

**A social and technological view of  
Ambient Intelligence in Everyday  
Life:  
What bends the trend?**

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## **Executive Summary**

Ubiquitous Computing (Ubicomp) and/or Ambient Intelligence (AmI) refer to a vision of the Information Society where humans will be surrounded by intelligent interfaces supported by computing and networking technology that is everywhere, embedded in everyday objects such as furniture, clothes, vehicles, roads and smart materials. It is a vision where computing capabilities are connected everywhere and always on, enabling people and devices to interact with each other and with the environment. It is envisaged that Ambient Intelligence will be aware of the specific characteristics of human presence and personality, and will be capable of meeting needs and responding intelligently to spoken or gestured wishes. It could even engage in intelligent dialogue.

This vision of Ambient Intelligence is far-reaching and all encompassing. It assumes a paradigmatic shift – not only in computing but also in society – towards what is described as “human centred computing” where the emphasis is on user-friendliness, efficient and distributed service support, user-empowerment, and support for human interactions. Today, most of the technologies needed for the realisation of this vision are next-generation technologies not currently on the market. They are, however, being researched by many research institutes and company laboratories throughout the world in order to develop the building blocks for AmI. In Europe, the IST Advisory Group (ISTAG) is a strong promoter of the AmI vision. This and its underpinning technologies are also omnipresent in the IST programme of the EU Framework Programme 6 for Research and Technological Development (2002-2006).

The objective of this study is to identify and document major challenges and bottlenecks for Ambient Intelligence in everyday life and to raise relevant social and Science and Technology (S&T) policy questions that should be taken into account in order to bend the trend towards Ambient Intelligence. Therefore, AmI is discussed in terms of visions, technologies, applications and social challenges, with a particular focus on everyday life and from an everyday life perspective.

The AmI vision has been made possible by progress in the development of key enabling technology fields, that is, microelectronics (for example, miniaturisation, processing power), communication and networking technologies (for example, broadband and wireless networks) and intelligent agents/user interfaces (for example, speech recognition). Progress in the social acceptance of past and current ICTs has also furthered the AmI idea. It will be

argued that the vision of AmI is embedded in the existing technological, social and economic context but that there is a need for research to make this context more explicit.

The vision makes huge claims for the degree to which AmI is people-oriented. However, claims are typical for vision building (for example, the earlier Information Society vision of smart homes, and even the early 20th century mechanisation of the household). They all promise to transform for the better the way we live, work, relax and enjoy ourselves. The AmI vision, however, specifically aims to avoid technological determinism. It recognises the need for AmI to be driven by human rather than technological concerns. It proposes human-centred design and development guidelines together with other social concerns to advance this process. However, it remains to be seen if and how this manifesto will influence further research, development and design of AmI applications in order for the vision to go beyond similar claims made in the past.

This report identifies and highlights some of the major socio-economic and policy-related issues to do with AmI in everyday life. It discusses whether the digital divide that exists today will continue with AmI. It also looks at privacy, security and surveillance issues, which present a crucial dilemma for the acceptance of AmI. This is part of a larger concern about control over an environment that is highly dependent on technology. The literature on AmI mentioned in this report also raises the importance of business models, standards and the potential economic implications of AmI.

A more radical, sociological everyday life approach (that is, the “domestication perspective”) is taken when raising other social dimensions of AmI. Domestication, one of the cross-cutting themes in many of the EMTEL 2 studies, shows that the process by which new technologies are accepted into everyday life is far more complicated than is usually portrayed. It makes a case for also looking at power relations in everyday life. This approach allows a number of crucial ideas about everyday life in AmI to be raised, in some cases for the first time (for example, housework). In other cases, where the concepts had already been considered, such as the notion of the home as a sanctuary, it allows significant advance. The domestication perspective on AmI also enabled to highlight a difference between the physical and mental disappearance of computing and to discuss the implication of this for the possible acceptance of AmI. A domestication perspective also raises other issues when looking at Ambient Intelligence, for instance, the need to find a design balance between technologies that leave room for user experimentation and that provide rigidity for guiding users through their uncertain and innovative potential.

There are also many technological challenges (for example, energy, power, context awareness, and natural interfaces) within the key enabling technology fields to be addressed before the so-called Ambient Intelligence Space can be realised. ISTAG has proposed Ambient Intelligence Space as a layer connecting different AmI environments (for example, home, car, public spaces) in a seamless and unobtrusive way. Obviously interoperability and standards are crucial in this respect. Context awareness is another issue that needs to be looked into more closely, especially when trying to integrate forms of context that are more sophisticated and user-oriented than current definitions of context.

The development of smart homes is also facing major challenges. This concept has been around for more than a decade with relatively little consumer interest but now new drivers of change based on the idea of “sharing” might push development further. However, mobile communications are, in contrast, one of the biggest success stories of the 1990s ICT consumer market. In the future, a mobile world is envisaged where nomadic users can have access to information, communication and knowledge, independent of the location of the user, of the data and applications, and of the access methods used. This poses not only technological challenges but also challenges our current notions of time and space and of private and public spaces.

The paper concludes with raising technological, social and science and technology (S&T) policy questions that should be taken into account in order to bend the trend towards AmI. It argues for research and RTD policy approaches that connect technological and social research on Ambient Intelligence.