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Examining the Research Trends in Human Computer Interaction (HCI): an Information Science Perspective

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Abstract:

Human Computer Interaction (HCI) is an interdisciplinary field focused on the interactions between human users and computer systems, including the user interface and the underlying processes which produce the interactions. It is being increasingly considered as a serious and advanced research arena within the domain of Information Science, with unbound applications in digital library interfaces and user experience studies. The study introduces the field of Human Computer Interaction (HCI) and attempts to trace its major research trends.

Keywords:

Human Computer Interaction (HCI), Information Science, User Experience, Research Trends

I. Introduction:

Human Computer Interaction (HCI) is an interdisciplinary field focused on the interactions between human users and computer systems, including the user interface and the underlying processes which produce the interactions. It is also a design that should produce a fit between the user, the machine and the required services in order to achieve a certain performance both in quality and optimality of the services. As observed in a number of bibliographic & special (ACM Computing Classification) classification schemes, HCI comes under the 'Computer Science, Information & Generalia' main class. HCI evolved simultaneously with the evolution of ICT tools and technologies like Visual Display Unit, Sketchpad, Windows-Interfaces, WYSIWYG, Hypermedia & WWW. Key components of HCI include user interface & interaction design, GUI, sociability, usability, Quality of Experience (QoE), linked immersive environments, digital genres, human performance, user studies, CSCW, HCAI, HCIR, real-time multimedia mix, Knowledge driven HCI & much more. Human Computer Interaction (HCI) draws from various fields of research like Information Design, Interaction Design, Interactive Art, Psychology, Human Memory, Information Retrieval, Machine Learning, Artificial Intelligence, Knowledge Organization & Representation, Information Science, Information Architecture, Knowledge Visualisation & Computer Graphics. These arenas of study contribute to the change as well as emergence of newer research trends in HCI.

There are several domains where Human Computer Interaction (HCI) acts as a valuable contributor, and, there are several domains which contributed to the development of Human

Computer Interaction (HCI) as an area of active research. There are broad disciplinary overlaps between HCI as a contributor and as a beneficiary. Few of such domains are categorized and listed below.

HCI AS CONTRIBUTOR:

- Psychology
- Social Sciences
- Computing Sciences
- Engineering
- Ergonomics
- Informatics

HCI AS BENEFICIARY:

- Linguistics
- Sociology and Social Psychology
- Cognitive Science
- Visualization
- Information Design
- Personal Information Management
- Interactive Art

II. Review of Literature:

Previous research has highlighted how the diverse agglomerates of communities, special interest groups & sub-domains, within the broader umbrella of Human Computer Interaction (HCI), has evolved and expanded at a rapid pace, and, how and at what rate researchers have incorporated emerging theories, methodologies & technologies. Montuschi *et al*. (2014) refers to the domain of HCI as multi-disciplinary involving computer science related disciplines (image processing, computer vision etc.) as well as disciplines more oriented towards human sciences (ergonomics, cognitive psychology etc.). It is also stated in the study that recent technological advances in consumer electronics have also opened up new, exciting scenarios in affordable user design. Lazar, Feng and Hochheiser (2017) proceeds a step further to logically tag ethnography, physiological measures, crowdsourcing, coding qualitative data and a few other essential elements, as emerging research trends which should be the part of any well- informed HCI researcher's toolkit. Even conferences like BCS HCI Conference is quantitatively compared, contrasted and analysed against, perhaps, the largest and most popular conference in the field- ACM CHI, in respect of their research trends & focal areas, using probabilistic analysis (Padilla, Methven and Chantler, 2016). Konstantinos (2017) re-affirms the emerging highlights of HCI as information architecture, cognitive psychology and a number of other areas formed through lamination. Marasek, Romanowski and Sikorski (2017) emphasises on the emergence of Artificial Intelligence (AI) in user interfaces as a breakthrough. Enhancing research trends in HCI like Virtual Reality (VR), User Interfaces and Instructional Design are focussed upon in the research conducted by He *et al*. (2017). Previous research thus points towards how the field of Human Computer Interaction (HCI) is becoming more and more interdisciplinary and diversified, with the emergence of research trends like the ones discussed above.

III. Scope & Objectives:

The report will examine research trends in conferences on Human Computer Interaction (HCI) of two previous years, namely 2016 and 2017. Data has been collected from selected international conferences in the field of HCI as well as from various trusted websites which are regarded as treasure troves in this specific discipline. The sources are listed as follows:

1. Conferences:

- Association for Computing Machinery Computer Human Interaction (ACM-CHI),
- International BCS Human Computer Interaction Conference,
- Association for Computing Machinery Multimedia.

2. Websites:

- www.interaction-design.org
- scholar.google.co.in

The objectives of the study are as follows:

- To present the current scenario of conferences on Human Computer Interaction (HCI) in the international sphere.
- To find the various themes of the selected international conferences on Human Computer Interaction (HCI), restricted to 2016 and 2017.
- Subsequently, to find out the most discussed / emerging topics of research in Human Computer Interaction (HCI) in the two-year time span specified.

The Trend Report is expected to understand & highlight the emerging research frontiers and its growth pattern, specific to Human Computer Interaction (HCI) as a discipline of study, and, to revisit any stagnation in the field, regarding its theory and practice as such.

IV. Methodology & Limitations:

In pursuance of the study, data was gathered both from the official websites and the official programme brochures of the selected international conferences on HCI. Further, some reports and articles about the said international conferences that appeared in the specified websites were examined as needed and the necessary information, specific to our scope, was extracted.

Official documentations and associated reports related to the three specified international conferences on Human Computer Interaction (HCI), within the timeframe of 2016 and 2017, were studied and key-terms (in the form of emerging sub-themes, as reflected in the conferences) were selected for analysis. Finally, the sub-themes were listed in varied representational forms in an attempt to find the various emerging research trends in Human Computer Interaction (HCI), specific to listed conferences. To make sure that the data collected is authentic, each of the conference websites and associated webpages were thoroughly surfed through.

The present study also has limitations, in the sense, information related to a particular research trend or conference theme might have been skipped, if that specific key-term was not indexed,

unavailable or not captured during the search conducted. Since a detailed and in-depth study at abstract level or theme level was not conducted, the various trends shown emerging cannot be absolutely ascertained. The trend has been realised only on the basis of data within a two-year time frame.

A more detailed, in-depth and realistic trend could have been generated if the time alloted for the study had been five or ten years. The data-set is limited to the source mentioned in the scope of the study, and, any other international conference or associated websites have been left out from the scope of the study.

V. Data Interpretation:

The top 10 conventional sub-themes (topical trends which are constant or decreasing in terms of research discussions) in the field of Human Computer Interaction (HCI), that were deliberated upon in the three selected international conferences within the specified time-frame are listed below; each key-term is listed with it's associated frequency/weight mentioned against itself.

SL. NO.	KEY-TERMS/ SUB-THEMES	TOTAL
1	WYSIWYG	1
2	Digital Metaphor	1
3	Input/Output (I/O)	2
4	Machine Environment	2
5	Touch Screen	2
6	Hypermedia	4
7	Web based Interaction	4
8	Augmentation	6
9	CSCW	6
10	Display Design	8

TABLE NO. 1

The top 10 emerging research sub-themes (topical trends which are in vogue, in terms of research discussions) in the field of Human Computer Interaction (HCI), that were deliberated upon in the three selected international conferences within the specified time-frame are listed below; each key-term is listed with it's associated frequency/weight mentioned against itself.

SL. NO.	KEY-TERMS/ SUB-THEMES	TOTAL
1	Digital Libraries	16
2	Quality Of Experience	16
3	Instructional Design	17
4	Social Computing	19
5	User Interface	20
6	Immersive Environment	22
7	HCAI	23
8	Information Architecture	25
9	Cognitive HCI	28
10	Virtual Reality (VR)	30

TABLE NO. 2

VI. Data Representation:

The following Bar Graph visually represents the top 10 conventional subthemes (based on Table No. 1) that were taken up for discussion in the conferences on Human Computer Interaction (HCI), within the scope as well as the limitations of the work. For example, 'Hypermedia' was a subtheme for 4 discussion sessions in the three listed conferences, in 2016 and 2017. Further, from the comparative visualization, we can understand that these topics/sub-themes have more or less become stagnant or are declining in terms of their potential to be researched upon or discussed at leading conferences.

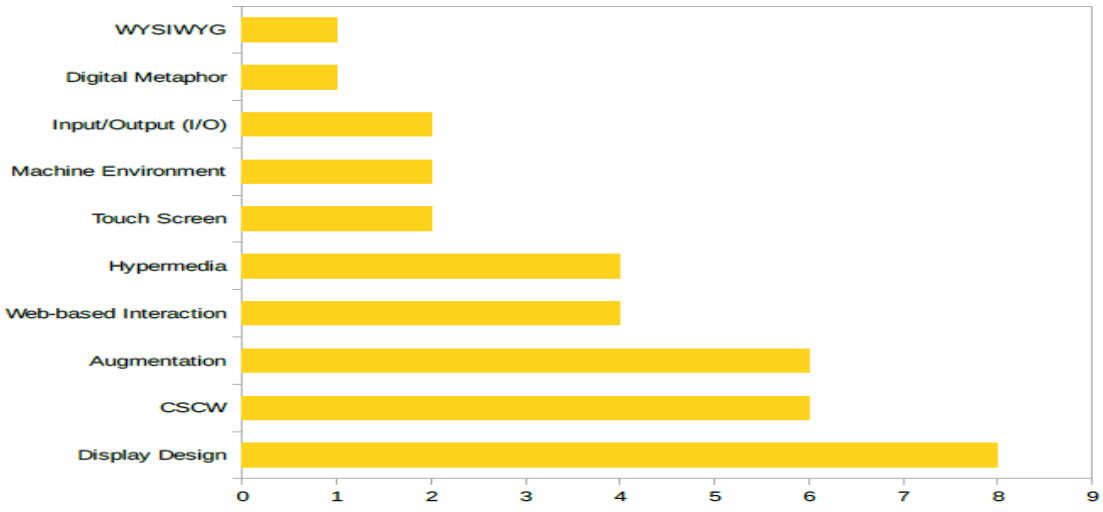

FIGURE NO. 1

The following Column Graph visually represents, in a superimposed manner, the top 10 conventional sub- themes (based on Table No. 1), and, the top 10 emerging research sub-themes (based on Table No. 2) that were taken up for discussion in the conferences on Human Computer Interaction (HCI), within the scope as well as the limitations of the work. From the comparative visualization, we can understand that the topics/sub-themes represented by blue columns have more or less become stagnant or are declining in terms of their potential to be researched upon or discussed at leading conferences, and, the topics/sub-themes represented by red columns are the emerging research trends.

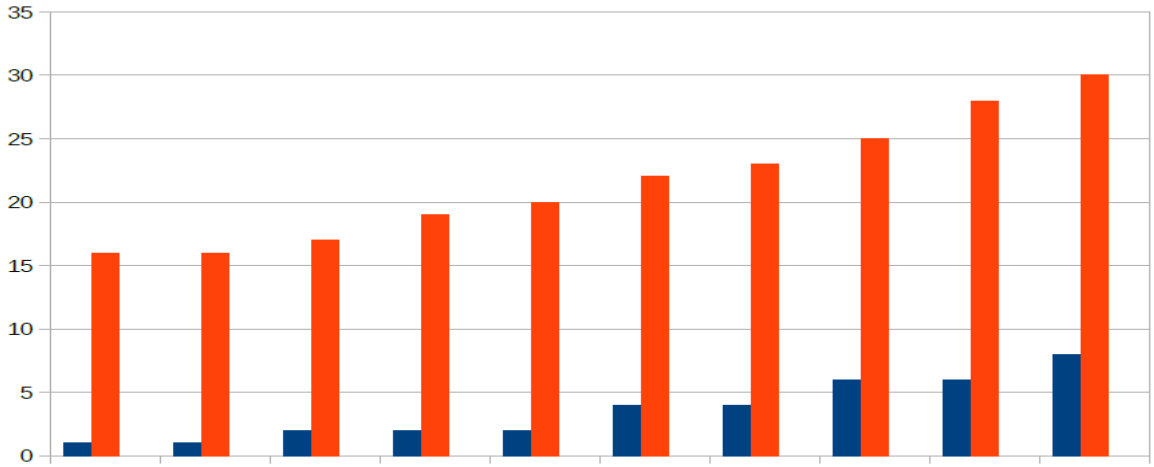

FIGURE NO. 3

VII. Conclusion:

Conference themes and sub-themes are understood to be an important and effective way of knowing what emerging research trends a particular domain is embracing in its fold. The identification of research trends, in any domain for that matter, significantly impacts in assessment of the gap between teaching and practice. It also aids in planning for further study and research. The study will acknowledge the direction in which the discipline of Human Computer Interaction (HCI) is moving, whether there is a shift in the fine-focussing of sub-domains within HCI and also to critically grasp the future course of research & development which is going to take place in the field of HCI.

In this study, critical analysis of existing literature, data tabulation, data analysis and data representation has been done; the data being collected from the three conferences and the two websites listed in the scope of the work, and, within the time-span of two years, i.e. 2016 and 2017. We can infer from the above exercises the topics in HCI which are declining or becoming stagnant in terms of their modern research potential, and also, most importantly, the emerging research trends which are supposed to dominate the course of research in this specific domain. Some recent papers building up on the general theme, best practices and research trends of HCI elucidated in this paper are referenced in [11-18].

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APPENDIX:

The acronyms mentioned in the Trend Report are expanded as follows:

HCI: Human Computer Interaction..
WYSIWYG: What You See Is What You Get
ACM: Association for Computing Machinery
GUI: Graphical User Interface
ICT: Information & Communication Technology
QoE: Quality of Experience
CSCW: Computer Supported Cooperative Work
HCAI: Human Computer Artificial Intelligence
HCIR: Human Computer Information Retrieval
VR: Virtual Reality