Human Factors in Emerging Markets: First World Solutions Addressing Third World Needs.

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Abstract
Drawing on the author's experiences in Third World telcos, field work in Nepal, Bangladesh and Ghana and a review of selected reports and research findings, this position paper attempts to formulate a tentative framework for conceptualizing a wide range of factors that will critically impact the success of telecom business ventures in third-world countries. A guiding premise is that usability engineering is also social engineering within a cultural context. Asserting that the field of human factors is the scientific application of knowledge of the capabilities and limitations of humans (as individuals, members of social groups and cultures) with the aim to make products, services and environments simpler to use, safer and more efficient, the author describes selected ICT products and application areas from emerging markets that illustrate the practical application of the framework.

Key words: ICT, human factors, ethnography, Third World, development, diffusion theory, poverty reduction, digital divide, UN Millennium Development Goals.

1. Background
The UN Millennium Development Goals stress the importance of making available "the benefits of new technologies - especially information and communications technologies" to developing nations [United Nations (2005)]. As an enabler, ICT is commonly considered to be an indispensable resource in the ongoing transformation process within healthcare, education, commerce, governance, industry and agriculture in third world countries. The quality of life for a majority of the world's population will be greatly enhanced, it is maintained, if we can successfully narrow the so-called digital divide. Until recently, the primary objectives of most programs addressing this disparity between First and Third World nations have been to provide reliable network access and low-cost hardware solutions to underserved and impoverished end user communities. In the wake of countless misguided and unsuccessful initiatives it is increasingly acknowledged, however, that providing network access and putting hardware into the hands of potential users is necessary but far from sufficient; hardware becomes a tool of lasting value *only* if it addresses a need, is successfully integrated into a socio-cultural setting and can actually be operated by members of its intended user community. This "revelation" opens new vistas for the field of human factors and may, in fact, require us to reexamine its scope and foundations.

This position paper will attempt to increase awareness of the role human factors expertise can play and to formulate a tentative framework for conceptualizing a wide range of factors that

will critically impact the fate of telecom business ventures in emerging markets. Although highly relevant and critical to success, our focus will *not* be on technology per se, nor on business strategies, proprietary vs. open-source or regulatory issues, but rather on the individual and social attributes and the cultural context of potential users of telecom services. Clearly, all of these factors are closely linked and collectively impact the sustainability of service offerings, but a comprehensive overview is beyond the scope of this paper. We will also restrict our focus to so-called "financially constrained" user communities in developing nations – to the group Prahalad (2005) refers to as "the bottom of the pyramid". This group today numbers over 4 billion people with an annual per capita income of less than USD 1,500, one quarter of them doing their best to survive on less than a dollar a day.

It is our contention that human factors theoreticians, researchers and practitioners have largely neglected the unique requirements of users in emerging markets. Our reluctance to confront the challenges of working with users and potential users on the far side of the digital divide may be attributed to the following factors:

- The human factors field's tradition-bound emphasis on *individual* user attributes rather than social context and culture, in no small part its legacy from cognitive psychology.
- The field's attraction to cutting-edge and "next generation" application areas rather than redesign and reengineering of existing or even "outdated" technologies to meet the needs of new user groups.
- The hassles and hazards associated with research and collaborative design in "primitive" and non-familiar environments.
- Going where the jobs and money (funding) are to be found.
- Various myths and orthodoxies surrounding the adoption (and indeed the relevance) of ICT in Third World nations. To the extent that ignorance and conventional wisdom in the telecom and IT industry stand in the way of progress, there is an urgent need to re-examine these tenets (see below).

Applying human factors methodology and insights in emerging telecom markets is now more critical than ever. UN agencies, ITU-D, the World Bank and regional development banks, NGO's as well as local government agencies are investing heavily in rural access, telemedicine, e-learning, e-commerce and e-governance initiatives, in many cases targeting end user communities lacking even the most basic computer skills. Furthermore, used computers and peripherals are being exported from developed to developing nations at an unprecedented rate[1]. UNESCO estimates that about 50% of the 7.5 million computers in Africa are units that have been discarded by Western companies. The incentives for benefactors are many, ranging from tax breaks and corporate social responsibility credits to efficient e-waste management[2]. We are confronted by a moral dilemma: Is it acceptable that the ICT revolution in developing nations is destined to be fueled by a stream of hand-me-down technology that may, in many cases, not meet the increasingly stringent user requirements of Western governments and companies? Or, if our only two options are no

[1] UNESCO estimates that there are over 600 million decommissioned computers in the world's 30 most affluent countries [Vecchiatto (2004)].

[2] Computers and peripherals also represent hazardous waste that is increasingly being "downloaded" to Third World nations. Toxic chemicals such as beryllium, lead, barium and mercury found in monitors and circuit boards thereby find their way into the local ecosystems. E-waste represents a potential environmental disaster in developing nations.

technology at all or poorly designed technology to address the challenges of the digital divide, must we reluctantly accept the lesser of two evils?

The much-publicized *One Laptop per Child*[3] initiative (a.k.a. *The $100 Laptop*) spearheaded by faculty members from the prestigious MIT Media Lab seeks to distribute inexpensive laptops to schools, primarily in developing nations. Its highly laudable objective is to "provide children around the world with new opportunities to explore, experiment, and express themselves" [(MIT OLPC, 2006)]. Quanta Computer Inc. of Taiwan are scheduled to start production as soon as 5 to 10 million units have been ordered and paid for in advance. Even if issues related to local distribution, support and the required links to Internet are ignored, one is initially struck by the total disregard of basic principles of ergonomics and alarmed by the prospects of 10 million or more children (and their social networks) relying on this device as their primary learning tool and gateway to the world (see Figure 1). Are we once again being coerced to choose between a flawed product that promises a hitherto unimaginable price/performance ratio on the one hand, and digital disenfranchisement on the other?

Figure 1. Prototype of the One Laptop per Child (OLPC) terminal with a hand-powered charging unit.
Source: http://laptop.org/download.en_US.html

2. Technology Adoption in Developing Nations

Prahald and Hart [Prahalad & Hart (2002), Prahalad (2005)], Mahajan & Banga (2006) and Rangaswamy and Toyama (2005) present convincing arguments for targeting markets in emerging economies and, significantly, for focusing **not** on the wealthy few or even the

[3] The proposed $100 machine will be a Linux-based, with a dual-mode display—both a full-color, transmissive DVD mode, and a second display option that is black and white reflective and sunlight-readable at 3× the resolution. The laptop will have a 500MHz processor and 128MB of DRAM, with 500MB of Flash memory; it will not have a hard disk, but it will have four USB ports. The laptops will have wireless broadband that, among other things, allows them to work as a mesh network; each laptop will be able to talk to its nearest neighbors, creating an ad hoc, local area network. The laptops will use innovative power (including wind-up) and will be able to do most everything except store huge amounts of data. (from http://laptop.org/faq.en_US.html).

rapidly growing increasingly affluent middle class, but the largely neglected aspiring poor – the so-called "bottom of the pyramid". Multinational corporations (including telecom operators) are encouraged to look for opportunities in these markets and adapt their business models, technology and service offerings to mesh with the local culture. Prahalad and Hart [op. cit.] emphasize that the first step that needs to be taken is to come to terms with some of the orthodoxies that have stood in the way of progress, among them the tenuous assumptions that:

- Current cost structures make it difficult to compete profitably
- The poor cannot afford and have no use for "Western" products and services
- Only developed markets can appreciate and benefit from new technology
- Aspiring poor are not important to the long-term viability of our business
- Too "humanitarian" and CSR oriented! Doing "good" and doing "well" are not compatible.
- The intellectual excitement for management is in developed markets (cf. the preference for leading edge applications and technology in the human factors field)

To this list of (false) assumptions Rangaswamy and Toyama [op. cit.] add "the myth of overriding physiological needs" which asserts that desires at the top of Maslow's hierarchy of needs [Maslow (1954)] are activated only when and if needs at the bottom have been fulfilled. Discussing the application of advanced technologies such as ICT to rural development, the same authors suggest that "preconceptions about villagers and their aspirations… create cognitive barriers to good product design."

Relying on a mix of local knowledge, demographics and case studies, all of the above mentioned authors have summarily dismissed these preconceptions about business ventures in developing nations and go on to point to a critical success factor for multinational companies entering developing markets. Success will depend on their ability to "nurture local markets and cultures, leverage local solutions, and generate wealth at the lowest levels of the pyramid… To do this [multinational companies] must combine their advanced technology with deep local insights… New business models must not disrupt local cultures and lifestyles. An effective combination of local and global knowledge is needed, not a Western system." [Prahalad & Hart (2005), p.10 - 12]. Large multinationals such as Intel have long been cognizant of this, conduction detailed ethnographic research within emerging markets in Africa and Asia in order to understand "the underlying social and cultural factors that influence technology adoption in [a] region, and their implications for new technology development." [Intel (2005)].

The dictate that product developers must fully understand and adapt to the local cultural setting fits perfectly with classical Rogerian diffusion theory [Rogers (2003)]. Rogers identifies five perceived attributes of innovations that will determine their rate of adoption, among them *compatibility*. Compatibility, according to Rogers, is the degree to which an innovation is perceived as consistent with existing values, past experiences, and the needs of potential adopters. Compatibility may be gauged in relation to sociocultural values and beliefs, previously introduced ideas and/or local needs for the innovation. The same author warns against "the empty vessel fallacy", the assumption that potential adopters are blank slates who lack previous experience with which to associate the innovative idea. Although this fallacy has largely been overcome in agriculture, health and family planning, there is a very real danger that telecom operators in non-Western emerging markets assume that their services will be readily adopted if they save time and travel, are easily accessible and cost

efficient, have visually appealing and intuitively understood user interfaces, etc. This may not always be the case. When designing and implementing e-commerce services such as a micropayment application for mobile phones, for example, one needs to be thoroughly familiar with not only the local legal framework regulating such activities, but also - and of equal importance - with religious and moral dictates that may result in rejection of the service offering. In Islamic cultures, for example, there are highly complex rules regulating the practice of paying and receiving interest. Any telecom service that involves elements of "riba" (commodity or money exchange with an augmentation or decrease in amount along the way) or "gharar" (gambling or transactions with uncertain outcomes) needs to be checked against the religious teachings and the basic principles underlying these restrictions[4].

Researchers at Intel [op. cit.] have also emphasized the link between spirituality and technology adoption. The dominant Western values of "always on" and "constant connectivity" that are valued by telecom operators (and presumably their customers), they maintain, conflict with all major world religions which prescribe certain times when followers must be *disconnected* from the material world and interaction[5]. Rather than merely testing for *compatibility* with dominant religious and spiritual beliefs, however, they go one step further and suggest that technology should ideally *support* such beliefs and practices. They cite examples of mobile phones that sound alarms at prayer times and phones with imbedded compasses which enable the devout to locate the direction of Mecca. An interesting spin-off of Intel's research is that it may compel us to reexamine the taken for granted value systems of our own culture(s) as reflected by the applications currently installed on the devices *we* are carrying in our pockets and purses: SMS, e-mail, to-do lists, reminders, appointments, addresses, entertainment, cameras, navigation aids, voice recorders, etc.

3. Expanding the Scope of Human Factors

These and many similar examples suggest that the scope of the human factors field should be expanded to include the social as well as cultural sphere. If we accept that HF is the scientific application of the capabilities and limitations of humans, with the aim to make products, services and environments simpler to use, safer and more efficient, then the social and cultural context of the end-user cannot be overlooked or relegated to the realm of entertaining anecdotes. Applications of telecommunications technology are not culturally neutral and its end users are not "empty vessels". Usability engineering in Third World settings therefore also entails social engineering within a cultural context.

We have attempted to depict the relationship between four levels of analysis in Figure 2 below. At the fourth (top) level (Individual as a biological entity) we address accessibility issues that relate to the physical characteristics of users. Since we are all endowed with roughly the same physical characteristics across cultures, we can assume that the principles of ergonomics will also apply in Third World settings (cf. our reflections concerning the OLPC terminal above). The higher incidence of certain genetically transmitted conditions and diseases in the developing world, however, should alert us to the need to apply principles of universal design whenever feasible, ensuring that the needs of users with, for example, visual impairments or reduced mobility are not forgotten. At the third level (Individual as an

[4] For a brief summary, see Hawary (2005):
http://www.uncdf.org/english/microfinance/newsletter/pages/2005_07/news_compatibility.php

[5] We also see signs that the dominant "always on" ideology is being challenged in more secular settings. Increasingly, the use of mobile phones in public spaces such as trains, busses and restaurants is being restricted or, at the very least, frowned upon.

information processing entity), we first confront the complexities of cultural variation. We assume until proven wrong that general principles of cognitive psychology will be applicable, but it will need to be supplemented with a deeper understanding of the relationship between language, culture and cognition and how mental models and metaphors impact product design and delivery (see examples below). Examples of the impact of the social setting (the second level of our model) on how products are used (or not) abound. In order to reduce the cost of mobile phone use, Donner (2005) describes the practice of "beeping" in sub-Saharan Africa (or "flashing" as it is termed in Ghana)[6]. Monitoring and understanding such socially negotiated mechanisms and the underlying needs is crucial to product design. The fourth and lowest level of our model (Cultural context) was illustrated above with reference to spirituality and religion.

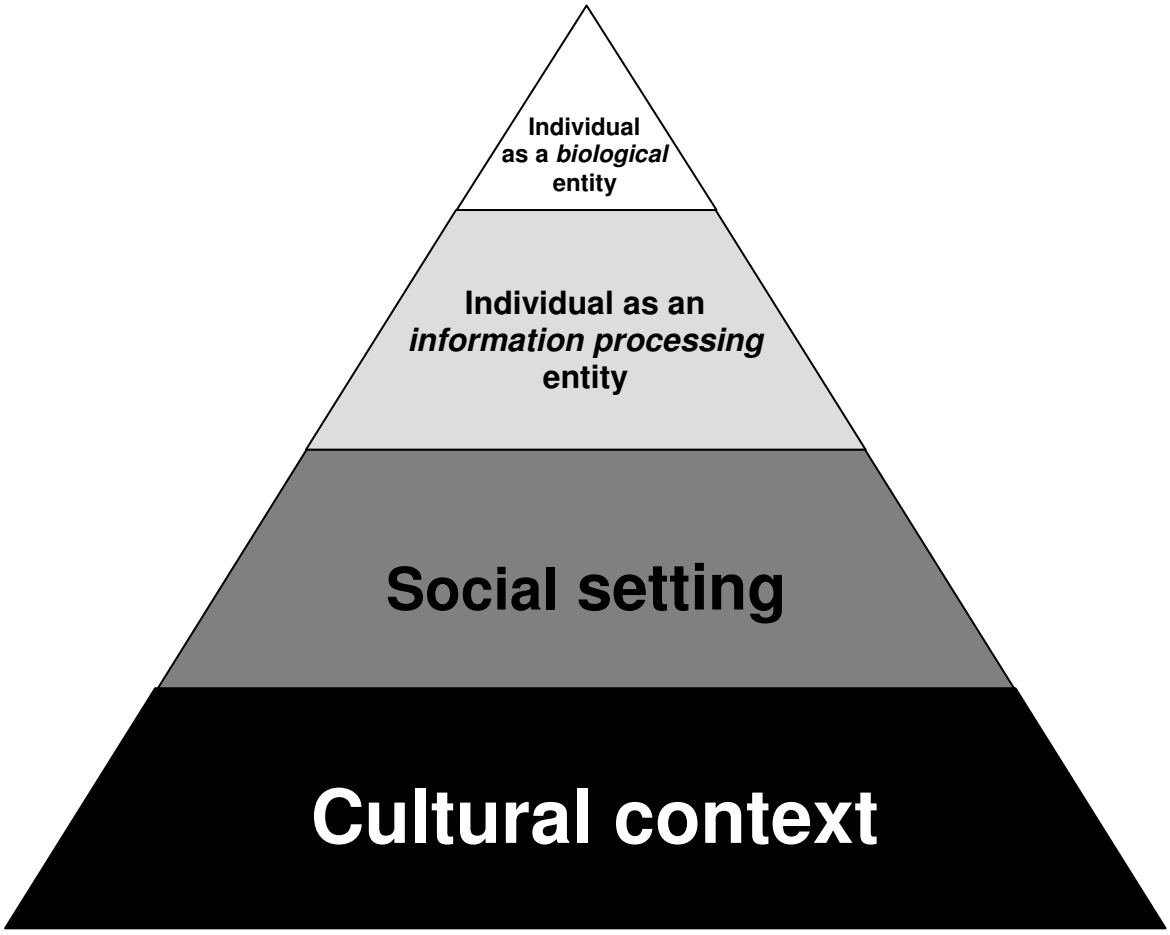

Figure 2. Representation of a framework for conceptualizing human factors research and practice in culturally diverse or emerging markets.

All four levels may impact a single product or service and should therefore be considered in consort. When designing and implementing a new mobile application, for example, we will naturally, as good HF practitioners, prototype and evaluate a user interface that matches the

[6] Beeping/flashing involves calling a number and hanging up before the mobile's owner can answer. The call log and address book identify the caller and allow the recipient to either call back or remind her of a pre-negotiated instrumental arrangement such as "Pick me up."

information processing capabilities of its intended users. Our Western "personalization" bias may lead us to take individual ownership for granted. In many Asian and African cultures, however, some form of "community" is the basic unit we should be addressing, be it the family, extended family, tribe or village. Mobile phones are frequently shared among family members, partly as a necessity, but not uncommonly as a social good. We should therefore look for some way to differentiate sets of user requirements associated with individual terminals or services, providing mechanisms to activate different user profiles to meet the needs of young and old, literate and illiterate users. Similarly, researchers from Intel [op. cit.] suggest that our Western conceptions of shared computing that require isolation of individual data and protection by means of passwords or biometrics may not be necessary or even desirable in community centered cultures. Multiple users may use the same computer without the need for isolation of data and password protection.

A second example of how this approach may enhance our theory and practice in emerging markets may be found in our understanding of role played by mental models and metaphor in diverse cultures. The desktop metaphor is taken for granted in virtually every PC application in existence since it constitutes the very framework within which we operate when using such a device. Desktops, files, folders and cursors are far from commonplace among financially constrained user groups in Asia and Africa, however. The link between culture and conceptualizations of the GUI is illustrated in the "Hole-in-the-wall" project. Sugata Mitra and his staff at NIIT (a New Delhi software firm) installed an accessible Internet-connected computer in a wall in a local slum area and observed what happened [Sood (2002)]. There were no operating instructions and no supervision was available. Within days a large group of ghetto children between 6 and 12 had discovered the PC in the wall and achieved a reasonable level of proficiency in basic operating skills (pointing, dragging, copying, etc.), producing drawings and surfing the Internet. The interesting observation in this context is that the children spontaneously developed their own vocabulary for GUI elements. The cursor was referred to as a needle, websites as channels (borrowing a metaphor from their encounters with television). The rotating hourglass indicating that an application or document is loading was termed a "double-sided drum" which, in their local culture, is used to generate a crowd by local street performers. The same GUI therefore generates two radically different metaphor structures, both functional in spite of the fact that they are derived from different life experiences. The question of how much *more appropriate* a GUI founded on the users' local culture and life experiences would have been remains unanswered, however.

4. Conclusion

First and foremost, this paper seeks to sensitize HF theoreticians, researchers and practitioners to the unique challenges and rewards of working with end users in Third World nations. Initiatives such as M.I.T.'s "One Laptop per Child" and projected heavy ICT investments in the Third World indicate that their skills will be needed to ensure successful deployment and lasting benefits of technology. The need for an overall framework that integrates traditional human factors theory and method with approaches derived from ethnography, sociology and anthropology has been identified and a rudimentary model proposed. The success of future service offerings in emerging telecom markets will to a large extent be determined by our ability to find an appropriate match between *real* rather than *imaginary* local needs on the one hand and applications that address those needs on the other.

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