

# A Normative Multi-Agent Systems Approach to the Use of Conviviality for Digital Cities

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**Abstract.** Conviviality is a mechanism to reinforce social cohesion and a tool to reduce mis-coordination between individuals, groups and institutions in web communities, for example in digital cities. We use a two-fold definition of conviviality as a condition for social interactions and an instrument for the internal regulation of social systems. In this paper we discuss the use of normative multi-agent systems to analyze the use of conviviality for digital cities, by contrasting norms for conviviality with legal and institutional norms in digital cities. We show the role of the distinction among various kinds of norms, the explicit representation of norms, the violability of norms and the dynamics of norms in the context of conviviality for digital cities.

**Keywords.** Conviviality, multi-agent systems, normative systems, social computing, digital cities.

## 1 Introduction

The role of norms for conviviality is a condition for social interactions and an instrument for the internal regulation of social systems [1]. For example, in digital cities “government regulations extend laws with specific guidance to corporate and public actions” [2].

In this paper we raise the following question: how can normative multi-agent systems be used to model conviviality for digital cities? We approach this question focusing on conviviality in digital cities, and by contrasting the use of normative multi-agent systems for conviviality with legal and institutional norms in digital cities.

Our main question breaks down into the following research questions: What are digital cities, what are normative multi-agent systems, what is conviviality and finally, can normative multi-agent systems be applied to conviviality for digital cities?

The layout of this paper follows these sub-questions. In section 2 we give a brief overview on digital cities, in section 3 we explain norms in regards to the legal and institutional aspects of digital cities, in section 4 we present a literature survey on the notion of conviviality and in section 5 we examine the use of norms for conviviality.

## 2 Brief Overview of Digital Cities

In their simplest form, digital cities are web portals using physical cities as a metaphor for information spaces. Depending upon their goals, they combine social, political and economic activities. Following are three examples showing their diversity: The city of Luxembourg that provides to citizens and visitors, information over the real city of Luxembourg as well as online forms and services, while eLuxembourg provides similar facilities at country level and eEurope at the European level. These types of digital cities are also called eAdministration and eGovernments; MSN CitySearch and AOL Digital Cities that offer services, shopping, entertainment and more generally, local easy to find and search information, are also referred to as eCommerce portals. Finally, Second Life and the Habbo Hotel are virtual worlds that provide infrastructures to users, 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*.

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 [3] raises the question whether public digital cities can compete with commercial ones. “Without profit services, digital cities become unattractive and fail to become a portal to the city. Without nonprofit services, the city may become too homogeneous like AOL digital cities as a result of pursuing economic efficiency.”

### 2.1 The Goals of Digital Cities

Commercial digital cities as websites started as local portals run by private companies, such as phone, web and airline companies, competing with each other. Nowadays, global companies such as Yahoo! and AOL 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, 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 emphasizing freedom of speech and activism. Their original goal was to create virtual information spaces, such as the WELL, *Whole Earth'LECTronic Link* and Blacksburg Electronic Village. US public digital cities main challenges are: Lack of synergy between community networks, private companies and administrations and competition between profit and non-profit organizations. Today they align with eGovernments.

In Europe, public digital cities evolved through the European Community leadership. Goals are to share ideas and technologies between all cities to strengthen

European partnerships, use information and communication technologies to resolve social, economic and regional development issues and improve the quality of social services. 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.

## 2.2 The Organizations of Digital Cities

Commercial digital cities count on accumulating 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 look toward open systems. The lack of funds and the complexity of their partnerships caused many downfalls (Digital Amsterdam). Public digital cities rely on high speed networks tightly coupled with physical cities (Helsinki) and platforms for community networks (Bologna). They have multilayer architectures: Information, interface and interaction layers (Digital Kyoto).

Asian digital cities, called *city informatization*, emerged as government initiatives. Their goal is to develop their country through technological innovation. There were attempts to integrate grass-roots activities and university driven projects in 1999 with Digital Kyoto and Shanghai but the greatest challenge still remains their top-down approach based on administration activity.

## 2.3 Summary

Commercial and public digital cities were originally very different but seem today to have more overlaps.

However, as yet, no one model has been identified. In the US for-profit businesses and non-profit organizations co-exist and compete, in EU the attempts are to coordinate administrations, companies and citizens while Asia pursues government directed growth. Governments' goals for digital cities consist in helping close geographic and social digital divides, with access everywhere and for all, in accelerating economic development, and making the governments of cities more efficient and accessible. Pluralism and participation are combined with multi-disciplinary approaches, synergy between administrations, companies and citizens and, most importantly, a shared vision between all stakeholders.

The success factors of digital cities 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 an 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.

### 3 Legal and Institutional Norms in Digital Cities

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” [4]. We first discuss the distinction among various kinds of norms, and then we discuss three issues in this definition, illustrated by examples in digital cities.

#### 3.1 The Different Kinds of norms

Several kinds of norms are usually distinguished in normative systems. Within the structure of normative multi-agent systems [5] 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” [6].

**Constitutive norms:** Boella et al. note several aspects to constitutive norms, one is an 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” [7]. As per Searle, “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” [8]. In digital cities, an example of constitutive norm is voting in the sense that going through the procedure counts as a vote.

Boella et al further believe that “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” [5]. The dynamics of normative systems is here emphasized as in *norm 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” [5]. Today “US government agencies are required to invite public comment on proposed rules” [2]. Citizens are therefore encouraged to propose their changes through the digital cities interface. All revisions are traced and searchable.

Two other aspects of constitutive norms are organizational and structural, that is, how roles define power and responsibilities and how 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” [5].

**Regulative Norms:** “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 common sense world under legal categories, like contract, money, property, marriage. Regulative norms can refer to this legal classification of reality” [7]. A regulative norm expressed as obligation is for example that, to access the administration documents on the Luxembourg digital city website, citizens must use the file format PDF rather than Postscript. Regulative norms also express permission, rights and powers, for example computer systems access rights and voting rights: You are allowed to vote in Luxembourg if you are resident for more than 5 years or were born in Luxembourg. “Regulative norms are not categorical, but conditional: they specify all their applicability conditions” [5]. In NYC, for instance, to renew online your Driver’s License the stipulation is: “You cannot change your address during this transaction. You must have a completed form MV-619 (Eye Test Report) for this transaction. Read the requirements before you begin this transaction” [9].

**Procedural norms:** Lawrence distinguishes two kinds of procedural norms, objective and subjective. “Objective procedural norms are rules which describe how decisions are actually made in a political system [...] they 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, on the other hand, are attitudes about the way in which decisions should be made” [6]. Procedural norms are instrumental for individuals working in a system, for example, back office procedures and processes in digital city administrations.

### 3.2 Explicit versus Implicit Representation 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, not specialized nor codified. Often, norms are given as requirements of computer systems but only implicitly represented, for example, a form in which you would be asked to state whether or not you keep a pet at home without mentioning to you the purpose of the information: if your answer is affirmative, either you could be requested to pay a license fee or the amount of the fee could directly be deducted from your bank account. An example of explicit representation of a norm is given by Paris digital city website with the stipulation that to create online library accounts, one must be over 18 years old, otherwise an authorization of the 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 reside in the explicit representation

of norms that can be addressed through the development of mechanisms for knowledge representation and reasoning.

Current efforts are somewhat in-between implicit and explicit representation with tools for text representation and retrieval with more advanced ontologies, semantic links and search capabilities. To this effect, the US government launched in 2006 a business portal to help small businesses comply with Federal regulations, a need that was not being met by any other Federal government program [9].

### 3.3 The Violation of Norms

The second property in the definition of normative multiagent systems, that norms can be violated, is also seen as a 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” [10].

If norms cannot be violated then the norms are *regimented*. For example if, in access control, a service can only be accessed with a certificate, then this norm can be implemented in the system by ensuring that the service can only be accessed when the certificate is presented. 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 subgoals to consider as a violation the behavior not conform to it and to sanction violations” [7].

Norms can be violated because they are soft constraints. In digital cities, disincentives are often the mechanism used to prevent users from infringing the norms. For example, the digital city of Issy clearly stipulates that malicious intruders into the digital city will be prosecuted. When norm violations are possible, there are normative multiagent systems in which the violations 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.

### 3.4 Summary

In many electronic institutions the norms are fixed and cannot be changed within the system, even though in many organizations there are roles defined within the system. The question is 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 The Role of Conviviality

Looking at some definitions shows that the meaning of conviviality depends on the context of use (table 1): In sociology, conviviality typically describes a relation between individuals and emphasizes positive values such as equality and community life, while in technology, it refers to being easy to use.

**Table 1.** Definitions of conviviality

<b>Etymological and Domain Specific Definitions</b>
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. User friendly, 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)

A less common view of conviviality emerges when it becomes an instrument to exercise power and enforce one point of view over another [11]. Conviviality is then experienced as a negative force by the losing side. We summarized from different sources, positive and negative roles of conviviality and present some excerpts as examples (table 2): The emphasis for positive sides is on sharing common grounds and on inclusiveness, whereas for negative sides, the emphasis is on coercive behaviors and division.

### 4.1 From Individuals to Groups

First used in a scientific and philosophical context [12], 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 [13], teacher role alternating with learner role, emphasizing the concept of reciprocity

**Table 2.** The different roles of conviviality

<b>Positive aspects</b> <i>(Enabler)</i>	<b>Grey aspects</b> <i>(Ignorance)</i>	<b>Negative aspects</b> <i>(Threat)</i>
Share knowledge & skills	Ignore cultural diversity	Crush outsiders
Deal with conflict	Hide conflict	Fragmentation
Feeling of “togetherness”	Promote homogenization	Totalitarianism
Equality	Political correctness	Reductionism
Trust	Non-transparent system- atic controls	Deception

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* [14].

But conviviality is also a social form of human interaction, [15] a way to reinforce group cohesion through the recognition of common values. “Thus the sharing of a certain kind of food and/or drink can be seen as a way to create and reinforce a societal group through a positive feeling of togetherness (being included in/or part of the group), on which the community’s awareness of its identity is based.” Physical experiences of conviviality are transformed into learning and knowledge sharing experiences: “To know is to understand in a certain manner that can be shared by others who form with you a community of understanding”.

However, the instrumentalization of conviviality occurs when one group is favored at the expense of another, “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 [. . .] Conviviality is achieved for the majority, but only through a process by which non-conviviality is reinforced for the minority” [16].

## 4.2 From Groups to Institutions

Conviviality also means “individual freedom realized in personal interdependence” [17]; It is 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 an enhancement to social capital and seen as a condition for a civil society, one in which “communities are characterized by political equality, civic engagement, solidarity, trust, tolerance and strong associative life” [18]. Conviviality also describes both “institutional structures that facilitate social relations and technological processes that are easy to control and pleasurable to use” [19]. However, “Conviviality masks the power relationships and social structures that



govern communities”. The question is “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 [. . .]. Community members 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” [11].

### 4.3 Summary

We summarize by first noting that conviviality is usually considered a positive concept but that a darker side emerges when it becomes the instrument of power relations. Then following our two-fold definition of conviviality as a condition for social interaction and an instrument for the internal regulation of social systems, we see the crucial uses for conviviality in digital cities as a mechanism to reinforce social cohesion and as a tool to reduce mis-coordinations between individuals.

## 5 The Use of Norms for Conviviality

Intelligent agents, with their artificial intelligence capabilities can assist users, act on their behalf, adapt and learn while performing non-repetitive tasks; with spontaneous interactions and innovative approaches based on dynamic notions such as conviviality, trust and behavior are required [20]. In this section we reconsider the issues discussed in the context of legal and institutional norms for digital cities, this time in the context of norms for conviviality.

### 5.1 The Different Kinds of Norms for Conviviality

Typically today, web communities use text-based multi-user synchronous and asynchronous conferencing capabilities such as web forums and chat rooms. It is considered bad practice to use offensive language in a public forum or a chat room; *Network etiquette* and sometimes FAQ outline dynamic set of guidelines to encourage behaviors conducive to pleasant, efficient and polite user interactions. The constitutive norm for the use of offensive language in a chat room would, in this example, be the definition of what constitutes offensive language for this particular chat room; a regulative norm, the fact that using offensive language is prohibited; and a procedural norm, the fact that if a member uses offensive language, then other members should not use the chat room to retaliate and send rebuffs.

### 5.2 Explicit vs. Implicit Representation of Conviviality

Norms for conviviality are social norms, and even though they can be communicated, they are typically not explicit. Explicit norms for conviviality often refer to cooperation among agents or between agents and humans. **Embodied Conversational Agents**, for example, are “autonomous agents with a human-like

appearance and communicative skills [...] To be able to engage the user in a conversation and to maintain it, the agents ought to have capabilities such as to perceive and generate verbal and nonverbal behaviors, to show emotional states, to maintain social relationship” [21]. Conversational agents in [22] must be endowed with *conviviality*: an agent is convivial if it is rational and cooperative, conviviality being the essential and global characteristic of services that “emerges from the intelligence of the system and not from a set of local characteristics that vary depending upon the application context 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.

**Intelligent tutoring systems** provide further examples of intelligent agents that must *understand and express* the implicate and explicit social norms. [23] propose an eLearning recommendation system for student tutors, in which “convivial social relationships are based on mutual acceptance through interaction”, e.g. on reciprocity, students helping each other. Looking at interpersonal factors, [24] propose *emotionally intelligent tutor agents* that try “to construct a model of the mental state of the student and is knowledgeable of the potential effects of tutoring acts on the mental state. These insights are used to determine the appropriate action sequence and the manner of executing the actions”.

**Reputation systems** highlight the need for explicit social norms: Reputation is the “indispensable condition for the social conviviality in human societies” state [25], because it encourages transparent information as in their system, all agents’ actions are instantaneously propagated throughout the system. Critical challenges raised by the development of such systems are ethical issues such as preserving students’ privacy and securing information gathered to create social profiles and more generally, the need to develop guidelines to safeguard users. Research examples addressing the issues are socially translucent systems characterized by visibility, awareness and accountability [26], and study of place-based presence and trust evaluation [27]. These research exemplify the challenges of formalizing implicate norms of conviviality with various degrees of explicitness and most importantly, the difference between social norms and norms for conviviality.

### 5.3 The Violation of Conviviality

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, 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. The online Paris library assures members of a *kind and pleasant service* and proposes a free mediator service in case of difficulties dealing with city clerks, therefore providing a compensation mechanism.

## 5.4 Summary

By definition, conviviality is a regulative instrument for social systems; it reinforces the group’s common values and encourages the auto-regulation of the group; Conviviality has a normative function. In table 3, we summarize the use of norms for conviviality by Comparing legal norms with social norms.

**Table 3.** Legal norms versus social norms

Type	Legal Norms	Social Norms
Kinds of norms	Constitutive, regulative, procedural	Constitutive, regulative, procedural: problematic
Norm representation	Usually explicit	Usually implicit
Norm violation	Not possible for preventive control systems	Always possible to violate
Norm modification	By regulators	Emerging

## 6 Conclusion

In this paper we contrast norms for conviviality with legal and institutional norms in digital cities. We consider the following issues. First, the kinds of norms typically distinguished in legal systems can be distinguished for norms of conviviality too. Second, norms for conviviality are often implicit, and we believe it is an important question when such norms should be made explicit. Third, the issue of violation of conviviality and ways to deal with it is of central concern in web communities like digital cities. Fourth, norms concerning conviviality should be able to change over time. Fifth, norms for conviviality can come from a wide variety of sources.

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