

Culture and Computers: A Review of the Concept of Culture and Implications for Intercultural Collaborative Online Learning

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Abstract. Our research is aimed at a systematic investigation of phenomena in the nexus of culture, technology and learning. The basic premise of our research is that social affordances of technologies might vary along cultural dimensions. In this paper we present a brief overview of the concept of culture. We then discuss empirical findings demonstrating cultural effects on social behavior, communication and cognition and draw implications to online collaborative learning. In the last part of this paper, we present a selective review of research in cross-cultural human computer interaction.

1 Introduction

Our research is aimed at a systematic investigation of phenomena in the nexus of culture, technology and learning. *The basic premise of our research is that social affordances of technologies might vary along cultural dimensions.* The challenge for technological learning environments is that interacting through technology is not unproblematic. First, it makes interaction more difficult [7, 52]. Second, it may not mean, feel and afford the same thing to students from different cultures. Designers assume that the online environment is the same for everyone, but do users perceive something different? One of our research objectives is to explore alternative representational contexts for interaction because they may provide resources that are appropriate for different cultural members.

In this paper we will present a brief history of the problematics associated with the notion of culture. A summary discussion of the intellectual history of the concept of culture follows. Hofstede's [27] definition of culture is mentioned next. The section on culture, behavior, communication and cognition discusses Geert Hofstede's cultural dimensions model [27], cultural differences in traditional learning settings; Edward Hall's [25] communicative context cultural dimension and cultural psychology findings of Nisbett & colleagues [47, 48]. This paper concludes with a selective summary of the growing literature on culture and computers.

2 Concepts of Culture

The concept of culture has a checkered intellectual history. Raymond Williams [66] has termed culture “*one of the two or three most complicated words in the English language.*” Williams attributes this complexity of the concept to its complicated historical development in many European languages and its subsequent adoption in to a plurality of academic disciplines. The further complications with the concept of culture arise from the slippage of meaning between the academic usages of the term and the popular usages of the term like in “high culture” vs. “pop culture.” As Williams [67] puts it “*the concept at once fuses and confuses the radically different experiences and tendencies of its formation.*”

2.1 Definitions of Culture

The Victorian Ethnologist, Edward Tylor, is generally credited for providing the first definition of culture in anthropology. According to Tylor [60], “*culture or civilization, taken in its wide ethnographic sense, is that complex whole which includes knowledge, belief, art, morals, law, custom, and other capabilities and habits acquired by man as a member of society.*”

A compiled list of over 200 different definitions of culture can be found in Kroeber and Kluckhohn’s [35] critical review of the concept of culture. Tracing the intellectual evolution of notion of culture from the German “*kultur*” and its tensions with the notion of civilization, Kroeber and Kluckhohn categorize the different definitions of cultures into 6 groups: *descriptive, historical, normative, psychological, structural and genetic*. The psychological definitions of culture have “emphasis on adjustment, on culture as a problem-solving device” [35] and also have an emphasis on culture as learning. Two other definitions of culture are listed below:

“Culture is learned and shared human patterns or models for living; day-to-day living patterns. These patterns and models pervade all aspects of human social interaction. Culture is mankind's primary adaptive mechanism” [11].

“Culture is the shared knowledge and schemes created by a set of people for perceiving, interpreting, expressing, and responding to the social realities around them” [37].

In the above two definitions, culture is defined as patterns or schemas. Culture is shared and is a factor in an individual’s social interactions. The definitions also emphasize the adaptiveness implicit in the notion of culture and the importance of culture as an active notion and not a passive one. The conception of cultures as instrumental adaptations to environmental demands has been a feature of cultural ecology strands of anthropology. For example, according to White [65], “*all life is a struggle for free energy*” and culture is a means in that struggle toward the ends of survival.

Geert Hofstede’s definition of culture has been influential in the organizational communication and business literatures. According to Hofstede [27] culture is “*the collective programming of the mind which distinguishes the members of one group or category of people from another.*” The emphasis in Hofstede’s definition is that culture is learnt in nurture and not inherited by human nature. The “*collective*

programming of the mind” highlights culture as a collective activity that is to be conceived as a dynamic process rather than a passive state. The other part of the definition “*which distinguishes the members of one group or category of people from another*” points out the individual and group identity formation and sustenance aspects of enculturation in social institutions like family, school and work. Culture comes from similarity of individuals within a cohort group (be it a linguistic community, an ethnic group or a scientific community) and in that sense it is collective. This similarity is not intended to be exact; neither does it imply essentialist homogeneity. In a multicultural society culture is about collective particularity.

Hofstede’s definition is best interpreted from the Vygotskian socio-cultural perspective of the “*social formation of the mind*” [64]. “*Collective programming*” is not to be understood as an external imposition but an active social composition in which the particular individual plays the protagonist. Taken together, “social formation” and “collective programming” of the mind indicate a cognitive schema. Culture is operationalized as a cognitive schema in our research.

In our own research the concept of culture is treated as an independent variable. Cognitive sciences have highlighted the role of schemas and models in the mundane activities of everyday life. Culture in this proposal is operationalized in this cognitive scientific sense. Cultural schemas are putative structures; they are properties of an individual’s mind. Cultural schemas are not things; neither are they substances. They are formed and forged from an individual’s biography. This biography includes the interactive effects of the geography of that individual’s upbringing (ecology) and the formative experiences of his/her life (history).

3 Culture, Behavior, Communication and Cognition

In the next three sections we will discuss three separate lines of empirical findings from the fields of social behavior, communication and cognition. We will attempt to concretize our discussion of cultural effects by drawing implications to *intercultural* online collaborative learning environments.

3.1 Culture and Behavior

Cultural models can be used to identify the differences in cultures that affect how computer supported collaborative learning environments (CSCL) are used. There are two kinds of cultural models: models that use typologies and models that use dimensions. Typologies describe a number of ideal types each easy to imagine. Dimensional models group together a number of phenomena in a society that were empirically found to occur in combination into dimensions. Typologies are difficult to adopt in empirical research as real cases very rarely correspond to one single ideal type.

In our own research the concept of culture is treated as an in Hofstede’s seminal work on cultures in organizations formulated a framework of four dimensions of culture identified across nations. Each dimension groups together phenomena in a

society that were empirically found to occur in combination. In this section, Hofstede’s definitions for these original four cultural dimensions are listed followed by a discussion of each dimension with respect to online learning. Hofstede’s cultural dimensions model indicates what reactions are likely and understandable given one’s cultural background.

Low Power Distance vs. High Power Distance. Power distance is the “extent to which the less powerful members of institutions and organizations within a country expect and accept the power that is distributed unequally” [27]. People in large power distance cultures are much more comfortable with a larger power/status differential than small power distance cultures. Table 1, adapted from Hofstede [26], outlines the effects of power dimension that have implications for online learning environments. It is important to note that Hofstede’s conception of power distance is not a bi-directional one; it is conceived as a subordinate’s expectation and acceptance of unequal distributions of power in a social setting.

Table 1. Power distance dimension in traditional classrooms.

| Small Power Distance Societies | Large Power Distance Societies |
|-------------------------------------------------------------------------------|----------------------------------------------------------------|
| Student-centered education (premium on initiative) | Teacher-centered education (premium on order) |
| Teacher expects students to initiate communication | Students expect teacher to initiate communication |
| Students may speak up spontaneously in class | Students speak up in class only when invited by the teacher |
| Students allowed to contradict or criticize teacher | Teacher is never contradicted nor publicly criticized |
| Effectiveness of learning related to amount of two-way communication in class | Effectiveness of learning related to excellence of the teacher |
| Outside class, teachers are treated as equals | Respect for teachers is also shown outside class |

If online education is offered as an alternative to traditional schooling then it is important to investigate how students perceive the social affordances of the virtual learning institutions. For example, in our ongoing research study, set within a context of collaborative problem solving, students co-constructing concept maps are provided information attributed to scientists who have authority by virtue of their expertise and experience. Arguments from authority are valued in the scientific enterprise if those authorities themselves adhere to the scientific method. The point here is not whether the issues of power distance will show up in online classrooms but rather how does this dimension help understand the interactional behavior in an online learning setting.

Individualism vs. Collectivism. “Individualism pertains to societies in which the ties between individuals are loose: everyone is expected to look after himself or herself and his or her immediate family. Collectivism as its opposite pertains to societies in which people from birth onwards are integrated into strong, cohesive in-groups, which throughout people’s lifetime continue to protect them in exchange for unquestioning loyalty” [27]. This dimension describes the degree to which a culture emphasizes an individual’s reliance on the self or the group. Table 2, adapted from

Hofstede [26], outlines the effects this dimension that have implications to online environments.

This dimension is of particular interest to the social constructivist theories of learning given the small group size emphasis of CSCL. In inter-cultural online learning groups, dynamics of in-group and out-group memberships might affect how certain technology affordances are appropriated as social affordances. They might also affect the perception of other students in the online learning environment. The notion of face-saving is of important when it comes to subjective perceptions and evaluation of the user interface, online interaction and instructional elements of an online course.

Table 2. Collectivism vs. individualism dimension in traditional classrooms.

| Collectivist Societies | Individualist Societies |
|--------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------|
| Students expect to learn how to do | Students expect to learn how to learn |
| Individual students will only speak up in class when called upon personally by the teacher | Individual students will speak up in class in response to a general invitation by the teacher |
| Individuals will only speak up in small groups | Individuals will speak up in large groups |
| Large classes split socially into smaller cohesive subgroups based on particularistic criteria (e.g. ethnic affiliation) | Sub-groupings in class vary from one situation to the next based on universalistic criteria (e.g. the task "at hand") |
| Formal harmony in learning situations should be maintained at all times | Confrontation in learning situations can be salutary; conflicts can be brought into the open |
| Neither the teacher nor any student should ever be made to lose face | Face-consciousness is weak |

Based on socio-cognitive conflict theory [17] collaborative learning effectiveness is thought to be influenced by the extent that students jointly identify and discuss conflicts in their knowledge beliefs [8]. This works well in an individualist culture but in collectivist cultures consensual forms of intersubjective meaning making processes may be more prevalent.

Femininity vs. Masculinity. “Masculinity pertains to societies in which the gender roles are clearly distinct; femininity pertains to societies in which the gender roles overlap” [27]. This dimension refers to expected gender based division of labor in a culture. The cultures that score towards what Hofstede refers to, in a confusing choice of category labels, as "masculine" tend to have very distinct expectations of male and female roles in society. The more "feminine" cultures have a greater ambiguity in what is expected of each gender. Table 3, adapted from Hofstede [26], summarizes the implications of this dimension for online learning environments.

Table 3. Femininity vs. masculinity dimension in traditional classrooms.

| Feminine Societies | Masculine Societies |
|--------------------------------------------|-----------------------------------------------|
| Teachers avoid openly praising students | Teachers openly praise good students |
| Teachers use average student as the norm | Teachers use best students as the norm |
| System rewards students' social adaptation | System rewards students' academic performance |
| Students practice mutual solidarity | Students compete with each other in class |
| Students try to behave modestly | Students try to make themselves visible |

Collaborative learning is often distinguished from cooperative learning by the argument that collaboration involves joint activity or an effort to maintain a joint conception [55] whereas cooperation involves a mere joining of individual activities [15]. Collaboration is often conceived of as being beyond a basic division of labor and more of an enterprise involving parties with equal stakes. Division of labor is one of the most important concepts in Anthropology [29] and in Sociology [19]. The effects of culture on the division of interactional labor and the distribution of cognitive work in collaborative learning can be understood by investigating how participants appropriate affordances.

High Uncertainty Avoidance vs. Low Uncertainty Avoidance. *“The extent to which the members of the culture feel threatened by uncertain or unknown situations”* [27]. This dimension refers to how comfortable people feel towards ambiguity. Low uncertainty avoidance cultures feel much more comfortable with the unknown. High uncertainty avoidance cultures prefer formal rules and any uncertainty can express itself in higher anxiety. Table 4, adapted from Hofstede [26], summarizes the effects this dimension that have implications to online learning environments.

Table 4. Uncertainty avoidance dimension in traditional classrooms.

| Weak Uncertainty Avoidance Societies | Strong Uncertainty Avoidance Societies |
|-------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------|
| Students feel comfortable in unstructured learning situations: vague objectives, broad assignments, no timetables | Students feel comfortable in structured learning situations: precise objectives, detailed assignments, strict timetables |
| Teachers are allowed to say "I don't know" | Teachers are expected to have all the answers |
| Students are rewarded for innovative approaches to problem solving | Students are rewarded for accuracy in problem-solving |
| Teachers are expected to suppress emotions (and so are students) | Teacher are allowed to behave emotionally (and so are students) |
| Teachers interpret intellectual disagreement as a stimulating exercise | Teachers interpret intellectual disagreement as personal disloyalty |

The dimension of uncertainty avoidance can affect how students perceive social affordances of the online learning environment. Also of importance are the effects of culture on the interpretation or an acknowledgement of the ambiguous data and judgment of the relevance of data in the unfolding interactional sequence.

3.2 Culture and Communication

E. Hall’s Low Context vs. High-Context Communication Dimension. Besides Hofstede’s cultural dimensions model the dimension of *“low-context”* vs. *“high-context”* cultures introduced by Hall [24] is important in the contexts and situations of intercultural communication. According to Hall [24], in high-context cultures, usually the cultures with high power distance and high collectivism, a member needs to be explicitly asked to respond to elicit behavior that is a deviation from the norm. In low-context cultures, by contrast, members expect to influence others to act by explicitly pointing out pertinent information. The information provided implicitly enables the communicating other to take the desirable decision. Table 5 lists patterns of Hall’s cultural communication context dimension. Hall characterizes speaking as an art in high-context cultures, with an emphasis on the emotional aspect. High-context

cultures privilege social motivation. Low-context cultures privilege rational information.

Table 5. Low-context vs. high-context cultural communication styles.

| High-context communication | Low-context communication |
|-----------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Communication is aimed at emotions and rhetorical persuasion | Communicative focus is rational information |
| Speech is unhurried and long, as persuasion takes time | Information is desired in quantity and expected to be delivered at once |
| The main emphasis is not laid on the transmission of information, as most of it lies in the context | Decisions are taken on the basis of information |
| Both speaking and listening are something to be thoroughly enjoyed | Speaker errors carry social costs as they blur information |
| Ambiguous interpretation is allowed | Unequivocal Interpretation is desired |

If the communicative context varies across cultures than it becomes a variable of interest in the learners' interactional accomplishment in online learning situations.

3.3 Culture and Cognition

According to Nisbett and Norenzayan [48], mainstream psychology in general had made four basic assumptions about cognition. Adapting from them, the four foundational psychological assumptions regarding human cognition are:

- *Universality*: Basic cognitive processes of sensation, perception, attention and memory are universal. In other words, basic cognitive processes are invariant across cultures and communities.
- *Content Independence*: Basic cognitive processes are invariant across contents. In other words, cultural differences in content do not affect the nature and structure of the basic cognitive processes.
- *Environmental Sufficiency*: Cognitive processes of general learning and interference operate upon environmental contents to equip the child for functional survival. The environment provides content to cognitive processes without the need for cultural or social interventions. In other words, cultural differences in cognitive processes are due to different environmental influences and not social influences.
- *Infinite Cultural Variance*: Since the universal basic cognitive substrate is content independent and environmentally-sufficient, the range of cultures is a function of the variance in environmental conditions. In other words, cognition places no constraints on the possible evolutionary design space of cultures.

All in all, these four assumptions have led to a belief in a fundamental dissociation between cognition and culture. One consequence of this was that psychology and anthropology evolved into independent academic disciplines with mostly non-overlapping research agendas. However there were some exceptions to this dualist view of cognition and culture. These exceptions include in psychology, Lev Vygotsky and colleagues [62, 64]; in cognitive anthropology, most notably D'Andrade [10]; and

in cognitive sociology, Dimaggio [16]. For work on connecting the universal and the specific in language and culture, see [22].

Nisbett and Colleagues’ Cross-Cultural Psychology Findings. Table 6, compiled from Nisbett [47] and Nisbett and Norenzayan [48], presents a concise summary of above discussion along with empirical evidence from the literature.

The cultural difference in attention to field vs. object might be relevant to collaborative “knowledge map” learning environments. East-Asian learners might pay attention to a meaningful group of interrelated knowledge map objects whereas Western learners might attend to individual objects and evidential relational links. The cultural difference in attention might vary the ways in which referencing and deixis are carried out in collaborative discourse. East-Asian learners might make more references to regions of the concept maps and groups of related concept map objects (i.e., to fields of interest), whereas Western learners might reference individual objects in their collaborative discourse. This can be translated into a tentative socio-technical design hypothesis that given the choice of referencing regions of concept map areas and individual objects in the concept map, East Asian learners may prefer to appropriate the affordances *for referencing fields*. On the other hand, Western learners may prefer to appropriate the affordances *for referencing individual objects*.

Table 6. Cognitive differences between East-Asians and Westerners.

| Cultural Profile → ↓ Cognitive Process | Westerners | East-Asians | Empirical Evidence |
|----------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------|-------------------------------|
| Attention | <i>Object</i> Westerners tend to attend to individual objects in the perceptual field | <i>Field</i> East-Asians tend to attend to whole fields rather than individual objects | [43] Field Dependence [68] |
| Perception | <i>Object-oriented</i> Westerners have lesser difficulty in detaching objects from their perceptual contextual fields | <i>Relation-oriented</i> East-Asians have difficulty in disentangling an object from its perceptual surroundings | [31] [42] |
| Causal Inference | <i>Dispositional</i> Westerners susceptible to overlooking of situational factors on observed behavior | <i>Situational</i> East-Asians susceptible to “hind-sight bias” | [50] [4] |
| Knowledge Organization | <i>Categorical</i> Reliance on categories of objects/events | <i>Relational</i> Reliance on relationships between events/objects | [5] |
| Reasoning | <i>Analytical</i> Application of formal logical rules and analytical procedures that emphasize non-contradiction in hypothesis | <i>Holistic</i> Willingness to simultaneously entertain several contradicting hypotheses | [49] [48] |

The implications from the cultural difference in perception is that Western learners by virtue of being more susceptible to “primacy effect” might favor earlier perceptions of information related to a collaborative learning task. East-Asian learners might perceive more relationships between the information in concept maps and instructional materials leading to a greater number of evidential relation links in the concept map.

The cultural difference in causal inferences implies that East Asian learners might be more inclined to reason-giving that prioritizes situational factors when compared to the dispositional attributions of Western learners. One particular implication would be the cultural affect on collaborative argumentation. Also, East-Asian learners’ perception of their collaborative partners might follow this same trajectory. This might manifest as East-Asians’ giving higher ratings for their collaborative peers due to situational attributions explaining any perceived unpleasant “performance.” Western learners might perceive their collaborative peers for their dispositional “competence.” This cultural difference in cognitive processes might manifest as East-Asian learners preferring a highly inclusive final conclusion in intercultural collaborative problem solving tasks. Western learners might argue for more differentiated analytical hypothesis that seems logically the most viable.

In the next section, a selective review of research into cultural issues in user interface design, usability evaluation, World Wide Web (WWW), information systems (IS), and computer supported cooperative work (CSCW) and online learning is presented.

4 Cultures and Computers

Research into social aspects of HCI [54] has shown that even computer-literate users tend to use social rules and display social behavior in routine interactions with computers. Social interaction is strongly grounded in culture as every person carries within himself/herself patterns of thinking, feeling, behaving and potential interacting. Much of this is learned during development processes in the childhood. As soon as certain patterns of thinking, feeling and acting have established themselves within a person’s mind they reside there awaiting activation or inhibition in appropriate situations. To learn new patterns of thinking, feeling and acting one has to unlearn the old patterns, which is more difficult than learning them in the first place for the first time [27].

4.1 User Interface Design

In a recent article, Marcus [39] has expressed how little we know or understand culture as it relates to user-interface usability and design. He uses several examples to highlight the importance of culture and points to recent developments as evidence that culture does matter for user interface design and usability. Fernandes [23] has identified various cultural issues of nationalism, language, social context, time, currency, units of measure, cultural values, body positions, symbols and esthetics that need to be addressed during global interface design. The various solutions suggested

include providing ample space for accommodating varying width of date formats and top-level menu design taking the languages with large words into account. Similarly, Russo and Boor [56] present a checklist of cross-cultural items to be considered in interface design. The checklist consists of text, number, date and time formats; images; symbols; colors; flow and functionality. They discuss each item on the checklist, the problems encountered in practice and propose solutions to avoid them. Russo and Boor place high importance on testing with native users as they can help in identifying the subtler issues of the interface. Khaslavsky [33] describes the impact of culture on usability and design, presents variables useful for incorporating culture into design and mentions issues in localization of design. Elnahrawy has given culture specific recommendations and guidelines for website designers. Elnahrawy concludes that differences between cultures affect the understanding of the websites and calls for further research on cross-cultural effects in user interface design.

4.2 Usability Evaluation

Just as different cultures call for different versions of the same software and products, different usability methods might be needed for different cultures. International usability testing generally involves a usability expert from the product country and a local facilitator in the target country [46]. When differences in cultures exist between the usability test evaluators/facilitators and the test learners, usability assessment techniques employed in the usability testing may mask the usability problems instead of discovering them. Prior research has found that culture affects the usability evaluation process [2, 14, 20, 21, 28, 45, 57, 61, 69]. For example, culture affected the functioning of focus groups [2], the think-aloud protocol [69], questionnaires [14], understanding of metaphors and interface design [21] and efficacy of structured interviews [61]. The role of culture in usability evaluation of online learning environments in particular and HCI in general remains largely unexplored.

4.3 World Wide Web

K-P. Lee [38] conducted a study to identify how cultural characteristics influence people's interaction with products and to evaluate using the WWW as tool for multicultural study. The results of the study showed significant differences between Japan, Korea and USA in interaction styles. Depth of the interface was turned out to be most contributing factor for usability of Korea and USA whereas layout was the most significant factor for Japanese users. Lee concludes that the difference in the cultural characteristics of users accounted for the differences in their interaction styles. Sears et al [57] examined the international differences and effect of high-end graphical enhancements on the perceived usability of World Wide Web. They found significant differences between the users belonging to the two different cultures of United States of America and Switzerland. Sun discusses the localization strategies for building culturally-competent multilingual and transnational websites. Preliminary findings from the exploratory study confirm that contextual clues and cultural markers in website design influence usability and there is a need for integrated localization.

4.4 Information Systems

A research study has shown that culture had a limited impact on some specific aspects of IT decision making [59]. Chong, Yang and Wong [6] examined moderation aspects of cultural differences on the relationships among online trust, perceived value of the goods and services and online purchase intention. They identify the *individualism-collectivism* and *uncertainty avoidance* dimensions of Hofstede's cultural model with the potential to influence trust formation and purchase intention amongst consumers. Chau, Cole, Massey, Montoya-Weiss and O'Keefe [51] explored the cultural differences in the online behavior of consumers from the US and Hong Kong and found significant cultural differences in online consumer behavior across the two countries. Kumar and Bjorn-Andersen [36] did a cross-cultural comparison of IS designer values between business and governmental organizations in Canada and in Denmark. For both countries they found the dominance of technical and economic values and cross-cultural differences in these values between Canada and Denmark. Borchers [40] based on his experiences with software development projects in India, US and Japan notes that cultural differences had a large impact on software engineering. Borchers states that in several instances Hofstede's cultural model closely matched the observations.

4.5 Computer Supported Cooperative Work

Setlock, Fussell and Neuwirth's [58] findings suggest that experimental groups homogenous and heterogeneous cultural backgrounds had different perceptions of the study task. They also report that even though cultural differences were reduced in the computer-mediated communication condition of instant messaging (IM) they were not eliminated. The findings of Setlock et al., contradict those of Anderson and Hiltz [1] who found that culturally heterogeneous experimental groups achieved greater consensus using asynchronous group support systems (GSS).

Olson and Olson [53] report a theoretical application of the cultural models to remote software development teams. They identify team composition and teamwork as the two classes of cultural differences that may influence multicultural teams independent of setting. According to Olson and Olson, culture influences both the process and the product of brainstorming, decision support systems, video as well as audio conferencing. Massey, Hung, Montoya-Weiss and Ramesh [41] studied the perceptions of task-technology fit in global virtual teams. They argue that different technologies may be better suited for conveyance of information against convergence to decisions. Their results from the post-study questionnaire showed significant differences in the perceptions of task-technology fit across the various cultures.

Krishna, Sahay and Walsham [34] explored cross-cultural issues in software outsourcing and state that challenges amount to the need to adapt to the cultural norms of social behavior, attitudes towards authority and language usage. The authors citing Brannen and Salk [3] state that "*an attempt to understand and move somewhat towards the other partner in a cross-cultural collaboration has been called a negotiated cultural perspective.*"

4.6 Online Learning

Kim and Bonk [13] report cross-cultural differences in online collaborative behaviors of the US, Finnish and Korean participants in their study. Daniels, Berglund and Petre [12] found cultural differences in international projects in undergraduate CS education. McLoughlin [44] based on her experiences with developing web-based instruction for Australian Indigenous education calls for a culturally responsive technology. Iivonen, Sonnenwald, Parma, and Poole-Kober [30] found culturally influenced differences in language and communication styles in a library and information studies course taught over the Internet in Finland and US. Walton and Vukovic's [63] work with south African students from disadvantaged backgrounds found that cultural differences make it difficult for the students to make the transition to the web use.

Crump [9] explored the effects of computing learning environment on the newly arriving international students at universities in New Zealand. The author reports that the cooperative and collaborative learning environment was an issue of concern to the students. The author says it is likely due to the oversimplification of social structure of groups, individual and group goals and the diverse nature of knowledge construction in the collaborative learning environments. Duncker [18] conducted an ethnography of the usability of a library metaphor used in digital libraries in the cultural context of the Maori, who are the indigenous population of New Zealand. Duncker says that metaphors and metaphorical thinking are strongly rooted in culture. The Maori found the digital libraries interesting but difficult to use due to the breakdown of the library metaphor caused by a number of cultural misfits. Keller, Pérez-Quñones and Vatrappu [32] outlined cultural issues and opportunities in computer science education.

5 Discussion

The cultural issues addressed in most of the prior cross-cultural HCI research studies are at the level of a direct manipulation single user interface and do not consider cultural issues in social interactional design. Symbols, rituals, norms, values and practices are amongst the most visible manifestations of culture, and taken together they cover important aspects of the concept of culture [27]. The cultural issues identified above consider only the symbols and rituals of different cultures, ignoring the basic question of the relationship between culture and affordances. Issues in interface design due to the differences in social and cognitive processes are left unidentified.

Taking the existing body of research on cultural effects on social behavior, cognitive processes, online pedagogies and HCI as the point of departure, we propose a new way of conceptualizing the relationship between cultures and affordances, and are initiating a systematic inquiry into the phenomena that emerge from the nexus of culture, technology and learning. The primary research problem addressed by our current research is the extent to which culture influences appropriation of technology affordances as social affordances and technological intersubjectivity of learners. A

systematic investigation of this particular research problem can inform the design of technology affordances. This in turn can increase the efficacy of pedagogical design as measured by individual learning outcomes as well as student perceptions.

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