

An Outline of a Socio-Technical Theory of Culture

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Abstract. This paper argues the need for a human-computer and human-information interaction oriented process theory of culture. It presents a critique of the current application of culture theory to HCI research. Specific criticisms of the current state of affairs in cross-cultural HCI in general include inadequate conception of the phenomena, tautological explanatory mechanisms, and failure to consider cohort and individual differences in the interpretation of empirical results. A positive theoretical contribution follows this negative critique. The theoretical emphasis is on the technology supported interactional process in intra- and inter-cultural socio-technical systems. The dual aspects of interaction in socio-technical systems-interacting with technologies and social others- are theorized based on the ecological approach to perception and action and the philosophical approach to intersubjectivity. The paper concludes with implications for research and practice of cultures and technologies for social interactions.

Keywords: appropriation of affordances, perception of affordances, technological intersubjectivity, socio-technical systems, interaction analysis, human information interaction, human computer interaction, computer supported intercultural collaboration, comparative informatics,

1 Introduction

In the past few years, there has been an increased awareness of and interest in the cultural aspects of interacting with computers¹. This increased awareness of cultural relativity and specificity in human computer interaction (HCI) hopefully leads to a critical assessment of the unexamined mono-cultural assumptions that permeate HCI research and practice. So far, empirical work in this emerging domain has sought to document cross-cultural differences in interacting with computers in established fields such as computer supported cooperative work (CSCW), computer mediated communication (CMC) and in emerging fields of inquiry such as computer supported

¹ This workshop, the International Workshop on Intercultural Collaborations (IWIC 2007, 2009), the Cultures and Technologies Workshop at CHI 2007, culture-themed sessions at CSCW and CHI, culture-focussed special issues of practitioner magazines and journals (e.g., interactions, International Journal of Design, Journal of Computer Mediated Communication, and Interacting with Computers).

intercultural collaboration (CSIC)² and comparative informatics³. The majority of empirical work¹ whether it is rationalized and legitimized from the positivistic or the hermeneutic traditions has sought to empirically re-establish prior results on cultural differences in social behavior, interaction, communication, and cognition in technology supported settings. Any systemic and systematic cross-cultural differences found and/or cultural influences uncovered are often attributed to culture theories in behavior[1, 2], communication [3], and/or cognition[4]. However, this mode of empirically establishing cross-cultural differences in technology supported/enhanced/mediated setting to culture theories based on traditional face to face interactions in organizational and/or university laboratory settings are problematic creates a self-referential loop of logic. To expand:

1. Most if not all of the current explanations of cross-cultural differences in interacting with technologies are tautologies. The explanations start with empirically prior cross-cultural differences and end up with attributing the re-found differences in a new application domain (such as HCI) to the prior culture theories. This creates a perpetual loop of self-reference and inference. Although the perpetual loop of inference creates a sense of theoretical coherence, it doesn't advance the theoretical understanding of the core phenomena of interacting with computers and social others in itself.
2. Given the chequered intellectual history of the concept of culture[5], the notion of culture needs to be carefully rethought conceptually, methodologically, and analytically. If the concept of culture stands for everything from the identity to the subjectivity of a given group of people to the "whole way of life", then it might lose its analytical power and potential to inform the research and practice of designing, developing, and evaluating socio-technical systems.
3. Another problem is the failure to consider cohort differences besides cultural differences in the use of Internet and other information and communication technologies (ICT). In the era of globalization, researchers need to understand the differential possession of digital media skills, devices, psychological motivations, and societal incentives in generalizing cultural differences found in studies across cohorts, cultures, and countries.
4. Finally, cultural differences in humans interacting with technologies and with each other remain phenomenologically opaque. We are currently not seeking a richer understanding of the "how" and "why" of cultural variation in informatics phenomena at the human-computer and human-information [6] interactional levels. The unique and distinct aspects of human social interaction mediated/supported/enhanced by information and communication technologies are not given necessary and sufficient theoretical consideration.

There has been scant attention to theory development and evaluation in the realm of socio-technical systems. Even scantier are efforts to address the concept of culture from a socio-technical interactional perspective within the HCI framework. As such,

² "Computer supported intercultural collaboration (CSIC) studies the iterative design, development, and evaluation of technologies that enhance and enrich effective intercultural communication and collaboration"

³ Comparative informatics is the application of the comparative method to the study of the design, development, evaluation, use, and impact of information technologies across a diverse set of domains, organizations, contexts, cohorts, cultures, and countries

there is a need for an empirically informed theory of socio-technical interactions that incorporates both culture-specific and culture-generic aspects of intra- and inter-cultural technology supported social interaction. Such a theory would seek to understand, describe, explain, and predict social interactions in technology supported settings across a diverse set of cultures, cohorts, contexts, languages, media and modalities. The analytical focus of such a “process theory of culture” should be on the actual and real interactional dynamics of culturally similar and dissimilar individuals situated in socio-technical systems. In the next few sections, an outline of a socio-technical theory of culture is offered. My primary purpose here is to help jumpstart an empirically informed theoretical discussion and debate on a theory of culture relevant for technology mediated/supported/enhanced interactional settings. In my opinion, it is high time we had such a conversation given that the topic of cultures and technologies is currently receiving the long overdue attention from the researcher and practitioner communities.

2. Theoretical Framework

Socio-technical interactions involve individuals interacting with (a) *technologies* and (b) *other individuals*. These two central socio-technical interactional aspects of technology enhanced environments are theoretically conceived as (a) *appropriation of socio-technical affordances* and (b) *structures and functions of technological intersubjectivity*. Briefly, socio-technical affordances are action-taking possibilities and meaning-making opportunities in an actor-environment system relative to the cultural-cognitive competencies of the actor and the technical capabilities of the environment. Technological intersubjectivity (TI) refers to a technology supported interactional social relationship between two or more actors. The rest of this paper is organized as follows. The first section discusses the concept of affordances, presents a brief history of its use in HCI, and offers a philosophical discussion of the concept of affordances. Drawing from ecological psychology, formal definitions of socio-technical affordances and their appropriation are then offered.

2.1 Affordances

The notion of affordance was introduced by J. J. Gibson [7]. Gibson was primarily concerned with providing an ecologically grounded explanation to visual perception. Affordance is a deceptively simple concept that hides a very radical hypothesis. Gibson wrote-

“I have described the environment as the surfaces that separate substances from the medium in which the animals live. But I have also described what the environment affords animals, mentioning the terrain, shelters, water, fire, objects, tools, other animals, and human displays. **How do we go from surfaces to affordances?** And if there is information in light for the perception of surfaces, is there information for the perception of what they afford? **If so, to perceive them is to perceive what they afford. This is a radical hypothesis, for it implies that the “values” and “meanings” of**

things in the environment can be directly perceived. Moreover, it would explain the sense in which values and meanings are external to the perceiver". [7, p. 127] [bold emphasis added].

Gibson viewed affordances as relational properties between an organism and its environment. Gibson was reacting against what he termed the overly subject-side analysis of information processing in the theories of perception of cognitive science. The notion of affordance places an equal emphasis on environmental properties in determining meaning. Gibson's theoretical project was to account for the variant and invariant properties of the environment and thereby provide adequate object-side analysis for the phenomena in visual perception. Gibson's theory of affordances is an ecological theory of meaning opposed to cognitive theories of meaning as interpretation.

Gibson's notion of affordance when taken together with his theory of "direct perception" is deemed problematic by cognitive psychologists in explaining higher order cognitive process like learning [8] and particularly problem solving [9]. "Direct perception" is the theory that all an organism needs for perception is a perceptual system and an environment. The organism perceives affordances by "direct pick up of information" from the "circumambient arrays" of the environment. In other words, the information for perception is out there in the environment and there is no need (in the ecological view) for top-down interpretation as cognitive psychologists contend. Gibson was arguing for perception as a basic ecological process. Of primary importance for the purposes of this paper is the tight coupling between perception and action in the ecological view of perception.

Norman's introduction of the concept of "perceived affordance" [10] brought the notion of affordance into human computer interaction. Relevant literature includes, Gaver's seminal articles on technology affordance [11], affordances of media spaces [12], affordances for interaction [13]; Bradner's notion of social affordance [14]; Hartson's [15] taxonomy of affordances into physical, sensory, functional and cognitive affordances; McGrenere and Ho's [16] critical review of the notion of affordance and a structuration theoretical interpretation of affordances [17]. Affordances in HCI have largely been misunderstood as widgets, features and functionalities despite a crucial intervention by Norman [9] himself. By drawing upon ecological psychology research, this paper attempts to address Torenvliet's [18] call to reclaim the notion of affordance.

The ontological foundations of the notion of affordances are materialist and dynamicist [19]. Turvey [19, p. 180] citing Lombardo [20] identifies "*the principle of reciprocity—distinguishable yet mutually supportive realities*" as the central insight of Gibson's ecological psychology of visual perception. This principle of reciprocity is highly relevant to technology supported collaboration as multiple individuals each with a specific subjectivity and identity shape mutually supportive interactional realities. The ecological approach is dynamicist but not dialectical and processual, holding that "*everything changes in some respects, but not in all respects*" [19, p. 175]. Drawing upon foundational work in ecological psychology on the formal definition of affordances [19, 21], we provide the following definition of *socio-technical affordance*. Narrative expositions follow the definition.

2.1.1 Definition of Socio-Technical Affordance

Let $Wpqr$ (e.g., person-sending-email-to-another-person system) = (Tp, Sq, Or) be composed of different things T (e.g., concept-mapping technology); S (e.g., concept-map node creator) and O (e.g., concept-map node receiving partner).

Let p be a property of technology T ; q be a property of subject S and r be a property of other O .

The relation between p , q and r , $p/q/r$, defines a higher order property (i.e., a property of the socio-technical system), a . Then a is said to be a socio-technical affordance of $Wpqr$ if and only if

- (i) $Wpqr = (Tp, Sq, Or)$ possesses a
- (ii) Neither $T, S, O, (T, S), (T, O), (S, O)$ possesses a

The formal definition of socio-technical affordance presented above is for the minimal situation of dyadic interaction in technology supported interactional environments. For a social situation involving n distinct social actors, an n -tuple would characterize the system. This formalism can be read as an activity system of subject, object and tools [22]. Relating the definition to Latour's actor-network theory [23], both actors and "actants" are implicated in the notion of socio-technical affordances. The formal definition of socio-technical affordance captures the two facets of interaction in socio-technical systems: (1) interacting with technology and (2) interacting with other persons (technological intersubjectivity to be discussed later). As discussed later in the empirical evaluation section, the definition of socio-technical affordance formed the basis for the design of the experimental study and the several theoretical predictions tested.

It is important to realize that affordances are action-taking possibilities and meaning-making opportunities in actual situations in an actor-environment system. Norman's [10] gulf of execution and gulf of evaluation can be read as gulfs in the perception of action-taking possibilities and meaning-making opportunities respectively. Socio-technical affordances are not things or widgets or features or functionalities. This category conflation has been the source of much confusion in the HCI design community [18]. Socio-technical affordances are the relational properties in particular situations of a specific user-technology system. By virtue of being relational properties with reference to an actor, socio-technical affordances can be termed relative to the actor and/or the technology, but relativity is not subjectivity. In that sense, affordances are not subjective properties. Affordances are neither arbitrary properties nor are they socially constructed [24]. Affordances are relational through and through, as they are the informational structure to be perceived in ambient arrays of the actor-environment system. The next section presents a brief discussion of the notion of "appropriation of affordances".

2.1.2 Perception of Affordances

Direct perception" is the theory that all an organism needs for perception is a perceptual system and an environment. The organism perceives affordances by "direct pick up of information" from the "circumambient arrays" of the environment. In other words, the information for perception is out there in the environment and there is no

need for top-down interpretation as cognitive psychologists contend. Gibson's notion of affordance when taken together with his theory of "direct perception" is deemed problematic by cognitive psychologists in explaining higher order cognitive process like learning and particularly problem solving [25]. Gibson was arguing for perception as a basic ecological process. For the purposes of this research, of primary importance is the tight coupling between perception and action in the ecological view of perception [7, 8]. The **weak argument** for cultural variation in the perception of affordances operates at the level of this tight coupling of perception and action. The **strong argument** posits an essential variation at the level of perception itself. As mentioned before, right now, in this paper, a theoretical committed is made to the weaker version of the argument. The weak argument remains agnostic that the perception of affordances varies essentially across cultures (that it is incommensurable between two culturally diverse actor-environment systems) but posits that it is the appropriation of affordances that varies.

2.1.3 Appropriation of Affordances

Zhang [25, p. 181], after Gibson [7], agrees that "the end product of perception is not an internal representation of the environment; rather, it is the invariant directly picked up from the environment". However, Zhang doesn't agree with the logical conclusion of "direct perception" theories that deny any active role for internal representations. He points to the "situated cognition" approach, which in his view, emphasizes "the structures of the environment and people's interactions with them without denying the important roles of internal representations" [25, p. 181]. Cognition in the ecological psychology sense has been articulated as the "*cooperative appropriation of affordances*" [26, p. 135]. After Rogoff and Lave [27], "*cognition is something one uses, not something one has*"

In my reading of Gibson [7], the notion of affordance simultaneously specifies the two concurrent levels of meaning and action. *Affordance is a meaning-making opportunity and simultaneously an action-taking possibility in an actor-environment system in a particular situation relative to actor competencies and system capabilities.*

Although the perception of affordances can be accounted on ecological grounds, the perception of events cannot be accounted on strictly ecological ontological grounds [28]. The perception of events has interactional consequences in technology supported collaboration. It is here that Gibson's rejection of a role for higher order cognitive processes is problematic. Social interactional consequences from an individual's perception of affordances are influenced by a prospective projection into the future as well as a socio-psychological imagination of the other. Adapting Stoffregen's discussion of behavior [21, p.125], appropriation is "*what happens at the conjunction of complementary affordances and intentions or goals*". Based on Stoffregen's definition of behavior [21], the following definition is offered for appropriation of affordances.

2.1.4 Definition of Appropriation of Affordances

Let W_{pqr} (e.g., person-sending-email-to-another-person system) = $c(a, i)$ be composed of different affordances, a (e.g., e , the opportunity to compose

email, f, the opportunity to forward email, g, the opportunity to solve a science problem); and complementary intentions, i (e.g., h, the intention to send email, j, the intention forward email, k, the intention to solve a science problem), where both affordances and intentions are properties of the socio-technical system.

A given appropriation b (e.g., sending email) will occur if and only if (and when) an affordance (e.g., e) and its complementary intention (e.g., h) co-occur at the same point in the space–time continuum, where c is a cultural-cognitive choice function.

Unlike orthodox cognitivist views of the representational nature of human cognition that posits “copying” the external world, the cultural cognitive conception of socio-technical affordances and their appropriation views interaction as “coping” with the contingencies of the external world [29]. Interactions in socio-technical environments are a dynamic interplay between ecological information as embodied in artifacts and individual interpretation grounded in cognitive schemas. The essential mediation of all interaction is the central insight of socio-cultural theories of the mind [30]. The conception of interaction as being mutually “accountable” and systematic are the critical insights of ethnomethodology [31] and conversational analysis [32]. Accordingly, the cultural-cognitive choice function c represents the cultural-cognitive mediation of interaction. We conceive of interactions in socio-technical systems as the appropriation of socio-technical affordances. Even if socio-technical affordances are to be directly perceived, their appropriation is still influenced by the cultural cognition of social actors. This renders the concept of affordance ecologically cognitive.

The notion of technological intersubjectivity (TI) is discussed next. TI addresses the second aspect socio-technical interactions in technology enhanced learning environments: how participants relate to each other during and after computer supported collaboration.

2.2 Technological Intersubjectivity

Intersubjectivity is the key presupposition underlying human social interaction [33]. Human beings are not only functional communicators but also hermeneutic actors. Technological intersubjectivity is an emergent resulting from a technology supported self–other social relationship. In technological intersubjectivity, technology mediation can sometimes (but not necessarily always) disappear like in Clarke’s [34] third law of technology. We offer the following definition of technological intersubjectivity.

2.2.1 Definition of Technological Intersubjectivity

Technological intersubjectivity (TI) refers to a technology supported interactional relationship between two or more participants. TI emerges from a dynamic interplay between the technological relationship of participants with artifacts and their social relationship with others.

Information and Communication Technologies (ICT) and the Internet have changed our social relations with others and objects in fundamental ways that

transcend technology mediation. For example, technology lets us assign distinct ring tones, images, priorities to our significant others. Our psychological perception and phenomenal relation with others is changed fundamentally by the advances in information and communication technologies and social software. Our interactions with others and objects are increasingly informed by the logic of technology, hence technological intersubjectivity.

It is important here to distinguish between the psychological, phenomenological, and technological aspects of intersubjectivity. From a functional perspective, psychological intersubjectivity doesn't require two or more persons to have the same or similar phenomenal experience. In psychological intersubjectivity, the other human being is always an object of our attention and an object in our awareness. We observe the other person for communicative cues relevant to the ongoing interaction. Phenomenological intersubjectivity requires an emphatic relationship with the other person. In the emergent technological case, there is a dynamic interplay between these psychological and phenomenological aspects. In technological intersubjectivity, information processing entailed by computational support can enhance the communicative possibilities and communion potentials of two or more human beings. Socio-technical systems have potentials for both psychological and phenomenological intersubjective experiences without the requirement that interacting persons be co-present in the same place at the same time.

The concept of technological intersubjectivity goes beyond the traditional human computer interaction (HCI) notions of presence [35] and connected presence [36] and the traditional humanities' notions of networked individualism [37], information subject [38], and time-space compression [39]. to incorporate both the psychological and phenomenological aspects of interacting with others via technologies. Technological intersubjectivity deals with the ICT enabled capabilities to **place-shift** (i.e., to be physically embodied in one physical space but to be able to virtually embodied in a different place) and the ability to **time-shift** (i.e., to be able to refer back to earlier interactions or to be able to defer forward interactions).

3. Discussion

Taken together, appropriation of socio-technical affordances and technological intersubjectivity are the same sides of a coin. They are interrelated and intertwined aspects of interaction in socio-technical systems. Technological intersubjectivity is formed, transformed, and reformed through individuals' appropriation of socio-technical affordances. Within this theoretical framework, prior empirical findings are interpreted as systemic differences in the apperception, perception, and appropriation of affordances (such as Nisbett's cultural cognition results and Hall's communication context findings). Cultural dimension models (such as Hofstede's and the GLOBE study) are interpreted as documenting cultural variance in the structures and functions of intersubjectivity.

Regarding empirical evaluation of the theoretical framework, an experimental study was conducted to evaluate the basic premise that the appropriation of socio-technical affordances and the structures and functions of technological

intersubjectivity vary across cultures [40]. The experimental study design consisted of three independent groups of dyads from similar or different cultures (Anglo-American, Chinese) doing collaborative problem-solving in a knowledge-mapping learning environment. Participants interacted through an asynchronous computer interface providing multiple tools for interaction (diagrammatic workspace, embedded notes, threaded discussion) as they worked on an intellectually challenging problem of identifying the cause of a disease outbreak. The analytical focus of the experimental study was to determine the influence of culture on the appropriation of affordances by individual participants in an online learning environment. The theoretical objective of the study was to inform the notion of technological intersubjectivity. Based on theories of culture and empirical findings in cultural psychology documenting cross-cultural variations in behavior, communication and cognition, several research hypotheses were advanced. Empirical data were collected using demographic, culture and usability instruments; participants' self-perception and collaborative peer-perception instruments; screen recordings and software logs of experimental sessions. Statistical results showed that members of different cultures appropriated the resources of the interface differently [41] in their interaction, and formed differential impressions of each other [42]. For example, on average, Anglo-American participants of the experimental study created more evidential relation links, made more individual contributions and were more likely to explicitly discuss information sharing and knowledge organization strategies than their Chinese counterparts [41].

The open research question then is to investigate the technological aspects of the phenomena. Any candidate for a process theory of culture should be able to adequately answer a set of critical questions:

- Where is the ecological, social, cognitive, and affective information located in a given interactional phenomenon of analytical interest?
- How is information perceived and acted upon? In other words, what is "it" that accounts for the observed empirical differences between cultural groups?
- How does "it" account for individual differences as well as cultural differences (within vs. between culture differences).

Applying these evaluative criteria for the theory presented is beyond the scope of this paper but could be discussed as a topic at the workshop.

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References

1. Hofstede, G.: *Cultures and Organizations: Software of the Mind, Intercultural Cooperation and its Importance for Survival*. McGraw-Hill (1997)
2. House, R.J., Hanges, P.J., Javidan, M., Dorfman, P.W., Gupta, V.: *Culture, Leadership and Organizations: The GLOBE study of 62 societies*. Sage Publications, Newbury Park, CA (2004)
3. Hall, E.: *The silent language*. Anchor Books New York (1990)
4. Nisbett, R.E., Norenzayan, A.: *Culture and Cognition*. In: Medin, D.L. (ed.): *Stevens' Handbook of Experimental Psychology* (2002) 561–597
5. Vatrapu, R., Suthers, D.: *Culture and Computers: A Review of the Concept of Culture and Implications for Intercultural Collaborative Online Learning*. In: Ishida, T., Fussell, S.R., Vossen, P.T.J.M. (eds.): *Intercultural Collaboration I : Lecture Notes in Computer Science*. Springer-Verlag (2007) 260-275
6. Jones, W., Pirolli, P., Card, S.K., Fidel, R., Gershon, N., Morville, P., Nardi, B., Russell, D.M.: "It's about the information stupid!": why we need a separate field of human-information interaction. *CHI '06 extended abstracts on Human factors in computing systems*. ACM, Montreal, Quebec, Canada (2006) 65-68
7. Gibson, J.J.: *The ecological approach to visual perception*. Houghton Mifflin, Boston (1979)
8. Noë, A.: *Action In Perception*. Bradford Book (2004)
9. Norman, D.: *Affordance, conventions, and design*. *interactions* **6** (1999) 38-41
10. Norman, D.: *The design of everyday things*. Doubleday, New York (1990)
11. Gaver, W.: *Technology Affordances*. *Proceedings of CHI 1991* (1991) 79-84
12. Gaver, W.: *The Affordances of Media Spaces for Collaboration*. *Proceedings of the 1992 ACM conference on Computer-supported cooperative work* (1992) 17-24
13. Gaver, W.: *Affordances for Interaction: The Social Is Material for Design*. *Ecological Psychology* **8** (1996) 111–129
14. Bradner, E.: *Social Affordances of Computer-Mediated Communication Technology: Understanding Adoption*. *Extended Abstracts of the Conference on Human Factors in Computing Systems*. CHI, Seattle, Washington. (2001)
15. Hartson, H.R.: *Cognitive, physical, sensory, and functional affordances in interaction design*. *Behaviour & Information Technology* **22** (2003) 315-338
16. McGrenere, J., Ho, W.: *Affordances: clarifying and evolving a concept*. *Proceedings of Graphics Interface 2000*, Montreal (2000)
17. Vyas, D., Chisalita, C.M., van der Veer, G.C.: *Affordance in interaction*. *Proceedings of the 13th European conference on Cognitive ergonomics: trust and control in complex socio-technical systems* (2006) 92-99
18. Torenvliet, G.: *We can't afford it!: the devaluation of a usability term*. *interactions* **10** (2003) 12-17
19. Turvey, M.T.: *Affordances and Prospective Control: An Outline of the Ontology*. *Ecological Psychology* **4** (1992) 173-187
20. Lombardo, T.J.: *The reciprocity of perceiver and environment: The evolution of James J. Gibson's ecological psychology*. L. Erlbaum Associates, Hillsdale, NJ (1987)
21. Stoffregen, T.A.: *Affordances as Properties of the Animal-Environment System*. *Ecological Psychology* **15** (2003) 115-134

22. Kaptelinin, V., Nardi, B.A.: *Acting with Technology: Activity Theory and Interaction Design*. MIT Press (2006)
23. Latour, B.: *Reassembling the Social: An Introduction to Actor-Network-Theory*. Oxford University Press (2005)
24. Hacking, I.: *The Social Construction of What?* Harvard University Press Cambridge, Mass (1999)
25. Zhang, J.: The Nature of External Representations in Problem Solving. *Cognitive Science* **21** (1997) 179-217
26. Reed, E.S.: Cognition as the Cooperative Appropriation of Affordances. *Ecological Psychology* **3** (1991) 135-158
27. Rogoff, B., Lave, J.: *Everyday Cognition: Its Development in Social Context*. Harvard University Press, Cambridge, MA (1984)
28. Stoffregen, T.A.: Affordances and Events. *Ecological Psychology* **12** (2000) 1-27
29. Blumer, H.: *Symbolic Interactionism: Perspective and Method*. Prentice Hall (1969)
30. Wertsch, J.: *Vygotsky and the social formation of mind*. Harvard University Press, Cambridge, MA, USA (1985)
31. Garfinkel, H.: *Studies in Ethnomethodology*. Prentice-Hall, Englewood Cliffs, NJ (1967)
32. Sacks, H., Schegloff, E.A., Jefferson, G.: A Simplest Systematics for the Organization of Turn-Taking for Conversation. *Language* **50** (1974) 696-735
33. Crossley, N.: *Intersubjectivity: The Fabric of Social Becoming*. Sage, London (1996)
34. Clarke, A.C.: *Profiles of the future: an inquiry into the limits of the possible*. Harper & Row (1962)
35. Lombard, M., Ditton, T.: At the heart of it all: The concept of presence. *Journal of Computer-Mediated Communication* **3** (1997)
36. Licoppe, C.: Connected presence: the emergence of a new repertoire for managing social relationships in a changing communication technoscape. *Environment and Planning D: Society and Space* **22** (2004) 135-156
37. Castells, M.: *The Internet Galaxy*. Oxford University Press, London (2001)
38. Poster, M., Aronowitz, S.: *The Information Subject*. G+ B Arts International (2001)
39. Harvey, D.: *The Condition of Postmodernity: an enquiry into the origins of cultural change*. Blackwell Publishing (1989)
40. Vatrapu, R.: *Technological Intersubjectivity and Appropriation of Affordances in Computer Supported Collaboration*. *Communication and Information Sciences*, Vol. PhD. University of Hawaii at Manoa, Honolulu: Available at <http://lilt.ics.hawaii.edu/~vatrapu/docs/Vatrapu-Dissertation.pdf> (2007) 538
41. Vatrapu, R.: Cultural Considerations in Computer Supported Collaborative Learning. *Research and Practice in Technology Enhanced Learning* **3** (2008) 159-201
42. Vatrapu, R., Suthers, D.: Technological Intersubjectivity in Computer Supported Intercultural Collaboration. *Proceeding of the 2009 international Workshop on intercultural Collaboration* (Palo Alto, California, USA, February 20 - 21, 2009). IWIC '09. ACM, New York, NY (2009) 155-164