THE DESIGN OF INTERACTIVE APPLICATIONS: A DIFFERENT WAY
First notes

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Abstract This paper wants to contribute to the vision of Convivio, the network for people-centred design of interactive systems, discussing the features characterizing interactive systems and their usage, the multi-disciplinary participatory process needed for designing them, their focus on communities rather than on single users, their creating augmented spaces for their users and, finally, their being rooted on European culture and production and service style.

Keywords: Design, interactive systems, people-centred, virtual, augmented, open, manifold, continuous, Made in Europe.

1. Foreword. Convivio - the network for people-centred design of interactive systems

The Convivio network builds on earlier actions within the EU FET Program to provide an infrastructure to the fledgling i3 community - namely, i3net. This European Network for intelligent information interfaces was launched in 1996 with the goal of advancing the development of novel human-centred systems and interfaces for interacting with information, aimed at people in their everyday activities. By 1997 the i3 community supported by i3net included more than 150 researchers working in thirteen research projects in computing for local and virtual communities running 1997-2000. In 1998 the i3 community was enlarged with twelve research projects in experimental school environments running 1998-2001. In 2000 a new Network, coordinating about 18 research projects on the Disappearing Computer (DC) running 2000-2003, was established. DC involves 45 organizations of which thirteen were already i3net members. A call for a new research program (Presence) in the area of Future and Emergent Technologies of the Fifth Framework Program of the EC (area of Information Society Technologies) has been launched in the beginning

of 2002 receiving a large number of proposals. These three initiatives share the same inspiration with respect to design of human-centred technologies (emphasizing multi-disciplinarity, user participation and innovation). i3net has currently more than 450 associated people, the number of projects within DC is still growing and its projects are in the middle of their research and development cycles, and 11 projects have been funded in the Presence call. The interest raised by these initiatives and its growing popularity in the research arena demonstrate the existence of a large and heterogeneous community extending beyond those directly participating in the projects: several national projects with similar aims are being developed in a number of European countries; projects with overlapping concerns are under development in America and Asia; and the industry is exhibiting a growing interest in their research themes and inspiration.

The community creating Convivio can be happy, since the VI Framework Program at the applicative level and in many other aspects has been widely influenced by its activities: the concept of "ambient intelligence" synthetizes the inspiration that was orienting the i3, DC and Presence FET initiatives; information management and interfaces have been from the very beginning one of its important issues; the social problems raised by the Information Society have been a concern in most of its research projects. Moreover, some of the key points that the VI FP brings forth are also hot questions for our community: the connection between scientific research and technological development, the way to bring SME inside the process of technological innovation, international cooperation crossing any type of boundaries, networking stakeholders and users. Even if it has been conceived in the V FP, Convivio therefore can play a major role also in the VI FP, if it is capable to propose its vision to the latter and, in the same time, its Participants and Associates are able to align their research programs with the way the EC has decided to drive its research.

This community culture is founded on radical innovation based on the union of design, technology and people. In the future, we see it growing and becoming diverse enough to act as a Europe-centred catalytic structure for those designing, implementing and evaluating new products and services that will impact on people's everyday work and domestic lives in significant ways. With the increase in both the size and the diversity of the community, it is time for a new network infrastructure to be put in place. The community needs to be involved in visionary anticipation, research and prototype demonstration, stakeholder community integration, and open discussion of perspectives and implications. The openness of the new Network will stretch beyond the community itself and include all actors targeted by the Network or attracted to it through shared interests – though not necessarily through shared opinions.

2. Interactive systems and their usage

The focus of the network, as well as of the projects performed by its participants, is on ICT applications involving a plurality of users both in work and social contexts. Users interact with these systems as well as interact among themselves through these systems, enhancing their joint performances and/or becoming able of new types of joint performances. Their focus, therefore, is not on technological innovation per se, but on the new potential technologies offer to human actions and interactions.

2.1 Technology is never the solution

Systems of the type above indicated emerge as responses to the problems users today encounter in their actions and inter-actions and are based on a deep understanding of their practice as well as of the peculiar characters of the society where they live. Its growing complexity, in fact, continuously creates new contradictory situations where human beings seem unable to restore the conditions for giving a common sense to their actions and interactions.

Technology per se, as, for example, a computer, a data-base, an expert system, a workflow management system, can not be the solution human beings seek and/or need for their problems. The latter, in fact, can not be something built by external experts and/or professionals and given to users who, using it, will solve their problems, and can not be just a technological system: rather it must be a change process involving human roles and behaviors and emerging from their understanding.

On the other hand, it is always more rare that a solution can be found, that does not include a technological component, more precisely, an ICT based system. The growing amount of information and human relations people encounter in the “global village”, together with their planetary distribution can’t be faced without using in clever ways the powerful new processing capabilities and the new media ICT has created.

2.2 From interactions to functions

What is needed is, therefore, the capability to develop an ICT application so that it is capable to support the interactions users are expected to perform both with the ICT application itself and through it with other people. What matters, therefore, is not the type of functions the system is able to perform, but how much the functions it performs fit with the interactions of its users and support them adequately.

In the design of a system the specific form of interactions it supports

drives the characterization of the functions the system performs (its constituent algorithms as well as its information structure): less sophisticated functionalities may be preferred if the latter best fit with the way users interact with the system, and if they are able to deliver adequate services with respect to the expectations of the users.
Using the new system should be a learning experience, where users invent new behavioral patterns and guide the evolution of the system: the system therefore should be designed as open as possible to leave room for user further invention of new interaction patterns. Within this learning and invention process, more sophisticated functions can be developed as response to the changing user needs and expectations. Systems should be designed incrementally, intertwining the development of the technology with the development of the system for a specific group of users.

3. Multi-disciplinary, participatory design

The design approach sketched above can't be adopted without putting in it all the competencies that must contribute to it. As it will appear clearer here below, it is not only a matter of who should participate in the design process, but also how.

3.1 Learning with the users

Europe has a strong tradition in participatory design, where users are directly involved in the design process that has generated a great interest and many discussions. In particular two themes are still open and require further contributions: first, users may play a conservative role in the design process requesting that technology limits to improve efficiency of existing modes of doing work; second, while it is clear how users can participate in the design process of systems dedicated to a particular customer organization, it is not clear how they can contribute to the design and development of generic platforms, to be tailored for specific users.
With respect to the first point, it is necessary to grant that users do not limit to have voice in the design process, but enter in a learning process where they develop a new understanding of their working practice. This can be accomplished opening an action research on the work practice where the new system should be used, where social scientists interact with them in a dialogue where user experience is confronted with observers' insights, giving raise to a new understanding of the work practice itself. Social scientists may use in this endeavor what has been called "quick and dirty ethnography", since observers want to influence the observed users with their findings (Ian Sommerville, Tom Rodden, Pete Sawyer and Rcihard Bentely, *Sociologists can be Surprisingly*

Useful in Interactive Systems Design, 1992).
With respect to the second point, the role of social scientists become even more important, since it is their responsibility to derive from their observations the profiles of the stereotypical users to be taken into account in the design of the generic platform, or, at least, to offer to the designers the knowledge for doing it. This process may be enriched by the participation of some representatives of the users, at least in the beta test phase, but the base for a good design emerges from the capability of anthropologists to validate and/or criticize the invention of the designers.

3.2 Innovation and designers

Within the i3 projects (and not only there; see: Terry Winograd (editor), *Bringing Design to Software*, 1996), in the mid nineties, industrial designers made their irruption in the design of ICT systems, abandoning the ancillary role of interface design, to play a central role in the invention of new systems. The innovation of an interactive system can not be purely or mainly at the technological level: the capability of exploiting at best the potential of innovative technologies is in fact one of its fundamental components, but new interactive systems must be innovative at the level of the interaction they make possible, both between users and machines and between users through machines. Interactive systems are innovative if they open to users new possibilities of behavior and this depends on their capability to bring forth to users not only new functionalities with user-friendly interfaces, but also to present them in a way that induces users to experiment them and to learn, using them, new ways of acting and inter-acting. Industrial designers, in particular the European schools of industrial design, are already extending their area of intervention from the design of objects, spaces and machine interfaces, to graphic design, communication and the design of services: their participation in the design of interactive systems can be considered as the completion of a process bringing them to a 360° degrees engagement in the process of inventing a new sense for contemporary life. Interaction design, the new discipline that many schools in the world have begun to teach the last years, is one major outcome of the process I recalled above.
I underline the term ‘irruption’ I used at the beginning of this section, because the participation of industrial designers in the design of interactive systems is not a simple and peaceful event: the whole design and development process is impacted by it and needs new approaches to be managed effectively.

3.3 Multi-disciplinary projects

If social scientists, industrial designers and users must participate in the design process, then the development of a new interactive system becomes a multi-disciplinary project.

Three different cultures (social sciences, creative design, and information and communication technology) must cooperate in it, sometimes opening themselves to the participation of the future users of the system. The distance among the three cultures is very high, in terms of their competences, of their approach to the design process, of their self-representation; and these mutual distances are the major value of multi-disciplinary design because they grant that each culture brings a unique and substantive contribution to it. Even if it were feasible, and I think it is not, therefore, it seems not useful to try to create new professional figures, embodying the three cultures: the design of interactive systems does not need a generic person knowing with some knowledge of anthropology and other social sciences, a smattering of information and communication technology and some skills in design; rather it needs good experts in all the three above areas.

On the other side, these distances may create a great disturbance in the design process, since the communication and cooperation among them is difficult and many breakdowns occur during it. There are no simple rules for facing this problem: the first experiences we did in these years indicate us that multi-disciplinary design needs participants who are able to recognize the contribution of other cultures and to interact with them in an effective way. This may be improved if the participants without abandoning their specific professional skills learn to understand what the other cultures have to say and if they become able to explain what they propose to non-technical audiences, i.e. to their co-designers with a different background and to users.

4. Focus on communities

As their name explicitly states, Personal Computers were invented having in mind individual users. As consequence, all the applications designed to run on them focused on single persons -not only productivity tools but even communication systems and the first cooperative applications. Many projects developed within i3 and DC are explicitly conceived to support communities of users, trying to support and enhance not only individual performances but also the social bounds characterizing community membership and strengthening the identity and vitality of communities.

4.1 The social dimension of human interactions

Human-computer interaction deals with the way people interact with computers. With the diffusion of computer networks and of computer-based communication systems, as e-mail, chat-systems, teleconferencing systems etc., it has emerged that computers were frequently acting as mediators and that the true interaction occurred with other people through computers. This viewpoint can be adopted only when people are directly using communication media or, taking a broader view, in many more cases, whenever their actions and interactions are embedded in some interaction with other people: e.g. when they are using a word-processor to contribute to a document they are writing with other people. Generalizing this broader view, we can shift the focus from individual users to the social aggregates whose they are members, embedding any use of computer-based applications in the social interactions to which they contribute. The systems we design in accordance with this 'social' perspective aim, therefore, to support social aggregates and the 'social' effectiveness of the behavior of their users.

4.2 Community as the basic social aggregate

A community is an aggregate of people sharing an experience, a place, a language, a memory. A community has boundaries delimiting its place; its language decorates its place of sense allowing its members elliptical discourses; the experiences of its members feed its memory creating a tradition on which an identity is created for it and its members. Being member of a community helps, therefore, any person to have a well-defined identity and to face breakdowns thanks to the help network the latter, or better, its members provide her.

In the last years the attention of various disciplines has gone back to the concept of community, both to underline the crisis of social experience and to suggest the potential for socialization human beings can still access. The French philosopher Jean Luc Nancy (*La communauté désoeuvrée,* 1990), in particular, has interpreted the concept of 'da-sein (being there)' of Martin Heidegger (*Sein und Zeit*, 1927) as 'mit-sein (being with)' claiming that our life experience is essentially social and that the place of this experience is the community. Even without adhering to the radical view of Nancy, for which from the 'mit-sein' within communities emerges the personal identity of human beings, the Californian school of work ethnography has defined the concept of 'community of practice' to characterize the communitarian dimension of any work-practice. It is something more than recognizing that human work is frequently performed in teams: communities of practice constitute the social context where we live our working experiences and we build our competence in performing them. Communities, in fact, are

the place where people learn to practice in a process moving them from a peripheral to a central participation (Jean Lave and Etienne Wenger, *Situated learning. Legitimate peripheral participation*, 1991).

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4.3 Supporting communities

The shift of focus from individual users to social aggregates and, in particular, to communities plays a relevant role in determining the distinctive features an interactive system should have. Communities, in fact, constitute an intermediate level between single persons and the whole society and, therefore, they require something different both from productivity tools and publication systems.

With respect to the former they need that any user interaction is embedded in the context of the community in which the user participates: for example, whenever a user writes something, she does not only need to have a word processor and/or an editor, but also the possibility to access any document and/or object that is related to what she is writing as well as any other member of the community plays (or has played) a role in the history of those documents and objects.

With respect to publication systems, they must allow users, when they need to access any document and/or object, to modify and/or re-use it, without limiting their capabilities as if they were passive readers, consumers.

Systems supporting communities, finally, should offer different supports to experienced users and to newcomers, helping the latter to learn to practice as and with the former.

4.4 A network of networks

Since communities, today, are frequently distributed in space and their members are mobile, systems supporting communities based on Internet offering to their users universal e-mail and www sites. But they don't exploit the global network offered by the web: rather, they shape the web as a network of networks, where each community has its own supporting network, where its members can find the community support they need, and each community network is open to the networks of other communities and users can move from one network to another one, as they need since they are members of several communities, and people may, at any time, join and/or leave any community.

Thanks to the above outlined features, interactive systems supporting communities may play an important role in avoiding that globalization deploys its most negative potential. We know that if Internet is only a big repository of documents, objects and information made accessible to any person, as if she were only a consumer and not an active player

of social interactions, then it will contribute to homogenize and void social relations. Interactive systems supporting communities can shape Internet in such a way that its global reach deploys its positive potential of connecting the whole humanity without affecting its diversity and its capacity of creating continuously new diversity.

5. Between virtual and physical

As we have said in the previous section (4.4) communities are frequently distributed in space and people move continuously. So frequently people need to interact each other remotely, even when they are members of the same community.

We could say that today a community may have no more a place, focusing our attention into its language and its common memory and designing its support system as a knowledge base. But a community, as its discourse continuously recalls, builds its identity on the place where its member live and interact, and loosing its place can cause its decline.

Information and communication technology allows to create virtual spaces where its users act and interact, simulating the physical space and/or offering metaphorical possibilities of movement and encounter. An interactive system can therefore offer to a community the possibility to live in a virtual space, either extending its (physical) place or constituting its (virtual) place. In the first case, the virtual space created by the interactive system is connecting and integrating the separated physical spaces where community members live making of a distributed space the place of the community. In the second case, the virtual space constitutes the virtual place of the community, whose life is therefore fully detached from the physical world.

5.1 Augmented places

Howard Rheingold (*Virtual Community*, 1993), and after him many other, have called 'virtual communities' those living in a virtual place. When the members of a community live in different parts of the world, their interactions can be hosted in a virtual place created by an interactive system, so that physical distances can't affect the community bounds. The concept of 'virtual community' is controversial, since many observers question that a community can be based on experiences where the bodies and senses of their members are not fully engaged.

To virtual communities and their virtual places, may be opposed the communities living in 'augmented places' (Paul Wellner, Wendy Mackay and Richard Gold, (editors), *Special Issue on Computer-Augmented Environments: Back to the Real World*, 1993). With 'augmented places' we mean a (distributed) physical space,

interconnected by communication media and/or shared information spaces and made plastic by the changing features of its digital components, in such a way that its inhabitants can recognize it as their place overcoming physical distances and the noise created by other communities. 'augmented places' do not detach their inhabitants from the physical world, but they enrich the latter in such a way that it exhibits properties making it more capable to host the growing complexity of social relations.

5.2 Mixed objects

Augmented places suggest that the real challenge of interactive systems is not to create virtual substitutes of the physical reality that users are unable to distinguish from the latter, but to create a new augmented world having properties that the physical world didn't have, offering to human beings new possibilities of action and interaction for dealing with the growing complexity they face everyday. If we move from the configuration of spaces to the objects populating it, we discover that the same paradigm can also inspire the creation of a new type of objects, being both 'physical' and 'virtual'. Within the DC project Atelier, it has been built a prototype of a digital brush, allowing to cover a tri-dimensional physical model of a building with a 'virtual' texture, physically brushing it. When you look at the model after it has been brushed, what you see is neither a purely physical nor a purely virtual object: it is a 'mixed object'.
Mixed objects are, I think, a good example, of what we can envision, when we look to interactive systems from a perspective where interaction comes before functions; users, social scientists and designers join technologists in the design process; the 'virtual' is coupled with the 'physical'.

5.3 Open, manifold, continuous

In the new augmented world we evoked above, three qualities emerge as crucial to deal with the growing complexity of human life: openness, multiplicity and continuity (Giorgio De Michelis, *Aperto molteplice, continuo,* 1998) and therefore for effective interactive systems.
'openness' is required to avoid that systems constrain the interactions users can perform: the distinction between registered and non-registered users should be fuzzy; when different options are offered to users, choices should not be irreversible; in any moment and in any situation, the user should have the larger set of possibilities open to her; etc.
'multiplicity' is required to create distinctions between: different classes of users, different applications, different functions, different situations, etc.

'continuity' is required to let the system be able to couple openness and multiplicity. Openness in fact requires no boundaries to allow that any possibility is always open, while multiplicity needs for boundaries for creating distinctions. How can we couple two contradictory requirements? John Seely Brown and Paul Duguid (*Borderline Issues: Social and Material Aspects of Design*, 1994) discuss how putting resources at boundaries can provide any system with the 'continuity' necessary to switch between openness and multiplicity when needed. The combination of openness, multiplicity and continuity constitutes the main quality an interactive systems should have.

6. Conclusion. An European perspective

The view on interactive systems we have sketched above doesn't raise by itself: it has deep roots in the European culture and tradition and reflects its richness and diversity. It is not by chance, therefore, that it has emerged from the experience of the i3 and DC projects and networks; rather, it is one of its most relevant and, hopefully, durable outcomes. In any case, even if it has European roots, the new perspective has taken inspiration from the work of people all over the world (as some of the references made in the previous pages clearly testify) and is open to the participation and to the contribution of every person from everywhere.

6.1 Design-driven innovation

The innovation we have described above can be brought back to neither technology push nor market pull model. It is not based on technology push since its driving forces are, together with technology, design and user learning. Technologists do not invent new systems looking for people using them; rather, they cooperate with designers and users to create new possibilities of action and interaction for specific user profiles. It is not based on market pull since it does not react to users' demands but proactively seeks ways to transform the behavior of well defined classes of users: technological research is not a means of improving the performances of existing systems, but of creating, together with users and designers, new systems offering new possibilities of action and interaction to emerging user profiles. The innovation we refer to in these pages can be called 'design driven', since it is driven by the invention of both a new user profile and the products/services satisfying the same.

6.2 Angelus Novus

"A Klee painting named 'Angelus Novus' shows an angel looking as though he is about to move away from something he is fixedly contemplating. His eyes are staring, his mouth is open, his wings are spread. This is how one perceives the angel of history. His face is towards the past. Where we perceive a chain of events, he sees one catastrophe, which keeps piling wreckage upon wreckage and hurls it in front of his feet. The angel would like to stay, awaken the dead, and make whole what has been smashed. But a storm is blowing from Paradise; it has got caught in his wings with such violence that the angel can no longer close them. This storm irresistibly propels him into the future to which his back is turned, while the pile of debris before him grows skyward. This storm is what we call progress." (Walter Benjamin, *Theses on the Philosophy of History*, 1940).

As the 'Angelus Novus' of Paul Klee, designers of interactive systems should move towards the future looking back to their past: like new knowledge (Ikujiro Nonaka and Hirotaka Takeuchi, *The Knowledge Creating Company*, 1995), new systems (and their related ways of thinking and behaviors) are not created from nothing, rather they are always the outcomes of a transformation of existing systems, ways of thinking and behaviors, where past experiences are better understood and reinvented and open the way to new experiences.

6.3 Made in Europe

The design approach we have sketched in the above pages, is deeply related to the way in Europe industries like fashion, furniture, small electric appliances, food, etc. innovate their products and services, brands and communication, market channels and production processes. Design driven innovation, in fact, characterizes that way of production that is typical of what is called 'Made in Europe' industry. The use of the word 'design' in naming this new type of innovation is not casual: on the one hand, the design of products and/or services plays a relevant role with respect to innovating user profiles and creating a valuable brand image; on the other, the European industrial design school stands apart in terms of its visionary and strategic perspective. The New Industrial Design being promoted for example in Italy (Domus Academy Research Centre, *The New Industrial Design*, 1998) aims to go beyond designing the physical look of products and relative user interfaces, to create a corporate vision permeating production and brand policies (or at least contributing to it). In this perspective designers become –along with entrepreneurs, marketing managers, researchers and even customers– actors in a new cultural approach to business where production must be able to support individual customer needs at the social/cultural level. While technology-push and market-pull are based on specialized knowledge (of a scientific and/or engineering nature) design-drive is based on the universal knowledge linking consumer and producer, user and designer: in short, the social and economic dimensions. Design-driven innovation is therefore rooted both in the social and cultural resources of a territory (its engine) and in the changing consumer behaviour (its target). Taking as reference the fashion industry, we can say that within design driven innovation, technological research reacts to precise requests by the designers of the fashion industry and cooperates with them to create new materials and/or new production techniques. Moreover, technological research is not only a means of competing in existing well defined market segments, but also of creating new market segments and assuming a leadership position in them. The innovation we refer to in these pages has been quite effective in using technology to innovate both products and production processes while it has been weak in innovating the information and communication infrastructure of the companies. Even leaders of 'Made in Europe' industry have been unable up to now to become innovative users of Information and Communication Technology. The new approach to the design of interactive systems I envision in these pages is therefore doubly coupled with 'Made in Europe' industry: on the one hand, it reflects its design-driven innovation indicating the space for a new competitive ICT industry in Europe, on the other, it promises to the 'Made in Europe' industry effective information and communication infrastructures.

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This paper presents my personal view on the vision accompanying the projects developed within the i3 and DC clusters and inspiring the creation of the Convivio network. Therefore, while I must thank all the community of researchers who participated in those initiatives and in particular, the founding members of Convivio and its Coordinating Group, I am the only responsible of what is written above. I hope that these notes will contribute to the definition of a shared vision within Convivio helping to inspire a new way to design and develop interactive systems.