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Solving the Battle of First-Authorship: Using Interactive Technology to Highlight Contributions

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Abstract

Human-Computer Interaction research is traditionally collaborative. However, the current authorship model – i.e., placing authors' names in a particular order – makes the contributions of collaborators who are not the "first author" (or not mentioned) less visible which negatively affects career paths. Still, if smaller and larger contributions are equally rewarded with a "good" position in the author list, a researcher's achievements may be overrated. We suggest a solution with interactive technology to highlight contributions. The benefits include high visibility of contributions, in-situ access to in-depth researcher profiles, *in situ* access to similar work by the contributors, and low incentive for artificial credits.

Author Keywords

Authorship; first author; contributor model; visualized contributor model; contribution; interactive technology.

ACM Classification Keywords

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

Introduction

Human-Computer Interaction (HCI) research is characterized by collaboration and is frequently of interdisciplinary nature. Often several researchers with different backgrounds contribute to a project. In the current publishing practice that puts a list of authors in a particular order (i.e., "author list" authorship model), some contributions are hidden one or the other way. It is impossible to put all the contributors as the first author. This is particularly challenging when everybody contributes equally to the research; it results in what we call "artificial ranking".

A proposed solution to overcome these problems is the "contributor model" of authorship, which is a means for transparently indicating specific roles of contributors in a research and manuscript writing project [1]. This model has been discussed in various disciplines such as medicine [3, 4], engineering [2], and the social sciences [5]; but the model is still on a more conceptual level and has not been

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[1] This paper has been written in a word by word collaboration, and the order of authorship does not reflect differential contributions. An "artificial" first author has been introduced, indicating the collaborative efforts: AC BD indicates the initials of the co-authors first names (Afsaneh and Christine) and last names (Bauer and Doryab). CMU is the abbreviation of Carnegie Mellon University and UzK refers to the University of Cologne.

Afsaneh Doryab's contributions:
- Idea generator
- Idea conceptualization
- Scenario development
- Visualization
- Writing
- Coordination

0 papers related to authorship

1 paper related to interactive technologies
- Bewell: A smartphone application to monitor, model and promote wellbeing

4 papers related to collaboration:
- Context-aware information adaptation in collaborative settings
- Activity-aware recommendation for collaborative work in operating rooms
- …

Christine Bauer and Afsaneh Doryab other co-authored papers: 0

Christine Bauer's contributions:
- Idea conceptualization
- Scenario development
- Literature search
- Writing

0 papers related to authorship

2 papers related to interactive technologies:
- Active Listening" to Instant Messaging and E-mail: Benefits and Limitations
- …

2 papers related to collaboration:
- Collaboration by Location-based Crowdsourcing
- …

Arthur Small: Copy editing

operationalized through technology. In this paper, we propose to use interaction technology, which is developed and widely used in the HCI community, to operationalize the contributor model.

Contributions of this paper are as following:

- An honest discussion of the challenges inherent in the current authorship model (i.e., an ordered list of authors), and describing the consequences of this model on collaboration, motivation, and career opportunities.
- An interactive design based on the stakeholder perspectives that promises a viable solution for revealing the visibility of contributions.

Challenges With the Current Practice of Authorship in HCI

Collaborative research in HCI typically unites different disciplines and skills. Especially in big, interdisciplinary projects, a large group of people is involved in the research, with each person making distinct contributions. When it comes to the dissemination of results, two main scenarios exist: (1) Either all participants of the research project collaborate in writing a manuscript, or (2) only a subgroup of researchers engage in the writing process. As Borenstein & Shamoo [1] point out, "[W]riting is not the paramount component of every researcher's job, but the published paper is the main vehicle for communicating research findings to colleagues and the broader world". In other words, a work may be worth publishing only if the group contributes to the research endeavor and writing is not the only way to contribute to a publication.

We identify two major challenges inherent to the "author-ordered model": It is not transparent, and it has a strong impact on researcher's motivation to contribute.

Lack of Transparency
A main challenge in the currently applied model of authorship is the lack of transparency concerning the content and importance of authors' respective contributions. Borenstein & Shamoo [1] point out that in the current model, the "author list on a manuscript is often used as a proxy for determining who made which type of contribution to a project. Yet, decoding what the list means and who even actually wrote the relevant manuscript is quite difficult" [1].

If there is a list of authors, it is not clear who, for instance, had the idea, who designed and implemented the machine learning process,

and who documented the research for publication. It is almost necessary to be an "insider" to a particular research field to know how to interpret a particular author list [1]. For example, in a field such as in mobile health, an interdisciplinary team of researchers with backgrounds in health, software engineering, machine learning, psychology, and social science would be necessary to perform a comprehensive and strong study. The bare author-order list fails to convey the important nuance of these differentiated contributions.

Similarly, if a paper, for example, introduces a mobile application to collect data, includes some machine learning analysis on the data, and also has a qualitative section with interviews and qualitative coding, it is difficult to create an ordered list of authors that would reflect who and what is most important in the paper, as the paper only exists in its "entirety/collaboration". Not to mention one of the researchers as an author or to credit participating researchers as second, third or later author would mean not to equally recognize/appreciate the contribution of all of the team members.

Furthermore, a limitation of the current authorship system is that it creates inequality and invisibility of contributions. On the one hand, some readers just look for the more "famous" names (usually an advisor or senior researcher) and do not recognize the additional efforts of other researchers involved. On the other hand, some readers actually pay attention to the authors next to the more famous one, recognizing those as the "newcomers" who deserve attention. The latter might be one of the motifs behind recruiting "guest authors" (a guest author is a person who does not contribute but is given credit as author (e.g., [7]) to get better recognition oneself.

Damaging Effect on the Motivation to Contribute
As Borenstein & Shamoo [1] point out, decoding the order in an author list is quite difficult, because research teams decide on their "author list strategy" themselves – or it is imposed on the team by one of the senior researchers in the team. For example, some advisors favor to put the names in an alphabetic order. Others might decide to put the PhD student who needs to graduate first. Others might decide to identify the first author before the work has actually started. Others let the work be done and then decide who writes the paper and should be the first author.

In some cases, people also compromise on the order of authors. Compromising prevents fights and conflicts; yet, it has long-term consequences on career paths (e.g., the number of one's first authored papers is frequently used as recruitment criterion for research positions) and may create an uncomfortable working atmosphere (e.g., emotional stress). In some cases, a compromise on the order of authors negatively affects the spirit of collaboration and reduces motivation for the rest of the team to contribute as much as they would for a paper where they would be the first author [6].

The contribution of some researchers may be so vital that without it no paper would exist. Yet, when such key contributions are buried through less prominent placement in authorship rankings, it affects the motivation and effort to make a stronger contribution.

Contributor Model as a Viable Solution

One possible solution to address the mentioned challenges is the contributor model of authorship. The contributor model [9] was suggested as a solution to the problem of the ill-defined authorship. While different variations of the contributor model exist (e.g., [8], [10]), the unifying theme among them is

the goal of revealing the respective contributions of multiple authors, thereby "creating a more meaningful opportunity to delineate each person's range of tasks" [1].

Applying this contributor model solves various challenges:

▪ Strong contributors are identified by the quantity and significance of their contribution, not by the order their names appear in the author list.

▪ Contributions are systematically visible: there is no need for negotiation and authorship policies.

▪ Authorship can go beyond the writing task; everybody who has contributed to the research can and should be credited. For example, if a research assistant built the system that was evaluated, he or she is listed as contributor even if they did not participate in the writing task.

▪ The tension and competition that result from the order system are reduced. Most people would not care about the order as long as their contributions are visible.

▪ Accountability for each team member increases. If the contribution of someone cannot be visualized, then it is also no contribution.

While the contributor model does certainly not resolve all authorship-related problems [1], it has many benefits over the current authorship system. Notwithstanding its theoretical benefits, the discussion on possible implementation approaches has raised many questions (e.g., how to leverage tools that are familiar to non-tech end users or who will gather the required information and how) [5] but has not provided any concrete solutions. We contribute to closing this gap by suggesting a solution that implements the contributor model with interactive technologies and recommendation algorithms.

Our Approach

Our approach is to pick up and extend the contributor model with links where contributions for a paper are clearly described and visualized. In addition, our model visualizes an automatically collected summary of contributions and research record per author, across several work.

As can be seen in Figure 1, we take an interlinked approach. For every paper, related papers to the topic are shown; this is a feature that many scientific literature databases have already implemented. For each contributor on a paper, the respective contributions (e.g., methods, idea generator, statistics) in the respective paper are given. In addition, our approach anticipates listing related papers by the specified contributor/author using recommendation techniques. This feature has the benefit of emphasizing each author's research expertise and making this information easily available. Furthermore, for the specific parts of a paper, similar papers are listed. This is different from the related work in the reference list. In Figure 1, we exemplify this by providing a list of other papers that use the same method as the current paper. This feature will give the readers an *in situ* access to similar application of this method.
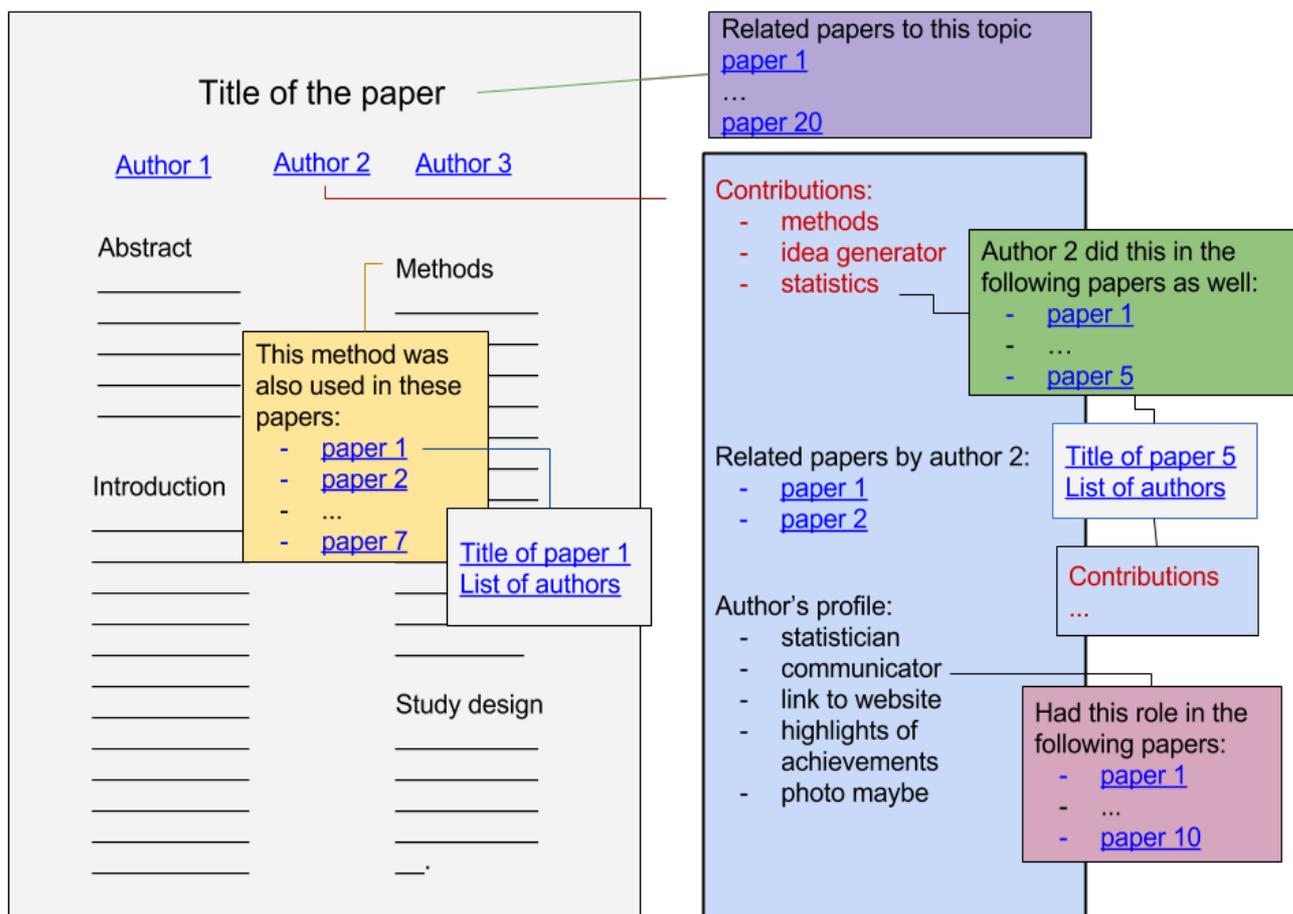
Figure 1: Our approach to implement the visual contributor model.

Stakeholders and Their Benefits

Several stakeholders may benefit from this interactivity model (Figure 1); the major benefits are summarized in Table 1 and detailed below.

1. Assessor (assessing work quality or profile)
   a) Recruiters can more easily and transparently assess the qualification of the person through their work and publications. For example, the search committee for a faculty position can go to the candidate's website and find the publications. When they hover over the name of the person on each paper, they see her/his contributions and similar papers to this one, list of collaborators, and overall weight of contribution in each area in case the work is interdisciplinary. For example, in the HCI community people use different methods from other domains. Not everyone has the same background and knowledge, but they get together to do research, and

everybody contributes according to her/his expertise. At the same time they learn something from other domains and over time they become experts in those disciplines as well. This expertise development is highlighted in form of weights in the researcher's profile when viewed in each publication.

b) Reviewers can more easily and transparently assess the quality of someone's research (papers and projects)

c) Ethics committee or editor can assess the real authorship (giving credit/fairness)

d) Program committee members of a conference can find the right reviewers to assess other people's work (identifying and then assessing the candidates). For example, a PC member is trying to find the right reviewer for a CHI paper in Meta-Analysis, and he currently does not know any candidates capable of reviewing the paper. His search on research papers in Meta-Analysis in Google Scholar return a large list of papers. He hovers the mouse on the name of each author and sees a brief list of contributions that particular person has made in that paper. He also sees the author's research background and her/his similar papers to this one. As such, the search space and the amount of time looking for the right person to do the task will decrease, as the PC member only needs to get access to one of the review candidates' papers to get a sense of their level of expertise in Meta-Analysis.

2. Authors themselves can have a record of their work/contributions as proof or evidence for later presentation. It helps their visibility and reduces the urge for active communication of research activities and highlighting their expertise and qualifications.

Stakeholder	Benefits of the visual contributor model
Assessor	- Recruiters or search committee can more easily and transparently assess the qualification of the person through their work and publication - Reviewers and ethics committee can assess the quality of someone's work and real authorship - Program committee members can effortlessly find the right reviewers to assess other people's work
Author	- A record of one's work/contribution history as proof or evidence for later presentation - Visibility - Reducing the urge for active communication of research activities and qualifications
Owner/ fundraiser	Having evidence of selling and communication skills
Reader	- Contacting the right person - Finding the right thread to continue the search

Table 1: Stakeholders and their benefits of the visual contributor model.

3. Owner/fundraisers who make the research a reality through their effort will have evidence on each publication on their abilities to sell and communicate research.

4. A reader interested to learn more about a specific topic can easily identify the appropriate contributor for potential further reading or outreach.

Application Scenarios

Table 2 lists the application scenarios where the contributor model can address some of the issues in the current author-ordered model. In scenarios, where one author is the main contributor, the interactive contributor model is similar to the traditional authorship model. However, it double emphasizes the contributions of this dominant contributor, quantifies the amount of contribution, and provides details about what has been done. As a result, the interactive contributor model makes the contributions more transparent in this scenario. For the readers, it takes less effort to engage in further search for relevant papers, as the model shows the authors' similar work by hovering on the names. At the same time, the model emphasizes the weight and impact of the contribution a person has made to the paper. For example, if the person has many papers in that particular topic, then s/he is likely to have expertise in this field.

Showing similar work of the contributors will mostly help the readers to find related work of the same topic/same researchers/same expertise without having to actively search for it. Existing strategies show similar papers to a paper's topic, but currently they do not show any similar people who do this kind of work.

This approach however, does not address the issue of invited/prestigious/forced authors; still, by adding/visualizing each author's contribution to this particular paper, it helps clarification. Although it does not completely prevent the possibility of invited and ghostwriters, but it increases the transparency. In fact, mentioning roles could be beneficial and prestigious. For example, highlighting one's role in a research paper as 'idea generator' or 'fundraiser' may have a major impact on future career/research opportunities that otherwise would not be visible by only looking/searching for the name of an author of the paper.

The proposed model captures the ghostwriters and identifies the holes in the contribution. For example, if the paper is heavily statistical but none of the author's background/related papers/contributions are about statistical methods, then it will raise the question: who has done the statistics?

Case	Challenge with the author-ordered model	Interactive contributor model
One dominant contributor	With order the "dominant" contribution is not really visible (whether 90% or just 70%)	The first author is the main contributor maybe the same way as it is now, but it double emphasizes her/his contributions, quantifies the amount of contribution, and gives details about what has been done which makes it more transparent and effortless for the readers for further investigation
Equal contributors	Impossible to distinguish the roles and – above all – the order of contributions	- Showing authors' similar work by hovering on the name emphasizes the weight and impact of the contribution this person has made to the paper. For example, if the person has many papers in that particular topic, then s/he must have expertise. - Showing similar work of the authors will mostly help the readers to find related work of the same topic/same researchers/same expertise without having to actively search for it. Existing strategies show similar papers to this topic, but they do not show any similar people who do this kind of work.
The contribution of other authors is so vital that without it no paper would exist	Impossible to make those vital contributions visible on the paper (the important 10%)	Showing authors similar work by hovering on the name emphasizes the weight and impact of the contribution this person has made to the paper. For example, if the person has many papers in that particular topic, then s/he must have expertise.
Joint work, but only one is doing the writing task	No clear distinction between contributor/author (definition gap)	- Makes everybody's roles and skills visible e.g., the ability to get funding
Significant contribution but not the main concern of the 'study'	No clear distinction between contributor/author (definition gap)	- Showing similar work of the authors will mostly help the readers to find related work of the same topic/same researchers/same expertise without having to actively search for it. Existing strategies show similar papers to this topic but they don't show any similar people who do this kind of work. - Makes everybody's roles and skills visible e.g., the ability to get funding
No/little contribution by a person	- Possible to have the role of coffeemaker - Putting the novice Ph.D. students to motivate them - Inviting guest authors to make their name look good	- It does not completely inhibit the possibility of invited authors but it increases the transparency - Captures the ghostwriters and identifying the holes in the contribution. For example, if the paper is heavily statistical but none of the author's background/ related papers/contributions are about

	- Ghostwriting (with money and without) - Outsourcing (e.g. statistics) - One person has to do the work, but another person is the author (the first person is not mentioned as author)	statistical methods, then it will raise the question: who has done the statistics?

Table 2: Application scenarios

Discussion

The proposed contributor model can address the main issues of the current author-ordered model and add more transparency and fairness to the authorship model. However, a number of concerns might arise in applying this model, which need to be discussed:

The contributor model does not completely solve the first-authorship problem. While the 'traditional' system requires authors to agree on the order of authors, the contributor model requires agreement on contributions, and that might lead to even more discussions among collaborators. We, however, argue that this situation can actually be an opportunity for the people involved in the research to highlight their contributions that would otherwise be hidden. It also motivates the collaborators to be aware of their roles and to make visible contributions. As mentioned before, if a contribution cannot be visualized, it is no contribution.

When discussing authorship/contributions, it is important to consider the citation method as well. As papers are generally referred to by the first author's name, it may happen that the first mentioned name will (still) be perceived as the most 'prominent' one, which could weaken the benefits of the contributor model. Further investigations are necessary to deal with this issue. However, a simple solution could be to use a random/signature name in the first-author place, e.g. a combination of initials derived from the authors' names. We have shown this in our paper by placing our initials in the first author's place followed by the alphabetic order of our last names.

The contributor model can also be gamed in the same way as the current authorship model. The concern is whether the ghostwriting role may end in a 'ghost-contributor role', where someone claims contributions they did not make. While this might be the case, we still think that discussion about the contributions and listing them explicitly will narrow down the problem because many (or at least some) will shy away from getting credit for tasks they did not perform.

The interactivity will only be useful in the online version and the issues will remain in the printed version. The solutions for how to represent our approach in the printed documents are yet to be explored. However, as most papers are first viewed online and the printed version is rarely used, we consider this issue to be of minor importance. The main idea is to make the contributions visible to the stakeholders, and the interactive online version of the paper fulfills this purpose.

Conclusion

We believe research and tools developed by HCI researchers can offer a practical solution to the first-authorship battle that almost all researchers in any discipline face at some point in their career. In this

paper, we took the first step to introduce the benefits of using interaction technology and recommendation techniques to highlight the contributions of collaborating researchers instead of letting the author-ordered list implicate the weight of contributions. Our goal is to motivate the HCI researchers to actively participate in changing the traditional perspectives on research collaboration and paper writing, and to help develop a transparent system for presenting collaborative research accomplishments without the need for negotiation, conflict, or compromise.

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