Research Contribution Types in Human-Computer Interaction

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Research in Human-Computer Interaction (HCI) contains both technological and human-behavioral concerns. As a result, the contributions made in HCI research tend to be familiar to either engineering or the social sciences. The research types covered here are empirical, artifact, methodological, theoretical, dataset, survey, and opinion. Of course, many articles make more than one type of contribution. The goal of this document is to give students insight into the contribution types found in HCI papers, and to provide examples for further reading. I do not claim that the examples chosen are the “best of each type;” rather, they are examples with which I am familiar and papers that I appreciate.

1. Empirical

Description. Empirical research contributions consist of new findings based on systematically observed data. Empirical contributions may be quantitative or qualitative (or mixed), and usually follow from scientific studies of various kinds (e.g., laboratory, field, ethnographic, etc.). In HCI, the purpose of empirical contributions is, by providing new data, to reveal formerly unknown insights about human behavior and its relationship to technology. Empirical research methods commonly used in HCI include formal experiments, field experiments, field studies, interviews, focus groups, surveys, usability tests, case studies, diary studies, ethnography, contextual inquiry, experience sampling, and automated data collection (e.g., sensing, logging).

How this work is evaluated. Empirical contributions are considered trustworthy when the methods that produce them are executed with rigor and precision. “The devil is in the details” in empirical work. Identifiable confounds and biases must be avoided in studies of all types. If methods are sound and findings important, empirical contributions will be judged favorably.

Examples.


2. Artifact

**Description.** Artifacts in HCI are inventions, including new systems, architectures, tools, techniques, or designs that reveal new opportunities, enable new outcomes, facilitate new insights or explorations, or impel us to consider new possible futures. Artifact contributions are, by definition, dependent upon never-before-seen inventions that are instantiated as prototypes, sketches, mockups, or other portrayals, and are often at least somewhat functional. Novel systems, architectures, and tools provide new knowledge by showing how to accomplish new things formerly impossible, or how to accomplish formerly possible things more easily (e.g., Dixon, Gajos, Greenberg, Myers, Patel, Wobbrock). Novel techniques provide new ways of interacting with a range of technologies, striving to be reusable across many platforms or situations. (e.g., Baudisch, Grossman, Kristensson). Novel designs may be prototypes, sketches, mockups, or other portrayals whose purpose is to exhibit new possible futures (e.g., Kane, Schwesig, Wigdor).
**How this work is evaluated.** Artifact contributions are often accompanied by empirical evaluations but they do not necessarily need to be. New systems, architectures, and tools are often best evaluated in a principled, holistic fashion on the basis of what they make possible, how they do so, and what new possibilities they open. Techniques, on the other hand, are almost always evaluated formally and quantitatively, as human performance with techniques is central to understanding techniques’ merits. New designs, in general, are evaluated according to the bold and compelling vision they propel, and how richly painted is the possible future created by the design. Designs that are deeply implemented also may be considered systems and may be evaluated accordingly.

**Examples.**


3. Methodological

**Description.** Methodological research contributions add or refine the methods by which researchers or practitioners carry out their work in HCI. Research methods enable scientists to make new discoveries, while practitioner methods enable designers and developers to apply their craft to greater effect. While entirely new methods of either sort are infrequently proposed, method variations are regularly proposed.

**How this work is evaluated.** Methodological contributions are evaluated on the basis of the novelty and utility of the new or improved method. Demonstrating the utility of a method usually requires an empirical validation of some kind. Such a validation may be formal in nature (e.g., an experiment in which one of two groups uses the new method, while the other group uses a *de facto* method), or a case study (e.g., where the method is applied in a particular setting and outcomes are analyzed and reported). The goal of validating a methodological contribution is to convince readers that the new method or method variation is useful, valid, and reliable for its intended purpose. As the method is to be used by others, it should be described well enough to be employed by experienced researchers or practitioners.

**Examples.**


4. Theoretical

Description. Theoretical contributions consist of new models, principles, concepts, or frameworks, or important variations on those that already exist. These may be quantitative or qualitative in nature, but are always structured so as to be useful in the pursuit of future knowledge. Theories are built over time, and in some fields (e.g., psychology), after repeated and rigorous validation, may attain the status of “laws.” Theories are both descriptive and predictive in nature; that is, they reveal the essential features of what is while accounting for as-yet unobserved outcomes. Theoretical contributions significantly advance our understanding by providing inherently reusable constructs and “ways of thinking” about problems.

How this work is evaluated. Theoretical contributions must be validated for their novelty, importance, descriptive power, and predictive power. A theory that accounts well for observed data from a particular situation but has no ability to transfer to any new situation is inherently limited in its usefulness. (The theory may be said to be “over-fit” to the observed data.) Conversely, a theory that is so broad it can “predict anything” probably does not contain any real descriptive power. (It lacks specifics and is “under-fit.”) For these and other reasons, theory validation is almost always accompanied by empirical observation.

Examples.

5. Dataset

Description. Datasets are infrequent contributions in HCI, but they do occur. A dataset contribution provides a new and useful corpus, often accompanied by an analysis of its
characteristics, for the benefit of the research community. Datasets enable evaluations against shared benchmarks by new algorithms or systems. Dataset contributions are common in the pattern matching, operating system, and database communities, among others.

**How this work is evaluated.** A dataset contribution is judged favorably the extent to which it supplies the research community with a much-needed corpus against which to test future innovations. Also, datasets should be accompanied by explanations of how and where the data was gathered, why it is adequately representative, and common procedures to employ with it. Often, datasets are published with new tools that instantly give researchers greater facility with the data.

**Examples.**


6. **Survey**

**Description.** Survey contributions are attempts to review and synthesize work done in a research field with the goal of exposing trends, themes, and gaps in the literature. Survey contributions take a step back, organizing the literature of a field and reflecting on what it means. Often, survey contributions are conducted after a field has reached a level of maturity. It is not uncommon for surveys to be over fifty pages in length, with references numbering in the hundreds.

**How this work is evaluated.** To be effective, survey contributions must not be mere catalogs of prior work. Rather, they must review and synthesize this work, extracting emergent themes or trends, and identifying gaps where new opportunities lie. Surveys are judged on their completeness, thoroughness, organization and of material, the depth of their synthesis, maturity of their perspective, and fairness with which other authors’ work is characterized. Surveys are also judged favorably the extent to which they uncover promising new areas for future work.

**Examples.**


7. **Opinion**

**Description.** Papers making opinion contributions seek to change the minds of readers through persuasion. Although the term “opinion” might suggest a less-than-scientific effort, in fact, opinion contributions, to be persuasive, often draw upon any or all of the above contribution types to advance their case. Opinion contributions are such not because they lack any empirical or theoretical basis, but because of their goal, which is to persuade rather than simply to inform. Along with persuasion, the goal of opinion contributions is to impel discussion, reflection, and even dissent or a change in course for the field.

**How this work is evaluated.** Opinion contributions are evaluated on the credibility and use of their supporting evidence, on the fair consideration of alternate perspectives, and on the strength of their articulated persuasion. Essentially, opinion contributions must center on topics of vital interest to an academic community, and should therefore have broad appeal.

**Examples.**