Challenges in Human-Computer Interaction from a Retrospective Perspective: A Global Reflection with Emphasis on Latin America

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Acceso abierto diamante

Editorial

Undeniably, the design and construction of tools to support task execution marked a turning point in our development as a species and society. Some even argue that this point defines our transition to intelligent beings. One of the most significant consequences is that we understand our ability to change and modify the environment for our benefit and comfort. However, it took several thousand years, with the advent of the information and computing era, for us to feel the need to reflect on how we interact with and relate to a particular tool, one that has enabled significant transformations in our environment. This need transformed the human-computer relationship into a subject of interest, study, and research [1], [2]

It is impossible not to wonder what makes the human-computer relationship so special. Looking retrospectively, we must remember that the computer was the first programmable tool at our disposal, endowing it capable of assisting us in any task. Thus, tasks performed with the aid of a computer became more complex from a cognitive perspective, necessitating the design of visual artifacts that abstracted processes, leading to the introduction of the graphical user interface [1], [2]. Achieving this required designing an entire flow of activities that a "user" needed to perform correctly. The terms "user" and "interface" began to be studied within the field of Human-Computer Interaction (HCI), with the goal of seeking alternatives to improve, evaluate, and understand this symbiosis [1], [2]. Several decades have passed since the first studies in interface design and evaluation laid HCI's theoretical and conceptual foundations. Although these foundations remain relevant, technological advances have introduced changes substantially affecting the human-computer relationship.

The first thing we must consider is that today, any device around us can contain a computing element, meaning that any "object" is potentially a computer and, as such, requires an appropriate interface for its use

[3], [4]. A very common example is smart televisions, which now have an operating system allowing us to install and uninstall applications according to our needs, with interaction occurring through a remote control, voice commands, or even manual gestures [5]. Another example is infotainment systems, increasingly common in cars, which allow us, through voice commands, a control embedded in the steering wheel, or a touchscreen, to choose the music we want to listen to, adjust the air conditioning temperature, review our to-do list, check the weather forecast, and, of course, navigate to our destination using GPS [6], [7]. We could continue mentioning similar examples, such as smartwatches [8], virtual assistants that automate our homes [9], or our mobile phones [10]. In the coming years, almost anything could technically be a computer, such as a refrigerator, a bus stop, our glasses, or even the clothes we wear [3], [4].

The second element to consider is the other end of the relationship: the human. Although there are significant gaps and many aspects to discuss regarding the theory of digital natives and immigrants, evidence has shown that the environment in which an individual develops shapes their mental models and how they relate to their environment [11]. One example of this is experiments where groups of children or adolescents have been allowed to interact with rotary dial phones. In these cases, it has been observed how their mental model of a phone constitutes a barrier that prevents them from identifying the correct procedure to accomplish the task for which the device was designed: making a call. Another example is our social interactions: text messaging changes our standard communication protocols. For many, it is now considered disrespectful to call someone without first asking via text if they can take the call. We must recognize how we work today; it is unthinkable for an employee not to have a mobile phone to read their requests immediately. Even linguistic studies analyze the impact of emoticons and the transformations they have generated in our language. In other words, our environment's developments create changes in mental models that either facilitate or hinder any interaction process [11].

For this reason, we speak of the symbiotic relationship between humans and computers, where we construct and design computational tools that facilitate our lives. These computational devices alter the mental models with which we interact with our environment. This symbiosis is evident in the renowned Generative Artificial Intelligence (GenAI), introduced to the general public a few years ago. It has sparked significant controversy across all sectors of our society. Discussions have permeated the educational and academic sectors, the legal field, the economic world, and not to mention the audiovisual market. The idea behind GenAI is both fascinating and unsettling [12]. With a single fragment of text, even if poorly written with spelling, grammatical, and stylistic errors, we can request a system to generate an image of a child eating ice cream in front of Castillo de Chapultepec or to provide us with a poem that expresses someone's concern about the political situation in Venezuela, a video of a child dancing at the Carnival of Barranquilla, or a character model for a video game that, although it is a rabbit, has the facial features of the footballer Messi. Yes, all this with just a fragment of text that anyone can write. While it is true that there are still many issues with the results generated by these tools, the changes they are already creating and could create in our mental work models are evident. For example, Adobe Photoshop is probably the most used photo editing tool. It used to require years of experience to perform tasks such as removing an annoying dog from a photo or correcting poor lighting. With Adobe Firefly, we can accomplish these tasks with a text description of what we want: "Remove the white dog from the photo" [13]. We cannot deny the impact this will have on the way we interact when we can request with our voices something like: "Change the style of the presentation to the background I used at the brand launch two weeks ago and include the logo of our new partner" [12].

While the concepts of ubiquity and natural interaction have been fundamental in the study of the human-machine relationship, it cannot be denied that research and development have focused on graphical user interfaces for many decades. For this reason, major HCI conferences and forums have created specific spaces with sessions and specialized talks on topics such as interaction with automobiles, tactile and intelligent interaction, affective interaction, immersion, and interaction, ubiquitous or pervasive interfaces, and of course, interaction with GenAI.

However, these discussions need to be quickly transferred to the professional sector. Currently, most companies dedicated to software development and IT solutions have UI/UX teams primarily focused on designing and evaluating graphical user interfaces, with staff often trained in audiovisual communication or graphic design. In conversations with the Latin American business sector, the need to include professionals with computer science and computing backgrounds, particularly those with knowledge in HCI, has been raised. However, this proposal has yet to be well received. It is curious that decades ago, the academic sector was the first to highlight the importance of including individuals with backgrounds in graphic design, sociology, and anthropology in the software development process.

As we have noted, the HCI community faces the challenges of the constant changes in the human-computer symbiosis. However, the question arises: What is the state of HCI in Latin America? It is important to mention that our academic community has been in tune with these challenges. In the state of the art, relevant studies have been discussed in Latin American conferences and forums and globally impactful events. Latin American authors have made contributions on topics such as natural interaction [14], voice interaction with virtual assistants [15], virtual and augmented reality [16]–[18], infotainment systems [19]–[22] and interaction with GenAI [23], among others. Despite these advances, there is a significant gap in Latin America. According to academic production figures indexed in Scopus and as reported by SciVal, only 6.7 % of the region's scientific production is among the top 10 % of the most cited publications worldwide. In comparison, the same indicator is 11.6 % for Europe and 15.9 % for North America. Although the figures are not the best, the indicators have shown a generally positive trend, which allows us to maintain an optimistic perspective [24]. For this reason, it is essential to identify the strategies that have enabled the development of HCI in Latin America, continue working along the same lines, and implement new strategies that will drive growth in the region.

Consolidating collaborative networks is one of the best strategies for encouraging impactful regional and global teamwork. A successful example is the Collaborative Network for Supporting Teaching and Learning Processes in the Field of Human-Computer Interaction in Ibero-America (HCI-Collab) [1]. His network has aimed to create spaces for academic discussion, develop resources for teaching and learning HCI, and generally provide a framework that enables joint work both within Latin America and with collaborators from other regions [25]–[27]. In the same direction are the professional and student chapters of various academic and professional societies, which contribute to organizing events, panels, discussions, and the formation of expert committees. In Latin America, ACM SIGCHI (Special Interest Group on Computer-Human Interaction) chapters are notable, with chapters in México, Costa Rica, Colombia, Chile, and Brazil [2].

Another strategy that has yielded significant results is consolidating academic events with business presence. This is the case with the Latin American Conference on Human-Computer Interaction (CLIHC), a biennial event endorsed by ACM, and the Ibero-American Conference on Human-Computer Interaction, an annual event organized by the HCI-Collab Network. The latter has established itself as a benchmark for the Latin American HCI community, becoming a must-attend event for discussing new advancements, providing feedback on results obtained by graduate and undergraduate students, and seeking synergies with the business sector [25]–[27]. However, the publications presented at these events have yet to achieve the visibility and impact desired. Consequently, efforts have been made to find alternatives for greater dissemination of these results. For this reason, various journals have been approached to publish extended versions of the best papers, as is the case with the work being carried out with this journal.

Student design competitions, such as those organized by the Jornadas Iberoamericanas de Human-Computer Interaction, are another important strategy that provide an invaluable platform for fostering innovation, collaboration, and discussion without the formality of research results [28]. With a focus on the United Nations Sustainable Development Goals (UN SDGs), these competitions challenge student teams to develop creative solutions to pressing global issues. The rigorous structure, which includes a design brief, a

selection committee, a four-day workshop for all students to develop their ideas, and a final presentation before an esteemed panel of academic and industrial judges, ensures that participants are thoroughly prepared, and their ideas are critically evaluated. This format not only hones the participants' technical and creative skills but also fosters a spirit of cross-disciplinary collaboration, as students from various fields such as computer science, design, and entrepreneurship come together to tackle common challenges. The outcomes are projects that are more innovative, well-rounded, and less prone to failure, thanks to the diverse perspectives and expertise brought to the table [28]. At this point, it is important to highlight the participation of Latin American teams in various design and interaction contests, which have distinguished themselves by winning or achieving prominent positions [29]–[31].

Moreover, the value of these competitions extends far beyond the development of individual projects. By bringing together students all over Latin America, these events create a vibrant community of future leaders who are well-versed in both the regional and global contexts of their work. This community-building aspect is crucial, as it encourages the exchange of ideas and experiences across borders, enriching the participants' understanding of different cultures and approaches. The events in Buenos Aires, Argentina in 2023 and in Pereira, Colombia in 2024 exemplify this dynamic, with students and judges from diverse backgrounds contributing to a rich learning environment. Such exposure is instrumental in broadening participants' horizons and enhancing their critical thinking abilities [28]. The competitions also serve as a unique opportunity for students to network with peers, academics, and industry professionals, thereby laying the groundwork for future collaborations. It is imperative for educational institutions, industry leaders, and policymakers to support and engage with these initiatives, recognizing their significant role in shaping the next generation of innovative thinkers and problem solvers in Latin America [28].

In summary, the challenges arising from the changes in the human-computer symbiosis are significant, creating new spaces for academic discussion to understand, explain, and improve the interaction mechanisms between humans and a diverse ecosystem of computational devices. The HCI sector in Latin America has responded to these challenges appropriately, although evident gaps persist. Nonetheless, strategies have been implemented that have allowed growth and increased visibility. It is essential to continue working on these strategies and to combine efforts to advance further the development of the HCI sector in our region.

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