Designing Convivial Digital Cities: A Social Intelligence Design Approach

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Abstract: Conviviality has been identified as a key concept necessary to web communities, such as digital cities, and while it has been simultaneously defined in literature as individual freedom realized in personal interdependence, rational and cooperative behavior and normative instrument, no model for conviviality has yet been proposed for computer science. In this article, we raised the question whether social intelligence design could be used to designing convivial digital cities. We first looked at digital cities and identified, from a social intelligence design point of view, two main categories of digital cities: public websites and commercial websites; we also noted the experimental qualities of digital cities. Second, we analyzed the concept of conviviality for social science, multi-agent systems and intelligent interface; we showed the distinction among various kinds of use of conviviality, the positive outcomes such as social cohesion, trust and participation but also the negative aspects that emerged when conviviality became an instrument of power relations. Fourth, we looked at the normative aspect of conviviality as described in the literature and found that social norms for conviviality paralleled legal and institutional norms for digital cities. Finally, as a first step towards obtaining measures for conviviality, we presented a case study describing agents and user's interactions using dependence graphs. We also presented an analysis of conviviality requirements and described our plan and methodology for designing convivial digital cities.

Keywords: Conviviality, multi-agent systems, normative systems, social intelligence design, ergonomics and human factors, digital cities.

1 Introduction

Generally speaking, a convivial place or group is one in which individuals are welcome and feel at ease, but definitions in literature spread from individual freedom realized in personal interdependence, to rational and cooperative behavior, to normative instrument (Caire, 2007b; Caire, 2008a, Caire et al., 2008).

In the context of digital communities and institutions, such as digital cities, conviviality often refers to qualities such as trust, identity and privacy. One of the four themes of the European Community 5th framework, the Societe de l'Information Conviviale, translated by User-Friendly Information Society (1998-2002) promoted conviviality through broad projects and initiatives; for example, the Convivio Net Consortium (2003-2005) fostered *convivial* technologies, e.g. people-centered, and aimed to address the growing challenges raised by digital cities such as the increasing digital divides between social groups, nascent social fragmentation and isolation, by increasing social cohesion, strengthening community identity and supporting new communication and interaction models.

Even though digital cities were originally an American phenomenon, the European Community encouraged their development as early as 1993 with the Telecities Network and in 2000, with a 30year plan encouraging member countries to build their own digital cities based on a common vision while following a technological step-by-step approach: Systems interoperability, Intelligent City Systems (2009), Ambient Intelligence (2013) and Smart Cities (2030). Digital cities were considered as virtual presence and extensions of our physical cities by means of information and communication technologies. However, whereas the main goals of commercial digital cities are to innovate with next generation networks, to create spaces allowing users social information exchanges and to explore vertical markets, for example online shopping and rated services, the principal objectives of public digital cities are to "transform and modernize local administrations in order to improve the level and quality of life of the population at both individual and community levels" (Ishida, 2000), for example, with multilinguism and 24/7 online access to municipal services.

In this article we raise the following question: How can social intelligence be used to design convivial digital cities? Our main question breaks down into the following research questions:

(1) What is a digital city as far as social intelligence design is concerned? From social intelligence design point of view, there seems to be a distinction between public and commercial websites. Indeed, social intelligence design main themes are about using new technologies to "mediate human communication and collaboration across geographical and cultural divides" and to enhance the relations between "people and technology in the full richness of human social and

cultural life" (Fruchter et al., 2005). While such priorities are expected for public digital cities, they seem more problematic to ensure for revenue-driven commercial websites. We therefore discuss our application domain based on this distinction.

(2) What is social intelligence design applied to digital cities?

(3) What is the role of conviviality for digital cities? We argued that the concept of conviviality brings challenges not only for literature but also for computer science (Caire, 2007a,Caire, 2007b; Caire, 2008a; Caire et al., 2008).

(4) What are social norms for agents in digital cities? One view of social intelligence is that it may be "attributed to a collection of actors/agents and defined as an ability to manage complexity and learn from experiences as a function of the design of social structure. This view emphasizes the role of social conventions that constrain the way individual agents interact with each other" (Fruchter et al., 2005). The role of norms has also been emphasized in the literature pertaining to conviviality, specifically when conviviality is defined as a condition for social interactions and an instrument for the internal regulation of social systems, whereas in digital cities, for example, "government regulations extend laws with specific guidance to corporate and public actions" (Lau et al., 2005).

(5) What plan and methodology do we propose for designing a convivial digital city? Following Illich definition of conviviality as individual freedom realized in personal interdependence we use dependence networks methods and apply them to use cases from the digital city of Luxembourg to describe user interactions. This is our first step towards obtaining measures for conviviality as also shown in (Caire et al., 2008).

The layout is as follows: In Section 2 we contrast digital cities as commercial websites to digital cities as public websites and note their experimental qualities. In Section 3, we analyze the concept of conviviality by contrasting the positive aspects of conviviality to its negative aspects, we review social and computer science literature. In Section 4, we look at legal norms for digital cities as opposed to social norms for conviviality. In section 6 we describe our plan and methodology for designing convivial digital cities and present our interaction description using dependence graphs. In section 7 we look at related works and in section 8 we discuss results and summarize our findings.

2 Digital Cities

Digital cities are web portals using physical cities as a metaphor for information spaces; “they can be seen as a *local social information infrastructure*, providing information over the ‘real’ city to locals and of course to visitors of the real city” (den Besselaar et al., 2000).

2.1 Different Kinds of Digital Cities

Digital cities present various combinations of political, economic and social activities. The following examples show the diversity of the combinations:

- eCities, eAdministrations and eGovernments, such as eLuxembourg (Figure 1, left: eCity Luxembourg), and eEurope are the official portals of cities and countries used as tools to improve local democracy and participation; they provide local social information infrastructures over the real city with public and administrative services to citizens and visitors; the activities are predominantly political and to a lesser extent, economic and social.
- eCommerce portals, such as MSN CitySearch (Figure 1, right), and AOL (America On Line) Digital Cities offer commercial services, shopping, entertainment and more generally, local easy to find and search information; they provide practical resources for the organization of everyday life and the support of local economic activities; the activities are predominantly economic and to a lesser extend social and political.
- Social virtual worlds such as Second Life and the Habbo Hotel (Figure 1, center), provide a communication medium primarily to conduct social experiences through role playing while, at the same time, attracting advertisers and businesses by the size of their massive multi-player communities. ”experiment with new forms of solving problems and coordinating social life” (den Besselaar et al., 2000). Activities are predominantly social and to a lesser extend economic and political.

Figure 1: eCity Luxembourg, Habbo Hotel and MSN CitySearch

Observing that "Digital cities commonly provide both profit and non-profit services and have a dilemma in balancing the two different types of services", Ishida (2000) raises the question: Can public digital cities compete with commercial ones? Indeed, "without profit services, digital cities become unattractive and fail to become a portal to the city. Without non-profit services, the city may become too homogeneous like AOL digital cities as a result of pursuing economic efficiency. In any case, digital cities are forced to face competition with private companies, which provide only profit services."

2.2 Commercial versus Public Websites

Commercial digital cities started as local portals run by private companies, such as phone, web and airline companies, competing with each other. Nowadays, global companies such as AOL and Microsoft offer city guides with services: Shopping, entertainment, local information and maps. Their business goals are geared toward vertical markets and their revenues are generated by advertising. Their general trend is to provide information that is easy to find and search for, good maintenance of systems and frequent updates. They are effective in Asia, where they complement government agencies, but limited in scope by their top-down controlled and selected content, lack of two-way interaction with users and main advertising purpose.

Public digital cities started in the US with American community networks, inspired by a tradition of community-centered, grass-roots engagements that emphasized freedom of speech and activism. Their original goal was to create a virtual information space demonstrated by the WELL Whole Earth'Lectronic Link, *Blacksburg Electronic Village* (Example 1) and *Seattle Community Network* (Example 2). However, today, American digital cities align with eGovernments and their main challenges are: the lack of synergy between community networks, private companies and administrations as well as the competition between profit and non-profit organizations. In table 1, we present a summary of our findings.

Example 1: *Seattle Community Network (SCN) emerged in 92 as part of the Computer Professionals for Social Responsibilities group's civil activities. It was first hosted on a donated Intel 386 running a donated copy of BSDI UNIX operating system, using FreePort (Cleveland FreeNet text based) user interface software. Lead by citizens, SCN grew in size by cooperating with regional libraries and offering to all free network access and services, such as email and home-page. Due to continuous financial problems and competition with commercial portals, the*

activity decreased to its current reduced level, mainly to provide free public-access network. Interestingly, among the more recent grass-roots activities is the emergence of the Seattle Community Wireless Network that creates a broadband wireless metropolitan area network.

Example 2: *Blacksburg Electronic Village (BEV) was built in 91 as a consortium lead by universities, such as Virginia Tech. University, by regional companies such as Bell Atlantic and local authorities. It was a high profile project but with very little community involvement to the vision. It was constructed from a technological point of view and the first project of the kind with web interface. It rapidly grew until 95 then its activity decreased due to fundamental disagreement between all the partners' expectations. The companies looked for revenues elsewhere and universities stopped providing internet to non-university members. Although still active today, BEV has only a very local focus on community use of technology and learning.*

Table 1 Digital Cities: Commercial vs. public portals

	Commercial	**Public Websites**
Goals	For profit. -Geared towards vertical markets (shopping, entertainment, etc.) -Revenues generated by advertising	Not for profit. -Make government efficient/accessible -Accelerate economic development -Improve local democracy
Technology	-Well maintained, frequent updates -Proprietary software & multimedia -Search (ranked results), easy-to-find local info, top-down filtered content	-Not always well maintained -Use open source systems & forums -Rely on high speed networks coupled with the real city (parking payments)
Organization	-Business strategy based on fierce competition -Mergers, acquisitions and delocalization	-Political agenda based on incumbent majority and leadership priorities -Complex consortia administration, universities & companies

In Europe, public digital cities evolved through the European Community leadership. The main goals are to share ideas and technologies between all the cities to strengthen the European partnerships, use information and communication technologies in order to resolve social, economic and regional development issues and improve the quality of social services. Their characteristics today are to be networks generated within and for specific regions and to emphasize social inclusion. The main challenge, shown by the relatively slow commercialization of services and information, is the difficulty to integrate grass-roots communities and commercial points of view.

2.3 Digital Cities as Experiments

Commercial digital cities aggregate urban information; they are well maintained, use proprietary software and rely on search engines, ranking interest links by sponsors, for business opportunities. Early on, commercial digital cities recognized the importance of usability and have done well to make their services usable by many.

Public digital cities seek to enforce the use of open systems. The lack of funds and the complexity of their partnerships caused many downfalls (*Digital Amsterdam*, Example 3). Public digital cities rely on high speed networks tightly coupled with physical cities (*Helsinki*, Example 4) and platforms for community networks (Bologna). They have multilayer architectures: Information, interface and interaction layers (Digital Kyoto). In Asia, public digital cities, called *city informatization*, emerged as government initiatives to develop countries through technological innovations. There were attempts to integrate grass-roots activities and university driven projects in 1999 with Digital Kyoto and Digital Shanghai but the greatest challenge still remains their top-down approach based on administration activity.

***Example* 3:** *Amsterdam Digital City (DDS) started in 94 as a grass-roots initiative and evolved into a non-profit organization with government support and the participation of private companies. The goals of Digital Amsterdam were to support community activities and local economy, encourage political discourse by linking citizens to the administration and innovate. Its very successful interface of squares and cafes as well as interactive public debates inspired many other digital cities, among which Digital Bristol. The issues that caused its downfall were persistent technical problems and the initial lack of common understanding and vision between the stakeholders. Digital Amsterdam exploited all the early Internet possibilities such as USENET, IRC, GOPHER, MUDs, MOOs, Telnets and Free-nets.*

Example 4*: Virtual Helsinki started in 95 as a powerful consortium of Telecom such as Nokia and Elisa, the city of Helsinki, private companies such as IBM and local universities; however, it did not include any grass-roots community nor voluntary services. The goals were: Technological advances with, for instance, the use of ISDN and Video on Demand (95), DSL, Ethernet, ADSL (97), IP based Video conferencing (98), ISDN video telephony, 3-D mapping of Helsinki (99). Digital Helsinki has been highly profitable and socially relevant with citizens' participation and contribution to social cohesion. Its projects of using avatars for citizens inspired the Habbo community.*

"Where currently most activities are coordinated by the market or by the state, the digital city may become a tool that enables people to do things by *mobilizing the available local resources*, using existing and emerging social networks" (den Besselaar et al., 2000). Commercial digital cities that depend on business models and strategies to fight competition for market penetration, constantly innovate with new tools to gain new members while sustaining existing members' loyalty. Indeed, members are less likely to go to a competitive site if they invest time and efforts to build their avatars, fill their calendars, and build social networks and communities of friends. Public digital cities, on the other hand, depend on political agendas to motivate progress for technological and social improvements, however always searching to reach the citizens and fulfill their mandate. In 1994, for example, Italian progressive political leadership brought about great innovations to the digital city of Bologna *Iperbole*, by offering online open spaces to groups of citizens to allow them to publish information and engage in public debates with their representatives. Similarly, in 1996, the digital city for Issy-les-Moulineaux was developing its one-stop administration that included online live interaction of citizens to town meetings.

Whereas in the US, for-profit businesses and non-profit organizations co-exist and compete, in the EU the attempts are to coordinate administrations, companies and citizens and in Asia, government directed growth is pursued. The goals of European governments are to close geographic and social digital divides, with access to information and services everywhere and for all, to accelerate economic development, with business assistance, licenses and permits, and to make the governments of cities more efficient and accessible, for example with 24/7 access to municipal services and multilinguism.

2.4 Summary

As stated by Azechi et al. (2000), one concept of the digital city is "to provide infrastructure for networking local communities and to promote social interaction among people who visit or reside in a city". Indeed, many strategies are currently being used and more investigated to meet these goals, and the profound influence of social intelligence design approach can be felt "in the studies of online communities, where mediated communication is a key vehicle for creating and maintaining social contact" (Fruchter et al., 2005). The success factors of digital

cities therefore consist in achieving participation of institutions and communities, in balancing top-down direction, needed for technical infrastructure, and grass-roots initiatives, necessary to insure citizens' cohesion and in finding equilibrium between economic and civic motivations. Ultimately, digital cities need to deal with the same complexity as real cities to attract and retain usage, and to function as entities that augment their physical counterparts. Research in this field addressed such issues in the proceedings of digital cities (Ishida and Isbister, 2000; Tanabe et al.2002; den Besselaar and Koizumi, 2005) by focusing on concepts such as eDemocracy, digital divide and conviviality.

3 Conviviality

First, we note that the many definitions of conviviality remain vague and not technical (table 2). We further note that the concept can be related to other non technical socio-cognitive concepts, such as trust and power that have acquired more technical interpretation in multi-agent systems. We think current research is useful to develop user-friendly multi-agent systems.

Table 2: Definitions of conviviality

Conviviality	Etymological and domain specific definitions of conviviality
Origin	15th. Century "convivial", from Latin, convivere "to live together with, to eat together with". *(French Academy Dictionary)*
Adj. ***Convivial***	Of an atmosphere, society, relations or event: Friendly and lively. Of a person: Cheerfully sociable. *(English Oxford Dictionary)*
Technology	Quality pertaining to a software or hardware easy and pleasant to use and understand even for a beginner. (Adj.) User friendly, (Noun) Usability. By extension also reliable and efficient. *(Grand Dictionnaire Terminologique)*
Sociology	Set of positive relations between the people and the groups that form a society, with an emphasis on community life and equality rather than hierarchical functions. *(Grand Dictionnaire Terminologique)*

3.1 Conviviality for Social Sciences

First used in a scientific and philosophical context (Polanyi, 1974) in 1964, as synonymous with empathy, conviviality allows individuals to identify with each other thereby experiencing each other's feelings, thoughts and attitudes. By extension, a community is convivial when it aims at sharing knowledge: Members

trust each other, share commitments and interests and make mutual efforts to build conviviality and preserve it. A convivial learning experience is based on role swapping (Illich, 1971), teacher role alternating with learner role, emphasizing the concept of reciprocity as key component and creating concepts such as learning webs, skill exchange networks and peer-matching communication, later expanded by Papert and the Constructionists with concepts such as learning-by-making (Papert and Harel, 1991).

Conviviality is then described as a social form of human interaction, a way to reinforce group cohesion through the recognition of common values. The sharing of habits and customs, for example the sharing of certain types of food or drinks, create and reinforce a community through a "positive feeling of togetherness"; individuals become part of the community which in turn, reinforces the community's awareness of its identity. The physical experience of conviviality is transformed into knowledge sharing experience: "To know is to understand in a certain manner that can be shared by others who form with you a community of understanding" (Schechter, 2004).

Illich further developed the concept of conviviality with his notion of "individual freedom realized in personal interdependence" (Illich, 1974); Conviviality should then be the foundation for a new society, one that gives its members the means, referred to as tools, for achieving their personal goals: "A convivial society would be the result of social arrangements that guarantee for each member the most ample and free access to the tools of the community and limit this freedom only in favor of another member's equal freedom". Conviviality is then seen by Putnam as an enhancement to social capital, a condition for the civil society where communities are characterized by political equality, civic engagement, solidarity, trust, tolerance and strong associative life (Putnam, 2000), therefore tightly linking the performance of political institutions to the character of civil life (Putnam, 1988). These ideas are further developed by Lamizet who characterizes conviviality as both "institutional structures that facilitate social relations and technological processes that are easy to control and pleasurable to use" (Lamizet, 2004). An important use for conviviality today is for digital cities as a mechanism to reinforce social cohesion and as a tool to reduce mis-coordinations between individuals (Caire, 2007a; Caire, 2007c; Caire, 2008).

However, a negative side of conviviality emerges when it is instrumentalized, one group being favored at the expense of another. Ashby argues that "truth realities about minorities are built from the perspective of the majority via template token instances in which conflict is highlighted and resolution is achieved through minority assimilation to majority norms. It is argued that the resulting semiotic, narrative models of group interaction rest on a paradoxal convivial relationship; namely that conviviality is achieved for the majority, but only through a process by which non-conviviality is reinforced for the minority" (Ashby, 2004). Taylor further adds to this negative side the idea that conviviality can be used to mask the power relationships and social structures that govern communities. Taylor asks the question "whether it is possible for convivial institutions to exist, other than by simply creating another set of power relationships and social orders that, during the moment of involvement, appear to allow free rein to individual expression. The pantomime audience may experience a sense of conviviality which is deceptive and which disappears as soon as the members return to the alienation of their fragmented lives" (Taylor, 2004). In table 3, we summarized the different aspects of conviviality.

Table 3: Different aspects of conviviality

Positive Aspects ***(Enabler)***	**Grey aspects** ***(Ignorance)***	**Negative Aspects** ***(Threat)***
Share knowledge & skills	Ignore cultural or social diversity	Crush outsiders
Deal with conflict	Hide conflicts	Fragmentation
Feeling of "togetherness"	Promote homogenization & enforce exclusion	Totalitarism
Equality	Political correctness	Reductionism
Trust	Non-transparent systematic controls	Deception

3.2 Conviviality for Multi-Agent Systems

In multi-agent systems, "agents are capable of flexible (reactive, proactive, social) behavior" (Wooldridge, 2004), this capability is crucial for the use of conviviality since it allows agents to cooperate, coordinate their actions and negotiate with each other. These capabilities are fundamental to social intelligence design since "conventionally, social intelligence has been discussed as an ability of an actor/agent to relate to other actors/agents in a society, understand them, and

interact effectively with them" (Fruchter et al., 2005). Intelligent agents, with their artificial intelligence capabilities can assist users, act on their behalf, adapt and learn while performing non-repetitive tasks. Following are multi-agent systems applications that exemplify different aspects of conviviality.

Embodied Conversational Agents (ECAs) are "autonomous agents with a humanlike appearance and communicative skills. They have shown their potential to allow users to interact with the machine in a natural and intuitive human way: the conversation. To be able to engage the user in a conversation and to maintain it, the agents ought to have capabilities such as perceive and generate verbal and nonverbal behaviors, show emotional states and maintain social relationship" (Pelachaud, 2005). In Cassell's Rea system, embodied conversational agents are "specifically conversational in their behaviors and specifically human like in the way they use their bodies in conversation", they are capable of making content-oriented or propositional contributions to a conversation with human users (Cassell, 2000). For example, the Swedish online Customs Department opted to solve its increasing load in incoming communications, telephone, IM, chat and emails, for its human agents by implementing embodied conversational agents. The result was a 20 % load decrease for incoming communications, 40 % of all requests happening outside office hours and more than 1500 (fifteen hundred) simultaneous dialogs at peak hours.

Conversational Agents must be endowed with conviviality, that is "be rational and cooperative" (Sadek et al. (1997) and the interaction with the agent is convivial if the agent presents, jointly and at all times, one or all of the following characteristics: Capacity for negotiation, contextual interpretation, flexibility of the entry language, flexibility of interaction, production of co-operative reactions and finally of adequate response forms. Conviviality is the essential and global characteristic that emerges from the intelligence of the system, not from a set of local characteristics that vary depending upon the application contexts and the types of users. Consequently a list of criteria will by itself not suffice to express conviviality, additional critical factors are the relations that bind the criteria together and the way these relations are perceived by individuals. Building on this work, Ochs et al. distinguish felt emotions from expressed emotions noting that "a person may decide to express an emotion different from the one she actually felt

because she has to follow some socio-cultural norms" (Ochs et al., 2005). This is particularly relevant to the study of conviviality in multi-agent systems where agent communication distinguishes between private beliefs and goals and public opinions and intentions.

In the *Intelligent Tutoring System* proposed by Gomes et al., "convivial social relationships are based on mutual acceptance through interaction", on the reciprocity of students helping each other (Gomes et al., 2004). Students communicate through their agents: Each agent represents a student and has the function to pass information on the affective states of the student; this information can be inferred by the agent or adjusted by the student. A utility function takes as input a student's social profile and computes the student's affective states indicating if the student needs help, if it is the case, the system recommends a tutor. Remaining challenges are with defining utility function inputs to compute recommendations, presently a set of random values, and to automate inferences of students requiring help. This exposes the need for further research in evaluation methods and measures for concepts such as mood, sociability and conviviality. Further looking into interpersonal factors, Heylen et al. (2003) propose emotionally intelligent tutor agents that try to construct a model of the mental state of the student while being aware of the effects of the tutoring acts to determine the appropriate action sequences and the way to execute them.

Computational mechanisms for trust and *reputation in artificial societies* are widely researched (Sabater and Sierra, 2005; Boella and van der Torre, 2004a) and greatly relevant to conviviality. Reputation is the "indispensable condition for the social conviviality in human societies" state Casare and Sichman (2005). In this system, every agents are aware of every other agents' behavior and of their compliance, or not, to the rules of the group. A functional ontology of reputation is defined whereby "roles are played by entities involved in reputative processes such as reputation evaluation and reputation propagation." Concepts of the legal world are used to model the social world, through the extension of the concept of legal rule to social norm and the internalization of social mechanisms in the agent's mind, so far externalized in legal institutions. Reputation acts as a communication tool, ensuring complete social transparency throughout the

system. However, the strict application of legal norms to reputation may suffer from rigidity, and one can wonder about ethical issues, such as privacy, raised by these types systems. Research addressing such issues is for example, Erickson and Kellog's (2000) socially translucent systems, characterized by visibility, awareness and accountability, and ter Hofte et al. (2006) studies of place-based presence and trust evaluation.

3.3 Conviviality for User Interaction

The recent and large scale development of intelligent interfaces combines computing power, adaptive and dynamic systems for more natural and invisible interactions between users and computers. As technologies develop and user's expectations grow, interface and interaction design combine to create and enhance an optimal and seamless user experience. The field of human-computer interaction broadens to encompass a greater number and variety of fields that intertwine in more intricate and complex ways such as computer science, psychology, cognitive science, human factors, ergonomics, sociology, and artificial intelligence, showing the need for overarching concepts such as conviviality. Markopoulos et al. (2005) stress the new critical challenges now facing human computer interaction research: Designing systems and environments that can be perceived as socially intelligent; designing intelligence that will support human-to-human cooperation and social interactions; evaluating social intelligence and defining the benefits of social intelligence. Answering the last question certainly seems to be a requirement for the evaluation of social intelligence and for the design of intelligence that supports social and convivial interactions. Therefore, to study social user-interfaces, Markopoulos et al. experiment with their iCat robotic research platform, so that it exhibits a rich set of humanlike behaviors. Their conclusion is that the challenge ahead is "the need to make systems capable of understanding and relating to people at a social level, timing, and cuing their interactions in a socially adept manner", echoing the need for convivial tools argued by Illich and showing the need for measuring and evaluating conviviality for such systems. Moreover, Fruchter et al. (2005) add that "a desirable social culture will afford the members of the community to learn from each other" which is how Illich and Polanyi described as conviviality.

3.4 Summary

On one hand conviviality allows individual expression while, on the other hand, it contributes to the standardization and uniformization of representation systems. The negative sides of conviviality reveal mechanisms that indicate pitfalls and point to the safeguards needed to protect individuals, groups and institutions; such issues raise ethical questions that must be addressed with, for example, the set up of guidelines and best practices for example to enforce the inclusion of all groups' points of view. It is worth noting that the positive sides of conviviality contribute to promote values such as empathy, reciprocity, social cohesion, inclusiveness and participation, which are research areas in social intelligence design. This stresses the potential benefits of social intelligence design approach for this domain.

4 Legal Norms for Digital Cities versus Social Norms for Conviviality

In their introduction to normative multi-agent systems, Boella et al. give the following definition: "A normative multi-agent system is a multi-agent system together with normative systems in which agents on the one hand can decide whether to follow the explicitly represented norms, and on the other the normative systems specify how and in which extent the agents can modify the norms" (Boella et al., 2006). We first discuss the distinction among various kinds of norms, and then discuss the issues highlighted by this definition. We illustrate our discussion with examples from digital cities.

4.1 Different Kinds of norms

Several kinds of norms are usually distinguished in normative systems. Within the structure of normative multi-agent systems Boella and van der Torre (2004) distinguish "between regulative norms that describe obligations, prohibitions and permissions, and constitutive norms that regulate the creation of institutional facts as well as the modification of the normative system itself". A third kind of norms, procedural norms, can also be distinguished "procedural norms have long been considered a major component of political systems, particularly democratic systems" states Lawrence who further defines procedural norms as "rules governing the way in which political decisions are made; they are not concerned

with the content of any decision except one which alters decision-making procedures" (Lawrence, 1976).

Constitutive norms: Boella et al. note several aspects of constitutive norms; one is as intermediate concept exemplified by "X counts as a presiding official in a wedding ceremony", "this bit of paper counts as a five Euro bill" and "this piece of land counts as somebody's private property" (Boella and van der Torre, 2005). Searle further explains that "the institutions of marriage, money, and promising are like the institutions of baseball and chess in that they are systems of such constitutive rules or conventions" (Searle, 1970). In digital cities, examples are the marriage norms and voting in the sense that going through the procedure counts as a vote.

However, the role of constitutive rules "is not limited to the creation of an activity and the construction of new abstract categories. Constitutive norms specify both the behavior of a system and the evolution of the system" (Boella and van der Torre, 2004b). The dynamics of normative systems is here emphasized as in norms revision, certain actions count as adding new norms for instance amendments: "The normative system must specify how the normative system itself can be changed by introducing new regulative norms and new institutional categories, and specify by whom the changes can be done" (Boella and van der Torre, 2004b). In the US today, government agencies are required to invite public comment on proposed rules (Lau et al., 2005). Citizens are encouraged to propose their changes to regulations, and this is done through the digital city government interface that allows revisions to be traced.

Two other aspects of constitutive norms are organizational and structural, that is, how roles define power and responsibilities and how various hierarchies structure groups and individuals. "Not only new norms are introduced by the agents playing a legislative role, but also that ordinary agents create new obligations, prohibitions and permissions concerning specific agents" (Boella and van der Torre, 2004).

Regulative Norms: "Regulative norms are not categorical, but conditional: they specify all their applicability conditions" state Boella and van der Torre (2004); the authors further add that "legal systems are often modeled using regulative norms, like obligations and permissions. However, a large part of the legal code

does not contain prohibitions and permissions, but definitions for classifying the commonsense world under legal categories, like contract, money, property, marriage. Regulative norms can refer to this legal classification of reality" (Boella and van der Torre, 2005). A regulative norm expressed as an obligation in the Luxembourg digital city, is that citizens must use the file format PDF rather than postscript in order to access administrative documents on the portal.
Regulative norms also express permission, rights and powers. For example computer systems access rights and voting rights: In order to be allowed to vote in Luxembourg, an agent needs to prove it has been a resident for at least five consecutive years or was born in Luxembourg.

Procedural norms: are instrumental for individuals working in a system: Examples in digital cities are back office procedures and processes designed for administrators to do their work. Lawrence distinguishes two kinds of procedural norms: Objective procedural norms are rules which describe how decisions are actually made in a political system and specify "who actually makes decisions, who can try to influence decision makers, what political resources are legitimate and how resources may be used". Subjective procedural norms are "attitudes about the way in which decisions should be made" (Lawrence, 1976).

4.2 Representation, Violation and Dynamics of Norms

The first property of norms in the definition of normative multi-agent systems is that norms are explicitly represented; *explicit* meaning formalized and verbalized by some authorities, *implicit* meaning tacitly agreed upon, neither specialized nor codified. Often norms are given as requirements to computer systems but only implicitly represented. For example, you are filling out a census form and one question is whether you own a pet, but no explanation is given concerning the purpose of the information; assuming your answer is affirmative (you do own a pet), the outcome could be that either you are required to pay a pet license fee or the amount of the fee is directly deducted from your bank account. The digital city of Paris presents an example of explicit norm representation with the stipulation that, to create online library accounts you must be over 18 years old, otherwise an authorization of your parents is required.

Implicit representations are opaque to users and prevent governments to fulfill the democratic promise that transparency and explicit representations deliver. As users' need for explanation and understanding of rules and regulations grows, representations have to become more explicit and personalized to their expectations. Similarly, governments' interest also resides in the explicit representation of norms that can be addressed through the development of mechanisms for knowledge representation and reasoning.

In digital cities, efforts are currently between implicit and explicit representation of norms by providing tools for text representation and retrieval, more advanced ontologies, semantic links and search capabilities. In 2006 for example, the US government added a branch to its business portal to help small businesses comply with Federal regulations; a need that was not being met by any other Federal government program (Caire, 2008a).

Violation of norms: The second property in the definition of normative multi-agent systems is that norms can be violated. This is also seen as an important condition for the use of deontic logic in computer science: "Importantly, the norms allow for the possibility that actual behavior may at times deviate from the ideal, i.e. that violations of obligations, or of agents rights, may occur", as observed by Jones and Carmo (2002).

If norms cannot be violated then the norms are *regimented*. For example, if there is a norm in access control that a service can only be accessed with some certificate, then this norm can be implemented in the system by ensuring that the service can only be accessed when the certificate is presented too. Regimented norms correspond to preventative control, in the sense that norm violations are prevented. When norm violations are possible there is only detective control, in the sense that behavior must be monitored, and norm violations have to be detected and sanctioned. "Social order requires social control, *an incessant local (micro) activity of its units*, aimed at restoring the regularities prescribed by norms. Thus, the agents attribute to the normative system, besides goals, also the ability to autonomously enforce the conformity of the agents to the norms, because a dynamic social order requires a continuous activity for ensuring that the normative systems goals are achieved. To achieve the normative goal the

normative system forms the sub-goals to consider as a violation the behavior not conform to it and to sanction violations" (Boella and van der Torre, 2005).

In digital cities, disincentive is often the mechanism used to prevent users from infringing their norms. For example, the digital city of Issy clearly stipulates that malicious intruders into the digital city will be prosecuted. There are normative multi-agent systems in which norm violations are possible and can trigger new obligations, the so-called contrary-to-duty obligations. With contrary-to-duty obligations, there is not only a distinction between ideal and bad behavior, but there is also a distinction between various degrees of sub-ideal behaviors.

Dynamics of norms: In many electronic institutions, norms are fixed and cannot be changed within the system, even though in many organizations there are roles defined within the system. The questions are whether digital cities are a collection of electronic institutions, whether manipulations and changes are allowed within the system. The US Regulations' office may be contributing to bring answers to this questions as it now provides on its site Regulations.gov a national forum for users to comment on existing and pending federal rules, therefore encouraging a more dynamic process for the modification and explicitness of their rules and regulations.

4.3 Norms for Convivial Digital Cities

"Norms are cultural phenomena that prescribe and proscribe behavior in specific circumstances", state Hechter and Opp (2001). They are considered to be responsible for regulating social behavior: Interaction and exchange between strangers could hardly be imagined without norms. The law relies on norms as well but legal norms differ from social norms.

There is no common definition of social norms and no agreement on how to measure them. A large body of research suggests that social norms regulate such diverse phenomena as cooperation (Conte and Castelfranchi, 1995), collective action (Ros et al., 2007) and social order (Castelfranchi, 2003). Hechter and Opp (2001) distinguish two types of definitions for social norms:

1. Norms that entail a moral imperative, a sense of oughtness, of duty; a social norm behavior that people believe must be performed without concern for its consequence for the agent. For example, a man who was engaging in duels

was ready to die to save his honor. The sanction of an oughtness norm does not depend on the detection of the violation because violators internalize this type of norm; therefore its violation entails some internal sanctioning: the experience of guilt or shame.

2. Norms that generate social expectations without any moral obligations, basically behavioral regularity; a certain behavior is identified as a social norm if deviating from that practice incurs a cost imposed on an agent. For example, a person questioned by a police officer is expected to behave respectfully otherwise he or she may be prosecuted.

In digital cities, a number of security issues like identity management, authentication and authorization can prevent users to *feel at ease*. Some problems are new, for example, in contrast to the physical world, malicious users can create new agents repeatedly to lure beginners, insult them and take advantage of them. These unconvivial behaviors show mechanisms that differenciate social norms from conviviality norms. From personal powers to social dependence, sociality presupposes a *common world*, hence *interference*: "the action of one agent can favor (positive interference) or compromise the goals of another agent (negative interference)" (Castelfranchi, 2003).

Conviviality facilitates and regulates agent interactions, and therefore contributes to agent coordination. For example, digital cities can separate systems for beginners and experienced users, since beginners are frightened by the complexities of the real system, whereas experienced users are bored by the simplifications developed for beginners. However, since beginners and experienced users have to participate to the digital city at the same time, this introduces various challenges: when civil servants working for the digital city are confronted with a user, they have to adapt their behavior with respect to the experience of the user. Dynamic aspects of conviviality, such as the emergence of conviviality, occur from the sharing of properties or behaviors whereby each member's perception is that their personal needs are taken care of.

It is always possible to violate social norms and therefore conviviality. Ignoring cultural and social diversity is violating conviviality as it creates conviviality for a group at the expense of others. In digital cities, as in physical cities, being ignored

when asking advices to a city administrator represents a conviviality violation as it breaks the bilateral form expected from these communication acts to only allow for unilateral communication. Excluding, ostracizing, an agent that does not comply to the norms of the city when interacting with other agents from the city is a distributed mechanism that enforce the norms as in de Pinninck et al. (2008). Other violations would be to promote homogenization, fragmentation, totalitarism, reductionism, deception, to enforce exclusion and to crush outsiders.

4.4 Summary

We summarized the distinction between legal norms and social norms from various sources and present excerpts in table 4.

Table 4. Legal norms versus social norms

	Legal Norms	**Social Norms**
Kinds of norms	Constitutive, regulative and procedural	Consitutive and regulative; rarely procedural.
Norm representation	Exactly specified in written texts.	Unwritten, thus their content and rules are often imprecise.
Norm violation	Linked to distinct sanctions; enforced by specialized bureaucracy.	Enforced informally, but can be a matter of life and death.
Norm modification	Created by design, generally through deliberative process.	Spontaneous, of uncertain origine.

One important role of norms for conviviality in digital cities is to reinforce social cohesion by reflecting the group's core values internally as well as externally. Indeed, by making rules explicit, conviviality contributes to reduce conflicts, optimize members' performances within communities as well as between communities and improve coordination throughout. Moreover, social warranty and protection mechanisms are achieved through praise and encouragements toward members who conform to the rules, and anger and blame toward the ones who do not. Moreover, there are many possible approaches to address violations of conviviality: Enforcing values such as sharing knowledge and skills, equality or trust. In an overall computing environment, focus must be on people and their social situations (Stephanidis, 2006), therefore, social norms and their violations must be taken into account. By reinforcing common shared ground between the

members of a group, conviviality facilitates the auto-regulation mechanisms that digital cities seek for as protection barriers for their members and citizens.

6 Designing Convivial Digital Cities

The digital city of Luxembourg, the *eCity*, is integrated to the one-stop administration portal of the country (Figure 2).

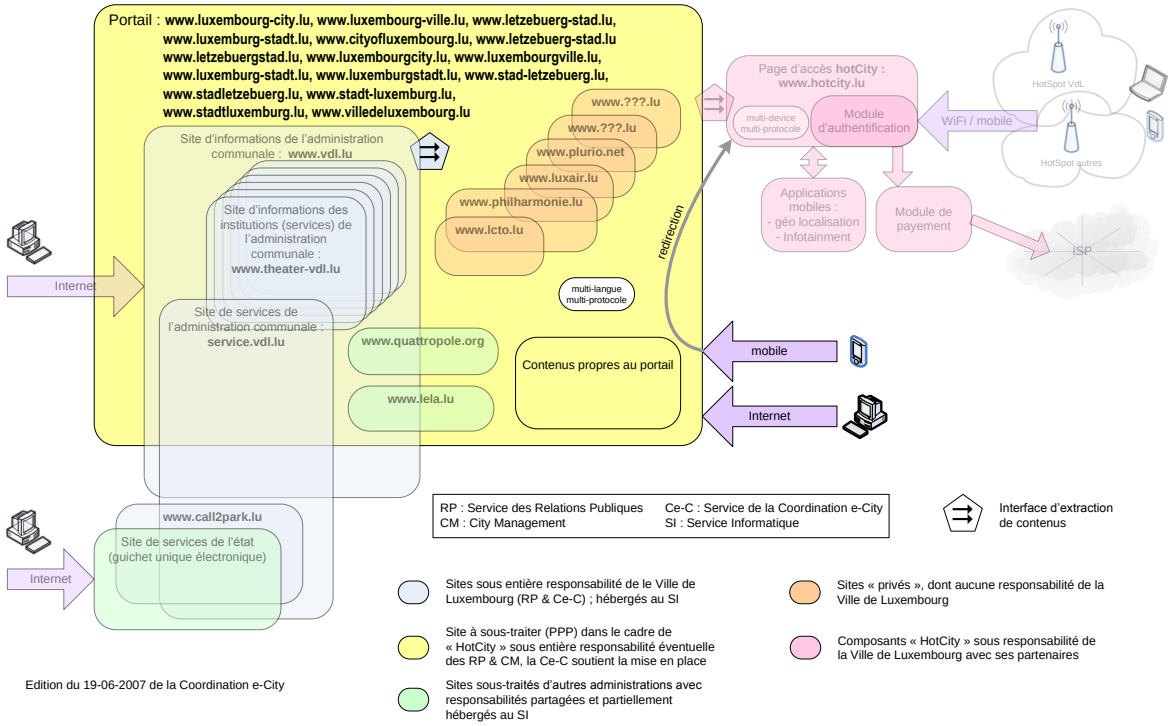

Figure 2. Luxembourg City portal: Organization & Structure (D. Goetz, 2007, eCity Luxembourg)

As a running example, we refer in this section, to the newborn baby regulations of a digital city, which consist of a number of processes (13 in Luxembourg) and establish one of the most important documents in a person's life: the act of birth that identifies the child by name, and establishes the child's citizenship and filiations, these regulations also include requirements for services such as financial assistance, insurance, parental leave and child care.

The declaration of the new born baby process presents non trivial issues such as how to model conviviality, how to evaluate it and measure conviviality. Our work is a conceptual framework and has not yet been implemented.

The newborn child use case captures the functionality and requirements needed by the system for the declaration of a newborn child. It is a complex example that

includes many stakeholders with different roles, dependencies between processes and pre-requisites spread over three years.

From the 13 processes, two are special cases: handicap children and children whose education is provided by their parents. The other processes are required for all other cases and include: requests for financial assistance, birth certificate, health insurance, education assistance, establishment of the child identity card and modification of the parent's tax card. In figure 3, we present a UML use case diagram of the process overview and in figure 4, a detail with the request for prenatal financial support process.

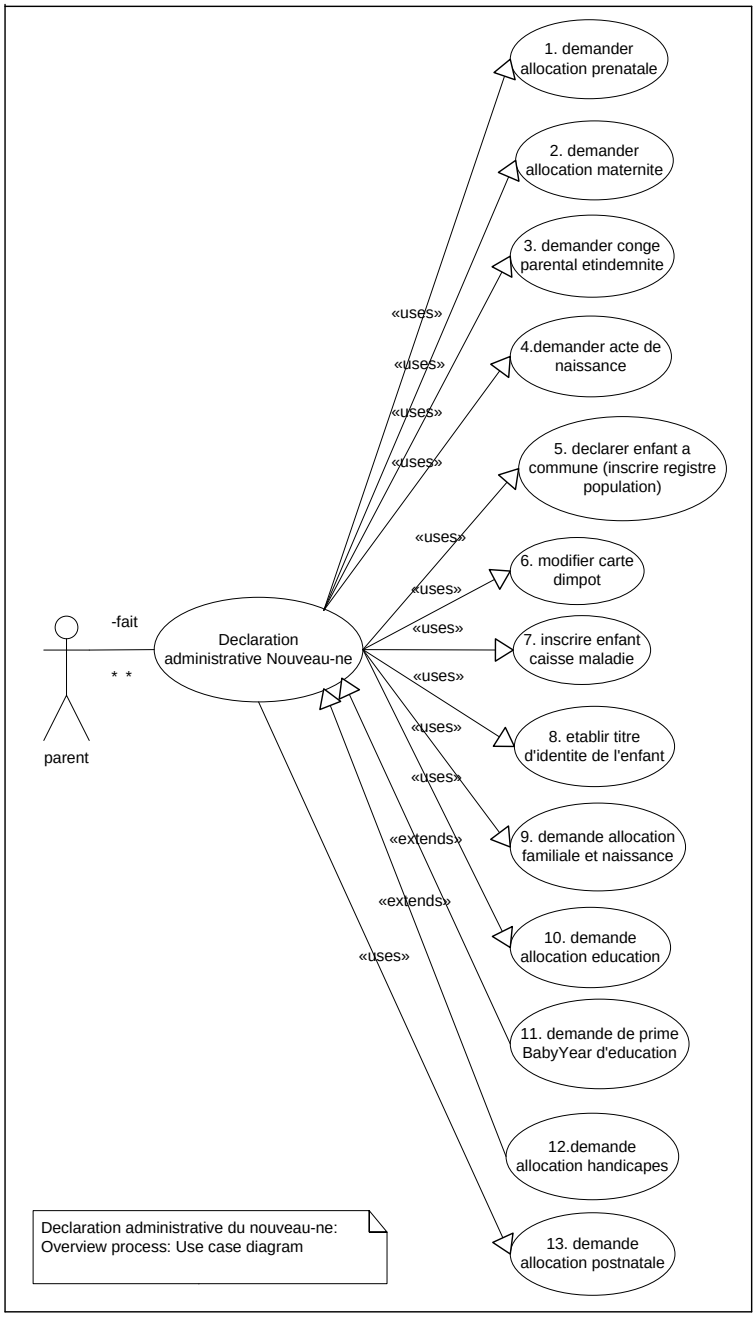

Figure 3. The new born child use case overview

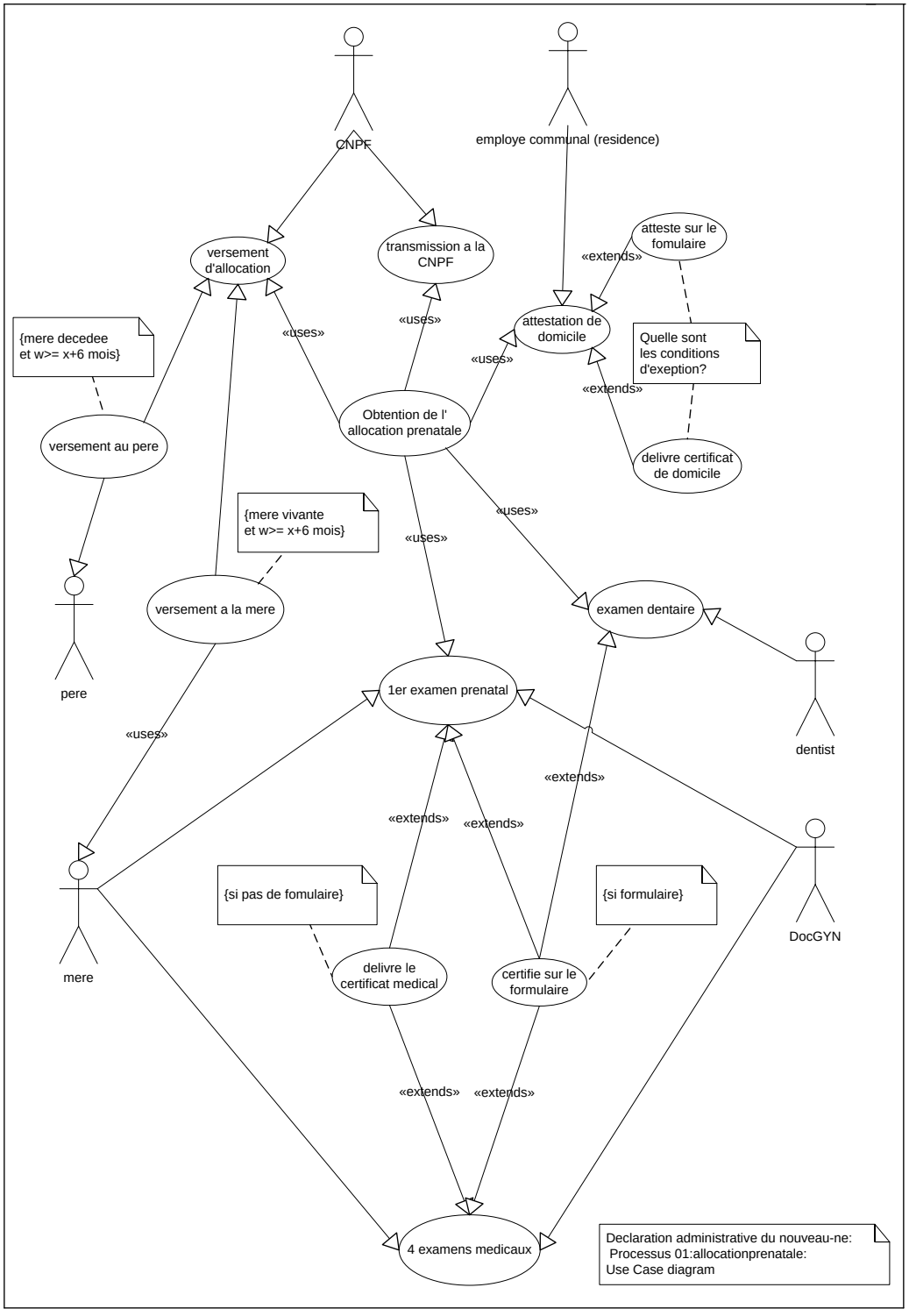

Figure 4. The new born child use case: Request for prenatal financial support process

6.1 Schematic Presentation: The New Born Child Use Case Process 1

The use case process 1 introduces six roles: The applicant (the mother), the beneficiary (mother or father), the doctor, the dentist, the census bureau and the funding agency. We first group the roles into three categories of stakeholders. This allows us to reduce the number of agents. We present the stakeholders' roles along with their goals (table 5), for example, the stakeholder "Parent" in the role "Beneficiary" has the goal *g1* to "get child benefit".

Table 5. Stakeholders, roles and goals

Stakeholder	Role	Goal gi	Goal description
Parent	Beneficiary (mother , father)	g1	Get child benefit
	Applicant (mother)	g2	Get medical and dental certifications
		g3	Get home address attested from Census Bureau
		g4	Get application
Caregiver	Doctor	--	None specified
	Dentist	--	None specified
Civil Servant	Census Bureau	g5	Know home address
	Funding Agency	g6	Give financial assistance to parent

Table 6. Stakeholders' power

Stakeholder	Role	Power pj	Power description
Parent	Applicant (mother)	p1	Fill application form
		p8	Attest home address to census bureau
	Beneficiary (mother , father)	p2	Mother fulfills conditions
Caregiver	Doctor	p3	Provide application form
		p4	Provide 5 medical certificates
	Dentist	p5	Provide 1 dental certificate
Civil Servant	Census Bureau	p6	provide home address certificate
	Funding Agency	p7	Pay prenatal benefit
		p3	Provide application form

The process descriptions further tell us which role can satisfy which goal, e.g. has the power to fulfill which goal. We therefore present (table 6, the stakeholders'

roles along with their powers, for example, the stakeholder ”Caregiver” in the role ”Doctor” has the power *p3* to ”provide application form”.

We illustrate the relations between Stakeholders, roles, goals and powers with a graph (figure 5): Vertices indicates roles, doted lines around vertices indicates the group of stakeholder and an arrow pointing from vertex *v1* to vertex *v2* indicates that role *v1* can see to goal *gi* of *v2*. For example, CB (the census bureau) can see to A’s goal g3 to “get home address attested by census bureau”.

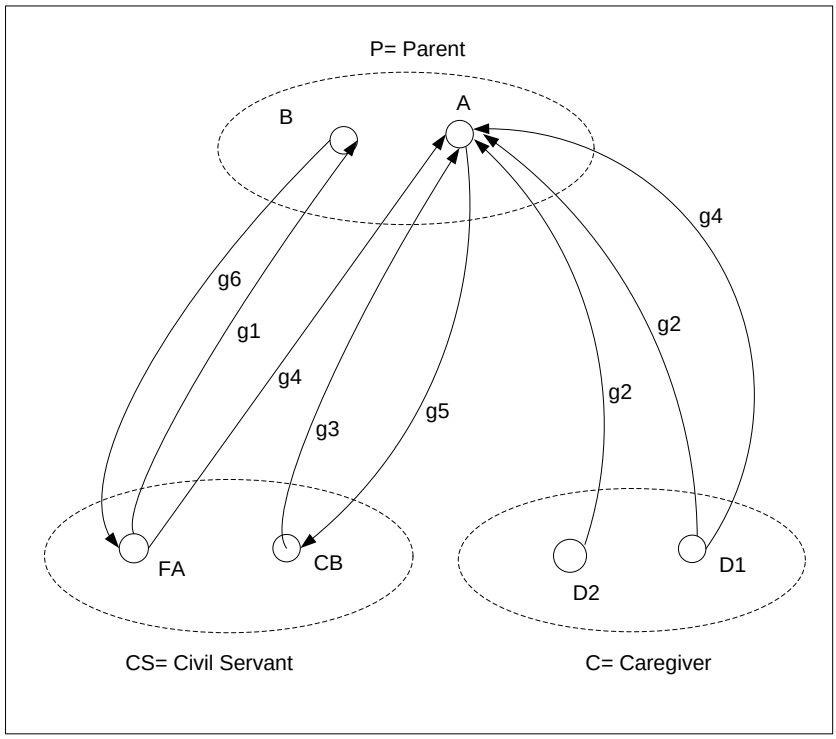

Figure 5. Stakeholders, roles, goals and powers

6.2 Requirement analysis

A convivial digital city is convivial for each stakeholder. In this section, we identify stakeholders’ missing concerns for conviviality requirements (table 7). We, then determine whether the stated requirements are unclear, incomplete, ambiguous, or contradictory and propose actions and methods to resolve these issues (table 8).

Table 7. Stakeholders concerns, missing concerns and conviviality requirements

Stakeholder	Concerns	Missing concerns	Convivial Requirements
Parent		Prepare child birth, e.g. get the best care for the mother and the child, and select a doctor.	Get personalized support and information, exchange experiences on pregnancy and child birth with other parents, get advices on choosing a doctor for services, child care and other tips.
	Respect administrative requirements to obtain prenatal financial benefit, e.g. miss no doctor appointment, and fill out all the forms.		Get friendly assistance to complete the required administrative processes e.g. which form to fill and how to fill it, understanding of the process, tolerance to mistakes, and delays.
Caregiver		Give the best care to the mother and the baby.	Ability to stay in contact with the mother and the baby not only during the visits but also remotely through the system.
		Exchange patient's medical data with colleagues, to get their opinion, pharmacies, laboratories and hospitals.	Quickly, securely discuss patients' cases and share files with colleagues.
	Deliver certificates as required by regulations.		Simplified, quick and efficient means to complete administrative requirements.
Civil Servant	Insure that all documents to be processed match regulations and include all required forms and certificates. Make no mistakes.		Become a source of guidance and advice to parents.
		Know all exception cases for domiciliation form.	Clear list of exception regarding the domiciliation form and certificate as well as references.
		Keep up with regulation and process updates.	Get assistance from colleagues and system when needing help.

Table 8. Requirements analysis

Stakeholder	Requirement analysis
Parent	To get personalized support, conversational software/ human agents and social intelligent design with consistent, predictable and controllable user interface to: • Provide guidance for parents through the process of adequately filling up forms. • Keep parents from missing doctor's appointments with calendars that provide an overview of the complete process and offer reminders capabilities and ways to correct mistakes, missed appointments, etc. • Reputation systems put in place to complete local information. • Effective feedback loops to allow parents' evaluation of the system and services are key to success, although often not fully implemented.
	To use social support to allow parents to exchange experiences provided by giving support to parent support groups (forum): • Parents benefit from empathic support from parent support groups; • The group assists new comers with clear definitions of purpose of the forum, people and policies; • Guide discussions, limit off-topic discussions and angry behaviors.
Caregiver	To stay in contact with the patients, the system can assist caregivers with forums and online meetings with parents. • Privacy and confidentiality are key issues.
	To facilitate the administrative requirements, set up interoperability between systems of hospitals, pharmacies, laboratories, doctors and the digital city. • This is a difficult step that reaches beyond the current scope of the digital city as it includes private practitioners. • However, setting a single online form to validate the complete process 1, for example, would prevent redundancies and minimize form losses, while still keeping the process flexible by allowing the inclusion of additional certificates.
Civil Servant	To become a source of guidance and advice to parents clearly will change the profession of civil servant, however, it is unclear on the best approach to achieve this goal and avoid resistance. • The system can assist civil servants with adaptive and interactive tools to help civil servants use new interface to discuss online with parents in need of advice. • The same document can be simultaneously consulted by both civil servant and parents to allow effective and relevant discussions. • Security issues and information leakage are prime concerns.
	To get assistance from colleagues and from the system. • Intranet with collaborative environment and e-learning capabilities set up to facilitate negotiations with parents or decisions making process when a question arises regarding exemption conditions for the domiciliation attestation. • Expert systems with natural interactive dialog interface assist civil servants to solve problems and access up-to-date regulations. • Service integration through interoperability, process standardization and simplification, templates, guidelines are promoted by the digital city planning to fight the isolation in which each administration and service is operating.

6.3 Design Process, Simulations and Testing

Design process for the digital city follows the four-stage process:

- Stage 1: Forms, brochures and information are put online. There is no interaction capability. Help is provided with static screen.
- Stage 2: Forms can be downloaded but and they have to be sent by mail to the digital city. This is one-way interaction. Help is provided with automatic word completion, tool tips and contextual help.
- Stage 3: Forms can be downloaded, filled in on line and uploaded to the digital city. This is two-way interaction. Help is provided with intelligent agents and expert systems through interactive interface.
- Stage 4: Interaction between all stakeholders (parents, caregivers, civil servants) is performed synchronously and asynchronously in both directions. This is full interaction. Help is provided with embodied conversational agent, adaptive and interactive environment.

This process is a difficult process due to legacy systems and migration challenges inherent to large systems such as the ones from a city, and our task will be to ensure conviviality be part of the design process.

Our plan is to use the city of Luxembourg as a test bed for our model. Following our running example, the evaluation should be performed for each stakeholder group as they are all users of the system. A number of metrics are being reviewed for appropriateness:

- Network analysis to evaluate and compare empirical data, for example from a log collected from experiments with a digital city prototype, over a few weeks or months, to see if the conviviality model actually facilitates conviviality.
- Predictive metrics, or design metrics to assess the quality of designs or prototypes, for example, ease of use for new parents to fill the forms, efficiency and error recovery.
- Preference metrics to quantify the subjective evaluations and preferences of the stakeholders using the system, for example, the affect of parents dialoging with an intelligent agent, the efficiency of the civil servants, the helpfulness of the social support forum for parents, the control and ease of learning.
- User interface design metrics: semantic metrics based on content, e.g. how the stakeholders using the system understand the components and their

interrelationships; procedural metrics that are task sensitive, e.g. how they follow a scenario by performing various tasks and structural metrics based on surface properties such as the number of visual components on the screen and the alignment of widgets.

6.4 Summary

We summarize by first emphasizing the current lack of measures for social concepts such as conviviality and therefore the important input of approaches such as social intelligence design. In order to design convivial digital cities, we need to measure and evaluate conviviality. We are currently further developing the use of dependence networks and graphs as shown in Caire et al.(2008). Future plans include the design of a validation process as well as a refinement of the conceptual model we presented in this article.

7 Related Works

The goal, to design interfaces that are closer to the way human think than the way machine operate, raises questions such as: "What is, at this very moment, the user's state? What does s/he want, like, need, wish? Is s/he alone, at home, in family, with friends, at work?" (Gross, 2001). In the context of such spontaneous interactions, innovative approaches based on dynamic notions such as conviviality, trust and behavior are required. Furthermore, in the area of the disappearing computer, "the shift from information worlds to experience worlds" (Streitz et al., 2005) is particularly significant (Caire, 2007a). As stated by de Ruyter and Aarts, user experience for ambient intelligence must be based on: "(i) safeguarding the privacy of the home environment, (ii) minimizing the shift of user attention away from the actual content being consumed and (iii) creating the feeling of being connected when consuming content over different locations" de Ruyter and Aarts (2004).

In a rather new area of research called mixed-initiative interaction "people and computers take initiatives to contribute to solving a problem, achieving a goal, or coming to a joint understanding" (Horvitz et al., 2004). A critical element is how users focus their attention: "Attentional cues are central in decisions about when to initiate or to make an effective contribution to a conversation or project" (Horvitz et al., 2003). Mixed-initiative research aims at developing software that

filters appropriately incoming information to shield users from incoming disturbances such as emails and phone calls. The filtering of incoming information is achieved through measuring user's keystrokes and scrolling activities, recording the number of opened windows, analyzing content, checking events in calendars, location and time of day and so on.

The Companions that Wilks (2004) envisions are persistent software agents attached to single users. They act as intermediaries for all information sources that users cannot manage. For instance, Companions for seniors provide company to senior citizens and they act as technical task assistant to search the web for travels or keep track of the events their owners forget. Conversely, Companions for juniors provide assistance with teaching, explanations-on-demand and advices.

Conclusion

In this article we raised the question whether social intelligence design could be used to designing convivial digital cities. We first looked at digital cities and identified, from a social intelligence design point of view, two main categories of digital cities: public websites and commercial websites; we also noted the experimental qualities of digital cities. Second, we analyzed the concept of conviviality for social science, multi-agent systems and intelligent interface; we showed the distinction among various kinds of use of conviviality, the positive outcomes such as social cohesion, trust and participation but also the negative aspects that emerged when conviviality became an instrument of power relations. Fourth, we looked at the normative aspect of conviviality as described in the literature and found that social norms for conviviality paralleled legal and institutional norms for digital cities. Finally, as a first step towards obtaining measures for conviviality, we presented a case study describing agents and user's interactions using dependence graphs. We also presented an analysis of conviviality requirements and described our plan and methodology for designing convivial digital cities.

Moreover, we noted that intelligent interfaces allow instant interactions and thereby create strong needs for coordination and regulation mechanisms. These needs have to be addressed to ensure the safeguard of individuals against abuses, such as privacy intrusions and identity manipulations. Therefore, it is crucial to build into the application designs of digital cities, the necessary protection

mechanisms against the potential negative aspects of conviviality, such as deception, group fragmentation and reductionism without, however, leaving aside the numerous positive aspects of conviviality. Best practices and guidelines elaborated by social intelligence research open new avenues in this direction and therefore provide an extremely valuable approach. In fact, using the concept of conviviality allows to take into account not only social and cognitive factors but also the ethical issues raised by large scale development of digital cities. Most importantly, conviviality highlights the crucial positive, fun and liberating aspects of social networks and digital life while pointing out the desperate need for measures to better design convivial digital cities.

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