Designing for Inclusivity

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Abstract. In this paper, the concerns of inclusivity with respect to technology are with the fragmenting effects upon our interaction and social practices of transferring and transforming knowledge when we use technology as part of our communication and decision-making processes. Through identifying and analysing these effects and the issues they raise for design and use of technology, the paper develops some basic principles of human-centred systems deemed essential for designing for inclusivity.

1 Introduction: Inclusivity

In this paper, the concerns of inclusivity with respect to technology are with the fragmenting effects upon our interaction and social practices of transferring and transforming knowledge when we use technology as part of our communication and decision-making processes. Through identifying and analysing these effects and the issues they raise for design and use of technology, the paper develops some basic principles of human-centred systems deemed essential for designing for inclusivity. Inclusion is considered here at a very basic level, as being about our capacity to engage with others in organisations and society as socially skilled persons (social intelligence). Our social interaction in any organisational context enables us to transfer and acquire knowledge and learn implicit organisational codes of conduct, moral practices, and cultures of behaviour. When our practices as 'social beings' in specific organisational contexts is caused to fragment with the integration of technologies, it is because the design of these technologies is not rooted in understanding the complexity of the social and personal dimension in organisational practices (e.g. healthcare systems). The problem of fragmentation arises because the technology is solely concerned with the functional dimension of organisational and domain knowledge, bounded within the functional definition of an organisation, abstracted from social and personal practices and knowledge, and this functionality defines the design requirements, design practice, and applications of interactive technologies. For 'inclusive' design where 'inclusive' refers to human engagement and commitment to socially sustainable knowledge, we cannot be so narrow as to only consider function. The design process needs to consider the social and personal dimensions of knowledge in relation to the objectifiable knowledge, in other words, to how we embed knowledge in our everyday practices. The design requirements then need to identify how the objective information structures that a technology can produce, can best work with or be applied with our everyday communicative

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knowledge practices, and this will shape the objective design. This paper discusses the inclusivity issues arising from the new conditions of interaction that arise with the integration of intelligent interactive artefacts, and proposes a human centred framework for inclusive design.

1.1 Social Intelligence, Human Synchrony and Coordination

The inclusivity concerns lie with the impacts of interactive design on human social intelligence which is considered as essential for sustainable social interaction and culture. In particular the concerns are with the affects on tacit knowing, embodied cognition, learning, and collective action. *Tacit knowing* is the unspoken dimension of human knowledge, formed in practice (through action, adaptation, negotiation, repair of breakdown), and is essential for skilled communication and skilled judgments/decision-making. *Collective action* is our co-performance with each other in the act of communication, achieved through our understanding of the performance of representations of the tacit dimension in our communication - gestures, non-verbal cues, speech, silence, touch, and other structures of information in our environment, evident in how we perform with them (Gill, SP 2006). In our co-performance of social intelligence, we are establishing the context of communication as well as imparting information… and we achieve this by "making mutually manifest the assumptions that underlie the act of communication – with sharing intentionality…"(Cross, 2006). This is achieved by our capacity to coordinate our autonomy in human synchrony, a necessary requirement for sustainable human communication.

Social interaction in everyday life is about making sense and this is shaped by social intelligence. It is the dynamics of the interplay of our personal (self) and experiential (our experiencing), objective (articulation and abstraction) and subsidiary (knowledge that resides in those around us, family, friends, colleagues) dimensions that makes social interaction meaningful and learning possible. The design of interactive intelligent technologies is bounded by rationality, the first order being to observe the present and describe and define the observations (conceptual gap). This raises a first order gap between what will be termed 'actuality' (the experiencing that draws on past, present, and expectations of future) and 'reality' (the observed present) (Uchiyama, K, 2003; Gill, KS, 2006). The second order of rationality is design (technical) limitations that come in designing the technology - create the second order gap that is design gap between human and the machine. The third order rationality of design is technical competence, the application gap - that can lead to the breakdown and disruption of our everyday practices as we interact with the technology, with the consequences that we become deskilled in our social intelligence without our even realizing it. The reason we cannot realize it is because this interaction is with our processes of embedded knowledge which are shaped, shared, and learnt within communities of practice. This is the inclusivity concern to be addressed with respect to social intelligence and social interaction.

Second, the following stages of cognitive walkthrough were adapted to fit in with the above method.

1. The expert (E) considers the initial appearance of the library.
2. E identifies the subject matter definition of the digital library.

1.2 Embeddedness and Embodiment

Embedded knowledge is about fixed and innate structures and we do not have conscious access to these but they are essential in our working, learning, and sharing knowledge within 'communities of practice' (Wenger and Lave, 1991). Organisational knowledge evolves and becomes embedded within organisations through evolving work culture, and within individuals through their social interactions within communities of practice. A reflection on inclusive interaction and embedded knowledge is important because intelligent interactive technologies, be they virtual/artificial agents, etc., necessarily seek to engage us at the embodied and embedded knowledge levels, and this raises concerns about the impact on inclusivity in that is essential for communities of practice.

2 Actuality and Reality Gap

To study the issues of inclusive interaction, we consider how the design of intelligent interactive systems makes salient the need to understand the interplay between technology, application domain (context), organisational domain (embedded knowledge of organisation as process), and cultural domain (moral and social values). Interactive technology needs to be considered as more than just design of an artefact. This interplay provides a holistic framework for the design and application of interactive intelligent systems where the cultural domain drives the application process within an organisation, so that interaction between human and technology could function in a manner that allows for inclusivity. Within the organisation, we look at gaps of responsibility, in knowledge, between actuality and reality, and with the consequences of disengagement of self from other, arising out of the interaction with intelligent interaction artefacts/agents.

3 Privacy and Trust

Interactive intelligent technologies range from digital devices that we wear in our clothing to virtual agents and moving artefacts in our social spaces. Privacy concerns our person in relation to others, involving our social values (from cultural practices in society), organisational values (through communities of practice), for example, the trust between a patient and a doctor. Integrating interactive technologies into the organisational domain has implications for disturbing and altering the value system and how we trust and interact with others. This effect on social values and trust is of concern for.

4 Autonomy and Coordinated Action

In the discussion on social intelligence, coordinated autonomy in human interactive synchrony is identified as a necessary requirement for sustainable interaction, as it carries knowledge transfer and transformation (Gill, SP. 2004). Autonomy in relation to human-machine interaction and design of autonomous or augmenting tools

assumes that decision making is a process undertaken by an autonomous agent. However, research on decision making and knowledge formation in collaborative activities shows that there is no such thing as an autonomous agent in human interaction, only coordinated autonomy performed by participants in the way they manage their relations with each other through synchronous adaptation and anticipation, and in the feedback they give each other about the state of their communication. In a study of collaborative activity using large-scale interfaces that did not support coordinated, there were breakdowns in commitment to communicate. Furthermore, the technology imposed a form of cognitive overload (Adams, 2006) onto the participants as they had to try to remember that they cannot perform together, only as separate entities, at the surface of the interface. They would keep forgetting and would automatically engage in attempts at coordinated autonomy. This is not something that we as humans can be trained not to do because it is an essential part of human synchrony, sense-making, and socially sustainable interaction.

5 Human-Centredness- Methodology for Inclusive Design

Our present everyday interactions, in various spheres and working and social life, with intelligent interactive and information technologies are increasing the complexity of our interaction environments in a manner we do not fully understand. This complexity is such that it is causing us to be aware of growing problems in human social practice such as cognitive and social disengagement and loss of privacy. The interaction complexities are disrupting our communities of practice within which we share and engage in the social practices, i.e. that enable inclusivity. Our uses of interactive technologies require us to re-appraise what we mean by human-machine interaction and understand its consequences for inclusive engagement, and use this to re-appraise design and application requirements for interaction environments.

At present, human-machine interaction is conceived as a dualistic relationship and this is extended to networked spaces. The problem is that it is a very limited conception of social interaction which actually consists in multiple structures of horizontal and vertical communications and operates at complex dimensions of human knowing in any communication setting. This limitation creates gaps in the reality and actuality of our experiences in the world. While the actuality is rooted in the past experiences and is shaped by the present reality and future possibilities, the reality is defined by the observable facts and data as of "now", the present. In an attempt to model the user interactive interface, the designer is limited to objectifying the situation as 'observed', thereby excluding the many of the possibilities of the situation as 'being observed'. This leads to a widening of the 'actuality gap' arising from the gaps between the actuality and reality of the both the user and the designer.

For example in addition to the actuality gap, our interaction experiences within our social life, especially the tacit dimension, are 'transparent' to us most of the time, while they may remain hidden to users from other contexts, thereby limiting the inclusive conception of user interaction from a cross-user perspective. Because of the actuality-reality gap (tacit dimension), the rich interaction experiences resulting form social and cultural contexts of users remain excluded from the design of the

techno-centric systems and technologies. This exclusion of the 'tacit' dimension impoverishes the design and applications of interactive intelligent technology within a wider societal context.

The consideration of interactive technologies within an ethical framework requires us to examine the processes of the design and application of these technologies. At present the design of interactive technologies and the concept of technology as a tool, is limited by a technocentric framework of reality. This limitation is recognised by proponents of the human centred systems framework (Gill, 1996, 2004,2006; Cooley, 1987) which aims to fill the gaps between the reality (observed) and actuality (practice, experiencing) of human interaction within the broader societal context.

At the heart of the human centred framework are the ideas of symbiosis, tacit knowledge, and machines with purpose. Symbiosis enables the continuous interrelationship between the personal, the experiential and the objective dimensions of human knowing and interaction. This extends the scope of seeing information and interactive technologies within an enriching and the holistic framework of technology, organisation, society, and culture, to support inclusive action embedded in the conduct of normal responsible behaviour. The 'tacit' is seen here as the inter-relationship between the 'personal' (person) (feeling/experiencing) and 'experiential' (group) (collective experience/practice) and the objective (society) (Gill, SP, 1995). This articulation of the tacit provides a conceptual handle to articulate interdependent (symbiotic) relationships between the 'personal', the 'experiential' and the objective. It can be argued that part of the 'personal' knowledge can become part of the 'experiential' dimension over time during the process of participation in a group, and that part of the 'experiential' knowledge can become absorbed into the 'objective' dimension over time through the process of collaboration. Following the similar argument, it is proposed that part of the 'objective' knowledge can also be transferred to the 'experiential' domain, and part of the 'experiential' knowledge to the 'personal' domain. It is further proposed that this symbiotic idea of transference between 'personal' 'experiential' and the 'objective' forms the core catalyst for designing technological architectures for interaction design. Actuality-reality gap: 'in comprehending reality, we construct a model which represents facts we observe, and use this model to design technology/techno-economic solutions. However in comprehending actuality, we experience actuality as it is practiced and experienced from within. The model of actuality represents practice (tacit dimension). Designs built on reality can only weakly be applied to actuality and we need to cultivate a design culture that overcomes this gap between what is experienced and the experiencing in order for there to be the merger between morality as practiced, and utilitarianism (rules/principles).

One way to handle this gap is to consider machines with purpose. 'Purpose' widens the design and application scope of systems and technologies whilst enhancing and enriching human potential. This is a developmental view that shifts the technical focus of technology from being concerned with human functions or characteristics, rooted in observation (e.g. observations of behaviour in social practices) to include concerns about inclusivity. It can be argued that human centred systems may provide

an ethical framework of 'governance' of technological architectures and their operations as they impact societies and cultures. Human-centredness raises three questions:

1. Could we design a technology even if it technically possible? Feasibility question.
2. Should we design a particular technology? Social responsibility question.
3. Is the technology socially sustainable? Inclusivity question.

In order to understand the gaps between actuality and reality, we can take health care as a scenario. In the human-centred perspective, the conceptual gaps between the medical model of health, practice based model of health and community model of health are mirrored by the knowledge gaps between the explicit knowing (e.g. medical), practice based knowing (e.g. health care professionals), personal (e.g. patient and community workers) and subsidiarily (e.g. family and friends) knowing. It is the awareness and understanding of these conceptual gaps, which help us to seek collaboration and interfacing between these models of health care. There are some fundamental research challenges that need to be met to develop a conceptual framework of health care which:

a. finds a symbiotic relationship between the medical, practice based, personal and subsidiary conceptions of health care provision.
b. fills the gap between the technical vision of health system and the social vision of health care systems.
c. develops a holistic approach that can bridge the gaps between the information and data handling requirements of the management and health care needs of both the professionals and users of health.
d. enables the development of interfaces that bridge the gap between the scientific knowledge of the medical practice, the communities of practice knowledge of the health carers and the social knowledge of the personal relations and social networks, in the health care and welfare chain (Gill, K S, 2006).

The health system example above illustrates the interactive and overlapping roles of stakeholders who include medical and health care professionals, voluntary and community organisations, the patients and their families and friends. The complexity of interactions and roles need to be considered as part of design requirements when building interactive technologies in any organisational context and their consideration makes for a complex picture of ethical concerns and overlapping social responsibilities. The challenge is to understand the complexity of inclusivity as socially sustainable interaction, and design based on the principles of human-centred systems that can shape the design of technologies to facilitate this.

The example of healthcare provides some clarity for what the designers for sustainable sociality/inclusivity needs to be aware of. In the first part of the paper we spoke of social intelligence, of embedded knowledge, coordinated autonomy, and communities of practice, all of which enable us to perform as social beings in a socially sustainable way. It was stated that the design of any integrated intelligent technology within the very fabric of human interaction and embedded cognition needs to support social sustainable practices, otherwise it will lead to fragmentation of the

communication process that leads to breakdowns, with the consequences that we may become deskilled in our social intelligence without our even realizing it. The reason we cannot realize it is because this interaction is with our processes of embedded knowledge which are shaped, shared, and learnt within communities of practice. A study of the use of large-scale interfaces for collaborative action (Gill, SP. 2004) has shown how they can impede natural social intelligence behaviours, causing participants to have reduced commitment to communicate and discomfort because participants had to hold back on their coordinated autonomy and synchronised behaviours, and would always forget that the technology cannot move with them. The design processes of technologies for inclusive sustainable interaction and communication need to embody the symbiotic idea of transference between 'personal', 'experiential' and the 'objective' knowledge dimensions if they are to avoid such breakdowns in human social intelligence.

The basic principles of human-centred systems are summarised as follows:

1. Symbiotic relations between the tacit, experiential, and objective dimensions of knowledge that underlie our everyday practices of human co-existence and enable us to have social sustainability.
2. Symbiotic relations between human agents and intelligent agents - bearing in mind that autonomy in human behaviour is a collective act of coordinated synchrony, and human-machine symbiotic relations will need to work with this in a manner whereby human behaviour is not compromised.
3. Socio-ethics, which is concerned with the challenges of gaps arising from the application of interactive technologies in the everyday practices of normal responsible behaviour that disrupt this, because the technologies have been designed outside of these practices. Socio-ethics within the human-centred framework acknowledges and supports the overlapping interactions between individuals, communities of practice and society: achieved by designing interactive tools as machines with purpose. It is an insult to people in communities of practice to offer them causal machines without purpose.
4. Risk – If we cannot predict the consequences or even know what action will be of the intelligent agent, we have to keep intervening to delimit the errors. Human agency is critical for the sustainable functionality of intelligent agents.
5. Privacy - This is much more than a matter of data control. Privacy is about the processes of the interrelationship with the communities of practice and society at large.
6. Social sustainability is achieved through tacit knowing and collective action of which coordinated autonomy in human synchrony is essential. Inclusive design has to be socially sustainable in order for inclusivity to be sustainable.
7. Coordinated autonomy – for social cohesion, autonomy is necessarily coordinated, and individuality is part of plurality, in order for collaboration/cooperation to be possible in human interaction. Any intelligent interactive agent has to function within this social system.
8. Minimising entropy - Technocentric systems are brittle and when they breakdown they cause disruption and entropy of the system. But machines with purpose increases both the tacit dimension and the objective dimension, and therefore can be seen to minimise the disruption, and in this sense minimise the entropy of the system where entropy is defined as indicative of the degree of disorder.

9. Responsibility - Communicating via technology, such as in distanced medication by a doctor for her patient, requires an ethical consideration as the more you give to technology, the less you are left with, and ultimately this leads to disengagement of social responsibilities.
10. Calculation and Judgement – Integration of interactive technologies in the complexity of the social domain reduces interaction to data (calculation) and leaves out human social values (judgement). This separation of calculation and judgement disrupts human communication.

These human-centred systems principles are important for the design of inclusive technologies. The key design challenge is that interaction between human agent and intelligent artificial agent needs to function in a manner that allows for inclusivity where inclusivity means socially sustainable interaction that is committed and responsible, i.e. socially intelligent.

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