou reestruturado), de modo a lidar com os conflitos existentes e efetivamente refletir os valores desejados. A seguir, descrevemos dois exemplos de análise conceitual no contexto do sistema Vila na Rede: um no qual há **conflitos** entre valores (promover um valor impacta negativamente em outros valores) e outro no qual há **dependências** entre valores (a consideração de um valor só é alcançada por meio da consideração de outros valores). Como o sistema Vila na Rede foi construído levando em consideração o que Baranauskas [3] chama de *Socially Aware Computing*: "teoria, artefatos e métodos que devem ser articulados para efetivamente fazer o design socialmente responsável, participativo e universal como processo e produto", os exemplos a seguir apresentam também a solução implementada pelos designers do sistema para resolver os conflitos e considerar os valores desejados.

O conflito: Visibilidade vs. Privacidade: este é um dos conflitos mais críticos em *websites* de redes sociais. Em geral, para "existir" em um sistema de rede social um indivíduo precisa se cadastrar e preencher algumas informações básicas que ficam disponíveis em um perfil. Porém, a **visibilidade** desse indivíduo possui relação direta com a informação que ele deixa publicamente disponível (*e.g.*, dados pessoais, lista de contatos, grupos), com as interações que ele mantém (*e.g.*, colaborações com outras pessoas) e com os resultados dessas interações (*e.g.*, conteúdos publicados). Ou seja, quanto maior a quantidade de informação abertamente acessível gerada pelo usuário, maior tende a ser a sua visibilidade. Conseqüentemente, quanto mais informação esse usuário deixar disponível na rede, menor é o controle sobre sua **privacidade**.

O problema desse conflito é que as pessoas normalmente não estão cientes dos riscos inerentes à disponibilização de informação na *Web*, e tampouco os sistemas de redes sociais alertam sobre esses riscos ou auxiliam os usuários a perceberem quais informações eles estão deixando disponíveis [8]. Nesse caso, percebe-se negligência também com relação ao valor **consentimento informado**, uma vez que os usuários não são requisitados para confirmar a disponibilização da informação e nem avisados sobre o fato. No sistema Vila na Rede o balanço entre os valores privacidade e visibilidade é proporcionado justamente pelo valor consentimento informado. Por exemplo: no momento em que o usuário está se cadastrando no sistema ele especifica quem poderá visualizar seu perfil (*e.g.*, todas as pessoas, apenas usuários do sistema, somente o próprio usuário). Além disso, o sistema exige do usuário apenas três informações (nome completo, nome de usuário e senha) não obrigando que sejam informados outros dados pessoais. Da mesma forma, ao criar qualquer conteúdo para ser publicado no sistema, o usuário pode especificar quem poderá ver esse conteúdo e quem poderá colaborar na sua criação. Como reforço, o sistema disponibiliza ainda recursos de meta-comunicação que explicam para os usuários o que são essas opções de configuração e para que elas servem. Ao não exigir informações pessoais do usuário o sistema promove os valores **privacidade** e **confiança.** Do mesmo modo, os recursos disponibilizados pelo sistema permitem que o usuário controle a **visibilidade** de suas informações, sejam instruídos sobre a finalidade desses recursos e sobre como utilizá-los, promovendo assim os valores **consentimento informado**, **privacidade** e **autonomia**.

As dependências para proporcionar Autonomia: o valor de autonomia está relacionado com a capacidade de uma pessoa de controlar a tecnologia e usá-la a seu favor. Para Friedman [11], proteger a autonomia significa fornecer aos usuários o nível apropriado de controle sobre suas máquinas. No contexto do Vila na Rede, o sistema foi projetado de modo a fazer sentido para os usuários. Os recursos existentes, os ícones utilizados para representá-los, os termos empregados, todos foram identificados e escolhidos em oficinas participativas [3, 29]. O sistema leva em conta a diversidade de usuários e oferece recursos para apoiá-los. Por exemplo, os usuários não precisam possuir uma conta de *e-mail* para se cadastrar no sistema; também não é preciso que os usuários tenham conhecimento sobre como organizar arquivos no sistema operacional para postar uma foto: basta possuir uma *Webcam* e o sistema já captura a imagem e a exibe para que o usuário escolha se deseja postar aquela imagem ou capturar outra. O sistema também possibilita que os usuários ajustem a interface de acordo com suas preferências (*e.g.*, alterem o *menu*, o tamanho do texto, o contraste das cores, etc.). Esses são exemplos de recursos que refletem os valores de **usabilidade**, **acessibilidade** e **adaptabilidade**. Outros dois exemplos de apoio à autonomia são:

i) Os recursos de meta-comunicação (em várias mídias: áudio, vídeo, imagens ou Libras) que explicam como o sistema pode ser utilizado, o que são e para que servem os recursos disponíveis, e apóiam os usuários de forma contextualizada no momento em que eles estão executando uma tarefa ou tendo alguma dúvida; ii) O apresentador virtual, que lê o conteúdo postado pelos usuários no sistema e permite que usuários não letrados ou com problemas visuais tenham acesso a informação.

Com um sistema acessível, fácil de utilizar, com alternativas para pessoas com necessidades especiais e com recursos que oferecem apoio ao usuário durante sua interação com o sistema, o conjunto de recursos oferecidos pelo Vila na Rede maximiza as possibilidades de que os usuários, em seus diferentes contextos, particularidades e limitações, consigam utilizar o sistema de forma efetiva e **autônoma**. Isso é especialmente importante em sistemas

relacionados ao exercício da cidadania, onde a tecnologia não pode discriminar ou privar os cidadãos de seus direitos e, portanto, onde a ausência de autonomia impacta na identidade do indivíduo, no seu bem-estar, autoconfiança e em demais valores ligados a afeto e emoção.

CONSIDERAÇÕES FINAIS

Os softwares sociais fazem parte das transformações que estão mudando o relacionamento das pessoas com a tecnologia. Os desafios relacionados ao design e avaliação de softwares sociais colocaram questões como design para todos, design socialmente responsável e valores humanos em foco, exigindo que os métodos e práticas tradicionais de desenvolvimento de sistemas computacionais sejam repensados de modo a atender as novas demandas.

Neste artigo apresentamos uma discussão sobre softwares sociais utilizando uma abordagem orientada a valores. Essa discussão teve como objetivo: i) rever as definições da literatura para o termo software social; ii) abordar a questão de valores como sendo crítica demonstrando, por meio de exemplos e argumentações, seu impacto no contexto de softwares sociais; iii) e propor um conjunto de valores pessoais, sociais e técnicos para fundamentar a análise de softwares sociais orientada a valores.

As discussões sobre o conceito de software social são uma tentativa de esclarecer e delimitar o uso do termo. Mais do que sistemas que conectam pessoas, softwares sociais são moldados (ao mesmo tempo que moldam), adaptados e influenciados pelo comportamento e pelas necessidades de seus usuários, sendo dependentes dos mesmos para terem alguma utilidade e oferecer algum benefício. Como Boyd [4] menciona, o termo software social representa um movimento no qual houve mudanças no modo como os sistemas são desenvolvidos, como a participação é disseminada e como as pessoas se comportam.

No que diz respeito a valores, os fatores, as listas, diretrizes ou elementos identificados na literatura normalmente apresentam um conjunto restrito de valores focados em um único aspecto (*e.g.*, ético ou técnico). O conjunto proposto neste artigo é resultado de uma revisão bibliográfica extensiva que abrange tanto aspectos técnicos, quanto éticos, pessoais e coletivos, chamando a atenção para esses diferentes aspectos e servindo como base para orientar designers e avaliadores sobre os valores existentes em softwares sociais. Os exemplos apresentados em nossas discussões demonstram que existem conflitos entre valores e que os mesmos são interativos: dependendo de quais valores são priorizados, do modo como esses valores são combinados e como eles são tecnicamente apoiados, tem-se um ambiente completamente diferente que propicia certos valores ao custo ou em função de outros. Deste modo, investigações conceituais, empíricas e técnicas são necessárias para que se compreenda como esses conflitos e dependências devem ser tratados para que o sistema produzido efetivamente reflita os valores desejados. Mais, os exemplos apresentados também demonstram que é preciso considerar os usuários em todo o processo para que não se corra o risco de desenvolver sistemas que reflitam os valores das pessoas a quem eles se destinam em vez dos valores dos designers do sistema

Como agenda de pesquisa na área, apontamos a necessidade de maiores investigações conceituais e empíricas para a construção de uma ontologia que formalize os relacionamentos entre os valores sugeridos neste artigo. Além disso, é necessária a realização de investigações técnicas considerando outros sistemas e recursos técnicos, para identificar como esses valores podem ser tecnologicamente apoiados e, deste modo, refletidos pelas aplicações. Os resultados dessas investigações poderão colaborar para a validação do conjunto de valores proposto e para a utilização desse conjunto na avaliação e no design de softwares sociais.

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Anexo 3 – Valuation Framing for Social Software: A Culturally Aware Artifact[20]

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VALUATION FRAMING FOR SOCIAL SOFTWARE
A Culturally Aware Artifact

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Abstract: Despite the popularity of the so-called social software, just a small fraction of the systems launched on the Web is really successful. The diversity of users, their limitations, preferences, values and culture, are examples that indicate the complexity of developing this kind of system; moreover there is still a lack of approaches, artifacts and methods for supporting designers to deal with this complexity. This paper presents an artifact specially adapted to support designers in the task of evaluating social software, taking values and cultural issues into account. It draws on Organizational Semiotics and on building blocks of culture to shed light on this research area. The artifact was applied to the evaluation of five different prototypes of systems for supporting cross-cultural collaboration, and the results demonstrate the viability of using this artifact for supporting the evaluation as well as the design of social software.

1 INTRODUCTION

Social software can be understood as systems that allow people, in their particularities and differences, to communicate (interact, collaborate, share ideas and information), mediating and facilitating any kind of social relationship; systems whose usefulness is dependent on and whose structure is shaped by the active participation, interaction and production of content by their users (Pereira *et al.*, 2010).

The term social software is usually used in many different contexts, and different technologies are covered by it. As Lazar and Preece (2003) claim in the context of Online Communities, we can say that social software is usually a subjective matter, easy to understand and recognize, but unstable to define and measure and even more complicated to evaluate.

After the Web 2.0 advent, new applications allowing mass collaboration, communication and interactivity, such as *YouTube*, *Delicious*, *Twitter*, *Flickr*, *Facebook* among others, were developed. These systems, named social software, invite millions of users to communicate, interact, create, share and organize information. They show the "power of the collective", the opportunities and knowledge that can be generated through collaborative work and through mass interaction. Social software were considered a mark of a web paradigm-shift, where more than connecting pages and resources the web became a connection of people and organizations — a social web.

In the previously cited systems, the interaction occurs in an unprecedented scale and intensity, leading to a situation in which issues related to human-computer interaction (HCI) are extended to issues related to human-computer-human interaction in social situations. Actually, social software made it visible part of the transformations that have redefined people's relationship with technology. As Sellen *et al*. (2009) point out, people now live with technology, not just use it; they are increasingly hyperconnected, increasingly dependent on technology and the information produced by them is becoming less ephemeral.

In this sense, as technology left the context of offices and workplaces to pervade every aspect of people's personal and social lives, a broad set of factors that range from emotional and affective aspects, sociability and human values, to issues of scalability, security and performance are now in play. This new and complex scenario brings challenges that research communities and practitioners, in not only HCI, Collaborative Systems and Software Engineering, but also in Databases, Computer Networks and other areas related to technical infrastructure, have never faced

before. Moreover, these challenges are reflected in the emergent interest and need for involving other fields that go beyond computing, such as sociology, psychology, anthropology, communication, etc.

Indeed, despite the popularity and growing in the number of users of social software, just a small fraction of these systems is really successful. Being completely dependent on their users, the success of social software heavily depends on how users feel when using them, on their interface features and on their interaction mechanisms. As Neris *et al*. (2009) suggest, for developing systems that fully meet users' requirements, we need to know users in their abilities and culture, formalizing the interaction requirements and investigating solutions of interaction/interface for the diversity. In fact, systems should reflect an understanding (and respect) about people's values, preferences, limitations and behaviors, including the way people actually interact, play, learn, work, and live in their organizations, groups, communities and other forms of societal life. Otherwise, as Ackerman (2000) asserts, the produced systems will be useless, inefficiently automating the collaboration, communication and other social activities.

Although the social software context is clearly recognized as complex and challenging, research initiatives on guidelines, methods, tools and even theories for supporting designers are still incipient. According to Hendler *et al*. (2008), a web application should be understood as a "social machine" which includes an underlying technology, but also rules, strategies and organizational structures used to manage the technology. This vision requires investigation in social software from two perspectives: as a social phenomenon in a macro level and as a technological artifact to be built in a micro one. As a consequence of these perspectives, the software development life cycle, which has been traditionally based on best practices in Software Engineering (specification, design, construction, testing, etc.), needs to be rethought. Cultural issues must be considered in an explicit and transverse way; the process has to be aware of the values of people who will be direct or indirectly affected by the development, deployment and use of the system. Similarly, traditional concepts and practices in HCI, such as usability and accessibility, need to be put into perspective and understood as technical values crucial to the project of any technological artifact.

Values are desirable, trans-situational goals, varying in importance and serving as guiding principles in people's lives (Schwartz, 2005). Hall (1959) explains that every innovation, e.g. a social software, brings negative and positive impact to the environment in which it is introduced. Indeed, because people's values are culturally built, we argue that people's culture influences the way an innovation will be valued by its direct and indirect users, being determinant in the appropriation or rejection of that innovation.

In this paper, we highlight the importance of taking people's culture and values into account when designing and evaluating social software and present a culturally aware artifact for analyzing them: the Valuation Framing (VF) (Kolkman 1993). This artifact, from the Organizational Semiotics Theory (Liu, 2000), was specially modified for the context of social software by explicitly suggesting values related to the context of this kind of system — we are naming it VF4SS.

The paper is organized as follows: section 2 presents a brief literature review on social software; section 3 presents the VF4SS as an artifact for analysing social software, taking into account people's culture and making values an explicit issue; section 4 describes our findings when using it for the evaluation of five different projects during their design phase; section 5 presents our conclusions and directions for future research.

2 LITERATURE REVIEW

When we talk about social software we are not just talking about a specific set of technologies for which the main focus is on people. Rather, as Boyd (2007) points out, we are talking about a movement in which there are three significant changes: the first is the way technology is developed — the perpetual beta instead of locked-down versions; the second is the way participation is widespread — the network effect and organic growth; and the third is the way people behave — the focus is on connecting people and watching the subject and shared interests emerging through that instead of creating pre-defined groups.

For Webb (2004), the main particularity of social software is in the design process because human factors and group dynamics introduce design difficulties that are not obvious without considering the human psychology and nature. The success and usefulness of social software rely directly on their users and, therefore, on aspects related to the user experience, such as emotional and socio-technical factors, including how the interface was designed. Therefore, it is urgent to discuss these concepts considering human values of a mutable society

where users are not only consumers, but also creators of content and programmers of *mashup*; where the technology should allow a creative involvement and consider the emotional aspects of the user experience; and where the interaction via Web can happen anytime, anywhere and from computer systems embedded in different objects.

However, neither the traditional approaches for software development nor the methods and tools for supporting software evaluation and analysis are able to deal with social software in its complex scenario. According to Thompson and Kemp (2009), traditional methods for usability evaluation, such as Heuristics Inspection, do not consider key-aspects of social software, such as technological aspects (e.g., scalability, collaboration) and those related to the users' experience (e.g., the quality of the produced contents and the interactions among users). The authors are based on previous studies by other researchers and conduct experiments to identify aspects that, although fundamental to determine the success of an application, are often not considered.

As an effort in understanding the social software nature, Smith (2007) proposes a functional framework composed of elements (e.g., identity, groups, reputation) that have been identified by researchers and professionals interested in the design and evaluation of social software. According to those authors, social software have a set of common elements that are combined and implemented in order to produce different environments. Although a good starting point, the framework was limited to functional aspects ignoring those related to sociability, values and other cultural issues. For instance, concepts such as accessibility, autonomy and collaboration could not be forgotten or neglected in a social software design and evaluation, but the framework does not draw attention to them.

In the context of social software design, we developed a discussion regarding the elements that compose social software, approaching them in terms of informal (e.g., personal), formal (e.g., social or collective) and technical values (Pereira *et al.*, 2010), and presented a set of values identified through technical analysis and an extensive literature review. This set encompasses technical as well as ethical, personal and collective aspects, and draws attention to their differences and interactive nature. The main idea is that depending on which values are prioritized, how these values are combined and how they are technically supported, quite different environments which promote certain values while inhibit others will be produced.

As Friedman (1996) asserts, the cost to disseminate a technology is insignificant when compared to the cost to develop it; moreover the values embedded in its implementations are deep, systematic and easily disseminated. To her, although the neglect of moral values in any organization is disturbing, it is particularly damaging in the design of computer technology, because, unlike people with whom users can disagree and negotiate about values and their meanings, they hardly can do the same with technology. In this sense, the set of values suggested in (Pereira *et al.*, 2010) can support designers, evaluators and analysts to keep values in mind mainly when the project of a social software is in its early phases; when they need to evaluate a social software and do not have any guide; or even when there is no time or resources for carrying out a deep analysis regarding the values involved.

Regarding values in technology design, Friedman *et al.* (2006) present the Value Sensitive Design (VSD): a methodology for involving human values in the project of technologies. Although pioneer in bringing the subject of values to scene, this methodology is concerned mainly with values of moral nature and still needs artifacts and tools for supporting designers to use it in a practical context. In fact, Harrison *et al.* (2007) and Sellen *et al.* (2009) highlight the need for developing and publishing studies in order to support designers and evaluators to deal with the complexity and different requirements that current technologies have. In agreement to them, Miller *et al.* (2007) state that if designers and developers in fast-paced and bottom-line oriented industry settings are to account for values, they must be provided with light-weight and principled methods to do so.

Adopting this view and arguments, we classified the values identified in the context of social software (Pereira *et al.*, 2010) according to their cultural nature and incorporated them into the VF artifact (Kolkman 1993) creating the VF4SS. The next section presents both artifacts and shows how they can be used for evaluating social software through the lenses of values and cultural aspects.

3 THEORETICAL AND METHODOLOGICAL BASES

According to Hall (1959), humans operate at three different levels: informal, formal and technical. Each level is present in any situation, but one will always dominate in a given instant of time. Sometimes, the

shifts (and boundaries) between these levels are subtle and rapid, but understanding these shifts is the basic requirement to understand the process of change.

In the Organizational Semiotics (OS) theory (Liu, 2000), an organization and its information system are considered a social system in which human behaviours are organized by a system of norms. In this theory, any technological artifact (e.g., a social software) is embedded in a formal system which, in turn, exists in the context of an informal one. The Semiotics Onion is an artifact of the OS that represents Hall's (1959) three levels (see Figure 1): the **informal**, where the organizational culture, customs and values are reflected as beliefs, habits and individual behaviour patterns of its members; the **formal** in which rules and procedures are created to replace meanings and intentions; and the **technical** that represents the computer system situated within the formal level.

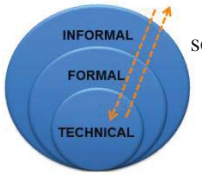

Figure 1: The semiotics onion.

Traditionally, the design process of technological artifacts occurs regardless the formal and informal aspects of organizations and the society. That is, technological innovations are produced and delivered for people to use them even without a clear perception of their utility and potential impact: it starts and finishes in the core of the Semiotics Onion. Grounded on OS theory, Baranauskas (2009) claims that we need discard this limited view in favour of one that understands the design process from a social perspective (see Figure 1): "*as a movement that starts in the society, crosses the informal and formal layers of signs, towards the construction of a technical system, returning and impacting the society*". In summary, to design systems that effectively meet users' demands, that understand and respect their culture and values, we need to see the world through the lenses of these users, taking into account and articulating the three levels represented in the Semiotics Onion; we need a new Science of Design aligning system development with social practices with the end user.

Besides the Semiotics Onion, the OS theory provides methods and artifacts, such as the Stakeholder Identification, Semiotics Ladder and Ontology Charts, that allow considering the social world from the articulation of problems stage to the modelling of computer systems. These methods and artifacts support designers in understanding the social world and formalizing it, moving from outside to inside the Semiotics Onion in order to produce a computer system. Following we present the VF, an artifact of OS created for assisting in the identification and understanding of the cultural (and social) dimensions of a product (technological or not) and its impact on people and their values.

3.1 Valuation Framing

Every innovation brings negative and/or positive impact to the environment in which it is introduced (Hall, 1959). There are people in that environment who suffer this impact, trigger others, and confer values upon such an innovation. Indeed, as Kolkman (1993) declares, people are always involved and attaching values to the systems we create because, otherwise, it would be useless in having these systems.

Values are defined by Friedman (1996) as something that a person, or a group of people, considers important in life; and by Schwartz (2005) as trans-situational goals that vary in importance and serve as guiding principles in people's lives. According to him, a particular value may be very important to one person but unimportant to another because, as Hall (1959) shows, it depends on the person's culture, being culturally developed and negotiated.

A culture consists of many patterns of behaviour that relate to each other in complex ways. In this context, each stakeholder group has a cultural system that governs how it will value an innovation: different stakeholders may react differently to the proposed innovation (Liu, 2000). For instance: the introduction of electronic payment systems through credit card. The stores, customers, employees, banks, card management agencies, insurance companies, IT professionals, and even criminals, are direct or indirectly interested and/or affected by the innovation and, consequently, are groups of stakeholders. These stakeholders may belong to quite distinct subcultures with different set of values so that the innovation tends to have rather different impacts on their lives.

Understanding the potential impact of the introduction of an innovation, however, requires that designers are aware of the reactions of these groups of stakeholders. Kolkman (1993) argues that if an innovation is inserted in each group accordingly, probably no serious problems will occur.

Nevertheless, sometimes there may be conflicts and designers will be able to anticipate the reactions of stakeholders only if they could see the world through the lenses of these stakeholders. The VF helps in carrying out this kind of analysis by supporting the identification and understanding of the cultural dimensions of a product (see Figure 2).

PMS	STAKEHOLDERS		
	Group A	Group B	Group C
Interaction			
Association			
Learning			
Play			
...			
Subsistence			

Stakeholder A's valuation of the innovation in the aspect of learning.

Figure 2: The VF – adapted from (Liu, 2000).

According to Hall (1959), there are 10 areas, which he calls Primary Message Systems (PMS), which allow mapping any culture: Interaction, Association, Learning, Play, Defense, Exploitation, Temporality, Territoriality, Bisexuality and Subsistence. The author explains that each culture develops values in regard to these areas. For instance, values in bisexuality center around preferred style of dressing, jobs, sports, and so on, of men and women. For the VF, Kolkman (1993) renamed "Defense" to "Protection" and "Bisexuality" to "Classification". Indeed, the scope of Classification goes beyond the notion of gender; it encompasses issues of age, instructional, social and economical levels, etc.

The basic principles of the VF are: all the stakeholders identified in a project are accustomed to have, in their cultural settings, a range of behaviour patterns divided into the 10 areas. The analyst's work consists of questioning, predicting and hypothesizing how the innovation can affect/is affecting these stakeholders regarding these areas. For instance, in the case of credit card systems, the stores' employees (stakeholders) could see the innovation as a threat in the sense they do not know how to operate the new machines introduced in their environment (learning); on the other hand, the manager could perceive this innovation as an unnecessary operational cost, once it requires firing and hiring more employees and/or training them. The other groups of stakeholders will also value the innovation from a different perspective. In this sense, the way we discuss, understand and deal with the values and cultural systems of each stakeholder group will determine whether such an innovation will be appropriated or rejected by them.

According to the exposed, we see the VF as a powerful artifact for enabling designers to anticipate and deal with cultural issues in the context of the project of any innovation. However, using this artifact is not a trivial activity because it requires knowledge in anthropology and social sciences. This knowledge is necessary so that designers are able to understand the areas that compose a culture and recognize the values related to each one.

As Sellen *et al*. (2009) point out, traditionally, the curricula in Computer Science do not direct much effort in order to enable its students regarding social issues. This fact makes it even more important the research and work with multidisciplinary teams that can contribute with different visions to a project. Although a desirable scenario, multidisciplinary teams are not always possible or viable. In the example of credit card systems, it would be more practical for designers to understand some of the 10 areas and their related values because the stakeholders and the values involved are more tangible and easy to identify. That is, the problem space is, at least in parts, well-known to them. However, in the project of social software it is even more complicated to know exactly what must be taken into account. For instance, what are the values related to the aspects of temporality, territoriality or association? Also, what values come into play when the innovation is not a tangible device but a computer system usable through different objects?

Indeed, regarding social software there are neither knowledge nor ways (or experience) for anticipating stakeholders' reactions, so that dealing with a so diverse range of stakeholders with quite different cultural systems become a very costly and complex task. In these cases, the need for light-weight and principled methods that support designers in seeing through the lenses of each stakeholder group are emphasized. In the next section we present an effort in this direction: a VF specially adapted to guide designers in dealing with values involved in the context of social software.

3.2 A Valuation Framing for Social Software

The main goal in creating an adapted version of the VF for the context of social software is to support designers in the understanding, analysis and evaluation of such systems. As explained previously, traditional methods for software evaluation do not draw attention to cultural aspects and the original VF is not an easy to use artifact by designers who do not have experience in social (cultural) issues.

The VF4SS includes an additional column named "Values" that suggest at least one value for

each one of the 10 anthropological areas (see Figure 3). These values are results of a previous research which aimed at identifying the values involved in the context of social software (Pereira *et al.*, 2010). We must highlight that the list of values is neither exhaustive nor complete; indeed, our main concern when creating it was to find a balance between letting it as comprehensive and diverse as possible without making it overly complex or detailed.

PMS	Value			STAKEHOLDERS		
	P	S	T	Group A	Group B	Group C
Interaction	Identity					
	Norms					
Association	Conversation, Trust					
	Relationship, Groups					
Learning						
	Meta-communication					
Play	Emotion and Affection					
	Aesthetic					
Defense	Informed cons. Reputation					
	Security					
Exploitation						
	Object, Ownership					
	Accessibility, Usability					
Temporality	Presence					
	Availability, Awareness					
Territoriality	Privacy, Visibility					
	Portability, Scalability					
Classification						
	Adaptability					
Subsistence	Autonomy, Reciprocity					
	Collaboration, Sharing					

Figure 3: VF4SS – valuation framing for social software.

To be included into the VF4SS, each value had to satisfy three conditions: 1. be classifiable into one of the 10 areas; 2. be discussed without referring to other values (or areas) and, paradoxically, 3. have relationships with other values (or areas) influencing and being influenced by them. These conditions were inspired in those used by Hall (1959) when defining the 10 building blocks of culture (areas).

In addition of being classified into the culture's areas, each value was also classified through the Semiotics Onion according to the level that represents its predominant state. Therefore, values were classified at the **informal** (mostly values of [P]ersonal and ethical nature), **formal** (collective or [S]ocial values where there is some rule or system of norms), or **technical** level (values that can be understood as attributes of quality or special features of [T]echnology). Although this distribution is not complete for some areas, the spaces corresponding to the three levels remain explicit in the artifact (Figure 3) in order to encourage designers to identify new values and think on the possible manifestations of each area in each three levels.

Embedded in the original VF, these values favor designers, evaluators and analysts to keep values in mind, helping them learn how to use the artifact itself and situate themselves with respect to what they must investigate and consider in each area. To situate our discussions in a practical context, in the next section we present an experiment in which the VF4SS was applied to the evaluation of five different projects.

4 THE CASE STUDY

Aiming at verifying the acceptance and applicability of the VF4SS, the artifact was used in the evaluation of five different projects related to the prototyping of systems for supporting cross-cultural collaboration. This context was an ideal setting for assessing our artifact due to the explicit need for dealing with cultural aspects and, consequently, with values. These projects were developed in a postgraduate course called "Topics in User Interfaces: Semiotics of Human-Digital Artifact Interaction" in which the Organizational Semiotics theory was used as an approach for the development of information systems. The group of participants was formed by 16 designers divided into five groups: G1 (formed by designers: D1, D2 and D3), G2 (D4, D5, D6), G3 (D7, D8, D9), G4 (D10, D11, D12) and G5 (D13, D14, D15, D16).

From the five projects for supporting cross-cultural collaboration, the Project of G1 was related to sporting events; the Project of G2 and G3 were related to gastronomy and culinary practices; the Project of G4 was related to musical tastes and compositions and the Project of G5 to residential tourism. This variety was useful because it favoured the diversity in terms of stakeholder groups, cultures, values, and also system's features.

When the evaluation activity started, each group had completed the documentation and had finished the prototyping of the first increment of their systems — see Figure 4 for an example. The main

goals in evaluating the prototype from designers' point of view were to identify: i) the impact the produced system could cause in its different stakeholder groups; ii) the possible conflicts between these groups; and iii) the values involved in the system and the way these values were being technically supported or promoted. On the other hand, the two main goals of this activity from our point of view were: 1. to identify if the VF4SS would help designers in evaluating social software; and 2. to verify whether the values suggested would make sense to designers and what other values should be included or removed.

Figure 4: Prototypes produced in the Project 1 (G1).

The evaluation activity was carried out as follows: the identification of all stakeholder groups involved in the project was already carried out through the use of another artifact from OS: the Stakeholder Identification diagram (Liu, 2000). This artifact distributes the stakeholders in different categories ranging from the actors directly involved in the project to the community who will not necessarily use the system but can be affected by it. In this context, in the **first** step designers should select 3 different stakeholders groups and place each group in a column of the VF4SS (see Figure 5). In order to ensure that the system's cross-cultural nature was explicit, the groups should be from different cultures (e.g., Italian, Japanese and Russian) and from different levels in the Stakeholder Identification diagram.

In the **second** step designers should look at the values suggested in the VF4SS and mark those they were already considering in their project. In the **third** step, designers should analyse and discuss the importance of each value and the impact it could cause on each stakeholder group. In the corresponding cell of the artifact, designers should indicate how that value was being technically supported in the project. Finally, in the **fourth** step designers should analyse if there would be any conflict in the way each value was being supported in the system according to the different stakeholder groups. If any, they should indicate how the conflict could be treated.

Area (PMS)	Value	STAKEHOLDER		
		Translator (Brazilian)	Amateur Cook (Japanese)	Culinary School (French)
I. Interaction	Identity	Translator's profile informing the languages he is fluent, the content he has translated and his/her ranking compared to other translators.	Cook's profile, including his/her tastes, culture, published recipes, followed recipes and comments on them.	School's profile, including its gastronomy style, its website, courses, published recipes, followed recipes and their evaluation.
	Nonni	System's use and copyright terms. It is possible to translate recipes and evaluate the translation accomplished by others.	Copyright terms; usage policy; This stakeholder can publish and evaluate recipes.	Copyright terms; usage policy; This stakeholder can publish and evaluate recipes and divulgate gastronomy courses.

Figure 5: VF4SS filled in the Project 2 (G2).

As background material for supporting the evaluation task designers were supplied with: i) guidelines explaining the four activity's steps; ii) the VF4SS both in press and digital format; iii) a document containing a simplified explanation of each area; and iv) a table containing a description and an example for each value suggested in the artifact. As activity outcomes, each group should fulfil the VF4SS, answer a survey related to its applicability, redesign the system according to their discussions and share their findings with the other groups.

4.1 Activity's Main Findings

In general, the evaluation of the projects through the VF4SS provided us data, insights and evidences that show the viability of using this artifact for social software evaluation as well as social software requirements elicitation and design. Following, we present some findings and highlight some results regarding our case study.

From designers' point of view, the activity outcomes confirmed our expectations regarding (i) VF4SS's usefulness for identifying the impact caused by the system on its different stakeholders. All groups reported that VF4SS was determinant in the process of discussing the challenges, difficulties and even opportunities for each stakeholder group regarding the system being prototyped. The VF4SS and its areas enabled designers seeing (or at least, trying to see) the system through the lenses of different stakeholders who would be affected by the system in different ways. For instance, D10 declared that "*the Valuation Framing brought us* [G4] *a better understanding about the impacts that the introduction of our system could bring to musicians,*

producers and fans". In this project, questions related to copyright, property and privacy that could be affected by the system usage were put into scene by the VF4SS.

Another point also indicated by the VF4SS was (ii) the identification of possible conflicts between the stakeholder groups. In some cases the solution to conflicts was achieved through the specification and design of other features in the system, while in other situations it was understood as a new norm, rule, or even as a system limitation. Some interesting examples are: "*Sponsors want a greater emphasis on their advertisements, while readers want a clean interface; Advertisers want to post any content, while the moderator have to supervise them*" (G1); "*A negative rating for a recipe by the users can bother the system's sponsor*" (G3); "*When musicians are composing a song in a private mode, their fans should not be able to view it. The system must offer features that enable them to manage the visibility of their productions*" (G4).

Finally, the VF4SS was also successful in supporting designers (iii) to identify the values involved in the project and the way these values were being technically supported. For instance, in the Project 2, the VF4SS led designers to think about the differences in the profile feature according to the stakeholder group and to redesign the system for reflecting these differences. In the same project, designers identified the need for mechanisms to encourage the participation of users as a way to technically implement the value of "Emotion and Affection". They proposed features that took into account the different needs and expectations of stakeholders. For instance, the feature for encouraging the participation of the "Translator" (of recipes) was prototyped as a scheme of credits (cash prizes were cited as an alternative) while the feature for the "Culinary School" was prototyped as the possibility for free announcements in the system.

According to designers' feedback and our own observations during the execution of the projects, we could perceive the VF4SS as an artifact capable of generating fruitful discussions among designers, allowing them to exercise a critical thinking regarding the whole impact of the solutions they are designing. This artifact contributes effectively to the development of products compatible with the values of the people they are intended for instead of the values of their designers. In doing so, it also contributes to a proper deployment of the product in the target environment: if a product reflects an understanding and respect to the values of its different stakeholders, then, it has better chances of being appropriated by these stakeholders. These findings are naturally extended to the original VF.

From the point of view of our research, we confirmed our hypothesis regarding (1) the utility of the VF4SS for assisting designers to evaluate social software, and also regarding (2) the relevance and benefits of the values suggested in it (i.e., whether the values suggested would make sense to them).

First, according to the survey designers answered after the valuation activity, 60% found the values very useful for the system evaluation; 40% found them useful; and none answered they are neutral, unhelpful or useless. According to D4, the suggested values assisted the group (G2) in carrying out the evaluation task because they were a starting point. Because they had no previous experience with cultural issues, if no values were suggested they could get lost without knowing what to do or how to proceed. Therefore, the values suggested in the VF4SS are important not only to support designers in carrying out the evaluation of their projects, but also in learning how to use the artifact itself.

Second, in the survey designers suggested no additional values to the 28 presented in the VF4SS. Using designer's words: "*we identified no values to be included in the framework*" (G1); "*the table* [with values' description and examples] *is generic enough for fitting any value into the available options*" (G3); "*the suggested values were capable of expressing in a complete way what we seek and discovered*" (G2). Other evidence that the values suggested into the VF4SS made sense to designers was the percentage of values that were effectively considered or discussed (pointed out as important) in the Projects — see Table 1. Designers from G3 considered 82% of the values suggested in the VF4SS but did not approach new values for their project, while designers from G1 identified all the values being expressed in some way. On the other hand, in the G2, G4 and G5 groups, designers were explicitly considering 39%, 57% and 79% of the values, respectively, when the evaluation took place. But, while filling the VF4SS they recognized the importance of including new values and discussed how these values could be technically supported in their systems.

Group	**G1**	**G2**	**G3**	**G4**	**G5**
Values considered	100%	39%	82%	57%	79%
Values discussed	100%	61%	82%	61%	100%

Table 1: Values considered in each Project.

We should highlight, however, that considering more or less values is not just a question of

designers' choice but also of the project context and scope. Consequently, these data do not suggest the values as a definitive and exhaustive set but that they made sense to designers, were useful in promoting critical discussions and met their needs in the context of their projects.

An interesting example from G2 is related to the value of "meta-communication" which was not considered by designers during the system's prototyping. However, because the VF4SS suggested this value in the cultural aspect of "Learning", designers started discussing how their system could technically support it and identified that each stakeholder group had different views and different needs regarding this value. For instance, the stakeholder "Translator" would need support to understand how the collaborative translation would work; the stakeholder "Gastronomy school" would need support to learn how to use the system for publishing, searching and evaluating recipes; and the stakeholder "Amateur cook" would need support through a resource other than text for teaching him/her how to cook the recipe. Thus, designers decided to implement the value of meta-communication through the use of tutorials and videos placed in the system's interface; e.g., each recipe should have a video showing a step-by-step of how to cook it. After these specifications, the system documentation was updated and the prototype was redesigned in order to include the new features.

In fact, the VF4SS not only supported designers in the task of evaluating the system they were projecting, but also made they think on new requirements and features that were missing or could be included in their systems. By suggesting values, the VF4SS incited designers to discuss and consider aspects that were being neglected. Therefore, it proved to be a useful artifact also for requirements elicitation. Some feedback from designers confirms this assertion:

D2: "*I would find it very interesting to apply this artifact* [VF4SS] *for requirements elicitation. The reason is quite simple: it enables those involved in the development process to see, or try to see, through the eyes of other stakeholders involved in the project they are proposing. As a developer, I feel that a lot of rework is caused by developing systems without thinking of people who will actually use it*";

D3: "*The VF4SS is very interesting because it forces us to imagine the system through the view of different stakeholders, making designers think whether the values are being addressed in the proposed project according to these different stakeholders. This activity resulted in new requirements identified. So, in my opinion, it is a very important activity to be performed at different times within a project, from requirements elicitation to the system evaluation*";

D5: "*VF4SS is, in my opinion, a great tool not only for evaluating the design of a system, but also to identify important requirements*";

D9: "*The VF4SS was the tool that I found most interesting in the whole process. It allows checking for any conflicting requirements between the various stakeholders and makes it possible to deal with this information so that such conflicts do not hinder the development of the project*";

Grounded on the results briefly discussed in this section, we are convinced of the viability of using the VF for the evaluation, and also for the requirements elicitation, of any technological artifact. Specifically in the context of social software, the VF4SS showed to be a promising artifact for supporting designers in dealing with the complexity imposed by the social context of these systems. Indeed, this artifact can be used in research projects as well as industrial settings favouring discussions around cultural aspects while guiding and capacitating designers regarding social subjects. Finally, this study also contributes to validate the relevance of the values in the context of social software we identified in (Pereira *et al*., 2010).

5 CONCLUSIONS

The design of social software still demand approaches, artifacts, methods and tools for reflecting and dealing with the social nature that characterizes it. In fact, there is even a lack of theoretically grounded approaches for investigating this kind of system. Moreover, although clearly recognized as important, there are few initiatives in literature related to values in technology. In the present paper we shed light to this scenario proposing the VF4SS, an artifact specially adapted to the context of social software. As a byproduct but equally important, we introduce and articulate key concepts and theories, such as the three levels in which humans operate, the ten basic building blocks of culture and the Organizational Semiotics theory with some of its artifacts.

The results obtained from the evaluation of five prototypes of systems situated in the context of cross-cultural collaboration indicate the benefits of using the VF4SS for evaluating as well as designing social software. Nevertheless, some important points still remain open and can be seen as a research

agenda in the area. For instance, the VF4SS produces results essentially qualitative making their analysis more difficult and their interpretation more subjective. Although its goal is to bring out aspects that are difficult to identify and cover areas that traditionally receive little attention, e.g., values and culture in technology, studies on possible means of formalizing and measuring its results are welcome.

Values are intertwined to each other through complex relationships and these relationships need to be clarified. Thus, it is difficult to involve values in the project of technologies if they are considered in isolation. When considering (or neglecting) a certain value, other values can be positive or negatively affected. For instance, depending on the way the value of meta-communication is being technically supported in a project, it can affect differently the value of accessibility, either making it more difficult (e.g., offering only explanation through sounds) or promoting it (e.g., offering multiple media, such as text, images, video, sound).

Consequently, besides the identification of the relationship among values, if we are to offer resources for supporting designers to understand and involve values in their projects, we also need suggest how these values could be technically supported in their systems. For instance, autonomy is a critical value especially in systems related to the exercise of citizenship, and it has a clear relationship with the values of accessibility, usability, identity, emotion and affection, and so on. Mapping this value to a technical feature is a challenging task not even always possible.

Finally, although a key artifact, the VF4SS alone is not enough to guarantee an effective consideration of values in social software design. Indeed, as the experiment described in this paper showed, other artifacts, methods and tools are needed in order to allow the articulation and involvement of values during the different stages of a system development (e.g., the stakeholder identification artifact). We are naming value-oriented approach (VOA) such set of tools and artifacts we are investigating in ongoing and further research.

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ANEXO 4 – Towards a Culturally Aware Design for Social Software[21,22]

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Towards a Culturally Aware Design for Social Software

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Abstract

Cultural aspects, such as values, beliefs and behavioral patterns influence the way technology is understood and used, and the impact it may cause on the environment and on people. Social software is a growing reality worldwide, while the interaction design of this kind of systems is still a challenging task due to the lack of artifacts, methods, tools and even theories for supporting designers in dealing with subjective and contextualized issues, such as the cultural ones. In this paper, we present a culturally aware artifact named VF4SS that can support designers in a requirements clarification activity. We demonstrate how it can be used for dealing with cultural issues in an explicit way, suggesting a practical guide to support designers in this task. We draw on Organizational Semiotics and on building blocks of culture to ground our discussions and situate them in a practical context related to the development of social software for professionals of the Special Education field.

1. Introduction

The so-called social software that emerged and became popular after the Web 2.0 advent is frequently cited as determinant of transformations that are changing the way people relate to technologies [1]. Systems such as *Facebook* and *Youtube* are examples of how technology has left the workplace context to pervade every aspect of people's personal and social life. This kind of system is used not only at home but also in schools, workplaces, public organizations, science, medicine etc., for several purposes, via different devices and with possible far-reaching consequences.

In fact, as Sellen *et al.* [2] highlight, people now live with technology, not just use it. In this sense, when designing people's interactions with computers and with others by using them, we have to consider new forms and dimensions of interactions that go beyond the task-oriented approach and that transcend the context of personal desktop computers.

This context brings to scene a broad set of factors that range from technical to legal and cultural ones, making the technology development an increasingly complex challenge that demands new theories, techniques, artifacts and tools for supporting their design. Cultural aspects such as values, behavior patterns, beliefs, preferences, as well as users' motivation, engagement, emotions, disabilities and the context of use are examples of concepts that have been recognized as critical to the development of technologies that meet users' needs in such new and challenging contexts.

Now, those concepts that were traditionally left on the margin of both Human-Computer Interaction (HCI) and Software Engineering approaches are moving to the centre, characterizing a new paradigm in the HCI area [3]. In this paradigm, artifacts and their contexts are mutually defining and being subject of different interpretations in a situated interaction, requiring an understanding of the establishment and multiplicity of meaning.

In this sense, researchers from academia and industry highlighted that HCI experts need to broaden the field scope and adopt new theories and methods if they are to be useful in the socio-technical environment of this scenario [2, 4, 5, 6]. Although focusing on different aspects of the same problem, they agree that we have a responsibility to ensure that the technologies we develop and deploy on society do not produce side effects that harm it; taking people culture and values in account is a basic condition for that.

However, it seems that culture and its aspects (mainly values) have become a kind of buzzword in technology design — a similar situation happened before with concepts such as usability, accessibility and, more recently, sustainability. When we talk about culture, we talk about the way of life of

people, the sum of their learned behavioral patterns, attitudes, values, material things, and other aspects [1]; culture is not a single unit that can be approached as an additional non-functional requirement. Although there is a crescent appeal for works that discuss and address cultural issues in technology design, there is a lack of concrete results, tools, approaches and even examples of how designers can deal with such issues in an explicit way.

Indeed, particularly in the context of social software, traditional approaches based on best practices in Software Engineering (specification, design, development, testing etc.) and agile methods, created for developing Web 2.0, applications need to be rethought in order to incorporate concerns relative to cultural issues. Nonetheless, because the curricula in computer science usually neglects the education of its students with regard to social subjects, if we are to develop new solutions for furthering discussions around cultural aspects, we have to build them in a way they can support, guide and capacitate designers in their activities.

Situated in this scenario, our research projects have been directed to the development of interaction design solutions for an inclusive social web, as well as frameworks and resources to support designers in doing so. In a previous work, we proposed a culturally aware artifact to support designers in analyzing and evaluating social software, taking values and other cultural issues into account in an explicit way [7]. The artifact, named VF4SS, was applied by a group of designers to evaluate five different prototypes of systems for supporting cross-cultural collaboration. The results obtained from this activity have shown that the artifact can bring effective contributions to the social software evaluation, and gave us indications that it can be applied as cultural lenses in a requirements clarification activity.

In this paper, we present and discuss the theoretical and methodological basis of our research projects and describe a case study on requirements clarification supported by the VF4SS and other artifacts from Organizational Semiotics [8]. The major goal of this case study was to make explicit identification and involvement of users' cultural aspects in the design of a computing system. We illustrate our discussion with examples from a practical context where prospective users of the solution we are envisaging were involved as active subjects. As an additional contribution, we organize and suggest activities for guiding designers to reproduce our case study in a practical context.

This paper is organized as follows: Section 2 describes the previous steps and presents the main theoretical and methodological basis used in this research. Section 3 introduces the VF4SS; Section 4 presents the case study; Section 5 suggests general activities for guiding designers in a practical context; and Section 6 presents our conclusions and directions for further research.

2. Research Grounds

When we talk about social software, we are not just talking about a specific set of technologies for which the focus is on people. In fact, we are talking about a kind of system that represents some of the great challenges we have to face in the digital age.

The impact of social software on people's professional, personal and social lives has been studied mainly by researchers from sociology, anthropology and communications areas. In this paper we do not enter in such discussions; rather, our focus is on the way technology can be designed in order to reflect peoples' values and culture, so that it could be naturally appropriated by them.

2.1. Social Software

The concept of social software as well as the particularities of its design, its elements, and the changes and challenges it brings, are being discussed in the literature and trough informal discussions on forums and blogs since the middle of 2004. A review and organization of some of those discussions are presented in [1], indicating the need of a paradigm change in the way we understand and design social software. Three main points were highlighted: two points are related to the way we design technologies, and will be discussed in the next section; the third one is related to the way we understand social software, indicating the need for approaching its elements as values — of different nature and with different relationships — instead of functional elements of software.

A set of elements in the context of social software that could be approached as values was identified in [9] through a literature review and empirical analysis of existing systems. Those elements were presented as interactive values bounded to cultural aspects (e.g., privacy, collaboration, accessibility) and some examples of how values could be promoted or inhibited by systems features were exposed. The set suggested in that paper is not exhaustive. Indeed, it is simple enough not to overload designers with a too large range of elements, while providing them with a useful list of generic elements that must be taken into account when designing social software.

In order to support designers in the evaluation of social software, the values identified in [9], complemented by an additional value (meta-communication), were embedded in an artifact to create the VF4SS (Valuation Framing for Social Software) and applied to the evaluation of five prototypes of systems for supporting cross-cultural collaboration [7]. This experiment evaluated the set

of values regarding its relevance and suitability and indicated the viability of using the artifact for supporting both the evaluation and design of social software.

In the experiment reported and discussed in [7], the VF4SS allowed designers to identify and clarify cultural aspects that resulted in new requirements for their projects; some of them could cause unexpected and undesired side effects once neglected. Although some examples had indicated it, these examples do not offer bases to reproduce such results in new situations. Therefore, it demands efforts in order to identify general activities that can guide designers to use the artifact for understanding cultural aspects favoring the requirements clarification, without limiting or narrowing them.

The identification of such activities requires attention to the two other points highlighted by Pereira *et al.* [1]: (i) we need to go beyond the consideration of technical issues, (ii) adopting a social perspective in social software design. Following, we describe and articulate these two points.

2.2. Theoretical and Methodological Basis

Traditionally, technological innovations have been produced and delivered for people to use them even without a clear perception of their utility and potential impact. Some investigations are carried out, usually by market specialists, in order to identify the overall economic viability of a given product. Cultural studies about the target audience are conducted (if any) usually to prospect selling rates. The impact that a given product (technological or not) can cause on its target audience is often neglected.

Hall [10] asserts that every innovation brings negative and/or positive impact to the environment in which it is introduced. There are people in that environment who suffer this impact, trigger others, and confer values upon such an innovation [11]. Values are defined as trans-situational goals that vary in importance and serve as guiding principles in people's lives [12] and, more generally, as something that a person, or a group of people, considers important in life [13]. In the context of technology design, Norman [14] says that people learn social skills, but machines, systems or other technological artifacts need those skills being designed into them. In this sense, as Kolkman [11] and Friedman *et al.* [13] argue, when designing a technology designers necessarily communicate their values, preferences and other cultural aspects. Consequently, the impact that a technology cause on its target audience may be the result of the match between the values of its users with the values of its designers.

A critical aspect regarding the values communicated through technology is that, usually, this communication is not a two-way one: unlike people with whom users can disagree and negotiate about values and their meanings they hardly can do the same with technologies [6]. Therefore, producing technologies that meet users' demands, that respect their culture and other social requirements, is possible only if designers could see the technology they are designing through the lenses of the prospective users and their socio-cultural particularities. However, as argued in [1], it requires a new Science of Design aligning system development with social practices with the end user.

Baranauskas [4] calls Socially Aware Computing "*the theory, artifacts and methods we need to articulate to actually make the design socially responsible, participatory and universal as process and product*". Grounded on the Organizational Semiotics theory (OS) [8] and inspired on Participatory Design [15], the author proposes a social perspective to the design of technologies, approaching it as a movement that starts in the society towards the construction of a technical system, involving representatives of the target audience as active subjects in the whole process.

To understand what this social perspective really means it is required an understanding about some basic structures of human society. Hall [10] explains that humans operate at three different levels he calls the major triad: informal, formal and technical; they are simultaneously present in everything, although one always dominate and we deal with them separately. For instance, people can learn from observing other people and imitating them (informal); they can learn from other's explicit feedback, suggestions and instructions (formal); or by books, guidelines and other materials that explain and justify things in a coherent outline form (technical). A given culture may emphasize technical learning while other may be heavily informal; on the other hand, in a same culture different levels will appear highlighted according to the context of learning: the problem-based methods used in physics are very technical while immersive approaches for cultural studies are essentially informal. Actually, we can identify all the three levels in almost any learning situation, but one will always be emphasized.

The OS theory [8] proposes a structure represented by the Semiotic Onion that explains how these levels exist in the context of organizations and information systems (see Figure 1). The informal represents the organizational culture, customs and values that are reflected as beliefs, habits and individual behavior patterns of its members. The formal corresponds to aspects that are well established and accepted, becoming social conventions, norms or laws; in this level, rules and procedures are created to replace meanings and intentions. Finally, the technical situated in the core

of the onion represents aspects that are so formalized that can be technically approached and supported.

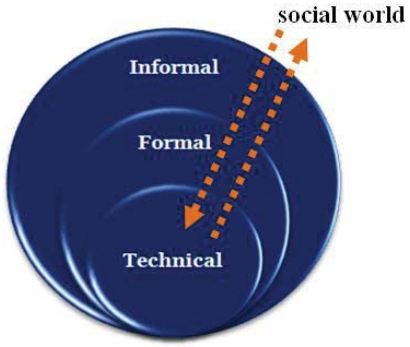

Figure 1. The Semotic Onion.

In technology design, the Semiotic Onion shows that any technological artifact is situated in a formal system that, in turn, exists in the context of an informal one, suffering and causing impact on them. Consequently, as long as design processes occur centred in technical aspects regardless of the formal and informal aspects of organizations and the society, they will not be able to deal with cultural aspects in an effective way. In this sense, when Baranauskas [4] talks about a social perspective to the design of technologies, she is defending that any design process must begin from outside to inside the Semiotic Onion (see figure 1), crossing the informal and formal layers of signs towards the construction of the technical system. The technical system, in turn, will cause impact on the formal and informal layers and on society. This movement favors the identification, articulation and formalization of relevant aspects of the social world, reflecting a respect and understanding to it and favoring the production of technologies that make sense to users and are appropriated by them.

Following, we present the VF4SS and describe how it can support a requirements clarification activity grounded on the theoretical and methodological bases discussed in this Section.

3. The VF4SS Artifact

Understanding the potential impact of introducing an innovation requires designers to be aware of the reactions of the different groups of stakeholders who will be direct and/or indirectly affected by it. If an innovation is inserted in each group accordingly, no serious problems might occur [11]. However, sometimes there may be conflicts and designers would be able to anticipate the reactions of stakeholders only if they could see the world from these stakeholders' point of view. Although there are some techniques, such as natural observation and ethnography, which have been used in software engineering practices to assist designers in such tasks, they offer little support regarding their theoretical basis. Designers who do not have background in social sciences might have difficulties in knowing what to do or how to proceed in order to obtain relevant requirements related to people behaviors, values, conflicts, dependencies and so on. Usually, these techniques do not offer practical artifacts that can guide designers in the requirements elicitation tasks while facilitating their understanding of social issues.

The Valuation Framing (VF) is an OS's artifact [11] created on the ground of the ten building blocks of culture [10] for supporting the identification and understanding of the cultural dimensions of a product. The basic principles of the VF are: all the stakeholders must be identified. These stakeholders have, in their cultural settings, a range of behavior patterns distributed into ten areas relative to the basic building blocks of culture, or Primary Message Systems (PMS) [10], e.g., Interaction, Association — see the first column of Figure 2 for the complete list. The analyst's task consists of questioning, hypothesizing and predicting how the innovation could affect these stakeholders in these areas.

Hall [10] explains that each one of the 10 culture building blocks is biologically rooted, and any culture can be seen as an evolution of human behaviors and interactions mapped by a combination of them. According to him, people develop values with regard to these 10 areas. For instance, values in Association refer to the way people organize and structure themselves in society; the groups they form, the kind of relationship they develop and maintain, etc. Family is a manifestation of the aspect of association in a given culture, and its role, structure, and relative importance on society can be understood as values developed in/by that culture. In this sense, the values identified in the context of social software [9] were classified according to their suitable cultural area and, then, embedded in the VF artifact creating the VF4SS [7] (see Figure 2).

The VF4SS presents all the 10 areas (PMS) preserving the structure of the original VF and includes a column named "Value" that suggests designers possible values relative to the area. Values are also classified according to the level they are better perceived in the social software context: Informal — mostly values of personal and ethical nature, Formal — collective or social values where there is some rule or system of norms, or Technical — values that can be understood as quality attributes or special features of technology. A new column is added in the artifact for each group of stakeholder identified in the context of the solution being designed. Therefore, each area and its values can be discussed and treated in a connected but independent way for each group of stakeholders.

We have applied the VF4SS in a practical context in order to clarify requirements to the development of a social software for professionals of the Special Education field — teachers who work with students that have some kind of impairment. The artifact has been useful in supporting the requirement elicitation activity and in promoting discussions regarding cultural aspects. The next Section presents some examples that illustrate the artifact usage and its contributions.

PMS	Value			STAKEHOLDERS		
	I	F	T	Group A	Group B	Group C
Interaction	Identity					
	Norms					
Association	Conversation, Trust					
	Relationship, Groups					
Learning						
	Meta-communication					
Play	Emotion and Affection					
	Aesthetic					
Protection	Informed cons. Reputation					
	Security					
Exploitation						
	Object, Ownership					
	Accessibility, Usability					
Temporality	Presence					
	Availability, Awareness					
Territoriality	Privacy, Visibility					
	Portability, Scalability					
Classification						
	Adaptability					
Subsistence	Autonomy, Reciprocity					
	Collaboration, Sharing					

Figure 2. The VF4SS.

4. The Case Study

In the last years, the Brazilian public policies for inclusion of disable students in regular schools created the Specialized Educational Services area (SES), in which qualified teachers accomplish activities with students in classes placed in traditional schools but equipped with specialized resources [16] — the multifunctional resources room (see Figure 3). In order to qualify professionals in this field, teachers from all over the country are being prepared for their responsibilities and activities via specialization courses within e-learning environments. However, these courses have a limited period and, after that, teachers will lose part of the support they have for accomplishing their daily activities.

Figure 3. Multifunctional resources room [17].

In this context, we are working in a research project called *TNR – Todos Nós em Rede* (in English: All of Us Networked) which intends to investigate the importance and usefulness of a social network system for supporting teachers into their day by day work with real cases in a continuing education process. This network has as premises the teacher autonomy, self-regulation and the construction of knowledge about issues related to SES by the discussion of cases from their professional practices.

According to our previous discussions, designing social software is a complex task because there is a broad range of factors into play (e.g., the cultural ones) that can influence the appropriation as well as the rejection of technology. Consequently, involving prospective users through participatory activities, and understanding and dealing with their cultural aspects (e.g., values) are primary concerns in this project and are in accordance to Baranauskas' social perspective [4].

In the context of the TNR Project, we are conducting participatory activities with 28 teachers — they are considered the SES sowers — from several regions in Brazil to identify existing solutions, requirements and features for designing a social system that make sense to them. In the first stage of the participatory activities, teachers experimented four different systems for supporting them in the discussions of their cases: *Yahoo! Answers* [18], *ACBP-Sakai* [19], *LeMill* [20] and *Vila na Rede* [21] — these systems were selected in order to cover different aspects that are important to the research. Teachers suggested cases they would find interesting to discuss supported by the selected

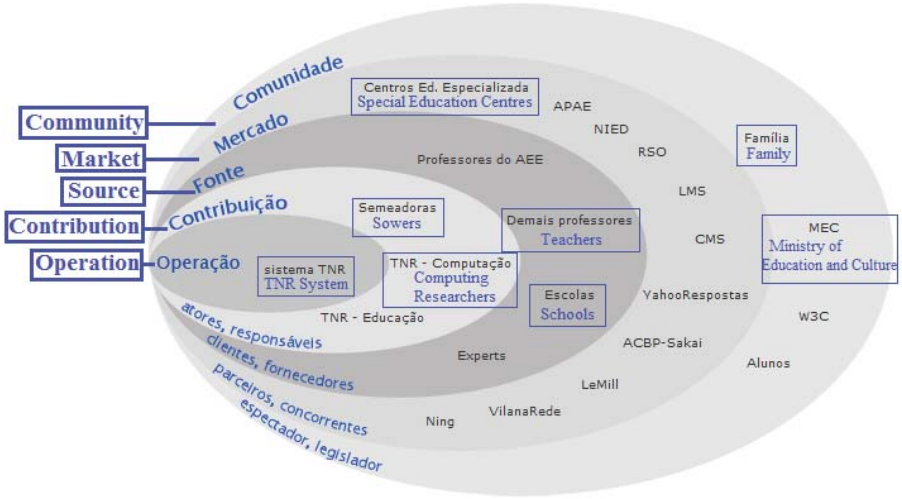

Figure 4. The Stakeholders Identification Diagram.

systems and the research team chose four of them (one per system), creating four different scenarios. The main goal in each scenario, however, was not solving the case itself but evaluating how useful these systems could be in supporting online construction of a case solution in teachers' real practices. Following, we describe a clarification activity conducted on the data produced in the first scenario.

The system used in this first scenario was the *Yahoo! Answer* [18]. This system was chosen because it allows users to interact in a question-answer scheme. For their interactions, we posted the description of the first case as a question in the system and asked them to come to a solution for it. After about a month using the system, teachers gave us their feedback by: i) their interaction through the system in order to solve the proposed case; ii) answering an evaluation questionnaire, pointing out the resources they liked, disliked, missed etc., and their opinion regarding the benefits and limitations the system brought to their discussions; and iii) a semi-structured interview with the researchers team. Then, we analyzed these data through the VF4SS's lenses in order to know users and their contexts (abilities, preferences, limitations, values etc.), drawing attention to the requirements elicitation for the system we are designing. The procedure we carried out was as follows:

First, we identified some groups of stakeholders involved in the solution we are designing, for instance: the Sowers, Computing researchers, Education researchers, Teachers, Students, Family, Schools, MEC (Ministry of Education and Culture) etc. The Stakeholders Identification (SID) diagram [8] from OS was used in this activity (see Figure 4 — translations were made by the authors): it distributes the groups of stakeholders in different categories ranging from the actors directly involved in the project (e.g., direct users such as the Sowers) to the community who may not use the system but can be affected by it (e.g., students' family). We selected the four most representative ones in the context of our Project, covering informal, formal and technical aspects: Sowers (informal), MEC (Formal), Education Researchers (Formal), and Computing researchers (Technical), inserting them as a new column into the VF4SS.

Second, we discussed how the different groups of stakeholders would understand each area and the values suggested in the artifact. For instance, regarding the aspect of "Association" sowers expect a system for supporting the discussion of their cases and for interacting with other teachers who have similar interests and/or difficulties. In the evaluation of the *Yahoo! Answers*, they pointed out that it does not support the value of conversation in an effective way; using a sower's words: "*(...) the system did not allow an effective discussion of the case. I felt frustrated when trying to complement my answers*" and "*it is not dynamic; I felt lack of dialogue with other participants*". This kind of complaint indicates that the value of "conversation" is very important to them for an effective interaction, having to be as flexible as possible. This feedback also gave us a cultural clue: it seems that teachers are not seeking for closed answers to their problems; instead, they expect a solution built from their discussions and ideas, and that will be suitable to their problems and context.

Third, we highlighted the values identified in sowers' answers, evaluations or interviews, discussed their scope and possible means for technically supporting them. For instance, sowers suggested they would want to complement their

answer because while other users post comments in a case, they could have new comments and ideas to show. They reported that: "*when I want to complement my answer, after a few days, I am not able to do it*"; "*I read everything, but I could not answer other comments. I like chats, where I can interact with others and know the opinion of my colleagues*"; and "*Once answered, I was not able to answer again in order to complement my answer or to post a question to a colleague. I could not reply comments or develop a discussion*". This kind of feedback shows us that the discussion is not a linear one, but iterative and collectively built. In this sense, a scheme similar to a forum might be more appropriate than a question-answer one.

PMS	Value			STAKEHOLDERS	
	P	S	T	**Sowers**	(...)
Association	Conversation Trust			Regarding the aspect of Association, teachers want to discuss their real cases, talk to other teachers, learn with others' discussions and interact with each other in different ways and through different resources. They believe a case can be more efficiently approached if they could exchange ideas with other professionals and see solutions to similar problems. These stakeholders like to find people with similar interests, from different places and with different experiences. To them, a conversation around a case of their practices needs to be flexible because the solution of a case is not a linear one. Therefore, they do need resources that allow them maintain a continuous conversation. Resources such as chats, forums and file (photo) sharing are familiar to these teachers. When teachers interact in a Web environment they want to know the people they are interacting with (...), seeing information about them (e.g., a profile with the person's name, picture, description, geo-localization, etc.). These data help them to recognize people they already know (or heard about before) or to introduce those who they are contacting for the first time.	(...)
	Relationship Groups				
(...)	(...)			(...)	(...)

Figure 5. VF4SS filled in the aspect of association.

Fourth, we analyzed the highlighted values looking for possible conflicts between the different groups of stakeholders. For instance, we identified a possible threat to the value of privacy in the perspective of students caused by the value of conversation in the sowers' perspective. When asked about their concern with privacy issues sowers answered: "*I have no problem with that* [on privacy]"; "*I am not worried about that because my answers are based on my practices*" and "*(...) in any social network we stay very exposed; there is no other way. I think it is important to share my thoughts (...)*". Some authors talk about privacy in social networks arguing that privacy is not well understood and/or considered as important by beginners while it is considered critical by expert users; Satchell and Dourish [22] consider that "privacy is a concern only for the concerned". However, because the cases being discussed are real cases, the concern with privacy here cannot be restricted to teachers. The identification of students and their personal information, for instance, may have deep and far-reaching consequences. Nevertheless, this type of concern was mentioned as important by only one sower during the whole activity. In this sense, the system we are designing has to let teachers aware of the impact the information they are producing can have, instructing them regarding privacy concerns — it corresponds to a value we call informed consent.

Fifth, we discussed how values, such as the informed consent, could be technically supported in the system. For instance, tips and advises regarding privacy issues could be displayed in the system interface, and mechanisms for controlling the visibility of the information produced by the users could be developed. For instance, when users create a new announcement at the *Vila na Rede* system [21], they have to configure whether the content will be visible only for registered users or for everyone who access the system; it also offers a feature that explains to users, using video, audio or pictures, the purpose of that configuration.

Finally, we could elicit requirements associated to values in the context of the solution we are seeking to design. These requirements can be formalized, for example, by defining norms [8]. A formalized norm for advising users regarding privacy issues when they are discussing a case could be: "whenever a new case is posted, if it is publicly available then the user is obliged to confirm his/her awareness about the risks of exposing personal information or any data that may affect his/her privacy or the privacy of other people". This norm can also be treated as a functional requirement.

4.1. Discussion

The VF4SS enables designers looking at the system being projected through the lenses of different stakeholders who would be affected by it in different ways. Besides, it also supports designers in identifying the values involved in their system and the way these values can be/are being technically supported. In fact, the values suggested in the artifact act as a starting point from which designers can elaborate further discussions and investigations. Hence, the suggested values are important not only to support designers to carry out the analysis of their projects, but to understand each PMS, discover new values and learn how to use the artifact itself.

In a requirement elicitation activity, one of the main contributions of the VF4SS is its capability of generating fruitful discussions among designers, allowing them to exercise a critical thinking with respect to the whole impact of the solutions they are designing. If applied in the early stages of software development, this artifact can effectively contribute to the creation of products compatible with the values of people they are intended for instead of the values of their designers, benefiting the system deployment and stakeholders' appropriation.

Regarding the artifact application, it was possible to identify some interesting points: 1. No matter the design process or the software development model adopted in a project, the artifact can provide

theoretical basis and promote further discussions in terms of values and culture. 2. The task of using the artifact is not linear; designers will move back and forth identifying new cultural aspects, discussing new values, revising requirements and so on. 3. Although the VF4SS brings the lenses of culture and values to the interaction design of systems, contributing to an understanding of the system from different points of view, it does not substitutes the figure of the user. Indeed, the artifact serves as a guide regarding cultural issues, and it is better applied in practical settings where representatives from the target audience are involved.

Besides identifying and clarifying requirements in the project context, the activity provided some indications for the next steps of the system design. Because they seem to be valid for the project of any technological artifact, they are presented in a generalized way:

First, it is necessary to take into account the views and interests of different groups of stakeholder. As previously argued, different stakeholders understand, value, cause and suffer the impact of an innovation in different ways. They also may influence/be influenced by other groups of stakeholders.

Second, discussing cultural aspects provide rich information about the target audience and the environment in which the solution being designed will be inserted. As illustrated by the Semiotic Onion, considering such aspects corresponds to consider part of the informal and formal systems that contribute to a fully comprehension about the problem domain.

Third, as Schwartz demonstrates in his circular model [12], values have an interactive nature. When a certain value is promoted or inhibited, it can affect other values, promoting or inhibiting them. Sometimes, a value can be promoted only by promoting other values; on the other hand, there are cases that a value has to be neglected in favor of others. Being aware of such interactive nature among the values themselves contributes to avoid pitfalls in the attempt of promoting\inhibiting a certain value.

Forth, it is possible to move from informal discussions regarding cultural aspects to formal requirements that can be technically approached — in a way analogous to Baranauskas' proposal [4]. This movement favors the clarification and elicitation of requirements that carry the concern for culture with them.

5. A Practical Guide for the VF4SS

Based on our examples and discussions, in this Section we suggest some general activities for guiding designers to apply the VF4SS in the practical context of an industrial setting as well as in a research environment.

The Figure 6 illustrates these activities indicating the artifacts that support them. The light blue rectangles represent general activities, while the rounded orange rectangles represent their outcomes. Solid arrows indicate an input or a result of an activity, while dashed arrows indicate that the activity can generate a re-input to another. The requirements clarification starts with the identification of the groups of stakeholders, is iterated and finishes when designers conclude they have clarified the relevant areas and their values for the groups of stakeholders selected, identifying requirements to the project.

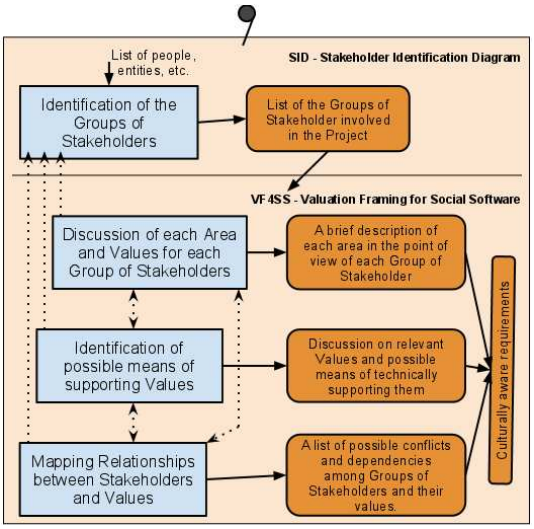

Figure 6. General activities for guiding designers.

Identify the groups of stakeholder direct or indirectly involved/interested in the system being developed. The SID artifact [8] can support this task. As a result, a new column for each group of stakeholders is included in the VF4SS. For practical reasons, we suggest selecting the most representative ones to the context of the project being developed. In order to keep a wide perception of the problem domain and the different stakeholders, consider selecting at least one group from each SID's layer.

The income of this activity can be the SID to be filled and a list of the people who are directly interested in the system development (e.g., teachers, researchers and students); the outcome is the SID filled with the groups of stakeholders direct and/or indirectly involved and/or interested in the system being projected.

Make questions, hypothesize and try to predict how the system can affect the groups of stakeholders regarding each area, and the way these groups understand, see and give importance to them — the suggested values can serve as a starting point for this kind of reasoning. For instance, how do teachers see the system regarding the aspect of Learning? Is the

system an opportunity for new learning by discussing their cases? Is it complex to learn how to operate the system? This activity allows designers to see the system being projected through the lenses of the different stakeholders groups and to understand how the system development may affect these stakeholders. If new values are identified in this activity, they can be added into the VF4SS.

Considering the values suggested or inserted in the VF4SS during the requirements clarification, discuss the scope and relevance of each value for each group of stakeholders and identify possible means of supporting these values in the system design. For instance, regarding Learning it could be identified that teachers want to discuss their cases in the system in order to improve their knowledge and experience. However, they do not know whether the system controls the visibility of information; so, they are afraid that publicly exposing their doubts may negatively affect their reputation in the work environment as well as in their personal lives. In this example, we can see both a concern regarding the possible impacts of i) using the system to ask for help and ii) operating the system itself. The first concern puts the values of privacy, reputation and trust in evidence and highlights the need for creating mechanisms that allow users to manage the visibility of the information they produce. The second one draws attention to the values of autonomy, usability, accessibility, meta-communication and informed consent, indicating that the system must be easy to learn, understand and operate, instructing users and letting them aware of the possible results of their actions. This activity favors the understanding of the way the values involved in the context of the system being projected are manifested, the relationships among them and the way these values can be technically supported.

Analyze and map the possible relationships between the different stakeholder groups regarding the analyzed values and specify means for supporting them (e.g., technical features, project constraints). Sometimes there are dependencies and even conflicts between different groups of stakeholders that must be taken into account in the system design. These relationships can be explicit, e.g., if the system is moderated then the teacher depends on moderators' approval to post a new case; or they can be implicit, e.g., the school director may not approve the teacher using the system because the exposition of information regarding school's cases, practices, rules and structure can be seen as a possible threat to him. The outcome of this activity is a mapping of the relationships between stakeholders' values that must be considered in the project and possible means of dealing with them. In some cases, as in the conflict between the teacher and the school director, a technical feature is not enough to solve a conflict or support a dependency, and perhaps there will be few (if any) possible ways of dealing with that. However, designers need to be aware of these conflicts and dependencies in order to reduce them (e.g., providing clear and effective privacy control resources) or, at least, to avoid making them harder.

When designers discuss a way of supporting a value or dealing with a conflict, they are also discussing about functionalities, constraints, quality aspects etc. that can be understood as requirements to the project. Hence, the discussions generated in these activities favor the identification of requirements contributing to the understanding of the environment in which the solution being projected will be introduced; it, in turn, favors the development of a solution that reflects a respect to the culture and values of its intended users, instead of the cultural aspects of its designers. As we mentioned before, the results obtained from the artifact usage can be even more promising if representatives from the target audience are involved in the process.

6. Conclusion

In this paper we approached the design of social software as a challenging task where values, emotion, motivation, and several other cultural aspects play a central role. Consequently, new theories, approaches, artifacts and tools for supporting designers when projecting systems placed in this scenario are needed. Within this context, we presented the VF4SS as an artifact for supporting designers in a requirements clarification activity. Then, we presented some examples, derived from a practical context, of how the artifact can support designers from informal discussions to requirements clarification, and suggested general activities for guiding them in the artifact usage.

The artifact as well as the general activities and the discussions we presented in this paper are grounded on Organizational Semiotics [8], the building blocks of culture [10], the Socially Aware Computing approach [4] and Schwartz's values model [12]. In this sense, we tried to present our research articulating theory and practice, exposing arguments and examples, so that the reader who is not familiar with such theoretical-methodological basis can understand it.

As future work, we are projecting a case tool for supporting the use of the VF4SS. The development of such tools and conceptual framework are part of a project named EcoWeb [23] that aims to empower professionals and researchers involved with the design and development of social systems to produce solutions that effectively meet users' requirements, taking into account their differences, needs, preferences, limitations, values and other cultural aspects.

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ANEXO 5 – The Value of Value Identification in Web Applications[23]

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THE VALUE OF VALUE IDENTIFICATION IN WEB APPLICATIONS

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ABSTRACT

Every technology triggers changes when it is inserted in an environment. Understanding the role of human values in technology design is a key factor for the development of technologies that make sense to people and do not produce side effects that harm them. Applications publicly available on the Web, notably the so-called social software, are worldwide diffused and used, generating far-reaching and unforeseen consequences. The explicit concern on values is not a common practice in technology design, in part, due to the lack of informed methods that support designers in this subject. In this paper, we present the Value Comparison Table, an artifact that supports designers in a value-oriented analysis of social software. A case study illustrates the use of this artifact to compare four different web applications regarding the values they promote or inhibit according to the way they were designed. The Value Comparison Table showed to be a promising artifact for supporting designers in the complex scenario of designing value aware technologies.

KEYWORDS

Values in design, Social Software, Organizational Semiotics, culture.

1. INTRODUCTION

Every time a technology is introduced in an environment it causes positive and/or negative impacts on it. We are surrounded by examples of what these impacts look like: from economic interests to bias in computer systems; from social reputation to over visibility; from people's autonomy to social exclusion; from privacy protection to security issues, just to name a few. As technology designers, we have the obligation to guarantee that the solutions we design are not imposing our values over the values of people these solutions are intended to serve. As technology researchers, on the other hand, we have the responsibility of developing informed and practical solutions that support designers and developers in academic as well as industrial settings to account for values.

Friedman *et al*. (2006) define values as something that is important to a person or group of people. In the Values Theory, Schwartz (2005) defines values as desirable, trans-situational goals that vary in importance and that serves as principles that guide people's lives. In this theory, values are understood as beliefs tinged with emotions, as motivational constructs that transcend specific situations and actions, serving as standards or criteria to guide the selection of actions, policies, people and events.

The concern with values in technology design has been an appeal strengthened by advents such as the social software emergence and the ubiquitous computing trend. As Sellen *et al.* (2009) highlight, we now live with technology, not just use it. According to those authors, transformations such as the increased dependence on technology; the end of interface stability; the increased hyperconnectivity; the end of the ephemeral and the increase of creative engagement have redefined our relationship with technology. These transformations draw attention to the existence of a broad set of factors that range from sociability and emotional aspects to issues of scalability, security and performance; such factors are related to human values in the computing age and need to be explicitly considered in technology design.

Curricula in Computer Science and Information Technology do not traditionally address methods that enable students to deal with social issues in systems development. While the need for considering values is becoming more evident, the inability of current approaches and methods in technology development for supporting it is becoming more visible. Several authors, such as Bannon (2011), Friedman *et al*. (2006) and

Sellen *et al*. (2007), highlight the need for developing and publishing studies to support designers and evaluators to deal with the complexity and different requirements that current technologies demand. In this sense, if we are to develop solutions in this context, our studies must include issues regarding values and cultural aspects in the agenda and our solutions must facilitate its use by professionals that are not familiar with social sciences.

In this paper, we shed light on this scenario by presenting an artifact that supports designers in identifying, analyzing and comparing web applications regarding the values promoted or inhibited by the way these applications were designed and are used. The artifact, named Value Comparison Table, favors the comparison of applications, keeping values in the designers' mind and making it easier the identification of solutions that could inspire them in similar contexts or help them to avoid pitfalls created when values are neglected or misunderstood.

The paper is organized as follows: in Section 2 we discuss the role of values in design presenting a literature review; in Section 3 we introduce and describe the Value Comparison Table; in section 4 we expose a case study situated in the context of the development of a social network for professionals of the Special Education field; in Section 5 we discuss results of the case study and the artifact itself, and in Section 6 we present our conclusions.

2. VALUES IN DESIGN

Knobel and Bowker (2011) assert that values often play out in information technologies as disaster needing management. For them, conversations and analysis of the values in technologies generally occur after design and launch. Consequently, most users are faced with undecipherable and sometimes weird decisions already made on their behalf, often not to their benefit.

Bannon (2011) provides interesting examples of the need for values consideration in the context of "Ambient Assisted Living". He mentions how often designers and even researchers conduct their researches and develop their products hoping they will support elderly people living independently, having a better quality of life at home instead in an institution, and not becoming a burden on other people or on the state as they grow older. However, although much of this work is justified by the need of "empowering older people through independent living", on closer examination they are more engaged in providing 24/7 remote monitoring of these people than in adding to their dignity or empowering themselves to remain autonomous.

In this sense, Friedman (1996) argues that designers necessarily communicate values through the technology they produce. Once the cost to disseminate a technology is insignificant when compared to the cost to develop it, the values embedded in its implementations are easily disseminated. For her, although the neglect of moral values in any organization is disturbing, it is particularly damaging in the design of computer technology, because, unlike people with whom we can disagree and negotiate about values and their meanings, we can hardly do the same with technology.

For Norman (2008), every product has a social component and correctly identifying it determines whether the interaction with this product will be sociable or not. People learn social skills, but machines, systems or any other technological artifacts, need those skills being designed into them. Accordingly, Sellen et al. (2009) highlight that human values, in all their diversity, should be charted according to the way they are promoted or inhibited by technologies. In Bannon's example (2011), the real needs, concerns and values of the central people involved are not in fact central but secondary. Thinking on technology development or medical assistance before understanding the stakeholders and their values may prevent the understanding of more basic issues, such as people's need to be in contact with family, friends and neighbors in a natural way; the need to manage their privacy and to keep control over themselves, etc.

Some works have explicitly focused on values in technology design. Cockton (2005) proposes a framework to support what he named a Value-Centred Design (VCD), suggesting some activities and artifacts to support designers in the development of value-centred systems. The focus of VCD, however, is not on people's values but on the understanding of technology design as a process of delivering value. On the other hand, since 1996 Friedman has been working on an approach she named Value-Sensitive Design (VSD). This approach is intended to support the concern with values in the design of computer systems, especially the ethical ones.

Sellen *et al*. (2007) stated that the biggest challenge confronting the Human-Computer Interaction (HCI) field in the present is explicitly considering values in technology design. Their assertion reinforces the choir of Friedman *et al*. (2006), Knobel and Bowker (2011) and Bannon (2011) that argues for methods, activities and artifacts that support designers in the development of value aware technologies. Although the previously cited works have contributed in this direction, there is an unfilled gap between discussions on values in technology design and the development of practical solutions for supporting designers in this task.

3. WEB APPLICATIONS AND VALUES

The Web 2.0 was a milestone in the development of rich and innovative applications in terms of interactivity, enabling the emergence of the so-called social software (e.g., social networks, wikis, social bookmarking). These applications are characterized by collaboration, communication and interactivity between users in unprecedented ways and scales, leaving the boundaries of offices and workplaces to pervade every aspect of people's personal and social lives (Pereira *et al*., 2010).

In this sense, because Web applications are worldwide available and can be used for several purposes, via different devices and with possible far-reaching consequences, accounting for values in their design is among the most complex scenarios we are facing nowadays. If we consider just a few examples of famous systems (e.g., *Facebook*, *YouTube*, *Twitter*), we hardly see the concern with human values such as privacy, reputation, autonomy, among other cultural aspects (e.g., beliefs, behavioral patterns), in their design. An evidence of the negligence with the social aspects of these applications is that users have been inadvertently serving as testers of beta applications as well as subjects of implicit behavioral experiments to identify the viability of a resource or product. Privacy policies and agreement terms are constantly changed and updated, many times without users' awareness. Products that were not approved in their beta tests are removed/discontinued disregarding possible effects on users. Accessibility issues are usually neglected making it difficult or even preventing the access of people that does not fit the myth of the "average user".

Indeed, little is known about values in Web technologies, notably in the so-called social software. What these values look like, their roles, the way they can be promoted or inhibited and possible means to deal with them still demand investigations. The artifact presented in the next section aims to support designers in these discussions, suggesting values in the context of social applications and favoring the comparison of different systems.

3.1 The Value Comparison Table

Technologies themselves do not have values — people do have, but the way they are designed makes them more suitable for a context of use and less suitable for another. For Friedman (1996), values emerge from the tools we build and how we choose to use them. Actually, depending on the way a technology is designed it will afford behaviors that are intrinsically related to individuals and the complex context in which they are using it. Individuals will interpret and behave over/through the technology influenced by their cultural systems (e.g., values, beliefs, behavior patterns). Their behavior can be in [dis]agreement with their values and/or the values of other people. This, in turn, will promote or inhibit certain values over others.

Values are culturally built (Hall, 1959; Schwartz, 2005). They can vary in meaning, importance and priority according to the culture being analyzed and across time and space. In an attempt to formalize the basic constructs of culture, Hall (1959) proposed ten areas he named Primary Messages Systems (PMS) — see the column "AREA" in Table 1. According to him, all cultures develop values regarding these areas.

In the context of Web applications, consider a social network like *Facebook*. The simple fact of requiring an email address to allow users to register in the system reveals at least two designers' basic assumptions: 1. Every possible user on the earth has (or must have) an email account. 2. Users will not be worried in informing their email address, sex and complete birthday (all fields must be filled). Although simple, this example shows how the system affects individuals' values of accessibility and privacy. What if people who are not used to operate computers want to use *Facebook*? — Elders, for instance, may want to keep in touch with their family and friends or just see their profiles and pictures. If the system is not intended to be used for people who do not have an email account, then it has a bias that excludes users made explicit in its design.

Additionally, what if users do not want to share their birthday? Some people do not feel comfortable in giving such data because it is strongly personal, but the system forces users to inform the full birthday and they need to believe it will be kept secret. Simple alternative solutions could be developed if designers had thought and put users' values first. An alternative feature for retrieving passwords through the recognition of pictures and/or sentences sensible to context and a check box attesting they are at least 13 years old, could be more natural and reflect a respect to their values.

Accessibility and privacy are just two examples of values commonly affected by social applications. In (Pereira et al., 2010) we presented and described values identified in this kind of system and in (Pereira and Baranauskas, 2011) we classified them into Hall's culture building blocks proposing the Valuation Framing for Social Software (VF4SS). The VF4SS is an artifact inspired on the Organizational Semiotics theory (Liu, 2000) to support the analysis and evaluation of Social Software through the lenses of culture, from the stakeholders' point of view. Here, we present the Value Comparison Table (VCT), an artifact inspired on VF4SS for supporting designers in identifying and comparing how values are being technically promoted or inhibited in different Web applications according to the way they were designed (see Table 1). The interested reader may consult (Hall, 1959) for detailed explanations on the 10 areas of culture, and (Pereira et al., 2010, Pereira and Baranauskas, 2011) for more discussions and examples on values in Social Software.

Table 1. The Value Comparison Table

AREAS (PMS)	VALUES	APPLICATIONS		
		A	B	C
1. Interaction	1.1 Identity			
	1.2 Norms			
2. Association	2.1 Conversation			
	2.2 Groups			
	2.3 Relationship			
	2.4 Trust			
3. Learning	3.1 Meta-communication			
4. Play	4.1 Aesthetics			
	4.2 Emotion and Affection			
5. Protection	5.1 Informed consent			
	5.2 Reputation			
	5.3 Security			
6. Exploitation	6.1 Accessibility			
	6.2 Object			
	6.3 Property (ownership)			
	6.4 Usability			
7. Temporality	7.1 Availability			
	7.2 Awareness			
	7.3 Presence			
8. Territoriality	8.1 Portability			
	8.2 Privacy			
	8.3 Scalability			
	8.4 Visibility			
9. Subsistence	9.1 Autonomy			
	9.2 Collaboration			
	9.3 Reciprocity			
	9.4 Sharing			
10. Classification	10.1 Adaptability			

How is Application "A" promoting the value of Identity? What are the elements/features that represent users' identity in the system?

Is the value of Accessibility supported by the "C" Application? What system's features support it? Is it enough to make the system accessible? Can it inspire the design of other systems?

Is it possible to adapt "B" Application according to different contexts of use, users' needs or preferences? What, when and how is it adaptable? Is it useful? What are the possible impacts of these adaptations?

The basic principles of VCT are: every system allows users to interact with it and through it, for different purposes and by means of different interface and interaction resources. Depending on the behavior favored or inhibited by the system, it will impact either positively or negatively on users' values related to cultural aspects that pervade everyday life: from the way we learn and play to the way we manage time and space; from the way we interact and associate to the way we work and subsist in the world. The analyst's work consists of exploring each system, questioning and analyzing how they support values.

The values suggested in VCT are not intended to be definitive or exhaustive, rather, they are simple enough not to overload designers with a too large range of elements, while providing them with a useful list of generic values that must be taken into account when dealing with social applications. Indeed, the values

are a starting point for analysis as, without previous exposition to cultural issues, it would be harder to proceed.

Once filled, the VCT provides designers with a map of how values are reflected by/on/through each application analyzed. Each cell presents reasoning about a given value in a specific application. Each line makes it possible for designers to identify the pros and cons of each application regarding a given value and to highlight which ones can inspire them when designing a new solution or alert them on what they have to avoid. Additionally, each column provides a picture of the values perceived in a given application, the way they are being supported and designers' impressions about them.

4. THE CASE STUDY

This case study is situated in the context of the development of a social network for Brazilian professionals of the Special Education field — teachers who work with students that have some type of impairment. In the last years, the Brazilian public policies for inclusion of disable students in regular schools created the Specialized Educational Services area (SES), in which qualified teachers accomplish activities with students in classes placed in traditional schools but equipped with specialized resources. This social network intends to support teachers in their day by day work with real cases in a continuing education process, having as premises the teacher's autonomy, self-regulation and the construction of knowledge about issues related to SES by the discussion of cases from their professional practices. The design of this social network is being informed by semio-participatory (Baranauskas, 2009) activities with representatives from the target audience.

In the first stage of the participatory activities, the main concern was to know the prospective users, understand their values, needs, expectations and what are (if any) the existing solutions that could already support them. In this sense, we looked for existing solutions, requirements and features that could characterize and ground the design of a system that makes sense to the teachers. Then, four different systems — (A) *Yahoo! Answers*, (B) *ACBP-Sakai*, (C) *LeMill* and (D) *Vila na Rede* — were selected in order to cover different aspects that could fulfill their needs, and 18 teachers, from several regions in Brazil, experimented these four systems to support the discussions of their cases. The teachers had no previous experience with the four selected systems; they were used to web applications such as blogs, email, and forums. The study was conducted as follows:

First, teachers suggested cases they would find interesting to discuss with support of the selected systems and the research team chose four of them (one per system), creating four different scenarios. For each system, a case was posted and teachers were asked to come to a solution for it. After about a month interacting with and through the system, teachers gave their feedback by: i) interacting through the system in order to solve the case; ii) answering an evaluation questionnaire, pointing out resources they liked, disliked, missed etc.; and iii) participating in a semi-structured interview with the research team. The main goal in each scenario, however, was not to solve the case itself but to evaluate how useful each system could be in supporting online construction of a case solution in teachers' real practices.

Second, for each system, the research team inserted a new column in the VCT and described the way each value was perceived and understood in the system (see Table 2). Interface resources, functionalities, constraints, quality attributes etc., are all candidates to impact on some values. After completing the VCT, the research team discussed each value considering the four different systems, and highlighted aspects that could inspire the design of the social network for teachers taking into account, for instance, the "6.1 Accessibility" value in Table 2.

Third, the research team mapped the teachers' explicit feedback into values in the VCT, identifying the values teachers most approved in each system, the ones they found important and even the ones they missed. This exercise contributed to a better view about the way teachers understood values through each system, giving indications to what they would need, expect, prefer and value in a social network for supporting their professional activities.

Finally, teachers' feedbacks were confronted with the research team's discussions allowing to identify the way different applications were supporting Project's key-values (e.g., accessibility, autonomy) and to justify what values (and the ways of supporting them) should be in a social network for the teachers. It also clarified and contributed with qualitative arguments to the problem domain.

Table 2. The VCT filled by Designers

AREAS (PMS)	VALUES	APPLICATIONS			
		(A) Yahoo! Answers	**(B) ACBP-Sakai**	**(C) LeMill**	**(D) Vila na Rede**
(...)	(...)	(...)	(...)	(...)	(...)
2. Association	2.1 Conversation	Users can post just one answer per question in a scheme similar to a forum. Users can send email and instant messages if allowed in their privacy settings.	There is a chat for supporting conversation in groups; an area for collaborative editing and the possibility of leaving comments when a specific kind of information is inserted in the system. The artifacts are used in a collaborative way.	The conversation takes place only through asynchronous messages. There are comments in objects and forums in communities.	Users can communicate through different tools such as chat, comments and posts. It is possible to use media (pictures, videos, audio) with synchronous as well as asynchronous communication.
(...)	(...)	(...)	(...)	(...)	(...)
6. Exploration (...)	6.1 Accessibility	No explicit feature to support this value was identified.	No explicit feature to support this value was identified.	No explicit feature to support this value was identified.	The system offers transversal media resources, simplified terminology and labels, an accessibility bar, a virtual presenter that reads the content and a meta-communication feature.
	6.2 Object	Interactions are centred on Questions and answers.	A problem to be collaboratively clarified and discussed.	Learning objects: pictures, exercises, web pages, videos, etc.	Announcements that may include video, sound and pictures.
	(...)	(...)	(...)	(...)	(...)

4.1 Discussion

All the four systems contributed with useful examples regarding the way values could be supported. However, the activity with representatives from the target audience demonstrated that no existing system we know would be satisfactorily suitable to the context of our Project. For instance, regarding the values of autonomy, collaboration and sharing involved in the conversation around the cases discussed by teachers, the VCT made it possible to identify that:

In application (A), the question-answer scheme was not approved because it did not favor the discussion and exchange of ideas in an interactive way. Using teachers' words: "*I missed a discussion with the group; each one posted the activities individually; the system should offer additional tools for providing more interactivity*"; and "*When I answered a question I could not answer again (...); I could only answer once, and I was not able to reply the answer of other colleagues or to continue the discussion*". In application (B), teachers considered useful the possibility to discuss the case through collaborative resources. They also had more facility in structuring their discussions in order to propose a solution to the case. However, they missed information about who is saying what in collaborative discussions and did not approve the possibility of modifying contents created by other users. For instance: "*I loved the mini-chat for information exchange, because it was an opportunity to systematize knowledge. Positive aspects: everyone has voice and turn; knowledge is collaboratively built.*" On the other side, "*I believe only the author could modify his own content; I found it interesting the discussion space, but it has to preserve the individual contribution*".

In application (C), although teachers considered it the simplest and easiest to use, after a month using the system they had not proposed a solution to the case yet. While teachers mentioned that rigid structure like in application (A) does not favor interactions, they concluded that a forum is not enough to support their work because it does not guide them towards a solution proposal. The following quotes demonstrate it: "*the system is easy to use, simple and allows us to create new discussions*" and "*just a forum is not enough to support a case discussion. I missed other tools that can better guide us (...)*".

Finally, the application (D) was considered the most accessible one and teachers found it useful the possibility of using different media (pictures, videos, and audio) into their discussions. However, by the same reasons reported for application (C), they had not reached a solution to the case after using it: "*All that accessibility icons are very interesting*"; "*I should mention that, in terms of accessibility the Vila [na Rede] was excellent*", and "*there were attempts to formalize the discussions but in a forum it is very difficult (...); we spent too much time discussing the case*".

Grounded on teachers' explicit feedback and on the research team analysis, the comparison of the way each application promotes/inhibits values contributes to determine what kind of interface and interaction resources the social network should provide in order to promote or inhibit the right values in the proper way. Table 3 provides an overview on the VCT filled for the four applications. In this table, a colored cell indicates that the value "X" was identified in application "Y" while a blank cell indicates it was not perceived any aspect related to that value. All values identified in applications are related to some characteristic of their

design (from their features to their quality attributes). The letter "R" in a cell indicates that the value was considered a [R]elevant example for the project by the research team, while the letter "A" indicates that, besides relevant, the value was explicitly [A]pproved by teachers when they evaluated the application.

Table 3. The VCT overview

AREAS (PMS)	VALUES	APPLICATIONS			
		A	B	C	D
1. Interaction	1.1 Identity			RA	RA
	1.2 Norms	R		R	RA
2. Association	2.1 Conversation		RA		RA
	2.2 Groups				
	2.3 Relationship			RA	RA
	2.4 Trust			RA	RA
3. Learning	3.1 Meta-communication				R
4. Play	4.1 Aesthetics			RA	R
	4.2 Emotion and Affection				R
5. Protection	5.1 Informed consent	R			R
	5.2 Reputation				
	5.3 Security	R	RA		
6. Exploitation	6.1 Accessibility				RA
	6.2 Object		RA		RA
	6.3 Property (ownership)	R			RA
	6.4 Usability[1]			RA	RA
7. Temporality	7.1 Availability				
	7.2 Awareness	R			R
	7.3 Presence				RA
8. Territoriality	8.1 Portability[2]	-	-	-	R
	8.2 Privacy		RA		RA
	8.3 Scalability	R		R	
	8.4 Visibility				R
9. Subsistence	9.1 Autonomy				R
	9.2 Collaboration		RA		R
	9.3 Reciprocity			RA	RA
	9.4 Sharing		RA	RA	RA
10. Classification	10.1 Adaptability				R

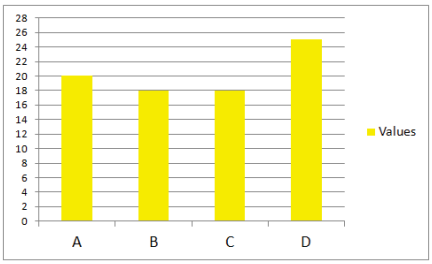

Figure 1. Number of Values identified in each system

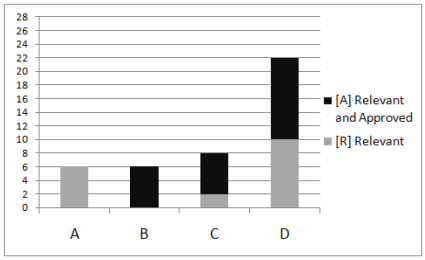

Figure 2. Relevant and approved examples on values

[1]Usability was identified only by teachers' feedbacks in informal discussions. Usability inspections were not conducted in this stage. [2]Portability was tested in no system but *Vila na Rede*.

Looking at Table 3's columns, it is possible to see that the application "D" (*Vila na Rede*) was the system with the greatest amount of values identified during the analysis (25 from 28) — see the graph in Figure 1. Application "A" had 20 values identified while Applications "B" and "C" had 18 each one. It allows us to say that application "D" is the one that have the most values in the context of social software being manifested in some way. Another interesting point is that the application "B" (*ACBP-Sakai*) is a Learning Management System that supports a problem-based collaborative learning (ACBP) by means of a module called PAM (Problem Articulation Method). This module implements some artifacts from Organizational Semiotics (Liu, 2000) that support the analysis and clarification of problems, and was the resource teachers used to discuss their cases. No forum, blog, wiki or other resources offered by Sakai, but user registration and authentication, were used. However, even considering only the ACBP module, it had as values as application "C" (*LeMill*), which is intended to be a social network for teachers creating and sharing learning objects.

Additionally, the application "D" also had the most relevant and approved values — see the graph in Figure 2. From the 22 useful examples the application provided to the research team, 12 were also explicitly approved by teachers through their evaluations and feedbacks. The application "C" had 8 values as examples for the research team, from which 6 were explicitly approved by teachers. The applications "A" and "B" had 6 relevant values each; the main difference, however, is that the application "A" (*Yahoo! Answers*) had no values positively mentioned by teachers, while all the values the research team found it interesting in application "B" were also explicitly approved by teachers. Table 3 also makes it possible to highlight many other interesting points. For instance, Accessibility and Autonomy are important values to our project, but only application "D" offers some support to them. Usually, "Group" is an important feature in social software, but the case study results suggest that no explicit feature have to exist in the social network for teachers. For them, the group is not a thing created by someone's wish, but it emerges from their interactions

around cases and their experiences. In this sense, a group will be naturally formed during an interaction in which there are two or more teachers and it will last indefinitely, changing with the course of interactions and assuming new dimensions. Furthermore, as important as understanding the way applications are promoting/inhibiting values is discussing the values they did not pay attention to (the blank cells). Values have interactive nature, in a way that ignoring key values might promote or inhibit undesired ones.

5. FINAL CONSIDERATIONS

Designing technologies that understand and respect human values is an ethical responsibility, a need and a challenge for all those who are direct or indirectly involved with design. This paper brought to discussion the subject focusing on the context of web applications, mainly the social software. As contribution, it presents the Value Comparison Table as an artifact to support designers in value-oriented analysis of web applications. The artifact was illustrated with a case study in which it was used to map the values manifested in four different web applications. This case study is situated in the context of a project that aims at developing a social network for teachers of the special education area; researchers from Education and from Computer Science and representatives from the target audience were involved in the activities. The observations and discussions presented in this paper reflect aspects of teachers' culture, including their values, preferences and behavioral patterns that would be hardly identified if no representatives from the target audience were involved.

The case study showed the artifact represents a promising tool to support designers in analyzing and understanding values in web applications, although further exposition of other professional designers in other contexts to the artifact is still needed. It also favored comparison among different applications regarding the values they promote, allowing the identification of examples that can inspire designers in other projects.

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ANEXO 6 – Keeping Values in Mind: Artifacts for a Value-Oriented and Culturally Informed Design[24]

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Keeping Values in Mind
Artifacts for a Value-Oriented and Culturally Informed Design

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Keywords: Design, Organizational Semiotics, VIF, CARF.

Abstract: Identifying, understanding and explicitly involving values and cultural aspects of stakeholders have been regarded as a challenge in the design of interactive systems. There is still a lack of principled and light-weight artifacts, methods and tools for supporting designers in this task. In this paper we propose two artifacts for supporting designers in making explicit both stakeholders' values and system's requirements taking these values into account. A case study reports the use of the artifacts in the design of seven prototypes of applications for the Brazilian Interactive Digital Television. The artifacts showed to be promising for supporting designers in the complex scenario of designing value-oriented and culturally aware interactive systems.

1 INTRODUCTION

Interactive systems are a growing reality worldwide. People use them for different purposes, in quite different and complex contexts, and with unforeseen and far-reaching consequences. They are a clear example of how technology has left the boundaries of offices and workplaces to pervade every aspect of people's personal and social life. As Sellen et al. (2009) highlight, as far as people are not just using technology but living with it, values become a critical issue and must be explicitly involved in the design of interactive systems.

As design is an activity no longer confined to specific contexts, several authors, such as Bannon (2011) and Cockton (2005), have claimed a rethinking of the way interactive systems are designed. For them, it is necessary to focus on the intention of design as a means to improve the world by reimagining, acting, and delivering new sources of value. Winograd (1997) had already asserted that the design role "goes beyond the construction of an interface to encompass all the interspace in which people live", requiring a shift from seeing the machinery to seeing the lives of the people using it. According to the author, there is a complex interplay among technology, individual psychology and social communication, in a way it demands attention to relevant factors that become hard to quantify and even identify.

Knobel and Bowker (2011) point out that conversations and analysis of values in technology usually occur after design and launch. Consequently, most users are faced with design decisions that are undecipherable to them, that do not reflect a respect and understanding to their way of life, their behavioral patterns and values. For the authors, the issue of values often arises in information technologies as disaster needing management.

Designers necessarily communicate values through the technology they produce (Friedman, 1996). In the context of interactive systems, depending on the way the system is designed it will afford behaviors that are intrinsically related to individuals and the complex context in which they are using it (Pereira et al., 2011). Individuals will interpret and behave over/through the system influenced by their cultural systems (e.g., values, beliefs, behavior patterns). In this sense, as Friedman (1996) highlights, although the negligence to values in any organization is disturbing, it is particularly damaging in the design of computer technology, because, unlike the situation where people can disagree and negotiate with each other about values and their meanings, they can hardly do the same with technology. Therefore, understanding the role of human values in technology design is a key factor to the development of technologies that make sense to people and do not produce side effects that harm them.

Miller et al. (2007) and Sellen et al. (2009) point out values as the critical issue when designing technologies for the digital age. Some authors have explicitly addressed issues on values in technology design. Cockton (2005) proposes a framework to support a Value-Centred Design, suggesting activities and artifacts to support designers in an understanding of technology design as a process of delivering value. Adopting a different perspective, Friedman (1996) has been working on an approach she named Value-Sensitive Design, to support concerns regarding values, especially the ethical ones, in the design of software systems.

Other authors have investigated the influences and impacts of cultural factors in technology design (Del Gado and Nielsen, 1996; Marcus, 2001) and other have argued for studies, methods, artifacts and examples for supporting designers to deal with the complexity and different requirements that current technologies demand (Harrison et al., 2007; Miller et al., 2007). Although the previously cited works have shed light on this subject, there is a gap between discussions about values in technology design and practical solutions for supporting designers in this task. Additionally, despite the acceptance of the cultural nature of values, values and culture are frequently approached as independent issues in technology design. To our knowledge, no informed approach or method is explicitly concerned with supporting the understanding and involvement of both values and their cultural nature in the design of interactive systems.

In this work, we draw on Organizational Semiotics (SO) theory (Liu, 2000) and the Building Blocks of Culture (Hall, 1959) to create two artifacts for supporting designers in a value-oriented and culturally aware design of interactive systems. The first artifact, named *Value Identification Frame* (VIF), supports designers to reason about and list the values related to the different stakeholders that may be direct or indirectly interested and/or affected by the system being designed. The second one, named *Culturally Aware Requirements Framework* (CARF), organizes the identification of requirements related to cultural aspects that may impact on stakeholders' values. The artifacts were conceived to facilitate their use by professionals that are not familiar with social sciences, and were experienced by 34 prospective designers in the context of seven different projects of social applications for the Brazilian Interactive Digital Television (iDTV). In this paper we present the artifacts, the theories underlying them, and discuss the results obtained from their usage in the practical context.

2 THEORETICAL AND METHODOLOGICAL FOUNDATION

Friedman et al. (2006) understand values as something that is important to a person or group of people, and Schwartz (2005) as desirable, trans-situational goals that vary in importance and that serve as principles that guide people's lives. For Schwartz, values are motivational constructs that transcend specific situations and actions, serving as standards or criteria to guide the selection of actions, policies, people and events.

Values are bound to culture (Hall, 1959; Schwartz, 2005) in so subtle ways that people realize they exist usually when rules that impact on them are broken or violated. In many different ways, culture influences on what people pay attention to and what they ignore, what they value and what they do not, the way they behave and the way they interpret other's behavior. The natural act of thinking is strongly modified by culture (Hall, 1977). In this sense, if we are to approach values in interactive systems design, we must pay attention to their cultural nature and complexity.

When talking about culture, Hall (1977) believes it is more important to look at the way things are put together than at theories. Hall (1959) introduces the notions of informal, formal and technical levels in which humans operate and understand the world, and approaches culture as a form of communication giving emphasis to the nonverbal. In the OS theory (Liu, 2000), the informal, formal and technical levels are structured in a scheme named "Semiotic Onion" that represents the idea that any technical artifact is embedded in a formal system, which in turn, exists in the context of an informal one. The OS considers an organization and its information system as a social system in which human behaviors are organized by a system of norms. For Stamper et al. (2000), these norms govern how members, think, behave, make judgments and perceive the world, being directly influenced by culture and values.

Aiming to formalize and structure the characterization, analysis and comparison between different cultures, Hall (1959) proposes 10 Primary Messages Systems (PMS), or areas, named the basic building blocks of culture — see Table 1. According to the author, all cultures develop values with regard to the 10 areas. For instance, values in "Defense" are related to the rules, strategies and mechanisms developed in order to protect the space (physical,

personal), the objects used to guarantee protection, the kind of medical therapy adopted/preferred, etc.

Table 1: Hall's (1959) building blocks of culture.

PMS	DESCRIPTION
Interaction	Everything people do involves interaction with something/someone else: people, systems, objects, animals, etc. The interaction is at the centre of the universe of culture and everything grows from it.
Association	All living things organize their life in some pattern of association. This area refers to the different ways that society and its components are organized and structured. Governmental and social structures may vary strongly according to the culture.
Learning	Learning is one of the basic activities present since the beginning of life. Education and educational systems are strongly tied to emotion and as characteristic of a culture as its language.
Play	Funny and pleasure are terms related to this area. Although its role in the evolution of species is not well understood yet, "Play" is clearly linked to the other areas: in learning it is considered a catalyst; in relationships a desirable characteristic, etc.
Defense	Defense is a specialized activity of vital importance. People must defend themselves not only against hostile forces in nature, but also against those within human society and internal forces. Cultures have different mechanisms and strategies of protection.
Exploitation	It is related to the use of materials in order to explore the world. Materials in an environment are strongly related to the other aspects of a culture. It is impossible to think about a culture with no language and no materials.
Temporality	Time is related to life in several ways: from cycles, periods and rhythms (e.g., breath rate, heartbeat) to measures (e.g., hours, days) and other aspects in society (e.g., division according to age groups, mealtime). The way people deal with time and the role of time in society varies across cultures.
Territoriality	It refers to the possession, use and defence of space. Having a territory is essential to life; the lack of a territory is one of the most precarious conditions of life. There are physical (e.g., country, house) as well as social (e.g., social position, hierarchy) and personal spaces (e.g., personal data, office desk).
Bisexuality	It is related to the differences in terms of form and function related to gender. Cultures have different forms of distinction and classification and give different importance to each one.
Subsistence	This area includes from people's food habits to the economy of a country. Professions, supply chains, deals, natural resources, are all aspects developed in this area and that vary strongly according to the culture, being influenced not only by the other areas but also by geographical and climatic conditions.

Values may also be developed in the intersection of different areas and one may approach them in terms of the informal, formal and technical levels. For instance, "Privacy" may be understood as a value developed in the intersection of "Protection" and "Territoriality" areas. People from different cultures tend to have their own informal understanding of what privacy is and what it means. There are social protocols, conventions, rules and laws that are formally established to define the meaning, limits and guarantees of an individual's privacy and that varies according to the culture being analyzed. There are also some facets of privacy that are so formally accepted that can be technically supported, such as a curtain to cover a window, the wall for restricting the visibility of a house and the privacy of medical examinations.

In the context of interactive systems, the way the value of "Privacy" (or the lack of it) has being handled and supported by applications, mainly the so-called Social Software, has been the cause of several problems widely reported in the Web. Winter (2010) draws attention to how *Facebook*® has become a worldwide photo identification database and highlights that privacy issues go from what the application does with users' data to what it allows other applications to do. In the complex scenario of designing interactive systems for wide audiences, designers have to show an understanding of the different ways people value and manage their privacy, and also to comply with the laws established in the social environment these people live. Otherwise, the produced system may trigger undesired side-effects both in the environment it is introduced and on the people living in it.

The OS theory (Liu, 2000) provides methods (e.g., Problem Articulation Method, Norm Analysis Method) and artifacts (e.g., Semiotic Ladder, Ontology Charts) that support designers in considering the social world and its complexity from the articulation of problems stage to the modeling of computer systems. The Stakeholders Identification Diagram (SID) is an artifact from OS — see Figure 1, that supports the identification of all the stakeholders direct or indirectly affected by the system being designed. The artifact distributes stakeholders into different categories: from the actors directly involved in the project to the people who may not use the system but may be affected by it. The SID considers that each group of stakeholder brings different perspectives to the innovation being designed, having its own cultural system that governs the way it will see, understand, value and react to the proposed innovation (Kolkman, 1993).

Understanding the way different stakeholders would value and react to an innovation requires designers to see the world through the lenses of these different stakeholders. The Valuation Framing (VF) is another artifact from OS (Liu, 2000) that helps in carrying out this kind of analysis by favoring the analysis of the cultural dimensions of a product — see Figure 2.

The VF is built on Hall's (1959) areas of culture with a few adjustments. For instance, "Defense" was renamed to "Protection" and "Bisexuality" to "Classification" (Kolkman, 1993) in order to encompass, beyond the notion of gender, issues of age, instructional, social and economical levels. In the artifact, the analyst's work consists of questioning, predicting and hypothesizing how the innovation may affect/is affecting the different groups of stakeholders regarding the 10 areas.

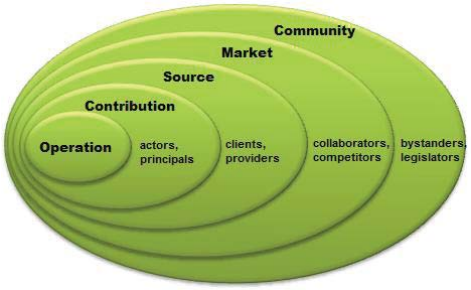

Figure 1: SID artifact. Adapted from (Kolkman, 1993).

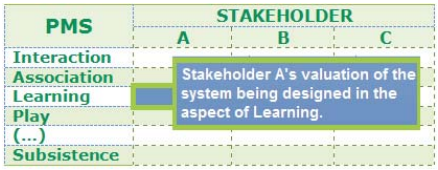

Figure 2: Valuation Framing. Adapted from (Liu, 2000).

3 TWO NEW ARTIFACTS

As Sellen et al. (2009) suggest, the curricula in Computer Science do not traditionally direct much effort in enabling its students to cope with social issues. It stresses as important the work with multidisciplinary teams that can contribute with different visions to a project. Multidisciplinary teams, however, are not always possible or viable due to project's scope, restrictions and limitations. Consequently, as Miller et al. (2007) highlight, if designers working in industrial settings are to account for values, we have to provide them light-weight and principled methods to do so.

We have used artifacts from OS and techniques inspired on Participatory Design (Schuler and Namioka, 1993) to support design activities in different contexts (Pereira and Baranauskas, 2011). However, dealing with values is not a trivial activity, and designers need practical artifacts to help them to think of values in an explicit way and to identify the project's requirements related to these values. Following, we present the VIF and CARF artifacts, both created on the grounds of OS theory (Liu, 2000) and Hall's (1959) building blocks of culture — the artifacts' templates can be downloaded at *www.nied.unicamp.br/ecoweb/products/artifacts*.

The **VIF artifact** was created to support the identification of the values related to the different stakeholders that may be direct or indirectly interested and/or affected by the system being designed — see Figure 3. Its input is the list of stakeholders identified through the SID artifact; and its output is a list of the values each different stakeholder brings to the project.

Project	Social TV
Values	Accessibility, Adaptability, Aesthetics, Autonomy, Availability, Awareness, Collaboration, Conversation, Emotion and Affection, Groups, Identity, Informed consent, Meta-communication, Norms, Object, Portability, Presence, Privacy, Property (ownership), Reciprocity, Relationship, Reputation, Scalability, Security, Sharing, Trust, Usability, Visibility
CONTRIBUTION	
Stakeholder	**Values**
Developers / maintainers	Accessibility; Adaptability; Aesthetics; Sharing; Availability; Meta-communication; Scalability; Norms; Portability; Security; Usability.
SOURCE	
Stakeholder	**Values**
User	Relationship; Privacy; Emotion and Affection; Conversation; Usability; Security; Accessibility; Adaptability; Usability; Reputation.
MARKET	
Stakeholder	**Values**
Advertisers and Sponsors	Visibility; Reputation; Scalability; Aesthetics; Availability; Security; Collaboration; Awareness; Sharing; Groups; Portability; Norms
Broadcasters	Visibility; Norms; Property; Reputation; Availability; Scalability.
COMMUNITY	
Stakeholder	**Values**
Viewer	Aesthetics; Usability

Figure 3: Value Identification Frame.

The basic principles of the artifact are: each stakeholder has a set of values that may cause/suffer impact with the introduction of the innovation being designed. The analyst's work is to map what values each stakeholder brings to the project and have to be considered in the design.

The artifact is inspired on the SID — illustrated by Figure 1. Its header has a space in which designers can put the name of the project — corresponding to the SID's core layer, and a list of values to serve as a start point for the activity. The VIF has also four blocks related to the other layers of SID: "Contribution", "Source", "Market" and "Community". Each block has two columns: in the first one, designers put the stakeholders identified in the respective layer; in the second one, they indicate what values the stakeholder is bringing to the project

and must be taken into account. Because the SID induces designers to think of all the stakeholders direct/indirectly involved in the system being designed, by preserving its structure, the VIF leads designers to think of the values of all the different stakeholders making them explicit.

The **CARF artifact** was created to support the identification and organization of requirements that are related to cultural aspects of the different stakeholders and their values — see Figure 4. Its inputs are: the 10 areas of culture; the stakeholders identified through the SID; and the values mapped for each stakeholder through the VIF. The output is a ranked list of requirements that are related to the stakeholders and their values.

PMS	P	REQUIREMENTS	STAKEHOLDERS			
			Social Network Participants	TV Shows	Adverti-sers	Users
(...)		(...)	X	X		X
Protection	2	It must be possible for users to configure the visibility of their personal data (e.g., it will be visible to other users and/or non-users)				
	2	The application's terms of use should be clear and understandable, and should ensure the data security and confidentiality.	X			X
Exploitation	3	The application must require only a standard remote control for any kind of data entry.				X
	1	The application should support an USB keyboard as an alternative input.				X
Temporality		For each TV channel, it must have a 24 hours channel available for comments of moderators and subscribers.	X	X		X
	3	Users may access the community topics of a program at any time, even when it is over.	X	X		X
	3	Chatting with other users included on users' friend list must be fulltime available	X			X
	2	Ads will appear for a specific period of time through banners displayed concurrently with the channel program.	X	X	X	X
(...)		(...)				

Figure 4: Culturally Aware Requirements Framework.

The basic principles of the artifact are: values are culturally developed according to the Hall's 10 areas of culture. Depending on the way the innovation is designed it will impact on different aspects of these areas, promoting/inhibiting the values of different stakeholders. The analyst's work consists of: i) identifying requirements for the project according to the 10 areas in order to respect the values of the stakeholders, ii) defining priorities among these requirements and iii) dealing with possible conflicts.

The artifact is inspired on the VF — illustrated by Figure 2. The column "PMS" presents the Hall's 10 areas; the column "P" indicates the priority of each requirement specified ("3"–High, "2"–Average; "1"–Low); the column "Requirements" describes the requirements related to each area of culture that may impact on stakeholders' values; and the column "Stakeholder" indicates the stakeholders whose values may be positively/negatively affected by the requirement.

In practical terms, the stakeholders identified through the SID are inserted into the artifact, and designers have to reason, make questions and try to identify, in each area, the requirements that are related to the values of these stakeholders. Finally, they mark an "X" in the column of each stakeholder that may be affected by the requirement and assign a priority to the requirement (from 1 to 3).

4 THE CASE STUDY

In 2003, the Brazilian government instituted the iDTV intending to promote: i) the formation of a national network for distance learning; ii) the access of people to knowledge by reducing economic, geographical and social barriers; iii) the research and development; and iv) the national industry (Brasil, 2003). In this context, values of different stakeholders may suffer and cause influence on the applications, the way they are used, and the impact they may trigger on the society. The government, private organizations, the media etc., have different interests and perspectives regarding the introduction of iDTV in the country. The contents broadcasted, the interaction possibilities, the applications' interface, and even the devices needed for receiving the digital signal and interacting with the iDTV, communicate some of those interests. Brazil is the fifth largest country in territory and population, having a very heterogeneous population in terms of ethnicity, social and economical conditions, and the analogical television is present in more than 97% of Brazilian homes (IBGE, 2010). Consequently, it becomes critical to think of values and culture when designing applications for the iDTV in order to not deliver applications that trigger undesired side-effects on the society. In this section we present a practical activity in which the VIF and CARF were used in the design of applications for the iDTV.

The case study was conducted in a Computer Science undergraduate discipline for "Construction of Human-Computer Interfaces", in which the Problem Articulation Method from OS (Liu, 2000) was used as an approach for the design of information systems. A total of 34 participants were divided into 7 groups: G1 (formed by the prospective designers: D1, D2, D3, D4 and D5), G2 (D6..D10), G3 (D11..D14), G4 (D15..D19), G5 (D20..D24), G6 (D25..D29) and G7 (D30..D34). The theme proposed to the participants was "social applications for the iDTV". The course took place from August to December, 2011, and by its end each group had to present a functional prototype of its project and socialize the final results with the other groups.

From the 7 projects: G1 and G5 are applications intended to promote sustainable behavior on their

users. G2 is an application to support social interaction on football matches programs. G3 and G4 are related to social networks for the iDTV. G6 is an application to support online chat and G7 is related to interactive online courses through the iDTV — see Figure 5 for some examples. After the course was finished, the groups were asked to voluntarily answer an online questionnaire in order to evaluate the activity and it was requested their permission for using all the material they produced in the course, including their answers to the questionnaire. Another group of 4 participants (G8) opted for not answering the questionnaire and is not being included in this analysis.

The activity was divided into two parts. In the first part, the groups used the VIF to make it explicit the values each stakeholder was bringing to the project. In the second part, the groups used the CARF to identify what requirements they should pay attention to in order to develop systems that make sense to users and do not cause negative effects on them. When the activity started, each group had defined the focus of its project, had identified the stakeholders using the SID, and discussed the possible problems, solutions and ideas related to each stakeholder using the Evaluation Frame (EF) (Baranauskas et al., 2005)— another artifact inspired on OS, which organizes the stakeholders according to the SID's structure and invites designers to reason about the problems and solutions related to each one.

The main steps when using the VIF artifact were: 1. Participants selected the most representative stakeholders identified through the SID and inserted them into the VIF's corresponding block. 2. For each stakeholder, participants discussed what values it would bring to the project; what would be important to it and how the system being designed would (should) impact on its values. In order to give participants a starting point, it was suggested 28 values in the context of systems for promoting social interaction (Pereira et al., 2010). As a result, each group had a map showing the different stakeholders and their values — Figure 3 illustrates the VIF filled by G3, translations were made by the authors.

The main steps when using the CARF artifact were: 1. Participants selected at least one stakeholder from each SID' layer, inserting them as a new column into the CARF's "Stakeholder" section. 2. For each area (PMS), they should identify requirements (resources, norms, quality attributes, functionalities, etc.) that should be considered in the system in order to support the stakeholders' values. 3. Participants should mark an "X" in the column of each stakeholder whose values would be promoted/ inhibited by the requirement. 4. After filling the artifact, participants should rank the requirements according to their importance to the project.

As a result, each group had a list of requirements related to cultural aspects and values of its stakeholders, a map of the possible impact of these requirements on different stakeholders and an indication of priority for each requirement — Figure 4 illustrates the CARF filled by G7, translations were made by the authors.

As background material for supporting the activity each group was supplied with: i) guidelines explaining the activity's steps; ii) the VIF and CARF artifacts both in press and digital format; iii) a table containing the list of 28 values in the context of social applications (Pereira et al., 2010); iv) a simplified explanation of each area of culture — as in Table 1; and v) at least 3 questions related to each area the groups should think about — see Table 2. The letters into the brackets in Table 2 indicate the stakeholders directly related to each question: [D] Designer, [G] Government, [S] TV Station, [T]

Figure 5: Prototypes from G1, G5 and G6.

Transmission Industry, [U] User.

The material produced in this activity was used to support groups in the forthcoming steps of their projects. 1. With the list of values and requirements at hands, each group produced the first version of its system's prototype — an adapted version of the Brain Drawing technique (Schuler and Namioka, 1993) was conducted and the iDTV design patterns from Kunert (2009) were followed. 2. The *Balsamiq*® tool was used to draw the users' interfaces and the *CogTool*® was used to create the interactive prototypes.

Table 2: Questions in each area for the iDTV context.

PMS	DESCRIPTION
Interaction	What interaction possibilities will the application offer? [D]; What kinds of actions can users perform? With what\who? Why? Through which devices? [U, T]; How do people interact with the analogical TV? What will be changed? [G, S, T, U]
Association	Is the application usage individual or collective? [U]; Is there any dependence on other organizations/ entities (e.g., data supply)? [S]; May it cause impact on any aspect of collective life? [G, U]; Is it associated with television content? [S]
Learning	Is it required any prior knowledge for learning how to use the application? What is the cognitive effort for learning it? What kind of learning it can provide? [U]; It is required training, new abilities or tools for developing the application? Which ones? [D]
Play	What kind of emotions the application may/should evoke /avoid (e.g., fun, challenge, warning)? Why? [D, G, S, U]; How the application has to be designed to promote/inhibit these emotions? [D]; What are the possible impacts on users? [U]
Defense	Can the application compromise users' safety? [U]; What are its policy and terms of use? [D, G, S, U]; Is there any rights, patent or property? [G, S, T]
Exploitation	What are the physical devices required to interact with/through the application? [D, T]; Is it required any other material or modification in the environment (e.g., sound, media)? [D, U]; Will the introduction of new devices generate the disposal of old ones? Is there any way to reuse? [D, G, S, U]
Temporality	Is there a formal period for interacting (morning, lunch)? [D, G, T]; What is the expected frequency of use (daily, monthly)? [U]; What about the interaction duration? Is it brief, medium or long? [D]
Territoriality	In which space the application will be used? [U]; Are there specific requirements for the interaction space (size, lighting, sound)? What kind of impact may be generated? [D, U]; Is the usage individual or collaborative? [D, S]
Bisexuality	Are the technologies necessary to develop the application open source? [D]; Is its final cost (including the physical devices) viable/accessible for the different socio-economic conditions of users? [U, G, S]; May it cause negative impact on economic issues? How? [U]
Subsistence	What is the target audience? [U]; Is it required minimum age to participate? [A, G, U, S]; Is it required information redundancy (the same information in different formats)? [D, G, S, U]

5 RESULTS AND DISCUSSION

Based on the material produced in the case study, including the final prototypes created by the groups, it was possible to identify the VIF and CARF as promising artifacts for supporting designers in a value-oriented and culturally aware design. Both the artifacts met the needs that led to their conception: i) thinking of values in an explicit way and ii) identifying the requirements related to these values.

As an illustration, Figure 6 shows the prototype produced by G3 regarding a social application for the iDTV. Through the VIF, the group made explicit the values of the stakeholders involved in the project. For instance, the group pointed out "Privacy", "Accessibility", and "Relationship" as values of the stakeholder "users". Through the CARF, the group discussed about the project according to each area of culture, and specified requirements that should be considered in order to account for the values.

For promoting the value of "Privacy", in CARF's "Protection" area, the group specified that: 1. "*Users have to agree explicitly for letting their profile publicly visible*". 2. "*The application must be included in the 'Parent's Control' functionality, protected by a password*". 3. "*The application must allow users to turn on/off the 'History recording' feature*". The detail (1) in Figure 6 represents the configuration feature that allows users to choose: i) whether their activity history will be recorded; ii) whether other users are allowed to see their updates; and iii) whether they want to receive recommendations from other users.

For promoting the value of "Accessibility", in CARF's "Exploitation" area, participants specified that the application must have: 1. "*The possibility of changing the size of interface elements and the color contrast*". 2. "*Subtitles for spoken communication*". 3. "*A help section and additional information about the features*". The detail (2) in Figure 6 indicates the possibility of changing the size of the interface

elements and the detail (4) indicates a "Help" feature — it is related to the "Learning" area. Understanding the "Exploitation" and "Learning" areas of culture is key to design an accessible solution in the proposed scenario because, as Neris et al. (2007) argue, designers need to know users in their abilities, preferences, and motor and cognitive limitations, formalizing the interaction requirements and investigating solutions of interaction and interface for the diversity. This is very different from developing applications for the "average user" that would not capture the reality of a plural context such as the Brazilian one.

Figure 6: Prototype designed by G3.

For promoting the value of "Relationship", in CARF's "Association" and "Interaction" areas the participants specified that: 1. "*It must be possible for users to interact with each other through chat and messages*". 2. "*The application should recommend 'friends' to users according to the information of their profile*". 3. "*It must be possible for users creating their lists of friends, family members, other groups, etc.*". The detail (3) in Figure 6 indicates the feature for managing "friends". Furthermore, we can point out another example: through the VIF, the G3 identified the value of "visibility" for the stakeholder "Sponsorship". In CARF's area of "Subsistence", G3 adopted the strategy of providing ads services for funding the maintenance costs: "*The profit will be generated through ads from sponsors and the TV programs*". The detail (5) in Figure 6 indicates a banner where ads are displayed.

Values of other stakeholders and their related requirements were also considered by G3. For instance, "Reputation" is a value of the stakeholder "TV Station" and is related to the area of "Classification". The group specified requirements and designed a feature in which users can rate programs, add them to their favorite list, and share the list with their friends. The same was identified on the projects of other groups. For instance, before using the artifact, G1 (designing a game for sustainable behavior) was not paying attention to the value of "Identity" of its stakeholder "user". When discussing the area of "Classification", participants perceived that their initial ideas would lead to a biased design in which users would have to use the avatar of a little boy — no possible changes were possible. After filling the artifacts, they designed a feature where users could choose between a little boy and a girl avatar, accounting for the differences of gender and preferences when playing.

According to the answers in the evaluation questionnaire, identifying the values of the stakeholders involved in the application being designed led the groups "*to evaluate the impact of the project on each stakeholder and, then, to adapt the project according to the stakeholders' needs and values*" [G4]. Other group mentioned that thinking of values "*contributes to have a wider perception and understanding of the stakeholders involved in the project, their point of view, and the real purpose of the application we should develop to them*" [G5]. And also, that thinking of values *"is of critical importance because it helps us to see who may be affected by the project, and what values we should pay attention to in order not to cause negative side-effects on any stakeholder*" [G6].

Regarding the utility of VIF and CARF, groups were asked about their perceived utility and contribution to the project. Two groups answered that both artifacts contribute strongly and were determinant to the identification of the values (VIF) and the requirements related to stakeholders' values and culture (CARF). Four groups answered they contribute to the process, and a group answered they are indifferent (neutral). None answered the artifacts do not contribute or make the activity difficult — see Figure 7.

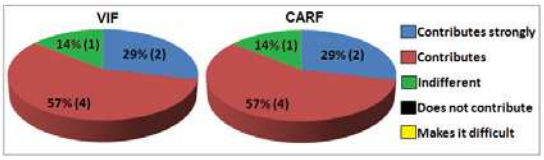

Figure 7: Contribution of the artifacts to the projects.

For G2, understanding culture and values is mandatory when designing applications for a wide and complex context like iDTV. For G3, this understanding favors "*the identification of important points during the design stage*" preventing re-work,

additional costs with modifications and even the project's failure. For G4, the artifacts "*contribute to structure and organize ideas*"; they "*support a better view and understanding of the project*", and they "*contribute to the development of the application taking into account the points that are truly important in the users' context*".

When asked about the positive aspects of both artifacts, G1 answered they "*provide a wide perception (what is needed and why), and a basis for reasoning about the project*". G2 cited the artifacts contribute to "*structure, organize and better understand the ideas for the project*". G4 pointed out that the artifacts are "*simple and easy to understand*" and that they "*direct the project toward the consideration of values*". And G6 answered that the artifacts contribute to "*manage and develop the project, respecting the values of each stakeholder and finding new requirements to the project*". On the other hand, when asked about the negative aspects, G4 asserted that the artifacts "*need additional information for supporting their usage*". G7 cited the high quantity of terms and aspects to be considered. And G2 suggested that the "*areas of culture in CARF could be more explained*" and that the artifacts have "*too many variables, making it difficult to keep the simplicity and to think of only a few stakeholders and their values*".

These aspects suggest that the artifacts must be as simple as possible in order to not overload designers with complex terms and unnecessary steps. However, as the authors we cited previously have argued, dealing with values and culture in technology design is a great challenge we are facing in the present. In part, it is due to the topic's inherent complexity, and that becomes even more difficult due to the lack of training and familiarity with social subjects students in technological areas have. Therefore, some initial difficulty in learning how to use the artifacts is expected.

Indeed, our main concern when creating the artifacts was to find a balance between making them self-explanatory and informative, while keeping them as simple and easy to use as possible. For instance, during the case study we identified that it would be useful to include a column named "Value" in the CARF in order to make explicit the relationship among the requirements, the areas of culture and the stakeholders' values. Additionally, the values included in the VIF artifact (see Figure 3) have been used in different contexts (Pereira and Baranauskas; Pereira et al., 2011) and seems to be a good starting point for the discussion on values in applications intended to promote social interaction. In the evaluation questionnaire, groups were asked whether the values contributed to the activity. Two groups (28%) answered they were indifferent, while 5 groups (72%) answered they contributed or contributed strongly to the activity.

For the CARF artifact, groups were asked whether the description of each area of culture, and the questions related to it, contributed to the clarification of requirements related to stakeholders' cultural aspects that could impact on their values. The 7 groups (100%) answered positively (the artifact contributed), and highlighted that the CARF "*is comprehensive, and the questions make it self-explanatory*" [G1]; "*give a direction in the requirements identification activity*" [G3], and "it is *a well-synthesized structure to support seeing and understanding culture during the development stage; they make you reason on all the aspects that can influence in the project development*" [G4].

Regarding all the artifacts used in the case study, the 7 groups (100%) answered they would use the artifacts to support their activities in other contexts, mainly when designing a new product to be used by a wide audience. The SID and CARF were cited by the 7 groups (100%); while 6 groups cited the VIF (86%) and 5 groups cited the EF (72%).

In sum, although further exposition of the artifacts to other students and professional designers in different contexts is still needed, the results obtained from the case study as well as the answers to the evaluation questionnaire indicate both VIF and CARF as promising artifacts for supporting designers in the complex scenario of designing value-oriented and culturally aware solutions.

6 CONCLUSION

Designing technologies that understand and respect human values is an ethical responsibility, a need and a challenge for all those who are direct or indirectly involved with design. However, although clearly recognized as important, there are few initiatives in literature relating culture and values to technology design. There is also a lack of approaches, methods and artifacts for supporting designers in dealing with values and cultural aspects in practical contexts. In this paper we shed light on this scenario proposing the VIF and CARF artifacts and suggesting other existing artifacts (e.g., SID, VF, EF) that may support designers in practical settings.

The artifacts were used by 34 prospective designers in a case study related to the design of applications for the Brazilian Interactive Digital Television. The results obtained from this case study

indicate the benefits of using the artifacts for supporting designers in keeping values in mind during the design activities and in identifying requirements related to the cultural aspects of stakeholders that may impact on their values. The case study also suggested some points that could be improved in the artifacts and that may be subject of further studies.

Finally, although the artifacts have shown interesting results, they alone are not enough to guarantee an effective consideration of values and culture in interactive systems design. Indeed, as the experiment presented in this paper has shown, other artifacts, methods and tools are needed in order to allow the articulation and involvement of values and other cultural aspects during the different stages of a system design. We are naming value-oriented and culturally informed approach (VCIA) such set of artifacts and methods we are investigating in ongoing and further research.

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ANEXO 7 – Considering Values and Cultural Aspects in the Evaluation of Interactive Systems Prototypes[25]

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Considering Values and Cultural Aspects in the Evaluation of Interactive Systems Prototypes

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***Abstract*—As interactive systems have left the context of offices and workplaces to pervade every aspect of people's personal and social lives, evaluating these systems is becoming an increasingly complex challenge. Issues that range from emotional and affective aspects, sociability, and human values, to scalability, security, and performance, are now in play. This situation is very different from all designers and researchers have experienced before. In this paper we focus on the evaluation of interactive systems in the context of the third HCI paradigm, proposing an artifact to support designers in a culturally informed and value-oriented evaluation. To situate our discussion in a practical context, we present a case study where the artifact was used to evaluate seven prototypes of social applications for the Brazilian Interactive Digital Television.**

Keywords- Organizational Semiotics, eValue, evaluation, iDTV.

I. INTRODUCTION

Interactive systems are a growing reality worldwide and people use them through different devices, for different purposes, in quite different contexts, and with unforeseen and far-reaching consequences. Every technology triggers changes and causes impacts in the environment it is introduced. We are surrounded by examples of impacts caused by technologies in our society: from access to knowledge to information overload; from privacy protection to security issues; from people's autonomy to social and digital exclusion, just to name a few.

Sellen *et al.* [1] argue that our relationship with technologies have been profoundly modified in the last years. For the authors, we are increasingly dependent on technology, in the sense that we rely on computers for practically everything in our lives. We are even more hyperconnected and pervaded by communication technologies and devices that put and keep us online everywhere, every time. Our footprints are not ephemeral anymore, in the sense that the lifetime of the information about our lives and actions has been permanently extended. In this new and complex context, even the terms "human", "computer" and "interaction" have assumed new dimensions, requiring a deeper understanding of what means to be human, what is the computer and how is the interaction in our digital age. In this sense, when designing people's interactions with computers and with others by using them, we have to consider users in de widest extension possible, the new forms of interactions that go beyond the task-oriented approach, and the context of use that transcend personal desktop computers.

Winograd [2] highlights that designing interactive systems goes beyond the construction (and evaluation) of an interface to encompass all the interspace in which people live. The author draws attention to the complex interplay among technology, individual psychology and social communication, requiring a shift from seeing the machinery to seeing the lives of the people using it. This shift, in turn, demands attention to relevant factors, such as the emotional and affective ones, and those related to the values and the culture of users, that become hard to quantify and even to identify.

In fact, the factors cited above were traditionally left on the margin of approaches to computer systems development, but now are being moved to the centre, characterizing what Harrison *et al.* [3] named the third paradigm in the Human-Computer Interaction (HCI) field. According to the authors, while the first and second HCI paradigms are oriented to issues of ergonomics and cognitive factors, respectively, the third one must deal with the establishment and multiplicity of meaning in situated interactions. In this paradigm, artifacts and their contexts are mutually defining and being subject to different interpretations.

Differently from the two first paradigms in which substantial work and knowledge have been produced since the last three decades, the third one remains quite unexplored by the HCI academy, requiring collaboration with other areas (*e.g.*, anthropology, sociology, education) and the development of theories, approaches, methods, artifacts and tools for supporting designers in understanding and dealing with its complex nature.

Our research projects have been situated in this scenario, investigating the design of interface and interaction solutions in the context of the third HCI paradigm, as well as frameworks and resources to support designers in doing so. Values are culturally built [4,5], and dealing with them in the design of technology has been pointed out as a great challenge for the HCI domain [1]. In this paper, we discuss issues regarding the evaluation of interactive systems taking into account the values and the culture of different stakeholders. In order to situate our discussions in a practical setting, we present a case study in which seven prototypes of interactive systems for the Brazilian Interactive Digital Television (iDTV) were evaluated through a value-oriented and culturally aware artifact named eValue. The artifact is grounded on the building blocks of culture [6] and on the Organizational Semiotics theory [7].

This paper is organized as follows: Section II introduces the subject of values and culture in technology design. Section III presents and explains the eValue artifact. Section IV presents a case study where the artifact was used to support the evaluation of prototypes. Section V discusses the case study's main findings and Section VI presents our final remarks.

II. LITERATURE REVIEW

Every innovation causes negative and/or positive impact in the environment it is introduced [6]. There are people in that environment who suffer the impact, trigger others, and confer values upon such an innovation [8]. Values are defined by Schwartz [4] as trans-situational goals that vary in importance and serve as principles that guide people's lives and, more generally, by Friedman [9] as something that a person, or a group of people, considers important in life.

Values as well as behavioral patterns, beliefs and preferences are learned and determined by culture [6,10]. They are determinants of attitudes, choices and actions, and influence peoples' judgment about products, events and other people. In the context of technology design, Friedman [11] and Bannon [12] suggest that designers communicate values in the solutions they design. However, for Friedman [11] it is not a two-way communication because, unlike people with whom users can disagree and negotiate about values and their meanings, they hardly can do the same with technology. For the author, when designing computer technology it is necessary to see human values from an ethical point of view.

If we consider just a few examples of famous web systems (*e.g.*, *Twitter*®, *YouTube*®), concerns regarding human values and other cultural aspects (*e.g.*, beliefs, behavioral patterns, formal systems) are hardly visible in their design. However, social implications related to values (or to the lack of them) in systems design are being widely reported and can be easily perceived. Winter [13] draws attention to the value of privacy in web applications. Using *Facebook*® as an example, the author states that privacy issues go from what the application does with users' data to what it allows other applications to do. In other interesting example, Mui [14] reports how pedophiles were using *Wikipedia*® as a medium to both disseminate their ideas and enter in schools, easily reaching students. Indeed, in practical terms, concern and analysis related to culture and values in technology seems to occur after the systems design and launch [15]. Consequently, as the authors suggest, most users are faced with undecipherable and unusual decisions already made on their behalf, and often not to their benefit.

In the context cited above, some authors have pointed out the inability of traditional inspection methods, such as the Heuristic Evaluation, to consider and deal with subjective and contextualized issues (*e.g.*, emotional and affective aspects, culture, values) [16,17] as well as characteristics of Web 2.0 applications (*e.g.*, collaboration, user-produced content) [18].

In reality, understanding values and culture in order to deal with them is only possible if designers could see the system being designed through the lenses of their users and their cultural particularities. However, curricula in Computer Science and Information Technology do not traditionally address methods that enable students to deal with social issues in systems development. In this sense, while the need for considering values and culture in the design process is becoming more and more evident, the inability of current approaches and methods in supporting it is becoming more and more visible.

Some authors have explicitly addressed issues on values in technology design. Cockton [19] proposed a framework to support what he named a Value-Centred Design (VCD), suggesting some activities and artifacts to support designers in the development of value-centred systems. The focus of VCD is on the understanding of technology design as a process of delivering values. Moreover, since 1996 Friedman [11] has been working on an approach she named Value-Sensitive Design (VSD), intended to support concerns regarding values, especially the ethical ones, in the design of software systems. Other authors have also dealt with the subject of culture in technology design, specially investigating cultural factors in usability evaluation [20,21], and the study of current HCI design methods from a cultural perspective [22].

Nevertheless, Sellen *et al.* [1] highlight that despite these efforts there is still a need for developing and publishing studies to support designers to account for values and deal with the complexity and the different requirements that current technologies have. Indeed, although researches related to Globalization and Internationalization [23] have the premises of not making assumptions based on a single place, culture and values are not often considered. Even the works cited above that look for explicitly dealing with culture and values treat them in isolation. However, as Hall [4] argues, the natural act of thinking is strongly modified by culture. Culture influences what people pay attention to and what they ignore, what people value and what they do not, the way people behave and the way they interpret other's behavior. Hence, if we are to approach values in systems design, and if we are to support designers in doing so, we must develop solutions (techniques, artifacts, methods, theories) that pay attention to the cultural nature of values, their diversity and complexity.

In the next section we present the eValue: an artifact created to support designers to keep values and culture in mind when analyzing and evaluating interactive systems.

III. THE EVALUE ARTIFACT

Depending on the way a system is designed, it will afford behaviors that are intrinsically related to individuals and the complex context in which they are using it [24]. As Kolkman [8] argues, if an innovation is inserted in each group of stakeholders accordingly, no serious problems might occur; but, sometimes there may be conflicts and designers will be able to anticipate the reactions of stakeholders only if they could see the world through the lenses of these stakeholders.

However, as designers usually do not have background in social sciences, they might have difficulties in knowing what to do or how to proceed in order to understand and deal with issues related to stakeholders' culture, behaviors, values, conflicts, dependencies and so on. Consequently, they need concrete artifacts that could inform them during design activities while facilitating their understanding of social issues.

The eValue is an artifact created on the grounds of Organizational Semiotics (OS) theory [7] and the ten building blocks of culture [6] — see Figure 1. It is intended to support a culturally informed and value-oriented evaluation of existing applications, or their prototypes.

AREA (PMS)	VALUE	I	APPLICATION	NOTES
1. Interaction	1.1 Identity			
	1.2 Norms			
2. Association	2.1 Conversation			
	2.2 Groups			
	2.3 Relationship			
	2.4 Trust			
3. Learning	3.1 Meta-communication			
4. Play	4.1 Aesthetics			
	4.2 Emotion and Affection			
5. Protection	5.1 Informed consent			
	5.2 Reputation			
	5.3 Security			
6. Exploitation	6.1 Accessibility			
	6.2 Object			
	6.3 Property (ownership)			
	6.4 Usability			
7. Temporality	7.1 Availability			
	7.2 Awareness			
	7.3 Presence			
8. Territoriality	8.1 Portability			
	8.2 Privacy			
	8.3 Scalability			
	8.4 Visibility			
9. Subsistence	9.1 Autonomy			
	9.2 Collaboration			
	9.3 Reciprocity			
	9.4 Sharing			
10. Classification	10.1 Adaptability			

Figure 1. The structure of the eValue artifact. A template is available at: *http://www.nied.unicamp.br/ecoweb/products/artifacts*.

The artifact's basic principles are: every interactive system allows users to interact with it and through it, for different purposes and by means of different interface and interaction resources. Depending on the behavior favored or inhibited by the system, it will impact either positively or negatively on users' values related to cultural aspects that pervade everyday life: from the way users learn and play to the way they manage time and space; from the way users interact and associate to the way they work and subsist in the world. The analyst's work consists of exploring the system, questioning and analyzing the way it is communicating values.

In the eValue, the "AREA (PMS)" column presents Hall's [6] ten areas of culture. According to the author, any culture may be mapped through a combination of these areas and develop values with regard to them — for instance, values in association are related to the way society is structured, the groups people form, the role and importance of family, etc. The "VALUE" column presents a list of values we identified in the context of applications for promoting social interaction, and we classified according to their suitable area [25]. This list is not intended to be definitive or exhaustive; rather, it is intended to serve as a departure point for analysis as, without previous exposition to cultural issues, it would be harder to proceed if no values were suggested. The column "I" serves to indicate whether the value in its corresponding line was identified in the application being analyzed. The "APPLICATION" column is intended to describe the way the application is supporting (or neglecting) the value. For instance, in the value of "Accessibility", evaluators should verify whether the application being analyzed was supporting the value, what features are supporting it, whether they are enough to make the application accessible, etc. Finally, in the "NOTES" column evaluators may register important information regarding the value, highlighting both positive and negative points, benefits and drawbacks, warnings and ideas.

Once filled, the eValue provides a map of what values are being reflected by/on/through the application analyzed and the way it is done. It also presents evaluators' reasoning about each value, pointing out pending questions, critical issues, ideas and possible improvements. In the next section we describe the case study where the artifact was used to support the evaluation of interactive prototypes focusing on values and culture.

IV. The Case Study

This case study was conducted in a Computer Science undergraduate discipline for "Construction of Human-Computer Interfaces" where participants were assigned the task of designing social applications for the iDTV. The course took place from August to December, 2011, and by its end, participants had to present a functional prototype of their projects and socialize the final results with the others.

Brazil has more than 190 million inhabitants, a very heterogeneous population in terms of ethnicity, social and economical conditions, and the analogical television is present in 97% of Brazilian homes [26]. The iDTV is an emergent technology instituted by the Brazilian government in 2003 intending to promote social inclusion, cultural diversity, and the native language, for favoring the democratization of information and reduction of economic, geographical and social barriers [27]. In this sense, as Furtado [28] argues, an iDTV application "for all" should consider a comprehensive and contextualized analysis, bringing characteristics of the target audience for the design and evaluation. In fact, designing technologies in such a complex scenario demands a new perspective to the design. It requires what Baranauskas [29] has named a "Socially Aware Computing": "*the theory, artifacts and methods we need to articulate to actually make the design socially responsible, participatory and universal as process and product*". The eValue is an artifact intended to contribute in this direction.

The case study was conducted with 38 participants divided into 8 groups (from G1 to G8). G1 was formed by the prospective designers: (D1, D2, D3 and D4), G2 (D5..D9), G3 (D10..D14), G4 (D15..D19), G5 (D20..D23), G6 (D24..D28), G7 (D29..D33) and G8 (D34..D38). Finished the course, the groups were asked to voluntarily answer an online questionnaire in order to evaluate the entire process used to design the applications; the participants were also asked permission for using the material they had produced, including their answers to the questionnaire. G1 opted for not answering the questionnaire and is not being included in this analysis.

From the 7 projects: G2 and G6 designed applications for promoting sustainable behavior in its users: a game and a social application, respectively. G3 projected an application to

support social interaction over football matches. G4 and G5 designed social network applications for the iDTV. G7 designed an application to support online chat, and G8 a platform for interactive online courses through the iDTV.

Before the evaluation activity, each group had produced the first version of an interactive prototype — see Figure 2 for an example. The prototype should allow evaluators to perform the execution of at least one complete task relevant to the context of the application. During all the design stage, the concern with the values and culture of stakeholders should be made explicit by the groups. For supporting that, groups were instrumented with artifacts and methods from the OS [7], used Design Patterns for the iDTV [30], and applied techniques of design inspired by Participatory Design [31].

Figure 2. Prototype designed by G3.

Because the evaluation activity was to be performed, preferentially, by participants from other groups, each group shared: i) all the documentation produced in the previous activities; ii) a brief explanation of the application being designed, the target audience, goals, etc.; and iii) a description of the task to be carried out in the evaluation activity, including its initial and final states. Each group was randomly assigned to evaluate a different project (G1 evaluated the project of G8; G2–G5; G3–G1; G4–G4; G5–G2; G6–G7; G7–G6; and G8–G3). Groups received the following instructions for conducting the evaluation activity:

1. 'Read the description of the application, explore it, and execute the task indicated by its designers'. This step assures evaluators are relatively familiarized with the application, its purpose and features, before starting evaluating it.

2. 'For each value suggested in the eValue, analyze whether there is any feature or attribute of the application that is manifesting/reflecting/representing the value. In positive situations, indicate it in the corresponding cell ("APPLICATION" column) and mark a "C" in the "I" column indicating that the value was identified in the application, *.i.e.*, it was considered by designers'. This step induces evaluators to think of different values that may be involved in the application and to register that.

3. 'If the value was perceived/identified, discuss whether the application was properly designed to support the value according to the application's purpose, and leave comments, suggestions, and highlights in the "NOTES" column'. Here, evaluators are forced to critically analyze the application according to the values involved, the way they are being involved through design decisions, and the adequateness of such decisions to the application context.

4. 'If the value was not identified, verify whether it is not important to the application or it is being neglected/forgotten in the project. In the later case: i) mark an "N" in the "I" column indicating the value is being neglected; ii) leave your notes to the group drawing attention to the possible impacts of it; and iii) suggest means of supporting the value in the project'. This step favors evaluators to pay attention to aspects that, although critical, may have been neglected during the design stage. As values have an interactive nature [5], neglecting key values may ignore other similar values as well as promote conflicting and sometimes undesired ones.

As background material for supporting the evaluation activity each group was supplied with: i) guidelines explaining the activity's steps; ii) the eValue artifact in digital format; iii) a table containing the list of 28 values in the context of social applications [25], a description and an example for each value; iv) a simplified explanation of each area of culture; and v) at least 3 questions related to each area the groups should think about. For instance, questions to be analyzed in the area of "Temporality" were: what is the expected usage frequency (daily, monthly)? If daily, is there any strategy to promote users' participation? What about the interaction duration? Is it brief (specific tasks with short time duration), medium (interactions that require more effort) or long (interactions that require the involvement, demand attention, etc.)? What are the possible consequences?

At the end of the evaluation activity each group received a list of problems and notes, as well as suggestions and ideas, related to values and cultural aspects they should consider in their projects. After the evaluation activity, groups were instructed to discuss the feedback they received, and to redesign their prototypes taking into account the points they found relevant and arguing about the ones they did not consider. Figure 3 shows an example.

AREA	VALUE	I	APPLICATION	NOTES
1. Interaction	1.1 Identity	N		- There is no mechanism for user authentication; - There is no way to see information about other users; - There is no difference between messages (friends, non-friends)
1. Interaction	1.2 Norms	N		- There is no indication about the usage terms and conditions; - Rules are not clear; for instance, is there any kind of content moderation?
2. Association	2.1 Conversation	C	- The application is providing the communication between viewers of a same TV program.	
2. Association	2.2 Groups		- As users are watching the same program, they have at least a common interest. It characterizes them as a group.	- Even if it is possible to create private rooms for chatting, it was not possible to identify a feature for selecting specific users for chatting.
(...)			(...)	(...)
(...)			(...)	(...)

Figure 3. The artifact filled by G6 for G7 — translated by the authors.

V. DISCUSSION

During the design stage, groups used other artifacts to support: i) the identification of the different stakeholders; ii) the values each stakeholder would bring to the project; and iii) the functional and non-functional requirements to support these values. The main goals of the evaluation activity were to inspect whether the prototypes were designed in conformity to the requirements related to values and cultural aspects, and to provide feedback for redesigning the prototypes in order to support these values and cultural aspects accordingly.

Figure 4 presents a synthesis of the results from the evaluation activity. Each group is represented by a column in the "GROUPS" section, and each value corresponds to a line. The letter "C" in a cell indicates that the corresponding value is being considered by the corresponding group in its project, while the letter "N" indicates that the value is being neglected. Cells in blank indicate the value was not considered relevant to the project by both its designers and evaluators. The last line in the table indicates the groups that evaluated each project.

AREA (PMS)	VALUE	GROUPS					
		G2	G3	G4	G5	G6	G7
1. Interaction	1.1 Identity	C	C	C	C	C	N
	1.2 Norms		C	N	N	N	N
2. Association	2.1 Conversation		C	C	C	C	C
	2.2 Groups			N		C	C
	2.3 Relationship		C	C	C	C	C
	2.4 Trust	C	C	C		C	C
3. Learning	3.1 Meta-communication	C	C	C	C	N	N
4. Play	4.1 Aesthetics	C	C	C	C		C
	4.2 Emotion and Affection	C	C	C	C	C	C
5. Protection	5.1 Informed consent	N	N	N	N	C	N
	5.2 Reputation		C	C		N	N
	5.3 Security	N	C	C		C	N
6. Exploitation	6.1 Accessibility	C	N	N		C	N
	6.2 Object	C	C	C		N	
	6.3 Property (ownership)	C	C	N	C	N	N
	6.4 Usability	C	C	C	C	C	C
7. Temporality	7.1 Availability	C		C		C	
	7.2 Awareness	N	C	C		C	N
	7.3 Presence		N	N	C	N	N
8. Territoriality	8.1 Portability		N	N		N	
	8.2 Privacy		C	C	N	C	N
	8.3 Scalability		N	N		C	
	8.4 Visibility	N		N		N	N
9. Subsistence	9.1 Autonomy		N	N		C	
	9.2 Collaboration			C		N	N
	9.3 Reciprocity	C	C	N		C	
	9.4 Sharing	N		C	C	C	C
10. Classification	10.1 Adaptability	N	N	N	C	N	N
	Evaluated by:	G5	G8	G4	G2	G7	G6

Figure 4. Sumary of the evaluation results.

The "C" indicating that the value was considered does not mean it is being satisfactorily supported, but that the concern with it was made explicit in the project. Evaluators were encouraged to leave their impressions, suggestions and comments regarding the way the value was being handled. For instance, see the value "2.2 Groups" in Figure 3. Evaluators identified it being manifested in the prototype through a feature where users watching the same program would be able to talk to each other by means of synchronous messages. For them, it represents a group of people that has at least a common interest: the program they are watching. However, they pointed out the limitation of the feature regarding private conversations, and we extend it to the problem of scalability and information overload. In fact, if a high number of people begin to use the application, it will be harder to interact with specific users, and it will be impossible to control the visibility/privacy of the content being communicated. In turn, it also may be a problem of system scalability as well as of users' security.

The "N" indicating that the corresponding value was neglected means evaluators found it critical to consider and deal with it in an explicit way — whatever their reasons. It may also mean that they identified a gap between the project's documentation and the final prototype. For instance, see the value "1.2 Norms" in Figure 3. Evaluators start questioning about the rules for using the application, because there was no indication that designers thought about them. They also drew attention to the need of clear rules and protocols for interaction, because depending on the target audience, the period in which the application will be used, and the amount of information being shared, it may be necessary a feature to guarantee the quality, integrity and security of interactions (*e.g.*, filtering messages with offensive content).

As we cited previously, some authors have argued that traditional usability inspection methods do not allow evaluators to identify typical problems of social systems, such as the ones related to the content produced by users and to the protocols of social interaction [17,18]. Figure 4 shows that five of six groups of evaluators drew attention to the value of norms, and that four concluded it was being neglected by designers. Considering that G6 and G7 evaluated the project of each other, and that G4 evaluated its own project, the fact of the three groups were neglecting the value of "Norms" in their prototypes, but identified it being neglected when acting as evaluators, indicates the ability of the eValue artifact in favoring the critical thinking and the analysis of design decisions that may impact on values.

Figure 4 also allows the identification of interesting points regarding the values involved in the projects. For instance, "Emotion and Affection" and "Usability" were identified by evaluators in all the six projects. It suggests that the concern with such values was present during the design stage, although it does not guarantee they were satisfactorily considered. The values of "Identity", "Relationship", "Conversation", and "Trust", were also identified in the majority of the projects. This was expected because the projects were all intended to promote social interaction among iDTV users.

On the other hand, the value of "Accessibility" was identified in only two projects, indicating that the other four groups did not pay attention to it. It reinforces our observation in [32] that the concept of accessibility it is not often considered in the literature as well as in practical contexts. Additionally, the values of "Informed Consent" and "Adaptability" were being considered by one group only, and neglected by the other five. Friedman *et al.* [9] indicate that systems neglect the value of "Informed Consent" because they usually do not let users aware of the consequences triggered by their actions. Neris *et al.* [33], in turn, suggest that the value of

"Adaptability" should be considered in order to develop applications capable of supporting a heterogeneous group of users in their diversity of abilities, preferences, cognitive and motor limitations, etc. In this sense, these values seem to be critical when designing applications for a complex context such as the one in this case study, and Figure 4 shows that, although designers did not pay attention to them when designing their prototypes, they were forced to rethink of it when acting as evaluators.

Although further exposition of the artifact to other people and professional designers in different contexts is still needed, the results and observations from this case study indicate eValue as a promising artifact for supporting the evaluation of interactive systems focusing on values and cultural aspects.

VI. CONCLUSIONS

This paper approached the evaluation of interactive systems in the context of the third HCI paradigm: a paradigm where values, emotion, motivation, and several other cultural aspects play a central role. In the third paradigm, new theories, approaches, artifacts and tools for supporting designers when evaluating systems are needed. In this scenario, we presented the eValue, an artifact created on the grounds of Organizational Semiotics and the building blocks of culture, as a way of supporting designers in evaluation activities.

For situating our discussions in a practical context, we presented a case study where the artifact was used to support the evaluation of interactive prototypes of social applications for the iDTV. The case study indicated the artifact's viability for supporting designers in a value-oriented and culturally informed evaluation, and showed that, although advised to keep values in mind, designers neglected critical values when designing their applications.

ACKNOWLEDGMENTS

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ANEXO 8 – WebPAM: Especificação de Software[26]

[26] Este anexo apresenta uma especificação preliminar para o sistema. **Autores**: Roberto Pereira e José Valderlei da Silva.

Projeto WebPAM

1. Identificação do PI

Neste documento apresentamos a proposta para documentação e implementação de um sistema para clarificação de problemas.

1.1. Ambiente de Aplicação do PI

Sistema Web para clarificação de um problema. Dessa forma não importa a natureza do problema, quer seja computacional (desenvolvimento de um software ou de um hardware, etc.) ou outra atividade como a construção de uma casa, de um espaço público ou a criação de novos processos e regras de negócio, o sistema proposto irá ajudar no entendimento e na clarificação do problema a ser trabalhado. O sistema denominado WebPAM será disponibilizados online para acesso aberto e gratuito na Web.

1.2. Objetivos do Sistema Proposto

Independentemente da natureza de um projeto, a clarificação do problema a ser tratado é de essencial importância e deve ser conduzida tão logo o projeto passe a existir. Na Engenharia de Software, autores, como Sommerville (2007) e Chung et al. (1999), chamam a atenção para os "*early requirements*" ou "*organizational requirements*", argumentando que é preciso conhecer bem o espaço de problema antes de se definir soluções e iniciar maiores investimentos. Caso contrário, podem surgir problemas como, custos adicionais com manutenção, alterações de escopo e de requisitos, ou mesmo de tecnologias, cujo impacto em etapas mais avançadas pode implicar na inviabilidade do projeto.

Os modelos tradicionais de desenvolvimento de software *(e.g.*, cascata, iterativo e incremental) tendem a restringir a clarificação do problema à identificação de requisitos funcionais e não funcionais. Essa visão foca em aspectos técnicos da solução a ser desenvolvida e impede uma compreensão mais ampla do problema sendo abordado, como as diferentes partes interessadas envolvidas (*stakeholders*), os aspectos informais (*e.g.*, cultura, valores, padrões de comportamento, preferências, etc.), e formais (*e.g.*, leis , normas, regras e políticas) ligados a essas partes, e que podem sofrer e/ou causar impactos no projeto, nas parte interessadas e/ou no ambiente em que a solução desenvolvida for disponibilizada. De um lado, isso ocorre porque profissionais de tecnologia normalmente não são capacitados a lidar com aspectos sociais, éticos e normativos existentes no mundo. De outro, porque os métodos, técnicas e artefatos utilizados não apoiam e nem chamam a atenção para esses aspectos.

O PAM (*Problem Articulation Method*, ou Método de Articulação de Problema) é um método (Kolkman, 1993) da Semiótica Organizacional que visa apoiar a clarificação do problema e a proposta de soluções. A teoria da Semiótica Organizacional (Liu, 2000) entende uma organização e seu sistema de informação como um sistema social complexo no qual as pessoas e seus padrões de comportamentos são organizados por um sistema de normas. O PAM oferece artefatos práticos (*i.e.*, estruturas, guias, *templates*) que apoiam a clarificação do problema sob diversas perspectivas, e propiciam o entendimento compartilhado do problema e da solução a ser desenvolvida entre todos os envolvidos em um projeto. O objetivo do método, portanto, é trazer a tona a complexidade do problema abordado levando em conta o contexto social em que ele existe, discutir e propor soluções, e criar um entendimento comum acerca do projeto entre todos os envolvidos.

Como a clarificação e articulação do problema deve ser o primeiro passo em um projeto, o PAM pode ser utilizado independentemente do processo de desenvolvimento adotado, das tecnologias que serão utilizadas, e mesmo da natureza do projeto. De fato, além de ser aplicado na computação para apoiar o projeto de sistemas computacionais (Baranauskas, 2009), o método vem sendo utilizado para apoiar projetos relacionados à construção de edifícios sustentáveis (Shah et al., 2010), e práticas educacionais (Mantoan e Baranauskas, 2009). Entretanto, ainda não há um sistema computacional que possibilite seu uso de forma aberta e gratuita.

O objetivo desse projeto é o desenvolvimento de uma aplicação Web, denominada WebPAM, que permita a clarificação colaborativa de problemas na Web por meio de artefatos desenvolvidos e/ou inspirados no PAM. O projeto tem, portanto, uma natureza aplicada, e visa permitir que os artefatos possam ser utilizados em larga escala na Web. No aspecto **técnico**, o projeto se justifica pela sua complexidade de design, implementação e testes: são pelo menos oito artefatos a serem implementados, com requisitos de customização e comunicação

entre si; suporte a formação de grupos e uso colaborativo; necessidade de sincronismo na interação; gerenciamento e geração de documentação; entre outros. A condução do projeto necessita, portanto, de um gerenciamento das atividades envolvidas que aborde de questões técnicas (implementação, avaliação) à questões de gerenciais (prazos, escopo, tarefas). No aspecto **social**, como mencionado, espera-se que o WebPAM seja utilizado para apoiar projetos de diferentes naturezas (*e.g*., científicos, educacionais, empresariais), favorecendo um entendimento mais amplo do contexto social em que esses projetos estão sendo desenvolvidos e contribuindo para o desenvolvimento de soluções que façam sentido aos seus usuários. A **originalidade** do projeto está justificada tanto na inexistência de um recurso computacional[1] que apoie o uso dos artefatos, quanto nas teorias que os fundamentam.

1.3. Recursos de Software

Para o desenvolvimento do sistema WebPAM as seguintes tecnologias serão utilizadas: linguagens PHP 5.3, ou superior, HTML, JavaScript e CSS. Para a persistência de dados, o banco escolhido é o MySQL 5, ou superior. A Plataforma Drupla 7.0 será utilizada para apoiar a implementação de algumas funcionalidades básicas do sistema (e.g., cadastro de usuários, autenticação)

O Sistema deverá ser hospedado em um servidor HTTP com os recursos necessários para atendimento das requisições.

2. Inovações

Conforma já justificado na identificação do sistema proposto, o WebPAM deverá dar suporte na clarificação do problema de qualquer natureza.

3. Descrição Simplificada do Sistema Proposto

3.1. Especificação dos requisitos funcionais do sistema

Inicialmente, o sistema WebPAM implementará 8 artefatos criados/adaptados para apoiar a clarificação colaborativa de problemas, são eles: Diagrama de Partes Interessadas, Quadro de Avaliação, Framework Semiótico, *Value Identification Frame*, *Culturally Aware Requirements Framework*, *Valuation Framing for Social Software*, *Value Comparison Table* e eValue — ver detalhes na seção 4. Há uma série de requisitos que serão transversais ao sistema, i.e., independentes de artefatos, e que garantirão a integração das demais partes, bem como oferecerão recursos diferenciados para o funcionamento do sistema. Alguns deles são brevemente descritos na sequência. Na concepção do projeto WebPAM enumeramos os Requisitos Globais:

1. Suporte aos idiomas Inglês e Português.
2. Cadastro de usuários.
3. Gerenciar problemas (criar, editar, convidar participantes, definir visibilidade).
4. Adaptação/Personalização da interface (e.g., ordem na qual os artefatos aparecem).
5. Comunicação síncrona (e.g., chat).
6. Comunicação assíncrona (e.g. recursos para anotações, observações, etc.).
7. Área de Metacomunicação: recurso que explicará o uso do sistema de forma contextualizada.
8. Padronizações: definir e verificar padronização de código (integração) e interface.
9. Acessibilidade: implementação e avaliação.
10. Usabilidade: padronização e avaliação

A Figura 1 ilustra um protótipo criado para o sistema WebPAM. As principais funções do sistema serão descritas abaixo e poderão ser alteradas durante a execução do projeto.

- Escolher idioma;
- Cadastrar usuário;
    - Atribuir funções
- Aceitar termo de uso;

[1] O *ACBP-Sakai* é um sistema de gerenciamento de aprendizagem que implementa 3 artefatos do PAM para apoiar praticas didáticas. Entretanto, seu acesso é fechado e o problema a ser clarificado é determinado por um administrador.

- Cadastrar contas e alocação para um determinado problema.
    - Recuperar senha;

Gerenciar Problema:

- Escolher modelo de problema;
- Selecionar problema;
- Exportar problema;
- Importar problema;
- Compartilhar problema;
- Excluir problema;
- Cadastrar Problema;
- Permitir configurar as permissões de edição para cada usuário em um problema;

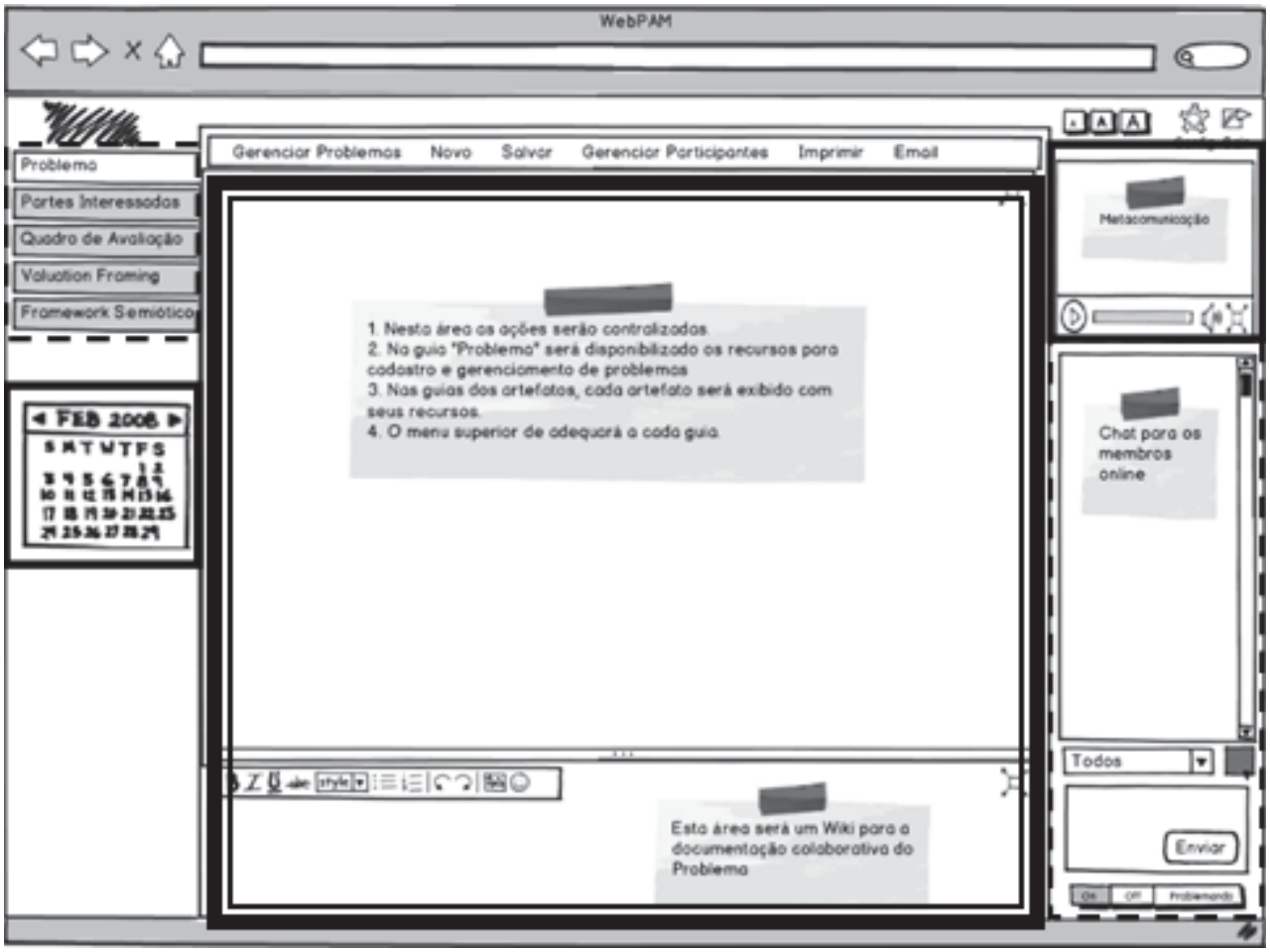

Figura 1. Protótipo do sistema WebPAM.

Adaptar interface;

- Disponibilizar projeto como exemplo;
- Fornecer um wizard para criação de um Problema;
- Fornecer um wizard para criação de cada artefato.

Preencher artefatos:

- Preencher os artefatos
- Descrever o Problema

Fornecer acessibilidade (funções)

- Permitir leitor de tela
- Permitir adaptação do tamanho da fonte
- Guardar\Visualizar histórico (*wiki*)

Funcionalidades de *awareness*

- Enviar email (cada participante)
- Chat online
- Notificações de alterações (e.g., desde o último acesso)

Visualizar participantes;

- Visualizar participantes online;
- Enviar email com sumário das atividades (sistema/servidor)
- Enviar email com lembrete de reuniões

Configurar preferências/configurações

4. Descrição dos Artefatos

O WebPAM será um sistema Web que implemente o PAM e possibilite o seu uso de forma colaborativa e aberta. No PAM não há regras rígidas relacionadas a quais artefatos devem ser utilizados, quais atividades devem ser concluídas, em que ordem, etc. Dependendo do problema sendo clarificado, alguns artefatos serão utilizados e outros não, e algumas atividades serão priorizadas sobre outras. Embora essa flexibilidade seja necessária, o primeiro passo ao se clarificar um problema normalmente consiste em saber quais são as partes interessadas no problema e/ou em sua solução. Na sequencia, apresentamos e explicamos os artefatos que serão implementos nesse projeto. Por critério de organização, os artefatos estão agrupados em 4 partes.

PARTE I: Diagrama de Partes Interessadas e *Valuation Framing for Social Software*

O **Diagrama de Partes Interessadas (DPI)**, ou *Stakeholder Identification Diagram* (Figura 2), é um artefato proposto por Kolkman (1993) para apoiar a identificação dos *stakeholders* envolvidos em um projeto. De acordo com Baranauskas *et al.* (2009), pressupõe-se que as partes interessadas no problema são governadas por forças de campos de informação e conhecimento, relacionadas a funções, tarefas, valores, metas sociais, etc. Essas forças influenciam o modo como as partes interessadas se comportam e, consequentemente, todo o projeto sendo desenvolvido.

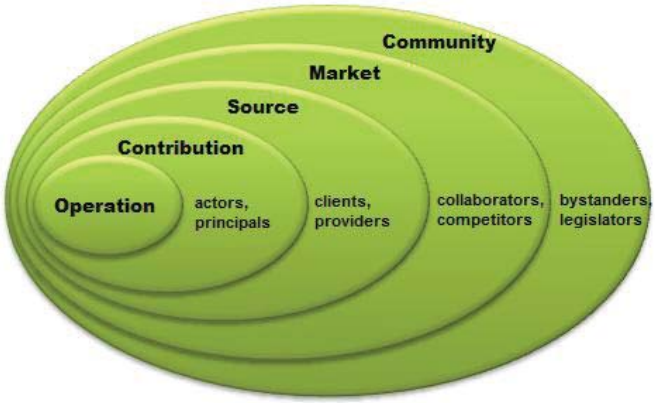

Figura 2. Diagrama de Partes Interessadas. Adaptado de (Kolkman, 1993).

O ***Valuation Framing for Social Software*** **(VF4SS)** — ver Figura 3 — é uma adaptação do *Valuation Framing* (Kolkman, 1993), que visa apoiar analistas no entendimento das dimensões culturais de um produto. O VF4SS foi adaptado por Pereira e Baranauskas (2011) para incluir a preocupação explícita com valores existentes no contexto de software social. Hall (1959) afirma que toda inovação causa impacto no ambiente em que ela é inserida. De acordo com Kolkman (1993) e Liu (2000), cada parte interessada tem um sistema cultural que influencia o modo como ela enxergará e reagirá à inovação proposta como solução para o problema. Uma inovação pode ser inserida em um ambiente sem que sérios problemas ocorram. Entretanto, pode haver situações em que fatores ligados à cultura e aos valores dessas partes interessadas sofram/causem influências fortes que podem resultar em problemas e desafios adicionais ou mesmo na rejeição de todo um projeto. Os analistas somente estarão aptos a identificar e se antecipar a esses fatores se eles conseguirem ver a inovação sendo projetada pelas lentes das diferentes partes interessadas.

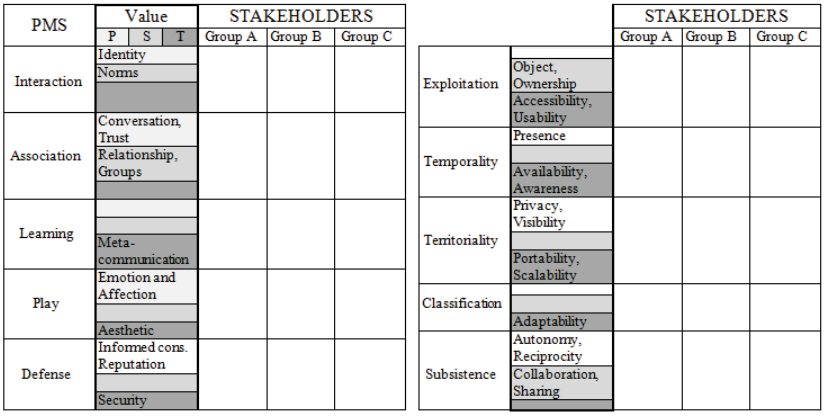

Figura 3. Valuation Framing for Social Software (Pereira e Baranauskas, 2011).

Do ponto de vista técnico, os recursos computacionais para apoiar o uso de ambos os artefatos devem:

- Conversar entre si (e.g., o VF4SS deve permitir que o usuário selecione as partes interessadas que ele já tiver informado (caso houver), ou inserir uma nova parte interessada.
- Permitir o preenchimento colaborativo dos artefatos
- Possibilitar a exportação/impressão das informações
- Exibir explicações e ajuda aos usuários (e.g., descrição das partes interessadas, das áreas da cultura, dos valores, etc.)
- Conversar com o recurso de Metacomunicação

PARTE II: Quadro de Avaliação e *Framework* Semiótico

A identificação das partes interessadas favorece uma visão mais ampla (e realista) das dimensões do problema sendo trabalhado. O **Quadro de Avaliação (QA)** — ver Figura 4 — é um artefato criado por Baranauskas et al. (2005) para apoiar a identificação e discussão de possíveis problemas, soluções e ideias relacionados às partes interessadas. O artefato organiza as partes interessadas de acordo as camadas do DPI e convida os analistas a raciocinarem, discutirem e tornarem explícitos os problemas e soluções relacionados a cada uma.

O ***Framework*** **Semiótico (FS)**, ou Escada Semiótica — ver Figura 5 — é um artefato que chama a atenção para diferentes aspectos envolvidos no desenvolvimento de uma solução. Depois de identificada as partes interessadas, discutidos seus problemas e proposto uma solução inicial, os analistas já possuem maiores condições de detalhar essa solução, identificando requisitos.

Figura 4. Quadro de Avaliação (Baranauskas et al., 2009).

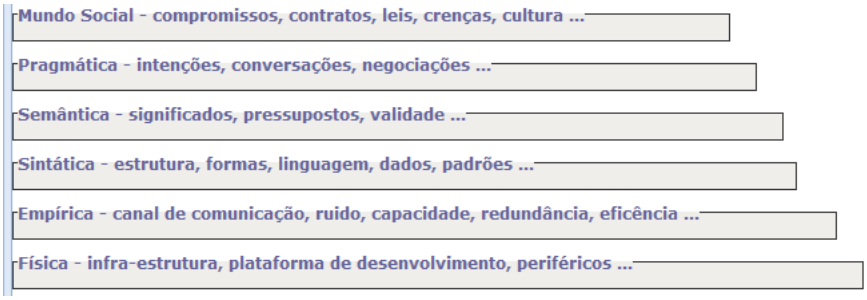

Figura 5. Framework Semiótico. Adaptado de (Liu, 2000).

Do ponto de vista técnico, os recursos computacionais para apoiar o uso de ambos os artefatos devem:

- Conversar com outros artefatos (e.g., o QA deve permitir que o usuário selecione as partes interessadas que ele já tiver informado no DPI (caso houver), ou inserir uma nova parte interessada; O FS deve permitir que o usuário vincule um "requisito" de suas camadas a uma discussão no QA (e vice-versa).
- Permitir o preenchimento colaborativo dos artefatos
- Possibilitar a exportação/impressão das informações
- Exibir explicações e ajuda aos usuários (e.g., descrição dos níveis do FS, etc.)
- Conversar com o recurso de Metacomunicação

PARTE III: *Value Identification Frame* e *Culturally Aware Requirements Framework*

O ***Value Identification Frame*** **(VIF)**, ou Quadro de Identificação de Valores — ver Figura 6, foi criado para apoiar a identificação de valores relacionados às diferentes partes interessadas envolvidas no problema sendo discutido. Os princípios básicos do artefato são: cada parte interessada identificada por meio do DPI possui um conjunto de valores que poderá causar e/ou sofrer impacto com a introdução da inovação sendo projetada. O trabalho do analista consiste em raciocinar, identificar e mapear os valores que cada parte interessada traz para o projeto e que precisam ser considerados.

Project	<Project's name>	
Values	<List of suggested values>	
CONTRIBUTION		
Stakeholder	Values	
Stakeholder A	Values related to the Stakeholder A	
Stakeholder B	Values related to the Stakeholder B	
SOURCE		
Stakeholder	Values	
Stakeholder C	Values related to the Stakeholder C	
(...)	(...)	
MARKET		
Stakeholder	Values	
(...)	(...)	
(...)	(...)	
COMMUNITY		
Stakeholder	Values	
(...)	(...)	
(...)	(...)	

Figura 6. *Value Identification Frame*.

PMS	P	Requirements	Value	Stakeholder			
				A	B	C	D
Interaction	#	<requirement 01>	<value>	X			X
	#	<requirement 02>	<value>		X		X
Association	#	<requirement 03>	<value>	X	X	X	
Learning							
(...)							
Subsistence							

Figure 7. *Culturally Aware Requirements Framework*.

O ***Culturally Aware Requirements Framework*** **(CARF)** — ver Figura 7 — é um artefato criado para apoiar a identificação e organização de requisitos que estão relacionados aos aspectos culturais e valores das diferentes partes interessadas. Os princípio do artefato são: valores são desenvolvidos de acordo com as 10 áreas da cultura de Hall (1959). Dependendo do modo como a inovação for projetada ela impactará em diferentes aspectos desses áreas, promovendo/inibindo valores de diferentes partes interessadas e com diferentes intensidades. O trabalho do analista consiste em identificar requisitos para o projeto de acordo com essas áreas no intuito de respeitar os valores das partes interessadas (identificados explicitamente pelo VIF), definir prioridades entre esses requisitos, e lidar com possíveis conflitos.

Do ponto de vista técnico, os recursos computacionais para apoiar o uso de ambos os artefatos devem:

- Conversar com outros artefatos (e.g., o VIF deve permitir que o usuário selecione as partes interessadas que ele já tiver informado no DPI (caso houver), ou inserir uma nova parte interessada; O CARF deve permitir que o usuário selecione as partes interessadas e seus valores preenchidos no VIF; o CARF também deve permitir que o usuário vincule/transporte os requisitos identificados no mesmo para o FS, e vice-versa).
- Permitir o preenchimento colaborativo dos artefatos
- Possibilitar a exportação/impressão das informações
- Exibir explicações e ajuda aos usuários (e.g., descrição dos campos dos artefatos, explicação sobre as áreas da cultura, etc.)
- Conversar com o recurso de Metacomunicação

PARTE IV: eValue e *Value Comparison Table*

Além dos artefatos para apoiar a clarificação do problema e a organização de requisitos, o sistema WebPAM também implementará 2 artefatos criados para apoiar analistas na avaliação de aplicações existentes ou de protótipos.

O **eValue** (Figura 8) foi criado para apoiar a avaliação de aplicações com relação aos valores e aos aspectos culturais das partes interessadas. Seu objetivo é auxiliar os analistas a verificarem se a inovação sendo projetada está de acordo com o esperado, e se as decisões de projeto estão efetivamente refletindo os aspectos culturais e de valores das diferentes partes interessadas que foram identificados por meio do VIF e especificados por meio do CARF.

AREA (PMS)	VALUE	I	APPLICATION	NOTES
1. Interaction	1.1 Identity			
	1.2 Norms			
2. Association	2.1 Conversation			
	2.2 Groups			
	2.3 Relationship			
	2.4 Trust			
3. Learning	3.1 Meta-communication			
4. Play	4.1 Aesthetics			
	4.2 Emotion and Affection			
5. Protection	5.1 Informed consent			
	5.2 Reputation			
	5.3 Security			
6. Exploitation	6.1 Accessibility			
	6.2 Object			
	6.3 Property (ownership)			
	6.4 Usability			
7. Temporality	7.1 Availability			
	7.2 Awareness			
	7.3 Presence			
8. Territoriality	8.1 Portability			
	8.2 Privacy			
	8.3 Scalability			
	8.4 Visibility			
9. Subsistence	9.1 Autonomy			
	9.2 Collaboration			
	9.3 Reciprocity			
	9.4 Sharing			
10. Classification	10.1 Adaptability			

Figura 8. e*Value*.

AREAS (PMS)	VALUES	APPLICATIONS		
		A	B	C
1. Interaction	1.1 Identity			
	1.2 Norms			
2. Association	2.1 Conversation			
	2.2 Groups			
	2.3 Relationship			
	2.4 Trust			
3. Learning	3.1 Meta-communication			
4. Play	4.1 Aesthetics			
	4.2 Emotion and Affection			
5. Protection	5.1 Informed consent			
	5.2 Reputation			
	5.3 Security			
6. Exploitation	6.1 Accessibility			
	6.2 Object			
	6.3 Property (ownership)			
	6.4 Usability			
7. Temporality	7.1 Availability			
	7.2 Awareness			
	7.3 Presence			
8. Territoriality	8.1 Portability			
	8.2 Privacy			
	8.3 Scalability			
	8.4 Visibility			
9. Subsistence	9.1 Autonomy			
	9.2 Collaboration			
	9.3 Reciprocity			
	9.4 Sharing			
10. Classification	10.1 Adaptability			

Figura 9. *Value Comparison Table*.

O ***Value Comparison Table*** **(VCT)** — ver Figura 9 — é um artefato inspirado no VF4SS, e seu objetivo é favorecer uma comparação de diferentes aplicações com relação ao valores que elas apoiam/negligenciam de acordo com o modo como elas foram projetadas (Pereira et al., 2011). Enquanto no VF4SS os analistas discutem os valores e áreas da cultura do ponto de vista de cada parte interessada, no VCT os analistas discutem os valores e as áreas da cultura de acordo com as aplicações sendo analisadas e o modo como elas foram projetadas (suas funcionalidades, restrições, elementos de interface, normas, etc.). Embora o foco do artefato esteja em aplicações sociais, o artefato pode ser utilizado também para comparar aplicações *Web* convencionais, e.g., LMS, CMS, aplicações de e-commerce, etc.

Do ponto de vista técnico, os recursos computacionais para apoiar o uso de ambos os artefatos devem:

- Conversar com outros artefatos (e.g., o eValue deve conversar com o VIF para que os analistas possam saber quais valores estão relacionados à quais partes interessadas; Deve permitir que os analistas verifiquem quais informações do CARF estão associadas com o valor, etc.).
- Permitir o preenchimento colaborativo dos artefatos
- Possibilitar a exportação/impressão das informações
- Exibir explicações e ajuda aos usuários (e.g., descrição dos campos dos artefatos, dos valores, explicação sobre as áreas da cultura, etc.)
- Conversar com o recurso de Metacomunicação

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