Designing Meaning Across Cultures a Framework for HCI from an Interdisciplinary Perspective

Mario Bisson, Stefania Palmieri, and Claudia Spinò(✉)

Politecnico di Milano, 20160 Milan, MI, Italy
{mario.bisson,claudia.spino}@polimi.it

Abstract. Design in Human-Computer Interaction (HCI) has evolved beyond usability toward systems that offer engaging experiences, systematically leveraging the mechanisms that regulate perception and meaning-making. Ongoing research reveals new layers of complexity regarding the role of context and subjectivity in perception (Levitt-Frank & Shoshana 2023), which risk limiting the transversality of experiences and challenging the creation of universally meaningful interactions (Plocher et al. 2021). Design practice has progressively integrated holistic theories of cognition, leading to structured methods that—borrowing from Norman (2004)—focus on the visceral and behavioral levels of emotion, while the reflective level—the domain of higher-order meaning and identity—remains elusive. This paper proposes an unedited transdisciplinary framework powered by a systemic perspective to coordinate tools and technologies in support of embedding powerful, intersubjective meanings into design. A broad literature was reviewed to: (1) integrate models describing the phenomenology of interaction; (2) analyze the state of the art in cross-cultural HCI design; (3) identify relevant findings in anthropology and psychology and explore their implications for HCI; (4) contextualize cross-cultural design in the aftermath of cultural globalization. Findings show that, just as the embodied nature of perception establishes a shared perceptual baseline (Plocher et al. 2021), cognitive structures exhibit universal patterns as well and while contents and functions may vary, their scaffolding remains stable across human experience (Lang & Kundt 2023). The interdisciplinarity of the proposed framework enables a more systemic and organic understanding of HCI: one that acknowledges complex, evolving phenomena and harnesses the embodied and cognitive foundations of human experience.

Keywords: Embodied Cognition · Scaffolding Theory · Ritual Design

1 Introduction

Globalization and mass consumption have given rise to a widespread commodification of virtually any industry sector. Many companies have reacted to this market flattening by opting for differentiation strategies whose key asset is the brand identity and the value system it communicates. In this context, an almost Platonic dualism occurs: the brand

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is the intangible depositary of transcendental and immanent ideas, while the product plays the role of its tangible embodiment: a condensation and actualization of a variety of complex meanings that do not just need to be perceivable but enable captivating and compelling interactions (Vaidya et al. 2021). This perspective poses non-trivial issues, as embedding abstract ideas into products requires entering a strongly subjective and layered dimension, shaped by individual peculiarities and socio-cultural context, which has become almost a taboo in the scientific community: findings keep highlighting the relevance of subjective and cultural differences in perception, which make it irreducible to a standard model valid for every individual. Nonetheless, when it comes to praxis, we maintain it is useful to both recognize and keep into account such findings, which can be enlightening in developing designs destined to specific contexts, and, contextually, to focus on available studies which have instead outlined a common ground of perception. We propose that an integrated perspective on the mechanisms that regulate individual and collective meaning-making processes can empower a practical framework for meaningful and cross-cultural design praxis for HCI. In the following chapters we will in the first place (1) cover the functioning of cognitive processes and provide a definition and an integrated model of interaction; (2) analyze the state of the art in HCI approaches, tools and technologies and; (3) introduce ritual as a cultural universal and propose its contribution in HCI practice; (4) we then contextualize findings in the light of the current cultural paradigm.

2 Cognition, Interaction and Affect

The field of Human-Computer Interaction and the research that regards it are in constant and rapid evolution, at the same pace with technological advancements following the exponential curve described by Moore's Law: if the first theories and studies on Human Factor design focused on making the use of one complex and task-specific machine understandable for a highly specialized operator, today we are in front of a variety of novel approaches concerned with the interaction of one or more users with a network of multiple interconnected machines in a IoT of ambient intelligence (Wadhwa et al. 2024), where agency is shared in different proportions between humans and machines (Mueller et al. 2020), now interpretable as a coupled system cooperating towards a goal, rather than as the mere use of a passive tool by a human agent. Technological advancements, in fact, keep opening to new horizons in terms of human-computer relationships, with concepts such as tangibility, affect, enactivism, embodiment and embedment being mentioned and elaborated on with increased frequency in pertinent literature (Höök, 2018; Bennett et al., 2021). These concepts - and all the approaches and theories that stem from them - are the signal of the shift from a perspective of Interaction between humans and computers, to one of Integration (Mueller et al. 2020; Cornelio et al. 2022), where Integration is not only meant as physical (as made possible by the use of wearable devices and embedded and ambient technologies), but also as psychological, through designs that acknowledge and leverage the very processes of cognition for natural and seamless user experiences, indeed, the aforementioned relevant terms belong to the third wave of theories developed in the context cognitive-behavioral psychology, which proved to particularly resonate with the objectives of HCI and HCInt research. In fact, in the past,

theories of cognition (Hanson 1984; Rumelhart 1999) proposed that the mind, akin to a computer, worked as an information processing organ that created and manipulated internal representations of the outside world. Later, this model was expanded upon by theories that have gradually considered and analyzed the interconnectedness of mind, body and external world and acknowledged that to fully grasp the complexity of cognition and interaction, it is impossible to separately analyze each element, as their mutual influences are inextricably interwoven. In this chapter we are going to investigate the function of cognition and affect and to provide a model of interaction that integrates different perspectives and theories.

2.1 Evolutionary Function of Affect

In the first place, from an evolutionary perspective, we can establish that affect and cognitive processes are functional to homeostasis: we can perceive, interpret and store for short or long-term external and internal stimuli (interoception), so that we can be aware of our needs and program our behavior accordingly (Cea 2023). Cognition is therefore predictive (Clark 1998) and embodied (Varela et al. 1991; Wilson 2002). To this end, we evolved to experience affect and emotions, as perceiving different stimuli with distinct hedonic valences (good or bad), is more convenient (Damasio 2020): for instance, affect is at the core of the phenomenon of motivated attention, where we tend to prefer and promptly focus on emotionally charged stimuli, because the intensity of the affect they elicit makes them feel more urgent and relevant to our preservation (Ali, 2023; Cea 2023). Findings identify this evolutionary transition marker as the very origin of consciousness, in fact affect, as "an additional layer of homeostatic regulation that allows sentient organisms to thrive at increasingly more complex levels of organization and interaction". Cea (2023) is the basis of Unlimited Associative Learning, which allows organisms to behave not exclusively on the basis of an inherited predefined set of automatic reflexes, but to open-endedly create and occasionally rewrite long chains of links of stimuli and actions that form an internal compass to perceive and navigate the world (Birch et al. 2020). UAL is one of the key factors in the subjectivity of perception, as the associations that shape our understanding of the world are strongly influenced by a wide range of variables, like social and cultural context and are defined by subjective experiences, making them unique for every individual. The subjectivity implied by UAL along with the agency of the environment, constituted by affordances (Gibson 1979; Mangalam et al. 2024) and sociocultural affordances (Ramstead et al. 2016), contribute to the enactivity (Thompson 2010) and situatedness (Robbins 2009) of cognition.

2.2 Towards a Model of Interaction

While foundational to understanding interaction, many cognitive theories still leave its dynamic and reciprocal nature underexplored. Hornbæk (2017) condensed findings that proposed definitions of interaction from different perspectives to unify them under an agreeable statement, from a HCI outlook. He first describes interaction as embodied and situated: "What we view as interaction emerges in a situation and cannot be reduced back to either the human or the world. This view also emphasizes how our bodies shape everything we think and do." then, to provide a broader definition, referencing

(Bunge 2009), he sustains that: "[…] interaction concerns two entities that determine each other's behavior over time. In HCI, the entities are computers (ranging from input devices to systems) and humans (ranging from end- effectors to tool users). Their mutual determination can be of many types, including statistical, mechanical, and structural. But their causal relationship is teleologically determined: Users, with their goals and pursuits, are the ultimate metric of interaction." This definition highlights interaction's reciprocity, shared agency, and goal-oriented nature, framing it broadly while clarifying key conceptual issues. It is therefore considerable an agreeable and satisfying definition that frames the matter from a broad perspective and that addresses and clarifies a number of relevant conceptual questions. In addition to it, it seems relevant to the scope of the research to also break down and schematize the different dimensions and stages interaction is articulated into. To do so, in Fig. 1, we reference the Theory of Action (Norman 1986); the Action Cycle Theory (Marks 2023); an embodied perspective on cognition and affect (Cea 2023); The emotional design theory (Norman 2004). The Theory of Action, for simplicity, proposes a sequential succession of phases, while the Action Cycle Theory, an enactivist theory that shows many points of contact with Norman's cognitive engineering concepts, emphasizes, despite being limited to the visual system, the determining role of affect in decision making and the loop of action-feedback involved in interaction; (Cea 2023) perspective, instead, is useful to sharpen the passage from the conscious part of the experience, namely the "purely felt" one, to the aware one; the Emotional Design Theory formulated by Norman, instead, is useful to discern the different types of emotion elicited in different phases, embracing a holistic perspective in which the way objects participate in reflective meaning-making processes is questioned and the issues that arise from its inherent complexity and contextuality are posed. Even if it constitutes a simplification of reality, since perception, interpretation and action take place in a continuum and their temporal dimension can be approximated to simultaneity, we can affirm that the model in Fig. 1 suits a variety of cases, satisfyingly describing, rather than the phases, the dimensions of interaction and the emotional levels mainly, but not exclusively, involved in each one. Based on the type of user, of technology and of goal, even the feedback of the System can be affectively intense and activate the visceral and reflective levels of emotion, beside the strategic planning of future behaviors. To exemplify, if a person is using their laptop computer to fill out an Excel spreadsheet, it is likely that each time they click a cell, or even the first time ever they click a cell, the behavioral level of emotion and the planning and executing processes will be mainly involved, as the feedback of the System is not emotionally charged; on the other hand, in the case of an artistic installation of ambient technology that reacts to the body movements of people without requiring them to perform any specific task, it is likely that visceral and reflective areas of emotions will be more strongly activated and that the planning and executing processes will take place in function of them. The model also emphasizes how some processes in particular belong in a blurred area, as detecting affordances is both part of the creation of the user model and the first step of programming behavior, similarly, executing action is both the result of said program and the trigger of almost instant new actions from the machine itself and therefore of their perception and interpretation by the user.

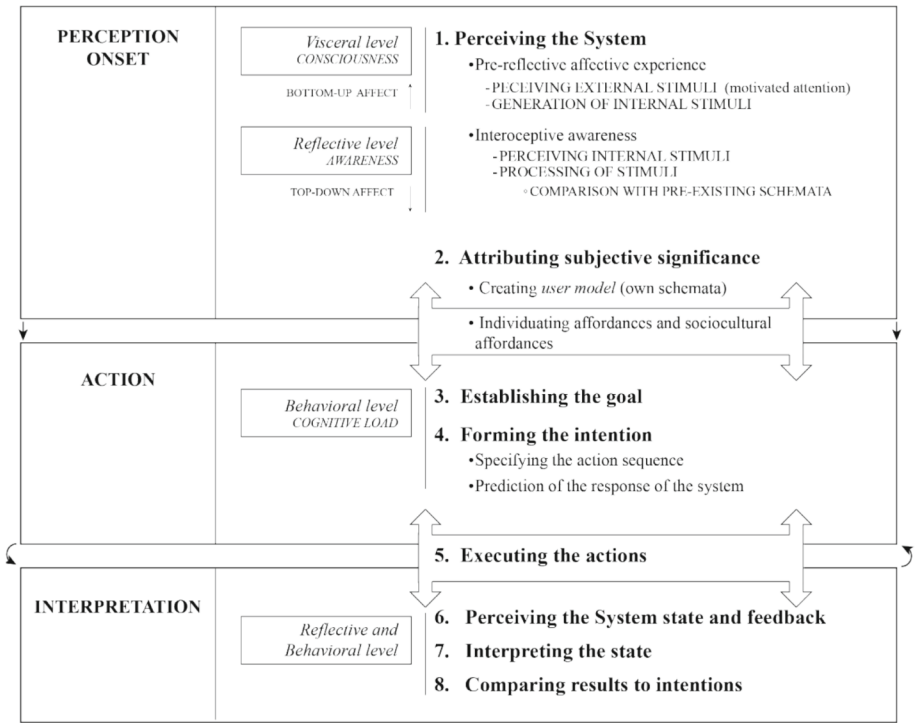

Fig. 1. An integrated model of interaction-

3 HCI Frameworks and Toolkits

As thus demonstrated, interaction is a complex phenomenon regulated by a variety of processes that act on different levels. Such processes can be leveraged in HCI design to achieve interactions that enable a spectrum of experiences that can range from simply acceptable, effective, pleasurable to even meaningful and emotional. In this chapter, our goal will be that of mapping the state of the art in said practice: what has, until now, been done to methodically leverage the very nature of human perception to create enticing HCI designs?

3.1 State of the Art

As widely renown, psychology has been informing HCI practices for as long as this field has existed. HCI researchers have in fact already investigated the findings of the third wave of cognitive-behavioral theories and bridged them to practice: a wide literature mentions and elaborates on concepts such as Tangible User Interface (TUI), Natural User Interface (NUI), Affective Interaction and Human Computer Integration. We will now provide (Fig. 2) a list of technologies, inputs and outputs used by these approaches, based on literature findings (Mueller et al.2020; Cornelio et al. 2022; Guribye et al. 2016; Zhou et al. 2024; Duarte et al. 2022; Liao et al. 2023) and shortly address the perspective, the tools and the goals of each one.

Tangible User Interface. This area of research emphasizes material engagement and embodied interaction, grounding computational processes and data in physical, sensorimotor forms (Hornecker et al. 2006), offering affordances that allow users to navigate the interaction also using their spatial intelligence, as it has been shown to help with cognitive tasks (Van Gennip et al. 2016). In addition, the perceptual qualities of the physical tokens can provide perceptual transparency (Mueller et al. 2020) over symbols lying on flat screens. They often involve different input technologies embedded in the token or in the surfaces it interacts with, like pressure sensors, temperature sensors and so on and their feedback can be output in a variety of systems.

Natural User Interface. This approach focuses on interactions that leverage users innate bodily behaviors, such as gestures, gaze, posture, and facial expressions, to control and communicate with digital systems (Wigdor & Wixon 2011) enabling cognitive offloading. These interfaces often rely on multimodal input technologies such as gesture recognition, voice input, eye tracking, and facial analysis.

Affective Interaction. The field of affective interaction seeks to enrich HCI by integrating the user's emotional states into the core of interaction, creating systems that perceive, interpret, and respond to affect as part of meaningful engagement (Picard 1997; Rosa et al. 2020). Unlike early affective computing's focus on detecting discrete emotional categories, contemporary affective interaction emphasizes context-sensitive, culturally nuanced, and embodied experiences of emotion (Ahmadpour et al. 2025). These systems leverage multimodal sensing, including AI models and algorithms for facial analysis, voice prosody, physiological signals, and haptics, to build richer, real-time models of user affect (Mueller et al. 2022).

Human Computer Integration. This field of research involves systems that augment the user's body, actions, or outcomes through tightly coupled technologies such as wearables, implants, or neural interfaces (Cornelio et al. 2022). These integrations vary in how control and agency are distributed between user and system. Design must ensure users retain a clear sense of agency, which depends on real-time feedback, adaptive autonomy, and strong sensorimotor coupling (Mueller et al. 2020).

3.2 Research Gap

Findings highlight how the aforementioned approaches are still mainly limited to small-scale experiments or art exhibitions and that, while their use and combination of the technologies in Fig. 2 is informed by embodied and enactive cognition theories, these are interpreted and put to practice based on their understanding and common sense, but there is a lack of a structured method (Duarte et al. 2022). Moreover, there are no consistent proposals that suggest cross-cultural tools to intentionally and methodically craft cross-cultural experiences involving higher-domain meaning. It appears that available literature vertically focuses on the cognitive processes of interaction, while, despite acknowledged and recognized, the highly subjective and contextual nature of meaning-making processes stays unaddressed and understandably so: it seems that the universal nature of cognition can only lead us this far, nonetheless, we maintain that other types of

universal scaffoldings exist across cultures and that in order to identify them, it is useful to adopt a wider trans-disciplinary outlook on the matter.

TECHNOLOGIES

INPUT			OUTPUT
BIOSENSORS •body temperature sensors •weight sensors •body mass sensors •blood glucose sensors •ECG sensors •EDA sensors •EEG sensors •EMG sensors •breathing sensors	SENSORS •movement sensors •light sensors •sound sensors •temperature sensors •pressure sensors •accelerometers •gyroscopes	HUMAN COMPATIBLE •Epidermal technologies •Subdermal technologies •Transdermal technologies •Deep implanted technologies •Pass through technologies	•VR/AR HMDs •CAVE •screens •holographic fans •smart surfaces •tangible interfaces (buttons, controllers etc.) •bionic limbs •sound systems •LED light •vibration motors •microcontrollers •actuators

INPUT		OUTPUT	
UNAWARE	AWARE	VISUAL	HAPTIC
BIOMETRIC •body temperature •weight •body mass •blood glucose •ECG •EDA •EEG •EMG •breathing	BEHAVIORAL •facial expressions •eye movement •whole body manipulation **•hand tracking** •one hand manipulation •two hand manipulation •fingers manipulation	•light •Animation •Image •3d scene	•vibration •force •heat
		AUDIO	OTHER
		•sound effect •music	•shapechanging behavior

Fig. 2. A list of tools for HCI.

4 A Cultural Universal: Rituals

In this chapter, we are going to demonstrate that beside the functioning of human cognition, that as a common and hollow structure, supports the infinitely diverse nuances of human experience, another transversal and ubiquitous phenomenon does exist as well and contributes to the presence of a common scaffolding. Ritual and ritual behavior exist across all ages and cultures and are performed for a variety of reasons and while their content or scope varies greatly, its essence remains unchanged (Kapitány et al., 2020), in fact, as (Lang et al. 2020) maintain: "Humans seem to come equipped with the psychological capacity to engage in ritual. Rituals are a culturally inherited, behavioural trademark of our species."

4.1 Definition

Anthropologists started to investigate rituals as a means of demonstrating some inherent difference between ethnicities to justify colonialist practices, instead, they unveiled and analyzed a consistent pattern of shared behavior valid across cultures (Bell et al. 2021), proposing, over time, numerous definitions for it. Before going through them, it is important to introduce another relevant theme borrowed from the anthropologic field

that helps us understand the gradient of different functions and social roles rituals can have.

Egemony and the Ritual Spectrum. According to de Pina Cabral (1997), societies operate as Egemonic Systems—metaphorically like spotlights—that legitimize certain experiences by granting them symbolic power, which is expressed through institutional support, representation, and ritualization (e.g., starting a family through marriage). In contrast, experiences outside this spotlight occupy a liminal space, lacking validation or facing institutional rejection (e.g., robbery). Egemonic Systems evolve through a bottom-up dynamic, as marginalized groups push for their experiences to gain legitimacy, often transitioning from "nocturnal expressions" (individual, informal rituals) (Whitehouse, 2024) to "diurnal expressions" (socially recognized rituals). The former type of ritual has become particularly relevant in modern and post-modern societies, with New Age practices that involve a shift of spirituality towards the private sphere and the ritualization of the secular dimension (Bell et al. 2021; Frost 2022). All these factors that will be clearer when we will cover the value ritual offers individuals, explain why, according to (Davis-Floyd et al. 2022), "[…] ritual should not be thought of as something fixed, concrete, and discrete, but rather can most usefully be understood as existing on a spectrum from loosely patterned and thinly symbolic (like conversation) at one end, to highly patterned and densely symbolic (like a Catholic mass or a presidential inauguration) at the other."

Characteristics and Neuro-Cognitive Functions. Now that we have defined the context within which rituals are formed and occur, we can proceed to define their characteristics and functions. According to (Legare et al. 2020), "Rituals are socially stipulated, conventional behaviours. They are (i) predefined sequences of action characterized by rigidity, formality and repetition, which is (ii) embedded in systems of meaning and symbolism, and which (iii) contains non-instrumental elements that are causally opaque and goal demoted." This affirmation addresses some of the main points regarding rituals: their rigid and repetitive nature, their symbolic value and most importantly their causal opacity, i.e. the absence of a causal correlation between the actions performed in the ritual and the result it is supposed to achieve. All these characteristics, that can at first seem incomprehensible and irrational, are easily explained if we take a look at the evolutionary origin of rituals and ritual behavior and the function they serve on a neuro-cognitive level: borrowing from (Tonna et al., 2019; Lang et al. 2020), when we face anxiety due to unpredictable threats that go well beyond our resources, we experience a high level of neuro-cognitive entropy, meaning that we feel like we are not able to make reliable predictions to inform our behavior and we therefore feel distressed or overwhelmed. This triggers ritualized behaviors: their rigidity and repetitiveness create predictable sensory stimuli, fostering a sense of control by increasing the rate of successful predictions and therefore reducing internal entropy. While this explains causal opacity and repetitiveness, the attribution of symbolic meanings to these practices can be explained by another characteristic of our meaning-making processes, deeply rooted in our brain structure, in fact, according to (Davis-Floyd et al. 2022), "Because the wiring of the brain is mostly bottom-up (from the lower, more primitive areas to the neocortex) rather than top-down, the messages evoked from the lower emotional or behavioral levels of the brain can be very compelling." They also add "Through symbols and the systems of meaning (like myths, paradigms, and other types of belief systems) that underlie them,

ritual bridges levels of the brain, entraining various neurocognitive structures through the associative linkages symbols provide. In other words, the ritual process integrates the neural networks of the conscious mind with those of the lower brain structures, which are not normally accessible to consciousness." This explains how rituals help individuals and communities make sense of otherwise abstract and intangible identities and values.

The Grammar of Rituals. It seems now appropriate to break down and analyze the constituent elements that concur to classify an action as a ritual, in fact, to paraphrase (Legare et al. 2020), rituals show a universal grammar, governed by core structural constraints, yet endowed with enough plasticity to enable wide cultural variation; humans naturally come equipped with the ability both to acquire ritual practices and to facilitate their transmission, which can take place both vertically (between generations) and horizontally (between communities). Figure 3 summarizes findings about the grammar of rituals, referencing the foundational work of (Turner 1969) and (Van Gennep 1960) and the enlightening inputs by Davis-Floyd et al. (2022), Trillò et al. (2022), Bell et al. (2021), Reynolds et al. (2017).

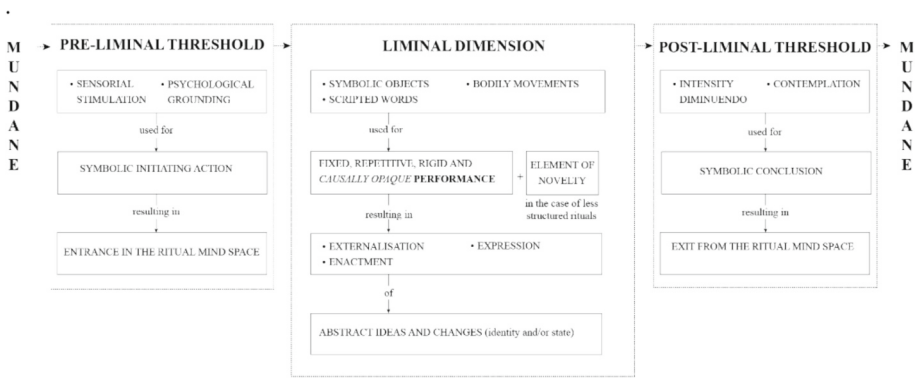

Fig. 3. Ritual structure with involved actions and requirements.

4.2 Bridging Theory to Practice

Now that we have defined the functioning and the structure of rituals, we can draw a connection between the HCI practices that we mapped in the previous chapter and ritual, by synergistically putting into system available tools following the scaffolding provided by ritual grammar to the end of implementing new types of social and cultural affordances. We propose that Systems should be designed in a way to recreate the structure of ritual processes, offering an affordance for repetitive, fixed and rigid behaviors and for the attribution of personal meaningful significance by users.

Pre-liminal Threshold. The incipit of the interaction corresponds to the pre-liminal threshold: similarly, to what happens in a ritual, this phase has the function of setting forth the beginning of the experience, signaling to the user. In this phase it is useful to

use attention-capturing strategies, for example, leveraging the mechanisms of motivated attention through visual/haptic/audio feedback with attracting rhythms, or the strategies of the Natural User Interface, where voice, bodily movement or hand gesture trigger a reaction in the system: objects that activate at our signal in a natural way awaken our instinct to anthropomorphize things, a universal human tendency (Aggarwal et al. 2007; Guthrie, 2012).

Liminal Dimension. The main phase of interaction corresponds to the liminal space. Depending on the type of System, the technologies involved and the goals the user approaches it with, the content of the interaction will vary, but the function of this phase must be that of offering affordances that enable repetitive strongly patterned behavior and induce a focused and mindful state of mind. Harnessing a Tangible User Interface approach, with its embodied strategies, fosters a sense of presence, thanks to physical tokens and haptic/visual/audio feedback. This is the phase where emotional change takes place, therefore it is relevant to instill meaning into designated interaction: configurability of the tokens allows for tangible representation of abstract phenomena, fostering externalization and representational significance (Hornecker et al. 2006), while Affective Computing strategies, providing representational visual/haptic/audio feedback for emotional states and biometric data, fosters sense of presence, immersion self-reflection (Sliwinski et al., 2017). Furthermore, despite cultural differences, it has long been found (Krout 1935; Aboudan 1996) that some primordial gestures retain a biologically grounded, cross-cultural meaning due to the intrinsic link between emotion and the body. Movements like approaching or withdrawing, and spatial metaphors such as high vs. low, are commonly associated with shared emotional and conceptual interpretations across cultures (Parkinson & Walker 2016). Therefore, the design of affordances and interfaces for meaningful interactions should keep into account such findings.

Post-liminal Threshold. The conclusion of the interaction, corresponding to the post-liminal threshold, should gently dismiss the user, creating an intensity diminuendo in the sensory stimuli and a distinctive codified signal to set off the end of the interaction.

5 Implications in Post-modern Society

The New Age phenomenon reflects the ritualization of secular life and a shift from collective to individualized spirituality, marked by rituals ranging from loosely to highly codified forms. This shift is tied to structural changes in modern and post-modern societies and the effects of globalization on individuals' identity formation in their reflective project of the self (Giddens 1991): where once individuals shaped their identities in response to localized cultural frameworks (Turner, 2024), even if of course, ever evolving and constantly influencing one another, they now navigate a vast array of lifestyle and ideological choices enabled by the internet and social media, leading to the emergence of micro-identities and the erosion of cohesive social fabrics (Kossowska et al. 2023). While this fragmentation can isolate, digital platforms also facilitate the formation of meaningful communities, especially for stigmatized groups (Santaolalla-Rueda et al. 2024), but also for more trivial but deeply felt matters, like lifestyles, hobbies, passions and so on. Acknowledging the discussed phenomenon does not mean denying the

subjectivity of culture but having a precious reading key to interpretate such diversity, identifying it with the mix of vertically and horizontally transmitted cultural elements. In fact, brands that recognize such dynamics have the opportunity to connect with emerging social groups by offering products that support and validate their idiosyncratic rituals and identities through culturally resonant affordances (Markum et al., 2023).

6 Future Work and Conclusions

In this work, we proposed an integrated model of interaction and bridged existent HCI and HCInt approaches and toolkits to a wider framework that, to the end of cross-culturaility, leverages the cultural universal constituted by rituals and ritualized behavior, contextualizing it, thanks to a trans-disciplinary outlook, in the phenomena of New Age and networked individualism fostered by post-modern social structure and media. We maintain that this framework represents a step further, on the course researchers have already embarked, towards holistic approaches that recognize and investigate the complexity involved in HCI. The next step is to test the proposed framework and expand on it, as to the end of transversality, the framework has a general outlook that needs concrete applications and verticalization on specific projects and contexts to verify its solidity and detect possible weaknesses. Another challenge that needs to be assessed through its use is that of ensuring it effectively supports designs that offer ritual affordance *and* fit mass production and everyday use, to avoid limiting its use to the design of speculative art installations.

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Constantine Stephanidis
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HCI International 2025 – Late Breaking Papers

27th International Conference
on Human-Computer Interaction, HCII 2025
Gothenburg, Sweden, June 22–27, 2025
Proceedings, Part III

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Editors
Constantine Stephanidis
University of Crete and Foundation for Research and Technology - Hellas (FORTH)
Heraklion, Crete, Greece

Margherita Antona
Foundation for Research and Technology - Hellas (FORTH)
Heraklion, Crete, Greece

Stavroula Ntoa
Foundation for Research and Technology - Hellas (FORTH)
Heraklion, Crete, Greece

George Margetis
Foundation for Research and Technology - Hellas (FORTH)
Heraklion, Crete, Greece

Gavriel Salvendy
University of Central Florida
Orlando, FL, USA

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Foreword

The HCI International (HCII) conference was founded in 1984 by Gavriel Salvendy (Purdue University, USA, Tsinghua University, P.R. China, and University of Central Florida, USA) and the first event of the series, "1st USA-Japan Conference on Human-Computer Interaction", was held in Honolulu, Hawaii, USA, on 18–20 August. Since then, HCI International has been held jointly with several Thematic Areas and Affiliated Conferences, with each one under the auspices of a distinguished international Program Board and under one management and one registration. Twenty-seven HCI International Conferences have been organized so far (every two years until 2013, and annually thereafter).

Last year, we celebrated 40 years since the establishment of the HCII conference, which has been a hub for presenting groundbreaking research and novel ideas and collaboration for people from all over the world. Over the years, this conference has served as a platform for scholars, researchers, industry experts, and students to exchange ideas, connect, and address challenges in the ever-evolving HCI field. The conference has evolved itself, adapting to new technologies and emerging trends, while staying committed to its core mission of advancing knowledge and driving change.

The 27th International Conference on Human-Computer Interaction, HCI International 2025 (HCII 2025), was held as an 'on-site' conference at the Gothia Towers Hotel and Swedish Exhibition & Congress Centre, in Gothenburg, Sweden, on June 22–27, 2025, with the additional option for 'on-line' participation. It incorporated the 21 thematic areas and affiliated conferences listed below.

A total of 7972 individuals from academia, research institutes, industry, and government agencies from 92 countries submitted contributions. 1430 papers and 355 posters (as short research papers) were included in the volumes of the proceedings published just before the start of the conference. Additionally, 439 papers and 104 posters were included in the volumes of the proceedings published after the conference, as "Late Breaking Work". The contributions thoroughly cover the entire field of human-computer interaction, highlight the evolving role of computers in diverse contexts, and demonstrate how HCI research is shaping and improving user experiences across a wide range of domains, influencing technological progress and its effective integration into various sectors. The volumes constituting the full set of the HCII 2025 conference proceedings are listed on the following pages.

I would like to thank the Program Board Chairs and the members of the Program Boards of all thematic areas and affiliated conferences for their contribution towards the high scientific quality and overall success of the HCI International 2025 conference. Their manifold support including paper reviews (via a single-blind review process, with a minimum of two reviews per submission), session organization, and their willingness to act as goodwill ambassadors for the conference is most highly appreciated.

This conference would not have been possible without the continuous and unwavering support and advice of Gavriel Salvendy, founder, General Chair Emeritus, and Scientific Advisor. For his outstanding efforts, I would like to express my sincere appreciation to Abbas Moallem, Communications Chair and Editor of HCI International News.

September 2025 Constantine Stephanidis

HCI International 2025 Thematic Areas and Affiliated Conferences

- HCI: Human-Computer Interaction Thematic Area
- HIMI: Human Interface and the Management of Information Thematic Area
- EPCE: 22nd International Conference on Engineering Psychology and Cognitive Ergonomics
- AC: 19th International Conference on Augmented Cognition
- UAHCI: 19th International Conference on Universal Access in Human-Computer Interaction
- CCD: 17th International Conference on Cross-Cultural Design
- SCSM: 17th International Conference on Social Computing and Social Media
- VAMR: 17th International Conference on Virtual, Augmented and Mixed Reality
- DHM: 16th International Conference on Digital Human Modeling & Applications in Health, Safety, Ergonomics & Risk Management
- DUXU: 14th International Conference on Design, User Experience and Usability
- C&C: 13th International Conference on Culture and Computing
- DAPI: 13th International Conference on Distributed, Ambient and Pervasive Interactions
- HCIBGO: 12th International Conference on HCI in Business, Government and Organizations
- LCT: 12th International Conference on Learning and Collaboration Technologies
- ITAP: 11th International Conference on Human Aspects of IT for the Aged Population
- AIS: 7th International Conference on Adaptive Instructional Systems
- HCI-CPT: 7th International Conference on HCI for Cybersecurity, Privacy and Trust
- HCI-Games: 7th International Conference on HCI in Games
- MobiTAS: 7th International Conference on HCI in Mobility, Transport and Automotive Systems
- AI-HCI: 6th International Conference on Artificial Intelligence in HCI
- MOBILE: 6th International Conference on Human-Centered Design, Operation and Evaluation of Mobile Communications

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HCI International 2026 Conference

The 28th International Conference on Human-Computer Interaction, HCI International 2026, will be held jointly with the affiliated conferences at the Montréal Convention Centre (Palais des congrès de Montréal), in Montreal, Canada, 26–31 July 2026. It will cover a broad spectrum of themes related to Human-Computer Interaction, including theoretical issues, methods, tools, processes, and case studies in HCI design, as well as novel interaction techniques, interfaces, and applications. The proceedings will be published by Springer (part of Springer Nature) in a multi-volume set. More information will become available on the conference website: https://2026.hci.international/.

General Chair
Constantine Stephanidis
University of Crete and ICS-FORTH
Heraklion, Crete, Greece
Email: general_chair@2026.hci.international

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