Conviviality for Ambient Intelligence

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Abstract. Conviviality is usually considered a positive concept related to sociability, however, further analysis reveals a negative side related to regulations. In this survey paper, we examine the multi-faceted concept of conviviality and raise the question: Which definition of conviviality can be used and made operational for ambient intelligence? We propose a two-fold definition of conviviality as a condition for social interactions and an instrument for the internal regulation of social systems. We, then, propose to use conviviality for ambient intelligence as a mechanism to reduce mis-coordinations between individuals, groups and institutions, and as a tool to reinforce social cohesion. Intelligent interfaces, for example, allow instant interactions and thereby create strong needs for coordination and regulation mechanisms that have to be addressed to ensure the safeguard of individuals against abuses, such as privacy intrusions and identity manipulations. It is therefore crucial to take into account social and cognitive factors and to address the ethical issues raised by the large scale development of ambient intelligent systems.

1 INTRODUCTION

Generally speaking, a convivial place or group is one in which individuals are welcome and feel at ease [1] [40] [39], but definitions in literature spread from individual freedom realized in personal interdependence [18], to rational and cooperative behavior [38], to normative instrument [45]. In the context of digital communities and institutions, conviviality refers to qualities such as trust, identity and privacy. One of the four themes of the European Community 5th framework program titled the *Societe de l'Information Conviviale* (User-Friendly Information Society) promoted user empowerment, human interactions, ambient intelligence and distributed services. The Convivio Net Consortium (2003-2005) fostered *convivial technologies* designed to be people centered, support communication and interaction, bridge the digital divide and increase social cohesion and community identity. Figure 1, adapted from [6], illustrates, with key reference dates, the conviviality theme, ambient intelligence vision and development of digital cities [11]; Their goal being to "transform, modernize and improve the level and quality of life of the population at both individual and community levels" [19]. In [6], we identified the need for survey on the use of conviviality.

In this paper, conviviality for ambient intelligence, we raise the question: Which definition of conviviality can be used and made operational for ambient intelligence? This breaks down into the following research sub-questions: What kinds of notion of conviviality exist? How can the positive aspects of conviviality be used for ambient intelligence? How should the negative aspects be taken into account?

In [38], conviviality is defined as "the essential and global characteristic of services ... it 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. Additional critical factors to consider are: on the one side, the relations that bind the criteria together and on the other side, the way these relations are perceived by individuals.

Ambient technologies, foresaw in 1991 as *ubiquitous computing* by Mark Weiser [46], rely upon transparent, unobtrusive and intuitive interfaces, closer to the way people think and feel than to the way machines operate.The term ambient intelligence, used in 1999 by the European Union's Information Society Technologies Program Advisory Group (ISTAG) [20], describes a vision where "people will be surrounded by intelligent and intuitive interfaces embedded in everyday objects around us and an environment recognizing and responding to the presence of individuals in an invisible way". One of its goals is to give individuals the possibility to express themselves more efficiently, accurately and effortlessly [20], by invisibly capturing and tracking their preferences into profiles [22]. Hence, the need for context aware applications to take into consideration notions such as privacy, identity and conviviality [44] [9].
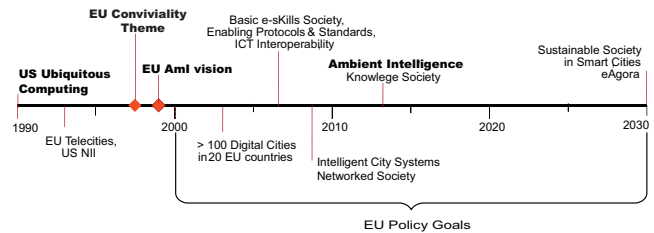

Figure 1. Reference dates for EU digital cities programs, conviviality theme and ambient intelligence

In this paper, we raise ethical issues, such as privacy threats, surveillance of users and identity theft, but do not review them in detail and leave as future work more in-depth analysis. Also out of scope, is how to provide a crisp and usable means of evaluation and measurement of conviviality.

Our methodology is a literature review. The layout is as follows: In each section, we first give an overview on the kinds of notions of conviviality that exist in the field and then suggest how these notions can be used for ambient intelligence. In Section 2 we focus on socio-cognitive approaches, in Section 3 on computer science, agent theory and multi-agent systems, in Section 4 on Human Computer Interaction and in Section 6 we discuss results and summarize our findings.

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2 SOCIO-COGNITIVE APPROACHES

2.1 Definitions 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. However, with power shifting between individuals and groups, conviviality relations change: Minority and majority groups form, outsiders are excluded, others force their way in. This process dynamic and temporal process raises questions such as: How is conviviality created? how does it evolve? What makes it fail?

Table 1. Definitions of 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)

2.2 The role of conviviality in social systems

A less common view of conviviality, that pertains to sociology, is when it becomes an instrument to exercise power and enforce one point of view over another [45]. Conviviality is then experienced as a negative force by the loosing side. We summarized, from different sources, positive and negative aspects of conviviality and present, as examples, some excerpts (table 2): The emphasis is on sharing of common grounds and inclusiveness for positive side, on division and coercive behaviors for negative side.

Table 2. Conviviality: Positive and negative aspects

Positive aspects (enabler)	Negative aspects (threat)
Share knowledge and skills	Crush outsiders
Deal with conflict	Fragmentation
Inclusiveness	Totalitarism
Equality	Reductionism
Trust	Deception

2.2.1 *Individuals vs. groups*

In 1958, Polanyi [34] is the first to use conviviality in a scientific and philosophical context; He describes it as synonymous with empathy "which alone can establish knowledge of other minds". By allowing individuals to identify with each other, empathy provides a way to acquire personal knowledge by experiencing the feelings, thoughts and attitudes of an individual. In 1974, Polanyi further describes a community as convivial when it aims at sharing knowledge: members trust each others, share commitments and interests and make mutual efforts to build conviviality and preserve it [35].

In his 1971 critical discourse on education, Deschooling Society [17], Illich defines a convivial learning experience as one based on role swapping, teacher role alternates with learner role, to emphasize the concept of reciprocity as key component to conviviality. In 1973, Illich's Tools for Conviviality [18] brings a new dimension to the concept defined as "an intrinsic ethical value". Indeed, for Illich, conviviality means "individual freedom realized in personal interdependence", it is the foundation of 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".

In the 1980's, Putnam and his colleagues further extend the concept of conviviality as an enhancement to social capital. In 1988, they refer to conviviality as a "condition for civil society" [36], and in 2000, argue that in a civil society "communities are characterized by political equality, civic engagement, solidarity, trust, tolerance and strong associative life" [37], stressing the strong link between the performance of political institutions and the character of civil life.

Building on Illich learning webs, skill exchange networks and peer-matching communication concepts, Papert and the Constructionists, emphasize in 1991 "learning-by-making" [32], and in 2001, Sipitakiat develops digital technologies for conviviality, stressing the notion of equilibrium" [40].

In a 2004 semiotics symposium on conviviality,, Schechter takes another look at the concept: "in a basic sense, conviviality is a social form of human interaction" [39]. The author binds interaction to physical experience and recognizes the social dimension of conviviality, as 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." Schechter transforms the physical experience of conviviality into a learning and 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".

It is worth noting that the conviviality values from socio-cognitive context, such as social cohesion, inclusiveness and participation, by putting individuals at the center of change, coincide with the very values praised by the ambient intelligence vision.

2.2.2 *The darker side of conviviality*

A negative side of conviviality can however emerge, when it becomes an instrument in the hand of power relations: "Conviviality is achieved for the majority, but only through a process by which non-conviviality is reinforced for the minority" states Ashby [2], who further denounces the instrumentalization of conviviality 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 masks the power relationships and social structures that govern communities" argues Taylor [45] who then, explores the contradiction between institution and conviviality, asking "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." These issues raise important ethical questions that must be addressed in the new world of ambient intelligence, for example, with guidelines and best practices, that include all parties point of views, and new co-ordination theories [27] and mechanisms that manage dependencies among activities.

"Until now, there has been no reasonably comprehensive survey of AmI research projects in Europe, the USA and Canada focused on privacy, security, identity and trust issues" states Wright in his *Safeguards in a World of Ambient Intelligent* project report [49]. No one has considered the range of safeguards needed to protect individuals. The negative sides of conviviality, by revealing these mechanisms, indicate what is to be avoided and point to the mix of different safeguards that have to be put in place to adequately protect individuals, groups and institutions.

2.2.3 From groups to institutions

While Lomosits recommends that conviviality be achieved through consensus and not imposed [26], Hofkirchner identifies the normative idea of unity-through-diversity as deserving attention "when applying conviviality to the level of world society" [14]. The author examines the unity-diversity relation, equates the terms unity-diversity with identity-difference and then describes the four resulting scenarios: (1) "establish identity by eliminating difference at the cost of the differentiated side" yielding reductionism and universalism or (2) "of the undifferentiated side yielding unity without diversity", that is particularism, totalitarism and homogenization; (3) "establish difference by eliminating identity yielding diversity without unity", that is fragmentation and (4) "establish identity in line with difference yielding unity and diversity". The achievement of conviviality is in this integration of difference and differentiation of identity, yielding for example, transculturalism.

"Conviviality (just like conflicts) is based on agreements or contradictions" states Somov [41] who further explains the normative aspect of conviviality with the idea that conviviality belongs to the area of regulation of human interrelations. This regulation aspect of conviviality makes it particularly relevant to future large scale developments of ambient intelligence devices.

2.3 The use of conviviality for ambient intelligence

In ambient intelligence applications, such as the mass-scale annotation system GeoNotes, users "annotate physical locations with virtual notes, which are then pushed to or accessed by other users when in the vicinity" [33]. Groups of users are hence formed by region. What happens afterward between these users would seem to be what is important. With the set up of convivial relations and spaces users are encourage to share knowledge and cooperate with each other, and discouraged to abuse other users. Another ambient intelligence application, Collaborative Capture [8] allows, for example, "a group of people taking pictures at an event to merge their captures and provide a complete collection" . This raises, of course, privacy issues as you may not want to share all your pictures. In the context of spontaneous interactions, traditional security, with authorizations, is difficult to apply and innovative approaches, based on more dynamic notions such as conviviality, have to be investigated. "The very notion of ubiquitous capture can be frightening: the potential capture activity of anyone, anywhere may change social relations between

people". In an overall computing environment, focus must be on people and their social situations [42]. Conviviality reinforces common shared ground between the members of a group and can thereby create protection barriers between and for its peers.

3 COMPUTER SCIENCE APPROACHES

3.1 The role of conviviality in Multi-agent systems

In multi-agent systems an agent is defined as "a computer system that is situated in some environment, and that is capable of autonomous action in this environment in order to meet its design objectives . . . Agents are capable of flexible (reactive, proactive, social) behavior" [48]. This capability is particularly crucial for ambient intelligence since it allows agents to cooperate, coordinate their actions and negotiate with each other.

3.1.1 The use of conviviality for Intelligent Tutoring Systems

The system proposed by Gomes et al. [12] provides a recommendation service of student tutors for computational learning environments. "Each agent pupil represents a pupil logged onto the system. One of the functions of the system is to be the client for an instant message service. Through its agent pupil, any pupil can communicate with other pupils in the system.Another function of the agent pupil is to pass information on the affective states of the pupil. This information can be inferred by the agent or be adjusted by the pupil itself."

The authors' claim that "convivial social relationships are based on mutual acceptance through interaction" hence on reciprocity and in this case students helping each other. 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 s/he does then 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 urgent need for further research in evaluation methods and measures for concepts such as mood, sociability and conviviality.

However, these critical challenges of a technical nature, pointed out so far, are pale in comparison with the ethical issues raised by the possible development of such a system: Preserving pupils'privacy, securing the information gathered to create their social profiles, deterring possible misuse of pupils' affective states and system errors concerning the data. In fact, it is imperative that designers of such systems use guidelines, for instance, the European Privacy Design Guidelines for the Disappearing Computer [21] in order to "implement privacy within the core of ubiquitous computing systems" [22].

3.1.2 The use of conviviality for Conversational Agent

"All service offerings must integrate conviviality to the interaction between user and system as an essential preoccupation" [38]. To fulfill this goal, Sadek et al. define a convivial agent as rational and cooperative. An interaction 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." These communicative capacities and social intelligence based on emotional intelligence are crucial to enhance agents'ability to interact with users.

Indeed, building on this work, Ochs et al. [31] 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". We believe this direction to be very relevant to the evaluation of conviviality as it dissociates personal feeling from social expression.

3.1.3 The use of conviviality for reputation systems

Reputation is defined as "the overall quality or character as seen or judged by people in general and the recognition by other people of some characteristic or ability" [29]. When Casare and Sichman state that "reputation is an indispensable condition for the social conviviality in human societies" [7], they emphasize that reputation provides transparency quality of the information provided with reputation, throughout the group about its member, this transparency insures the conviviality of the group, as all group members receive the same information about their peers. The authors' system insures that everyone is aware of anyone's behavior, that is anyone's compliance or not to the rules of the group. Casare and Sichman define a functional ontology of reputation for multi-agent systems whereby "roles are played by entities involved in reputative processes such as reputation evaluation and reputation propagation."

The authors' claim that "concepts of the legal world can be 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". In their system, the agents actual behaviors are compared to the social norms observed in their world. The process, however, presupposes an initial reputation profile of users that agents can then update in real time. Reputation acts as a communication tool, ensuring complete social transparency throughout the system. The strict application of norms to reputation however may be difficult and suffer from rigidity. Of course, the same holds for conviviality.

By its very definitions, "the vision of ambient intelligence has the potential to create an invisible and comprehensive surveillance network, covering an unprecedented share of our public and private life … Besides the obvious risk of accidental leaks of information, profiles also threaten universal equality, a concept central to many constitutions, basic laws, and human rights, where *all men are created equal*. Even though an extensively customized ambient-intelligence future where I only get the information that is relevant to my profile holds great promise, the fact that at the same time a large amount of information might be deliberately withheld from me because I am not considered a valued recipient of such information, would constitute a severe violation of privacy for many people" [5].

3.2 The role of norms in multi-agents systems and how it applies to conviviality and ambient intelligence

The role of norms is increasingly getting attention specifically in multi-agents systems (MAS) where the most common view is that "norms are constraints on behavior via social laws" [3]. 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." [3]. Agents therefore decide how to interact with each other, following conviviality conventions or

not, they can, also, modify these conventions and thereby contribute to their evolution. Furthermore, the role of norms for conviviality is an instrument for the internal regulation of social systems [6]: For example, in digital cities "government regulations extend laws with specific guidance to corporate and public actions" [24].

Several kinds of norms are usually distinguished in normative systems. Within the structure of normative multi-agent systems Boella et al 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" [4]. 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 define 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" [25].

Boella et al. further describe action models where "agents are goal directed and try to maximize their choice of means to obtain a goal". It is assumed that an agent belongs to a group and must follow the norms like all members of that group. In such a system, conviviality maximizes benefits for a group, for instance, by standardizing the conventions of the groups'communications, conviviality contributes to the efficiency of processes and the achievement of the group's common goals.

The role of norms for conviviality reinforces social cohesion by reflecting the group's core values internally as well as externally. By making the rules explicit the role of norms for conviviality contribute to reducing conflicts, to optimize members' performances within communities as well as between communities and improve coordination throughout; All crucial for the development of ambient intelligence applications and coordination. Finally, the social warranty and protection mechanisms of conviviality are achieved through the expression of its group member's feelings toward each other: praise and encouragements for members who conform to the rules, anger and blame for the ones who do not. Such behavior coordination and regulation mechanisms are the very ones that underlie future ambient intelligent society and can therefore greatly gain by explicit conviviality specifications.

4 HUMAN COMPUTER INTERACTION (HCI) APPROACHES

According to Lamizet, conviviality was elaborated to describe both "institutional structures that facilitate social relations and technological processes that are easy to control and pleasurable to use" [23]. On one hand conviviality allows individual expression facilitated by personalized interface and customized content while on the other hand it contributes to the standardization of media and the uniformization of representation systems. In her study of animated toys, Ackermann, looking at the relational qualities of playthings notes that beyond humanoid traits, it is an AniMate's manners of interaction that matter: "Beyond smarts, it is its conviviality. Beyond obedience or bossiness, it is an AniMate's relative autonomy and ability to share control" [1]. Building on Illich's notion of conviviality based on individual freedom and role swapping [18], Ackermann explores partial and shared control as critical quality of conviviality.

4.1 Toward social intelligence

Markopoulos et al. identify four critical challenges to human computer interaction research for ambient intelligence components: "Designing ambient intelligence systems and environments so that they can be perceived as socially intelligent . . . Designing intelligence that will support human-to-human cooperation and social interactions. . . How to evaluate social intelligence? . . . What are the benefits of social intelligence?" [28]. Answer to the last question would appear to be a requirement for the evaluation of social intelligence and for designing intelligence that will support social interactions. Markopoulos et al. experimenting with the iCat, a research platform that exhibits a rich set of human-like behaviors for studying social robotic user-interfaces, further state that for the ambient intelligence research community, 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" [28]. This are some of the challenges social intelligence design aims to address with "methods of establishing the social context, embodied conversational agents, collaboration design, public discourse, theoretical aspects of social intelligence design, and evaluation of social intelligence" [30]. We note with interest the relation between social intelligence and conviviality particularly in application domains such as: collaborative environment, e-learning, community support systems, symbiosis of humans and artifacts and digital democracy. However, in our opinion, as the pervasiveness and role of technology increases in our society, so does the role of conviviality, whereas social intelligence seem to remain focus on general intelligence applied to social situations.

4.2 Artificial companions and Mixed-Initiative Interaction

The Companions that Wilks envisions [47] 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 who feel lonely, they act as technical task assistant to search the web for travels or keep track of events their owners forget. Conversely, Companions for juniors provide assistance with teaching, explanations-on-demand and advices.

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" [16]. 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" [15]. 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.

4.3 Conviviality as user experience for ambient intelligence scenarios

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 [13]? 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" [43] is particularly significant. 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" [10]. From individual social assistants to communications facilitators, numerous research directions in HCI exemplify the interest for cognitive and social input to address issues as wide apart as information clutter and digital divide. We believe that conviviality can be an important concept to help address the broad challenges of ambient intelligence, by providing mechanisms for adaptive user interactions, while preserving the granularity of human experience.

5 CONCLUSION

We summarize by first noting that conviviality is usually considered a positive concept related to sociability, however, further analysis reveals a negative side related to regulations. In this survey paper, we examine the multi-faceted concept of conviviality and raise the question: Which definition of conviviality can be used and made operational for ambient intelligence? We propose a two-fold definition of conviviality as a condition for social interactions and an instrument for the internal regulation of social systems. We then raise the questions: How can positive sides of conviviality be used for ambient intelligence and can negative sides be taken into account?

Ambient intelligence applications can greatly benefit from the positive aspects of conviviality: Sharing knowledge and skills, dealing with conflict, enabling inclusiveness and encouraging equality and trust among parties. However, conviviality has first to be expressed explicitly and formalized before it can be used, efficiently, as coordination mechanism between individuals, groups and institutions, and as a tool to reinforce social cohesion.

It is crucial to build into ambient intelligence applications designs, the necessary protections against the potentially negative sides of conviviality, such as deception, group fragmentation and reductionism. Intelligent interfaces, for example, 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. Best practices and guidelines for designing ambient intelligence systems, must include aspects such as ensuring each party's point of view, in order to avoid the crushing of one side by another. The concept of conviviality, because it allows to take into account the social and cognitive factors and ethical issues raised by large scale development of ambient intelligence systems and also points out the negative sides to be prevailed over, plays a crucial role for ambient intelligence.

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