Not what, but HOW to study in HCI: tools, data, theory.

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Abstract

In considering what to study in HCI, we argue that there is no lack of research breadth in HCI: it could be argued that very few topics within HCI do not receive enough attention. However, in this paper we question the way research has been conducted within the HCI community, and propose a new ethos for evaluating research within our field. Our community should consider as valuable research outcomes tools, data or theory. In light of this, we describe a platform we have developed that brings together tools, data and theory in the context of mobile devices.

Author Keywords

Tools, data, theory, HCI, research.

ACM Classification Keywords

H.5.m. Information interfaces and presentation (e.g., HCI): Miscellaneous.

Introduction

At the 2014 ACM CHI Conference on Human Factors in Computing Systems, we published a bibliometric analysis of the conference itself over the past 20 years [10]. The extent to which the conference reflects the whole field of HCI is debatable, but it is acknowledged that CHI is the flagship conference of the field. Our analysis is agnostic of citation count and authors, as

this has been previously published for our field [2]. Rather, our bibliometric analysis approach is widely known as "co-word analysis" [3,4], which considers the keywords of papers, how keywords appear together on papers, and how these relationships change over time. Co-word analysis can map the "knowledge" of a scientific field by considering how concepts are linked together. This analysis has been conducted for various other disciplines including Psychology [9], Software Engineering [5], and Stem Cell Research [1]. Therefore, in addition to using an established methodology, we are also able to compare the findings of our analysis to previous findings. This way we identify how our own community's research compares to that of other disciplines and how it evolved in the past 20 years.

By far the most important finding in our paper was that CHI has systematically lacked mainstream or *motor themes* (Figure 1). Motor themes form the "heart and soul" of a discipline and are considered as the main topics or schools of thought. Our findings do not suggest that researchers who publish at the CHI conference systematically get behind a small number of topics to advance them sufficiently into mainstream. Rather, we found that all research themes at CHI remain at the bandwagon or chaos quadrants. In other words, we simply roll from topic to topic, year after year, without developing any substantially significant theme. We can hypothesize this to be a consequence of technological development and the need for novel interaction techniques.
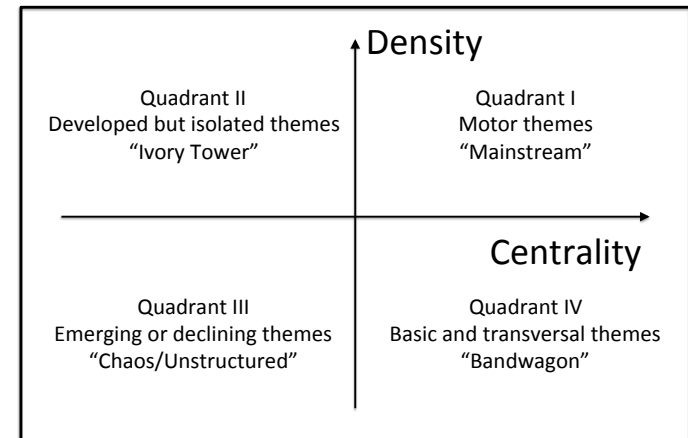

Figure 1. Strategic diagram showing the various stages of a research theme. HCI lacks Motor Themes (Quadrant I) [9].

Moreover, in a follow-up article [8], we argue that the reason why our discipline lacks mainstream themes, overarching or competing theories, and accumulated knowledge, is the culprit known as "implications for design." In a nutshell, an "implications for design" mindset places emphasis on re-usability of our work by practitioners and industrial actors: our work somehow needs to be relevant to designing products.

Unfortunately, an important shortcoming of this ethos of our community is that it completely overlooks the needs of fellow scientists and researchers. As a result, most research within HCI is not actually re-usable by other scientists!

We have argued in [8] that one way to address this shortcoming of our community is for us to place a renewed emphasis on the development of: **tools**, **data**

or **theory**. The rationale why we propose these three as desirable outcomes of research is that these can be directly re-used by other researchers in our community. We urge reviewers to not just ask the question: "*What are the implications for design of your work?*", and also question "*What tools, data, or theory does your work provide?*" We must acknowledge that thinking about the implications for design is a fundamental step for reflecting on future work. However, it is simply not enough if nobody can really reuse, improve and build upon your work.

A platform for tools, data, theory

In response to our own calls for the HCI community to reconsider its values and foci, we have developed over the past 4 years a research platform that aggregates tools, data and theory. Our platform has targeted research conducted using smartphones and other mobile devices as human-behavior probes. While it is beyond the scope of this paper to offer a detailed technical account of our platform, we nevertheless attempt to highlight how our platform encourages best practices for generating tools, data, and theory for HCI researchers.

Our platform is called AWARE[1], and over the past few years it has matured from a convenient tool into a doctoral project, and ultimately into a group project that brings together scientists across many disciplines. The premise of the platform is to enable the collection of various types of data from smartphones (both sensor data and behavior data), and remotely manage studies with large number of participants. In addition, researchers may wish to contribute their own code (in

the form of plugins) to enable new type of data to be collected from smartphones. Thus, our platform brings together scientists who produce:

- **Tools**: in the form of plugins that process & collect sensor data. For example, a plugin could read data from the accelerometer and generate pedometer counts in real time.
- **Data**: in the form of standardized datasets that can be collected & compared across multiple studies. Data collected by the same plugins in different studies is comparable.
- **Theory**: in the form of results generated by analyzing datasets. Developing improved tools & plugins may also test theory and results can be re-validated repeatedly.

Our platform is open-source and scalable, and in fact we have conducted two hands-on workshopsat UbiComp 2012 [7] and UbiComp 2013 [6] to show other researchers how they can use this platform in their own studies. More importantly, the platform has allowed collaboration across multiple disciplines, as it is open-source and free to use.

Conclusion

Our ongoing work is focused on extending our platform to enable new types of data collection. Through its plugin mechanism we are enabling the collection of explicit human input (e.g. questionnaires) on-the-fly, and new types of behavior that can be inferred from existing sensors or other plugins.

The response from the community has been supportive. Many researchers are now able to re-use the **tools** (plugins) that others have created and published on the platform. **Datasets** are collected in a systematic

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[1] http://www.awareframework.com

manner, enabling the easy comparison or aggregation across multiple studies. Finally, **theory** can be generated from data, and ultimately used to develop new tools.

We very much encourage the HCI community to consider valuing tools, data, and theory, and reconsider its high regard for "implications for design". Ultimately, we feel that HCI does not suffer from not paying enough attention to certain topic, but rather going about it in an unproductive way. We believe that platforms like AWARE, but targeted at different domains, could greatly advance HCI research.

Acknowledgements

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