Design and Deployment of Person-Centred Accessible Technologies by Enhanced Interdisciplinary Approach

Dr. N. Balasubramanian

***Abstract*— in this paper enriching the design philosophy of HCMC by considering perspectives from disabilities. The deployment and development of the proposed system is done by using enhanced interdisciplinary approach. We present an interdisciplinary approach to realizing person-centred accessible technologies. The basis of the approach is three complementary research thrusts: socio-personal dynamics, human-centred design, and socio-technological practices. These thrusts are interconnected through the disability research of technology, adaptation and policy. The result of proposed approach provides better performances than the existing system.**

Keywords—human-centred computing; person-centeredness; multimedia; assistive technology; interdisciplinary

HUMAN-CENTERED MULTIMEDIA COMPUTING

The interdisciplinary design theories and practices of Human-Centered Computing (HCC), a subfield of computer science, transcend traditional human-computer interaction (HCI) design theories by moving beyond the user interface to place the human at the center of research activities [1].

In the context of multimedia computing, Human-Centered Multimedia (HCM) [2-4]—also known as Human-Centered Multimedia Computing (HCMC)—has emerged as a field of computational science that applies the principles and theories of HCC to the design of multimedia systems including the production and analysis of multimedia data and our interaction with multimedia content.

HCC places emphasis on understanding human behavior, needs, preferences, expectations, adoption strategies, adaptation strategies, societal differences and cultural differences in the context of technology, and on using this knowledge to guide the design of more natural and accepted computational systems [2, 3].

The complexities of today's socio-technical environment has helped HCC grow into a major interdisciplinary subfield of computer science with graduate degrees in HCC now being offered by several universities including Georgia Tech, Clemson University and University of Maryland, Baltimore [1].

These degree programs combine computer science and engineering with the social and behavioural sciences to train students to become HCC practitioners and leaders in today's complex socio-technical setting. Guidelines for designing natural and accessible multimedia systems have been proposed for HCMC [2] including multimodal interaction for more natural use; understanding and accounting for societal and cultural differences for improved adoption; and ubiquitous computing solutions for accessibility beyond the desktop.

The accessibility of today's technologies and multimedia systems, however, is still limited given that designs are geared toward the "able" population. Accessibility features of commercial products are often an afterthought with features being added on after release rather than being an integral part of design from the start.

It is not uncommon to find ad-hoc solutions in which disparate technologies are combined to "solve" accessibility issues. But careful attention must be paid to designing accessible technologies—taking the approach of universal design to accommodate every user may result in overly complex systems deemed unusable by most given the diversity of disabilities [5].

The Human Dimension: Given the diversity of users and complexities of socio technical environments, understanding the behaviour, needs, and preferences, societal and cultural differences of a target user group is critical when designing natural, usable and acceptable technologies and multimedia systems. Often, though, users don't know their own needs—that is, needs are often subconscious or cannot be easily articulated to designers.

We refer to these needs as implicit needs. On the other hand, explicit needs may be readily identified by users. At the Center for Cognitive Ubiquitous Computing (CUbiC), we have reported on numerous case studies [6][7] in which the explicit needs of individuals with sensory, physical and/or cognitive impairments, identified during requirements gathering activities, such as focus groups and interviews, are either the yet unseen needs or the implicit needs of the broader population.

This corroborates the notion that designing technologies may be enriched when considering the needs of individuals with disabilities. Users with the same or similar disability may be quite diverse based on the type of impairment.

For example, a visual disability may be due to various impairments such as total blindness (sensory), color blindness (perceptual) or prosopagnosia (cognitive).

However, such diversity should be viewed as an opportunity to enrich our understanding of the human dimension as new channels of information flow through the sensation-perception-cognition model (Fig. 1) are opened. Such investigations can provide a unique perspective to HCMC and reveal deeper understandings of internal processing and integration in the absence of sensory, physical or cognitive functions, and in the presence of human coping mechanisms.

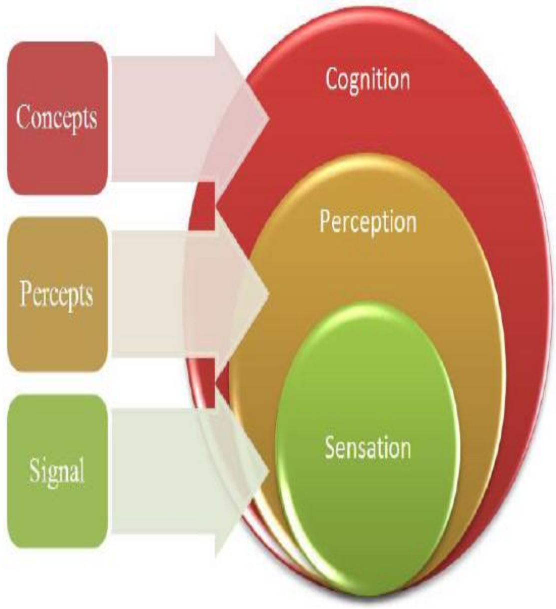

Fig. 1: Sensation-perception-cognition model of the human

In the context of assistive and rehabilitative technologies, overly complex technological solutions can further impair users rather than enhance ability. Another common mistake is the suboptimal choice of modality for information presentation and interaction in which good intentions are made to replace an absent modality with an alternative modality, but often the chosen modality creates additional problems due to information overload and/or interference.

Attention must be given to how information is processed and integrated across modalities when alternative channels are used in place of absent modalities. Feedback is an integral part of interaction, providing us with knowledge of the performance and results of our actions on the objects and environments we are acting upon.

In the context of technology, we rely on continuous feedback to effectively and efficiently manipulate switches, controls and interfaces to accomplish tasks and goals. But the reverse may be true—a system may seek user feedback related to its own performance or results. This notion is known as the human-in-the-loop, and is a well known approach to developing robust multimedia information systems. The human-in-the-loop paradigm is often employed for solving challenging problems where system operation and parameters may be adapted to user feedback and use patterns over time.

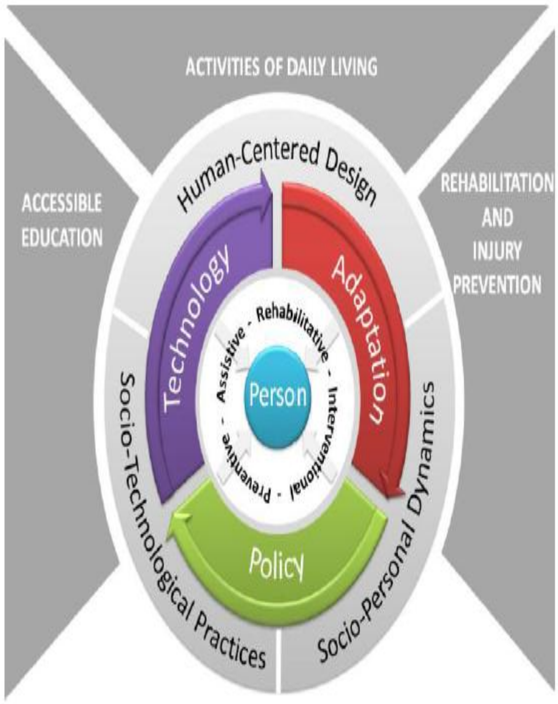

Fig.2: An enhanced interdisciplinary and integrated approach

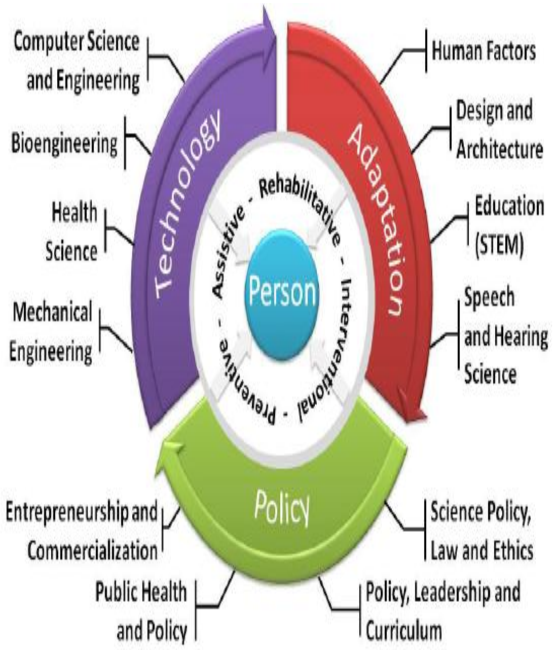

Fig.3: Sample of disciplines involved in each perspective of the proposed approach

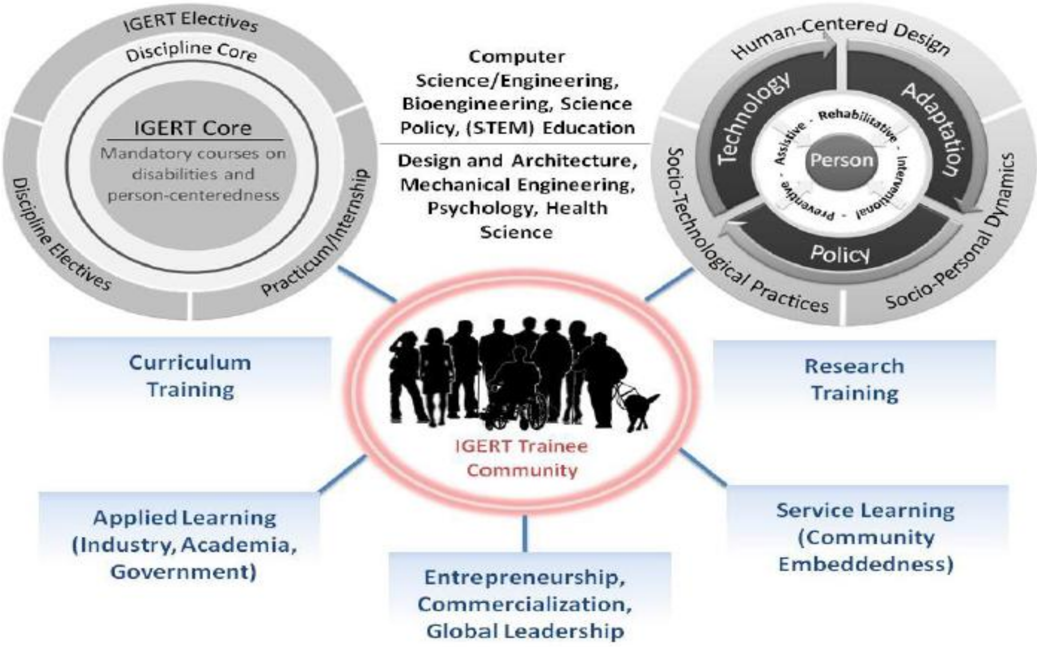

Fig.4: Integrated training model

CONCLUSION

We presented an interdisciplinary approach as an extension to our previously proposed enrichments to HCMC. The proposed methodology integrates three perspectives of disability research—technology, adaptation and policy—which interconnect three fundamental research thrusts: human-centred design, socio-personal dynamics and socio-technological practices. The presented case studies and the accomplishments of our participating IGERT faculty and trainees reflect the effectiveness of the proposed methodology for designing, developing and deploying person-centred accessible technologies and practices.

REFERENCES

[1] M. Guzdial, "Human-centered computing: A new degree for Licklider's world," *Communications of the ACM*, vol. 56, no. 5, pp. 32–34, May 2013.

[2] A. Jaimes, N. Sebe, and D. Gatica-Perez, "Human-centered computing: A multimedia perspective," in *Proceedings of the 14th annual ACM international conference on Multimedia*, 2006, pp. 855–864.

[3] A. Jaimes and N. Dimitrova, "Human-centered multimedia: Culture, deployment, and access," *IEEE MultiMedia*, vol. 13, no. 1, pp. 12–19, 2006.

[4] A. Elgammal, "Human-centered multimedia: Representations and challenges," in *Proceedings of the 1st ACM international workshop on Human-centered multimedia*, 2006, pp. 11–18.

[5] D. A. Norman, "Human-centered design considered harmful," *Interactions – Ambient intelligence: Exploring our living environment*, vol. 12, no. 4, pp. 14–19, Jul. 2005.

[6] S. Panchanathan, N. C. Krishnan, S. Krishna, T. McDaniel, and V. N. Balasubramanian, "Enriched human-centered multimedia computing through inspirations from disabilities and deficit-centered computing solutions," in *Proceedings of the 3rd ACM International Workshop on Human-Centered Computing*, 2008, pp. 35–42.

[7] S. Panchanathan, T. McDaniel, and V. Balasubramanian, "Person-centered accessible technologies: Improved usability and adaptation through inspirations from disability research," in *Proceedings of the 2012 ACM workshop on User experience in e-learning and augmented technologies in education*, 2012, pp. 1–6.

[8] A. F. Newell and P. Gregor, "Extra-ordinary human–machine interaction: What can be learned from people with disabilities?," *Cognition, Technology & Work*, vol. 1, no. 2, pp. 78–85, Sep. 1999.

[9] A. F. Newell and P. Gregor, "Design for older and disabled people – Where do we go from here?," *Universal Access in the Information Society*, vol. 2, no. 1, pp. 3–7, Nov. 2002.

[10] T. W. King, *Assistive Technology: Essential Human Factors*. Boston: Allyn & Bacon, 1999.