Human Computer Interface (HCI): The Next Frontier In Computing

With new technology advances shaping human-computer interaction in the form of first-of-its-kind, unique innovations, traditional interactive domains such as those based on the keyboard or mouse are fast-being replaced by more natural modes like speech, touch, and gesture. However, there are inherent interactive complexities that next-generation human-computer interface (HCI) devices must resolve before they can fulfil their usability.

For Small Business

Today, the advent of the Internet has revolutionized not our daily lives, but more importantly, it has presented a whole new frontier for modern businesses. Although the ability of computers (or machines) to serve as the main communication vehicle for the virtual platform has facilitated faster, more convenient forms of interactive transactions, on the flipside, users have also experienced many new complexities along with technological advancements. As new pervasive devices that operate on natural modes of interaction such as speech, touch or gestures banish the relevance of our very first traditional modes of human-computer, the overall user experience of interacting with computers will be radically different. This is especially true for the future as computers become aware of a richer set of explicit and implicit human inputs.[1] These inputs may include speech and direct physical actions such as touch that are familiar in Human-Computer interaction. But this may also include other detectable human activity such as entering or leaving a room, walking around, sitting down, hand gestures, gaze direction and even facial expressions.

And the day might not be far away, where these new impressive technologies, for example, gesture-enabled remote control, become the mainstream. Imagine standing in front of your television set and turning it on – with a simple, soft punch into the air. Flipping through channels will now be a breeze – requiring only a flick of your wrist. And if you need to toggle the volume levels, all you have to do is sweep your arm upwards. To adjust the size of the screen, you can enlarge it by simply holding your hands in the air and spreading the corners apart. Shrink the screen back to size by bringing your hands back together – as you would recall if you had watched the 2002 Hollywood classic, "Minority Report", where Tom Cruise manipulated images and documents around on futuristic computer screens with a few simple, sweeping moves from his hands.

[1] *Affordances for gestural control immersive human-computer interaction, HP Research*
  http://www.hpl.hp.com/open_innovation/irp/HPL_IRP_Topics_2009.pdf

HCI Defined

The implications of ongoing technological advancement towards human-computer interaction also means that there is now an inherent need for next-generation Human-Computer Interfaces (HCI) – that are easy-to-use, transparent and robust – to help users achieve the desired automation and assistance they need from their systems. Human-Computer interaction brings together humans and technology in order to accomplish a task. It involves the processes, dialogues, and actions that a user employs to interact with a computer in any given environment.[2] And Human-Computer Interface (HCI) would refer to the point where people and technology meet – any point where data is communicated from a user to a computer, or vice versa.

HCI allows users to input an instruction to the computer. In turn, the computer should provide a response or feedback to the user's input. Through input devices (mice, joysticks, keywords) and output devices (such as monitor displays), the user is able to see, hear, touch, and recognize the interaction. However, current output devices have extended to include anything from household computer monitors to head-mounted displays you can now wear to interact with your virtual environments. For example, these include datagloves, 3-D audio, haptic or tactile feedback devices to interact with virtual environments can be used to create simulations in the real world. This HCI concept can be as simple as the grip on a hand tool or as complex as the flight deck of a jumbo jet.

Common HCI today are known by various names – Human-Computer Interface (HCI), Man-Machine Interface (MMI), Human-Machine Interface (HMI), and many more.[3] Besides improving the recognition and understanding of the individual modes (speech, gesture, etc.) in a variety of environments, more importantly, HCI seeks to address the content and the context of the interaction. These include the usefulness and usability of the computer systems in the user perspective. By "usability", this refers to "the extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency and satisfaction in a specified context of use."[4] In the e-Commerce context, "web usability" refers to the ability to find one's way around the Web, to locate desired information, to know what to do next, and, very importantly, to do so with minimal effort. Central to this idea of usability are the important concepts of ease of navigation and search.[5]

SPOTTING THE GOOD, THE BAD & THE UGLY

In considering the significance of HCI in today's business world, users experience various frustrations and difficulties in using websites. And if you were any usual normal office employee before, you would

---

[2] Human-Computer Interaction:Overview
http://human-factors.arc.nasa.gov/web/hf101/interaction.html
[3] Human Computer Interfaces: Interface design considerations for today's solutions, Joseph Smelser
http://docs.google.com/viewer?a=v&q=cache:W7NvD8xT64wJ:www.smelser.net/blog/file.axd%3Ffile%3DHCI%2BConsiderations.pdf+human+machin
e+interface+%28hmi%29+or+human-computer+interface+%28hci%29+business+case+studies&hl=en&gl=sg&pid=bl&srcid=ADGEESjErf5kVlpV26-
UK05se8wUQxB-6lD-vUy7N9iWbjMTHqOPTx8lFrGtlsufzfNiaouyEQj1SjJzlgf2r4eJz0ERYLURKCZaD_-Bn0nFpFiRWU5ZLbrsyhuaDW5nED-GNQIIS_FK&sig=A
HlEtbSE57rHlyG4sv84O8XlKAh29-76gg
[4] Integrating Human-Computer Interaction Development into SDLC: A Methodology, Zhang, et al. Aug 2004
http://sigs.aisnet.org/sighci/amcis04/AMCIS_04_Zhang_etal_HCI_in_SDLC.pdf
[5] HCI research issues in e-Commerce, Nah & Davis
http://www.csulb.edu/journals/jecr/issues/20023/paper1.pdf

have encountered HCI complexities in either of the following ways: cumbersome data entry procedures, obscure error messages, intolerant error handling and confusing sequences of cluttered screens on the advanced hardware machine sitting in front of you. Some of the other major problems or difficulties users experienced include: illogical overall organization of data/information in the system, lack of task support, misfit between the nature of the task and the support provided, difficulty of navigation, and inconsistent mental models of system operation.[6] These incompatibilities may affect user reaction, acceptance, and use of the information system. Getting angry and frustrated is the norm for most, and it is now generally accepted that poor HCI can lead to increased stressed levels, lower productivity rates, decreased job satisfaction and higher absentee rates in employees.[7]

Good user interfaces are easy to spot. They are those which require the least efforts from the users in order to satisfy their needs of getting the automation and assistance they expect from their system. They drive all user functionalities, and although this might be an auxiliary point – appearance does matter – the interface has to be visually appealing for the user to derive any satisfaction from using it at all. A good graphical interface not only helps the computer to interpret the actions of a user, but also helps the user to anticipate the precise actions that will achieve some desired interaction goal. As for bad interfaces – well, they are equally easy to discover. These are mismatched with the users in terms of knowledge levels, does not flow with or facilitate their job tasks, or it simply has an ugly layout. High click counts and limited options are the other tell-tale signs – but in general sense, bad interfaces do not empower the user in "how they want to work".

For Small- Medium-Businesses (SMBs), which are HCI-related areas relevant for them to leverage on for their businesses?

THE RISE OF THE CONTEXTUAL USER INTERFACE

With Web 2.0 becoming a mainstay in the virtual world today, users can no longer ignore social dimensions like Facebook and Twitter, etc on the web. The old user interface approach – best illustrated by the Windows interface – is characterized by the overload of information dressed up in a huge number of options and settings called "tabs". However, today we have moved on (or most of us). Windows no longer dominates. And together with its demise, standards elements such as standard menus, tabs, combo boxes, tables, which have now been replaced by contextual domains based on user usage patterns instead of just choices. In the form of widgets – which include tables, combo boxes, check boxes, etc – mash-ups, and feeds, we now witness the rise of a contextual user interface. Such clarity and simplicity was never present in the old interfaces. However, this gives rise to yet another paradox – how about the non-technical users? Wouldn't the lack of knowledge in new contextual interfaces make it too complex for them to enjoy?

---

[6] *Integrating Human-Computer Interaction Development into SDLC: A Methodology, Zhang, et al. Aug 2004*
   http://sigs.aisnet.org/sighci/amcis04/AMCIS_04_Zhang_etal_HCI_in_SDLC.pdf
[7] *An Introduction into man-computer interaction, Paul Booth*
   http://books.google.com.sg/books?hl=en&lr=&id=9j7FLdLaVdoC&oi=fnd&pg=PR11&dq=Human+Machine+Interface+%28HMI%29+or+Human-Computer+Interface+%28HCI%29+business+articles&ots=ZXOeH_5YI-&sig=ey19UU4vY-qqUp2IUllf_NUTzfo#v=onepage&q&f=false

HCI & E-COMMERCE: USABILITY BEYOND THE WEBSITE

Another relevant HCI area intricately-linked to SMBs is e-Commerce. How positive their customers' experience with their e-Commerce platform will measure up proportionately to the SMBs' e-Commerce success. In various cross-disciplinary researches in HCI and relationship marketing, it was revealed that HCI and customer relationship management (CRM) strategies could be integrated into the design of e-commerce. This integration enables customer retention, trust and loyalty. A customer's experience with an e-commerce environment extends beyond the interaction with the website, including delivery of products, post-sales support, consumption of products and services, etc. A design strategy in the e-Commerce system that includes the most desirable functionality, usability and user experience perspectives – to generate an overall positive customer experience will also influence the customers' perceptions of value and service quality, consequently resulting in customer loyalty.[8]

HCI INNOVATIONS FOR THE SMALL- MEDIUM-BUSINESS (SMB): IMMERSIVE INTERACTION

Ideally, in today's current collaborative age, users want to stay connected – at all times, whenever they want. They expect technology to be easy-to-use, reliable, context-aware, and personalized. To be able to be truly immersed in their online content or activity, immersive interaction has to be enabled – "where human interaction through and with technology becomes completely seamless and intuitive".[9] There are various concepts that guide the development of successful interfaces. However, these are limited, and only a few are covered today. For the product developers, the challenge is to focus on the end-user experience, and try to empower the user in "how they want to work their products". The commercial industry has made lots of investments ensure these products are attractive to end users, and the most successful products are those that try define and conceptualize the end-effects. The relevant HCI innovations that can enable immersive interaction can be summarized by the following:

Radically simple user interfaces – using stylus, touch, speech, hand gestures and even facial expressions and gaze—that make user interaction with technology natural, personalized and enjoyable.

Case example 1:
The 3DNaviEditor™ is a 3D HCI device that offers six degrees-of-freedom (6DOF), as opposed to the conventional mouse's 2DOF. Through its proprietary TriTiltWheel™ technology, the 3DNaviEditor™ allows the user (with one hand and no need for a surface) to directly manipulate the cursor to freely rotate on and move along all three dimensions. This completely allows for dramatic improvements in user productivity and efficiency while enabling new software to be developed to access this feature.[10]

---

[8] *Integrating Human-Computer Interaction Development into SDLC: A Methodology, Zhang, et al. Aug 2004*
http://sigs.aisnet.org/sighci/amcis04/AMCIS_04_Zhang_etal_HCI_in_SDLC.pdf
[9] *Affordances for gestural control immersive human-computer interaction, HP Research*
http://www.hpl.hp.com/open_innovation/irp/HPL_IRP_Topics_2009.pdf
[10] *2007 Intel + Berkeley Technology Entrepreneurship Challenge Participating Teams*
http://www.entrepreneurshipchallenge.org/2007%20Teams.htm

Case example 2: Innovation is Skin-Deep

Skinput is a vastly-innovative device that makes use of the human body (skin) as a transmitting media to operate a device (such as a mobile phone) in close proximity. This invention is a breakthrough towards a smaller mobile device, or even that big step forward towards placing that chip into our heads![11]

Seamless high-quality video and audio collaboration across multiple locations

Case Study 1: Cisco Webex

This mobile meeting tool is available over the several smartphones as well as other mobile phone devices. Most recently, it extended its compatibility for the Apple iPad (another new user interface innovation!) platform as well, enabling mobile meetings anywhere on the device.[12]

THE FUTURE OF HCI

The increasing availability of sensors (such as touch sensors and cameras) and new, more natural input modalities (such as pen, touch and hand gestures) are redefining HCI. With regards to the innovative device's usability role, the main challenge for SMBs is to deliver not only HCI device functionalities, but on overall compelling user experience and to prove the device's availability, robustness, and efficiency of interaction as well. As long as these complexities are debunked, HCI will be as exciting and unpredictable as the next dimensional venture, in the not-too-far-away future, we might just witness HCI as that springboard to bring businesses to places that would otherwise be left ignored.

---

[11] *The next computer frontier: Your skin, 12 April 2010*
http://www.tmcnet.com/usubmit/2010/04/12/4721645.htm
[12] *Cisco WebEx: Now on an iPad Near You, 02 April 2010*
http://blogs.channelinsider.com/content001/cisco/cisco_webex_now_on_an_ipad_near_you.html

KEY SUMMARY

Human-Computer Interface (HCI) refers to the point where people and technology meet – any point where data is communicated from a user to a computer, or vice versa.

A rise in next-generation human-computer interface (HCI) devices have seen traditional interactive domains such as those based on the keyboard or mouse being replaced by more natural modes like speech, touch, and gesture.

HCI seeks to address the content and the context of interaction, including *usefulness* and *usability* of the computer systems in the user perspective.

The main challenge for SMBs is to deliver not only HCI device functionalities, but also, on overall compelling user experience and to prove the device's availability, robustness, and efficiency of interaction.

Top current HCI-related trends includes: the rise in Contextual User Interfaces, the increasing use of HCI in e-Commerce to extend customer experiences beyond the website, as well as the increasing significance of immersive interaction.

Americas Headquarters
Cisco Systems, Inc.
170 West Tasman Drive
San Jose, CA 95134-1706
USA
www.cisco.com
Tel : 408 526-4000
800 553-NETS (6387)
Fax : 408 527-0883

Asia Pacific Headquarters
Cisco Systems, Inc.
168 Robinson Road
#28-01 Capital Tower
Singapore 068912
www.cisco.com
Tel: +65 6317 7777
Fax: +65 6317 7799

Europe Headquarters
Cisco Systems International BV
Haarlerbergpark
Haarlerbergweg 13-19
1101 CH Amsterdam
The Netherlands
www-europe.cisco.com
Tel: +31 0 800 020 0791
Fax: +31 0 20 357 1100

Cisco has more than 200 offices worldwide. Addresses, phone numbers, and fax numbers are listed on the Cisco Website at **www.cisco.com/go/offices.**