Interaction Science Spotlight

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Abstract
Over the past 30 years science has played a key role in shaping and advancing research in Human-Computer Interaction. Informed in part by methods, theories and findings from the behavioral sciences and from computer science, scientific contributions to HCI have provided explanations of how and why people interact through and with technology. We argue that the contribution of science to HCI could be enhanced if key challenges are met. We discuss these challenges and propose a set of responses.

Author Keywords
science, theory, modeling, scientific method, empirical method, experiments, data, evidence, analysis, behavioral sciences, interaction science

ACM Classification Keywords
H.1.0 [General]; H.1.1 [Systems and Information Theory (E.4)]; H.1.2 [Models and Principles: User/Machine Systems]: Human Information Processing

Introduction
Informed in part by methods, theories and findings from the behavioral sciences and computer science, scientific approaches to HCI have provided explanations of how and why people interact with and through technology.

Explanations have been offered for a range of individual, social and cultural interaction phenomena and are not limited to any one facet. They include contributions to understanding elementary perceptual and motor interaction [7], of course, but also contributions concerning the use of knowledge to guide search [16], as well as contributions to explaining how people collaborate and share information [17] and how machines limit what interactions are possible [19]. Other work, more peripheral to HCI publication venues, has also offered key insights useful in our field, for example, [12, 18, 2]. Together this body of work forms part of what is becoming known as *interaction science* [6, 1].

A scientific approach offers cumulative theory and empirical rigor. Theories often consist of some systematic representation of individual and or collective interaction that leads to the generation of testable hypotheses. For example, a scientific theory might consist of a computational or mathematical specification of the human information processing mechanisms [11, 4], for others the science is more in the empirical method [8, 18, 20]. Cumulative theory offers explanations across a broad range of contexts and phenomena. Information Foraging Theory, for example, explains how people search for relevant information on a web where there are distal cues as to content and where relevant documents are clustered in distributed patches [16]. It gains its power and generality from a mathematical formalization of foraging and from a computational theory, ACT-R, of the mind. Theories of movement planning describe how long it takes to move a pointer to a button and also variation induced by changes in the cost of error [13, 15]. Theories of team diagnosis, making use of Signal Detection Theory, show the consequences of communication constraints on the integration of multiple diagnostic decisions [17]. But, however sophisticated the theory, evidence is essential. Controlled experiments are used to test theory. For example, they show how the costs of action imposed by an interface moderate planfulness [14, 10] and they are used to investigate social phenomena, for example to test game theoretic ideas concerning collaboration [2].

Importantly, interaction science has a symbiotic relationship with other activities in HCI. Engineering approaches are closely related but engineering is not synonymous with science. Engineering disciplines can have their own theoretical frameworks and empirical programs. These can inform and be informed by science. Similarly, qualitative approaches to observing interaction and user experience provide descriptions of what designers and practitioners find important for invention and thereby yield guidance as to what phenomena require explanation. In return, scientifically supported theories offer evidence-based explanations that have the potential to contribute to theory cumulation and understanding. They may also provide the underpinning assumptions for engineering methods, though this is not essential. Scientific theories may sometimes inform design immediately, but sometimes may only do so in the long run or may only be useful because they inform HCI education, or inform further scientific investigation of HCI phenomena.

While interaction science has had many successes there are a number of challenges. These include:

1. Despite the strong science contributions to HCI, and ACM CHI, over the past 30 years [7], these contributions sparsely populate an increasingly diverse field.

2. Interaction science methods and theories require years to learn and while a few efforts have been made to provide

educational material [5] these efforts are few in number.

3. The imperative for "design implications" can mediate against scientific values and against high risk work on hard problems.

4. A concern with the details of particular interaction instances rather than the statistics of task ecologies [3], central to many researchers experience of HCI, does not always accord with the scientific aim to abstract general principles.

5. Laboratory studies, which are often dismissed as irrelevant to the "real world", are essential to science's, including social science's, capacity to acquire causal knowledge through controlled variation [9].

6. Interaction science has overlapping goals with other fields – including economics, social science, and psychology – and as a consequence its nascent focus needs nurturing.

7. As with other science and engineering disciplines, interaction science suffers from limited diversity in its community of researchers.

Objectives

If the Spotlight is approved then our first objective will be to organise a Special Interest Group (SIG) as part of the technical program for CHI 2014. We will use this meeting to elaborate the following set of objectives.

1. *Develop a diverse community of interest, stimulate submissions to the conference, and engage researchers and practitioners in the reviewing process* - There are many researchers in a range of scientific disciplines who conduct work that is relevant to CHI. By providing a focal point for the science of Human-Computer Interaction we will provide an opportunity for these people to engage more fully with CHI researchers and research problems. In the long term we will actively seek collaborations with key individuals and journals to promote interdisciplinary work. The CHI Interaction Science Spotlight is intended to complement efforts by others to educate and promote in this area [5, 6, 1, 20].

2. *Work with the program committee to innovate content types and grow the spotlight area* - Innovation is required in part because of the changing landscape of publication models including the move toward open-access and, in some scientific disciplines, toward free-to-publish/free-to-read and a broader use of open peer review. Registered publication of empirical studies also provides an opportunity. Innovation is also required because of the differing value that disciplines perceive in conference versus journal publication.

3. *Provide tools to ensure that interaction science researchers are able to find relevant content* - This will be an ongoing area of investigation that is partly motivated by the need for new publication models, greater levels of interdisciplinary work and a drive towards a cumulative science of interaction. Providing tools requires resources but we will investigate sources of support that would enable relevant advances in this area.

4. *Meet the standard submission requirements and deadlines, and additional milestones required for an effective Spotlight program* - The applicants have demonstrated their commitment to the scientific approach to HCI over many years. We see the Spotlight program as an opportunity to further this commitment and we intend to fully engage with the agenda.

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