Guest editorial: Human–computer interactions: investigating the dark side and proposing a model based on an empirical collection of studies

1. Introduction

Several prior studies have extensively covered human–computer interaction (HCI). These studies examine several factors related to HCI such as psychological, physiological, business and social factors or those related to such factors affecting HCI (Walker *et al.*, 2020; Baccarella *et al.*, 2020; Shneiderman and Plaisant, 2010). Using technological advancement, it is possible to enhance HCI by recognizing affective states (Walker *et al.*, 2020; Baccarella *et al.*, 2020). In general, the recognition of affective states is based on passive stimuli such as watching videos, which do not reflect the actual interaction between people. To date, scholars have reached a consensus that this relationship is more cyclical, and there are attempts to strengthen it. For example, (1) Choudhury *et al.* (2020) emphasized the need to unify HCI and AI, (2) Ramos *et al.* Shneiderman and Plaisant (2010) discussed the qualities of effective HCI, Lazar *et al.* (2017) discussed exploration strategies of HCI and recently (5) Szameitat *et al.* (2009) discussed emotions in HCI (Baccarella *et al.*, 2020; Shneiderman and Plaisant, 2010; Behl *et al.*, 2021; Pandey *et al.*, 2021). Other than the engineering side of HCI, these are other developments. Interestingly, most of this research focuses only on the positive aspects of HCI. Baccarella *et al.* (2018), Baccarella *et al.* (2020) and Fox and Moreland (2015) explore the dark side of HCI.

As there is already a bright side of HCI extensively researched, this special issue explores its less attended side, the dark side (Szameitat *et al.*, 2009). The impact of HCI may vary greatly, i.e. from (1) attending to requiring ethical behavior, (2) detecting to causing occupational stress, (3) promoting privacy and protecting data to intruding into privacy space and compromising data security, (4) ensuring efficient operation to stealing several jobs and (5) helping mentally challenged to causing abnormal frustration (Bjørn *et al.*, 2019). HCI has several lows, but it is an emerging area of research. Humans can sustain and coexist with computers physically, psychologically and economically if these dark areas of HCI are seen as challenges instead of risks.

In light of the above rationale, this special issue aimed to address some fundamental research questions. The topics discussed were (1) what are the bottlenecks in the design, dissemination and adoption of new HC technologies?; (2) can the design of systems be generalized across technologies? (3) what role does ethics play in the management of HCI systems? and (4) how can advanced data analytics be used to reduce information loss and improve knowledge management systems?

In human-to-human interactions, one can intuitively predict an individual's emotional state based on facial expressions, body language and voice intonation (Karray *et al.*, 2008). Humans often adapt their behavior in response to inferences of this kind. Similarly, computer systems can acquire information about the user through various input modalities (Karray *et al.*, 2008; Walker *et al.*, 2020; Baccarella *et al.*, 2020; Reizer *et al.*, 2022). Audio–visual input

Aslib Journal of Information Management
Vol. 74 No. 5, 2022
pp. 749-757

2050-3806
DOI 10.1108/AJIM-09-2022-398

methods, such as eye-tracking, facial expression analysis, body movement analysis, speech analysis and auditory analysis, may be used. The behavior of users can also be better understood based on mouse movements, keystrokes, viewing of content or even a combination of these modalities (Duric *et al.*, 2002).

This editorial piece will be divided into two sections. The second section provided a brief overview of the negative aspects of HCI. An overview of the dark side of HCI is presented in this section, with a discussion of potential future research directions in each area. There will be two parts to this editorial. In the second section, we discussed the negative aspects of HCI. An overview of the dark side of HCI is presented in this section, with a discussion of potential future research directions in each area. The accepted papers in the special issue are described in Section 3. During Section 2, each of the accepted papers was briefly discussed and related to one or more of the themes identified and discussed. Finally, the editorial concludes with a discussion of HCI-based insights.

2. Scoping review of dark side of human–computer interaction

HCI seeks to understand the relationship between humans and new technology. Human factors in computer systems evolved from work on human factors in the 1970s to include methods and practices from Computer Science, Psychology, Sociology, Design and the Arts (Blackwell, 2015; Kim, 1995; Reeves, 2015). Oulasvirta and Hornbæk (2016) define HCI as a "problem-solving field." A lot of value is placed on dealing with constructive problems, and contributions are often valued according to how they deal with various computer technologies, systems, interactions and contexts.

The objective of this extensive scoping review was to systematically analyze all published works relating to one or more aspects of the dark side of human interaction. Unlike the traditional systemic review of the literature (SLR), which reviews the past and evaluates its outcome, scoping reviews aim to anticipate the future. It is a relatively new approach, and there is little guidance on the choice between systematic and scoping approaches. After mapping the gaps with the special issue papers, we discussed the "how" and "what" research gaps have been partially addressed by the special issue papers (Behl *et al.*, 2022).

Seven themes emerged from the scoping review: **C**ognitive, **O**rganization, **D**esign, **I**nformation, **C**ultural, **E**rgonomic and **S**ystem **(CODICES).**

2.1 Cognitive dark side of HCI

A subfield of computer science, HCI deals with the design, evaluation and implementation of computer user interfaces that are adapted to the user's needs and habits (Sun *et al.*, 2021). The cognitive system learns and interacts naturally with humans to extend the capabilities of humans or machines. Cognitive systems assist human experts in making better decisions by analyzing the complexity of big data. Cognitive science is concerned with how users perceive information, use knowledge and make decisions (Gavish, 2019). By understanding the user, the HCI researcher can predict and explain the interaction between the user and the computer system (Gavish, 2019). One core goal of HCI research is to make systems more useable and valuable by providing users with experiences tailored to their background knowledge and aims (Gavish, 2019). In an information-rich society, the challenge is not only to make information available to people at any time, in any location and any form but also to say the "right" thing at the "right" moment and in the "right" way (Candau *et al.*, 2017).

2.2 Organization dark side of HCI

If human–machine–environment interactions are considered together, people are now healthier and more productive (Campbell and Lu, 2007). The appropriate provisions have

been made to make their employment worthwhile (Campbell and Lu, 2007). Thus, advancements in ergonomics research appear to have contributed to a happier workplace during the previous half-century (Bjørn *et al.*, 2019). All human–machine systems strive to produce more output or to provide the same result with the same input. This is called efficiency. In light of the fact that the people employed in this system are simply human, they have a right to labor under humane conditions (Campbell and Lu, 2007). The technology-intensive production process has become an essential part of corporate life due to globalization, rapid changes and technological breakthroughs. Human–machine connections have grown in importance, and their rapid evolution and modifications have exposed the importance of managing their interactions with the environment (Bjørn *et al.*, 2019). These investigations led to the development of ergonomics. As mechanization and robots have grown in recent years, particularly during the transition to Industry 4.0, a human–machine link between the work environment and ergonomics has become increasingly important (Bjørn *et al.*, 2019).

Many of the collaboration and communication capabilities afforded by new IT paradigms (for example, cloud computing and tools) provide good outcomes like interoperability, productivity improvements and faster access to more significant amounts of information (Marabelli *et al.*, 2017). However, growing IT usage causes information overload and multitasking issues and changes how people perform in the office. One of the most significant indicators of workplace stress and job departure is information overload, that is when the amount of information to be processed beyond one's information processing capability (Campbell and Lu, 2007). Another phenomenon that happens because of the interaction of several IT-related elements, such as technology addiction, interruptions and the usage of noninteroperable devices, is multitasking (Campbell and Lu, 2007; Bjørn *et al.*, 2019; Marabelli *et al.*, 2017).

2.3 Design dark side of HCI

Interaction designers have created several strategies that are routinely used to urge users to click on adverts, remain on a website, play a game and return for more. Furthermore, many publications and recommendations have been released that explain how to modify users' behavior by implementing effective interface interventions (Rogers *et al.*, 2021).

There are many of them that serve a personal or social purpose, such as improving personal health, increasing job productivity, improving motivation and reducing energy consumption. These approaches can also be used for more sinister purposes. They are sometimes referred to as dark patterns, and they are simply tactics that websites and applications employ to force people to do something they did not plan to do, such as buy or sign up for something (Rogers *et al.*, 2021). There is an emerging backlash against interface design, pointing out that we are ultimately responsible for societal ills, like digital addiction, fake news, social media abuse and the like. Is it our fault that we let the genie out of the bottle? Many things that irritate consumers are on purpose (Paay and Rogers, 2019). Designers frequently attempt to persuade consumers to do things they would not usually choose to do if given the option. Designers back users into a corner and deceive, manipulate and pressure them to perform things that benefit the firm, business, web developers or owners (Paay and Rogers, 2019). These facts lead to awareness towards greater explorations of the topic under design, based on the dark side of HCI.

2.4 Information dark side of HCI

HCI has grown significantly since its inception (Tseng *et al.*, 2022). To use the early personal computers (PCs), extensive training was required, and the user experience suffered. Simple activities like moving the mouse or deleting text presented users with never-before-seen

difficulties, which represented significant hurdles to computer use. HCI began in the early 1980s to understand how and why computers could be made more user-friendly (Tseng *et al.*, 2022). The scope of the research eventually broadened to include practically all facets of information technology. HCI is essential since it will be required for items to be more successful, safe, useful and functioning. It will improve the user's experience in the long run. As a result, it is vital to have someone with HCI abilities involved in all phases of any product or system development. HCI is also required to keep products or initiatives from failing. HCI is crucial for developing clear, intuitive systems that will be accessible to people with a wide range of abilities and expertise and those who have not completed any formal training. By utilizing our everyday understanding of the environment, HCI makes software and devices more understandable and beneficial for everyone (Rogers *et al.*, 2021).

2.5 Cultural dark side of HCI

In the last several decades, researchers have made several attempts to understand HCI. Cultural settings in HCI design have been studied and documented in increasing numbers (Miehle *et al.*, 2016). The academic profession, however, requires a greater understanding of human–culture interaction, not only for the purpose of participating in cultural contexts but also for the purpose of designing interactive user experiences (Clemmensen and Roese, 2009). Additionally, until recently, culture in HCI was regarded as an issue of localization or internationalization (Clemmensen and Roese, 2009). As computers become increasingly commonplace worldwide, Clemmensen and Roese (2009) note that conventional approaches to cultural issues and HCI are woefully inadequate. Considering fundamental cultural differences when interacting with people from different cultural backgrounds is a fundamental goal of intercultural HCI designers and intercultural usability specialists (Ford and Gelderblom, 2003). Hence, it is vital to close the gap between cultural factors (which are derived from cultural dimensions) and HCI design in order to anticipate significant cultural parameters for multicultural user interface design through techniques of analytical research and empirical investigation. It is intended that these experiments reveal the extent to which human–machine interaction is influenced by cultural factors.

There are various definitions of "culture." Geert Hofstede, an organizational anthropologist, describes culture as the "collective programming of the mind" (Lin *et al.*, 2009). This article takes the perspective that culture is a set of facts (structural circumstances) constituting an orientation system (Bjørn *et al.*, 2013) produced through collective mind programming (Egger-Lampl *et al.*, 2019) among a group of individuals. Culture and communication, according to cultural anthropologist Edward T. Hall, co-occur. Hall (1959) defines culture as a "silent language" or "hidden dimension" that guides individuals instinctively. This causes communication problems with people from various cultures. One cannot comprehend the reasons and acts of others unless one is aware of one's own culturally impacted motives (Heimgärtner, 2013). Authors have calculated the idiosyncratic values of these characteristics for several nations (Levine and Norenzayan, 1999; Inglehart *et al.*, 1998). HCI design may be directly related to the model's output. As an example, an HCI designer can handle more elements in intercultural HCI design than essential translations and add input method editors for user interfaces in China. This application can help HCI designers gain an understanding of HCI aspects to consider while designing user interfaces for other cultures and using the cultural context based on the cultural distance between the HCI designers and the target end-users.

2.6 Ergonomics dark side of HCI

An ergonomic is a scientific study of work: the people who do it and the methods by which it is carried out. It is concerned (for example) with the tools people use, the environments in which

they work and the procedures and practices they follow (Helander and Palanivel, 1992). Working systems are essentially the focus of ergonomics while HCI research focuses on the role of computers as a tool or hindrance to human thinking (Gaines and Monk, 2015). It is a highly multidisciplinary discipline in which members from computer science, cognitive psychology and other fields come together to share ideas and research findings (Lin *et al.*, 2022). It is the aim of this essay to highlight some of the difficulties associated with cognitive ergonomics when it comes to computer-aided design. In this article, authors will explore some of the cognitive aspects of computer-aided design work and CAD systems, emphasizing benefits and highlighting potential sources of cognitive challenges. Examples will be drawn from a research project on "Competence development in CAD/CAM," currently sponsored by the Swedish Work Environment Fund. This project involves a series of field studies, two of which are described here (Long and Whitefield, 1989).

2.7 System dark side of HCI

The development of systems using the principles of usability and HCI is increasingly important to improve and increase system capacity and meet the needs of users. Designers, analysts and users can utilize HCI to identify system needs based on text style, fonts, layout, graphics and color. By contrast, usability helps determine whether the system is efficient, effective, safe, useful, easy to learn, easy to remember, easy to use and evaluate, practical, visible and provides job satisfaction to users. By incorporating these elements in system development and sustainable design, users' objectives and tasks will be measured and achieved using a specific technology (Hibbeln *et al.*, 2017). Finally, designers should incorporate these elements into their plans to improve technological acceptability, performance and user satisfaction. Experiencing negative emotions during system use can adversely affect important user behaviors, such as purchasing decisions, technology use and customer loyalty (Dhawan and Honrao, 2013). Therefore, the ability to evaluate users' negative feelings during live system use is of practical significance for designing and improving information systems. Attentional control theory is employed to explain how mouse cursor movements can serve as a real-time indicator of negative emotions (Dhawan and Honrao, 2013).

Figure 1 illustrates the CODICES framework in which this special issue papers were categorized.

3. An analysis of the accepted papers with the CODICES framework

The first article title is "User oppression in human-computer interaction: a dialectical-existential perspective". Authors in their conceptual article took a dialectical-existential perspective to conclude that though aesthetic interactions may become a medium of increased oppression, there is a possibility of subverting them for liberation. After looking at the history of production relations between those who design computers, the alleged designers, and those who use them, the so-called users, the authors conclude that these social groups are bound by the oppression that prevents human development to their full potential. From a theory review and synthesis, the revision of previous work and the development of a dialectical existential theory framework over users developed the concept of users and overstated ideology that authors recognized and denounced the userism ideology in the HCI field. Userism consists of denying, underestimating, preventing, locking and exploiting the handiness of people deemed computer technology users. People who suffer from userism are already suffering from other kinds of oppression, adding to the historical dehumanization of workers, women, Black, indigenous, LGBTQiA+, disabled and other disenfranchised people. These people need HCI to produce their existence, yet after this research, it may become more apparent that HCI also needs these people to liberate the field from userism.

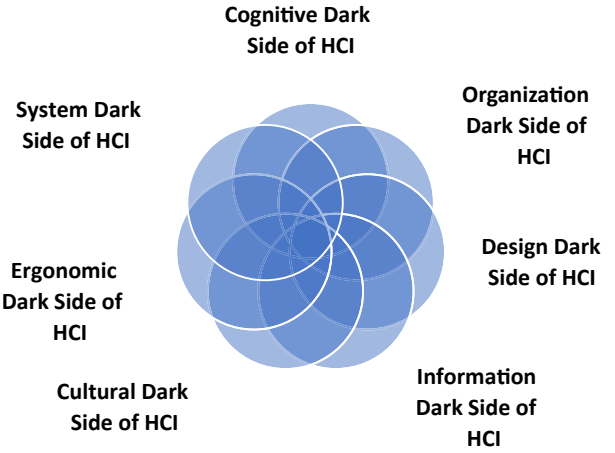

Figure 1.
CODICES framework

Source(s): Authors' compilation

The second article, "Conceptualizing the role of blockchain in omnichannel healthcare: a Delphi study," by Shreya Sangal, Achint Nigam and Chitrakshi Bhutani, used the Delphi technique with healthcare experts to identify the omnichannel setup adoption-related challenges in the healthcare industry. Blockchain for healthcare omnichannel adoption presented key propositions for strategic decisions. The authors conducted an in-depth review of the existing literature before conducting a Delphi study with 24 healthcare experts. Authors assessed the potential of blockchain in addressing these challenges. The authors utilized a qualitative approach to explore the challenges in the omnichannel healthcare industry as well as the scope of blockchain in building an omnichannel healthcare system.

The third article, "Dark side consequences of cyberchondria: an empirical investigation," by Abdul Wahid Khan and Jatin Pandey, used protection motivation in India theory to explore the consequences of cyberchondria, the repeated and excessive search for health-related information online. One of the results revealed a nexus of cyberchondria lowering trust in physicians and increasing self-medication propensity. Trust in physicians has a negative effect on the propensity to self-medicate as well as a positive effect on therapy compliance.

The fourth article, "Barriers to entry of gig workers in the gig platforms: exploring the dark side of the gig economy," by Aastha Behl, K. Rajagopal, Pratima Sheorey and Ashish Mahendra systematically reviewed the literature to propose a framework using interpretive structural modeling (ISM) and linked the entry barriers to gig platforms. In this study, ISM is used to investigate the relationship between various entry barriers for gig workers to gig platforms. Along with MICMAC analysis, it also validates the relationship and explains the reasons for this association. The model was developed through consultation with gig workers and experts affiliated with food delivery platforms, such as Zomato and Swiggy.

The fifth article, "Fake or real news? Understanding the gratifications and personality traits of individuals' sharing fake news on social media platforms" by Brinda Sampat and Sahil Raj, grounded their quantitative study. Extraversion, neuroticism and openness act as facilitators. An Indian sample of 221 social media users was used to test the conceptual model. Partial least squares structural equation modeling (PLS-SEM) was used to determine the effects of UGT and personality traits on fake news sharing.

The sixth article, "Examining boss phubbing and employee outcomes through the lens of affective events theory," used SEM to study a sample of head nurses working in public and

private hospitals. Results, among others, showed that boss phubbing negatively influences employees' sense of work meaningfulness and was linked both directly and indirectly with employee phubbing and self-esteem threats.

Among the seven articles in the volume, "View analysis of personal information leakage and privacy protection in the big data era–based on the Q method" by Lei Huang, Jingyi Zhou, Jiecong Lin and Shengli Deng used the Q method to propose a framework for examining the emotional aspects of personal information leakage and privacy protection. There are three categories of stakeholders' subjectivities: macropolicy sensitive, trade-off sensitive and personal information sensitive. Based on the Q method, which is to study subjective thought patterns and identify users' potential viewpoints, we identified three categories of stakeholders' subjectivities: macropolicy sensitive, trade-off sensitive and personal information sensitive, each of which perceives risk and affordance of information leakage and importance and urgency of privacy protection differently. In all subjectivities of respondents, there is an awareness of the issue of information leakage; that is, interested parties, including social networking sites, are unable to protect their full personal information, and they display varying degrees of resistance and susceptibility to disclosing this information to big data technology applications.

4. Conclusions and reflections

Collectively, the articles in this special issue consider the dark side of HCI. The investigation for the question, "What are the bottlenecks in designing, distributing, and adapting new HC technologies?" revealed the issues such as high competition, longer login hours and late-night deliveries in the case of food delivery apps. Similarly, the studies attempted to answer the question, "Can systems design be generalized across technologies?" hinted at the importance of dominant personality traits that could facilitate generalization across technologies but within the same dominant personality trait groups. Next, the question of "What is the role of ethics in managing HCI systems?" was addressed by discovering patterns in information leakage in the article concerning privacy issues. Finally, the use of advanced statistics such as SEM and Q methods addressed the question of how can advanced data analytics be used provide rich insights into the various issues that HCI has and the remedies to deal with those issues, both conceptual and empirical.

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