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Approaches and Frameworks for HCI Research

This chapter introduces human–computer interaction (HCI) and HCI research and describes their current states. Challenges to HCI research are identified and the aims of the book presented. The concepts of 'approach' and 'framework' are outlined, together with their relations. The chapter sets the scene for the following two chapters, which address respectively approaches and frameworks separately and in greater depth.

1.1 Why HCI?

HCI, as a description of the field of human–computer interaction, is more established and general than alternative descriptors. For this reason, it is retained here. HCI continues to be in a permanent state of change. [1] As a result, no description of the field is excluded. HCI is interpreted inclusively and is considered to comprise ease of use/usability, applied psychology, engineering, human-centred design, cognitive engineering, interaction design, user experience (UX) design, technical art, graphic design and digital interaction, along with others.

Given the growth and diversity of new computing technology, however, HCI is understood as human–computing technology interaction, rather than just human–computer interaction. The latter term is more associated with personal computing. The term 'HCI', however, has been retained, as having greater currency in the HCI research literature at this time. This is in contrast to others, such as 'UX design' and 'digital interaction design', more favoured by the practitioner community.

1.2 State of HCI

Since its inception in the late 1970s, HCI has grown and diversified extensively and continues to do so. This growth and diversification constitutes a challenge for HCI research.

A roughly historical perspective suggests the following development of human, interaction and computing technology scopes. The human scope has increased to include more abilities, ages, social classes, communities, societies and cross-national communication groups. The interaction scope has increased to include keying, pointing/clicking, drawing, speaking, touching, gesturing, smelling, electro-mediated communicating, tasting, whole-body moving and electrode-conducted thinking. The computing technology scope has increased to include portability, distributed social media communicability, artificial intelligence, autonomous devices, implantability, interconnectivity, robots, wearability, mobile and ubiquitous digital technology. Together they constitute the increase in the scope and diversification[2] of HCI and the challenge for HCI research.

1.3 State of HCI Research

It is assumed here that HCI research of whatever kind acquires and validates HCI knowledge as design knowledge. Or at least as knowledge associated with, derived from or potentially applicable to design. Different assumptions would require different proposals to those made here. Some alternative and additional assumptions, however, are reflected in the differences between the specific frameworks proposed (see 4.3–9.3). However, while retaining these differences, the specific frameworks are all based on a common core framework. In this way, the general overall assumption is made compatible with different underlying assumptions. This compatibility is essential for researchers to build on and to validate each other's work. Such compatibility is almost entirely absent from current HCI research. It has been absent historically from its beginning. This is the case both for its frameworks (see 12.3) and for its theories (see 13.3).

HCI research has responded to the increase in the scope and diversification of HCI with growth and diversification of its own. Following the HCI literature, the latter can be considered to take two forms – fields and theories. This increase in growth and diversification of HCI research constitutes an ongoing challenge.

First is the growth and diversification of the fields of HCI. For example, Rogers (2012) distinguishes seven academic disciplines, five design practices and seven interdisciplinary overlapping fields. This constitutes 19 fields of HCI in all.[3]

Second is the growth and diversification of types of HCI theory. For example, Rogers (2012) distinguishes three classical, nine modern and five contemporary types of theory. This constitutes 17 types of HCI theory in all.

1.4 Challenges for HCI Research

The growth and diversification of HCI research has led, in the absence of consensus among researchers about either, to two outcomes: first, to a failure to build on and to validate each other's work and second, to a fragmentation of both HCI fields and theories. The challenge for HCI research, then, is to address the growth and diversification of HCI and of the associated research, while decreasing the fragmentation of fields and theories. The latter requires researchers to build on and to validate each other's work and so to increase consensus. The result would be to increase HCI discipline progress.

A number of authors, while celebrating the growth and diversification of HCI and its community, have analysed and documented the lack of HCI discipline progress (Long and Dowell, 1989; Newman, 1984; Rogers, 2012). For example, Newman claims that only 30 per cent of HCI research reports enhancements in modelling techniques, solutions and design tools. This is against 90 per cent for the discipline of engineering more generally. The remainder of HCI research describes radical solutions, not derived from incremental solutions of the same problem. Also included are experience and/or heuristics gained from studies of radical solutions. Radical solutions and experience and/or heuristics characterise the 'design-an-application-for-a-good-user-experience' line of HCI design practice research, identified earlier. Analysis of more recent research reported in the literature or presented at conferences, such as the ACM CHI Conference on Human Factors in Computing Systems series, indicates the situation as being unchanged since Newman's findings. If anything, the percentage of radical solutions and experience and/or heuristics continues to increase (Dix, 2010; Long, 2010).

1.5 Aims of Research Textbook

The aim of the research textbook is to propose a way of meeting the challenge to HCI research outlined in the previous section. The proposal consists of identifying and grouping common approaches to HCI research reported in the literature. On the basis of an existing HCI conception, a core framework for HCI, including HCI research, is proposed. The latter is particularised to create

a specific framework for HCI research for each approach identified. The specific frameworks are then generalised to create a general framework for HCI research. The latter is assessed against other HCI frameworks and HCI theories.

The book illustrates and then shows researchers in some detail how their own approaches may be identified and new approaches created. The application of the frameworks to the approaches is intended to support the explicit specification of both. This application, in turn, better supports researchers building on and validating each other's work. The aim is to increase discipline progress, as required by Newman (1984) – see earlier. Progress here includes the acquisition of HCI discipline knowledge and the practices which it supports. Also included is the validation of both by research. Following Kuhn (1970), discipline progress is to be contrasted with community progress. The latter refers to the cultural/social activities of the researchers, such as attending workshops and conferences, informal communications and the formation of interest groups in the manner of the CHI and other conferences.

1.6 HCI Research Approaches and Frameworks

Here, approaches and frameworks are defined as having the same scope – that of HCI research. However, frameworks are more rigorously specified. They are more complete, coherent and fit for purpose with respect to HCI research than approaches. Included here are HCI research approaches classified as innovation, art, craft, applied, science and engineering. Each type of approach has an associated HCI research framework (see 4.3–9.3). Other types of HCI approach and framework could be created as required. The creation would follow the same process proposed here, as supported by the textbook's research practice assignments, presented at the end of each chapter (see 15.3).

The frameworks to be applied to the approaches have a common basis in a conception for HCI originally proposed respectively for the HCI discipline (Long and Dowell, 1989) and for the HCI design problem (Dowell and Long, 1989). Detailed reference to, and the importance of the relations between, this conception and the General Framework proposed here are made throughout the book.

Conclusion

This chapter introduces HCI and HCI research in general. It describes both their current states and challenges, as they relate to the textbook and its aims. The concepts of approach and framework are outlined, together with their relations.

The outline provides the necessary basis for the separate and respective address of approaches and frameworks in the following two chapters.

1.7 Research Practice Assignment

- Describe in writing the state of your research in terms of the state of HCI research, as presented in 1.3. If you have no research of your own at this time, select a suitable publication from the HCI literature.
- List the challenges to your (or others') research. How do they compare with the challenges presented in 1.4?
  - Evaluate how well your (or others') research meets your research challenges and those presented in 1.4.
  - Identify what changes to your (or others') research might better meet your research challenges.
- Do you think the concept of challenge is useful in this assignment? If so, give your reasons. If not, suggest and justify an alternative concept motivating your (or others') research.

Hints and Tips

Difficult to get started?

Try reading the chapter again, while at the same time thinking about how to describe your own research. Note similarities and differences between the two lines of thought as you go along.

Describe your research in its own terms, before attempting to apply those of 1.3.

Difficult to complete?

Familiarise yourself with the major challenges to HCI research identified in the HCI research literature before attempting to address those in 1.4.

Consider synonyms of the term 'challenge', before considering its utility and suggesting alternatives.

Test[4]

- Write down the titles of 1.1 to 1.4. Complete the sections very briefly from memory and in your own words.
- Propose a new and improved set of titles for 1.1 to 1.4.

- Complete the new 1.1 to 1.4 in your own words.
- Read and reflect on the chapter endnotes (see 1.8).
- Suggest additions to the chapter endnotes.

1.8 Notes

1. Extended descriptions of these changes in information technology, constituting the growth and diversity of new computing technology, can be found in Harper et al. (2008). As stated, the chapter introduces HCI and HCI research in general. It describes their current states and challenges within a roughly historical perspective, as they relate to the textbook and its aims. Other general descriptors of the field include 'cognitive ergonomics', 'software engineering' and 'interface design'. Other domain-specific descriptors include 'architectural informatics', 'medical applications', 'digital archives' and 'library information technology'. Cockton (2014) is a useful additional source for information on this point, together with Rogers (2012).
2. A more complete description of the scope and diversification of the state of HCI can be found in Harper et al. (2008) and Rogers, Sharp and Preece (2011).
3. Following Rogers (2012), these 19 fields comprise:

   - academic disciplines: ergonomics, psychology/cognitive science, design, informatics, engineering, computer science/software engineering and social sciences
   - design practices: graphic design, product design, artist design, industrial design and film industry
   - interdisciplinary overlapping fields: ubiquitous computing, human factors, cognitive engineering, human–computer interaction, cognitive ergonomics, computer-supported cooperative work and information systems.
4. The test encourages researchers to commit the approaches and frameworks to memory. Such internalisation facilitates their subsequent application.