Publications beyond traditional papers: sub-papers, modular papers, what next?

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At a recent Panel of Editors meeting, John Baillieul, Chair of the IEEE Publications Strategic Planning Committee, challenged the audience to think beyond the traditional view of papers as publication units.

At first glance, one may wonder why do we need to go beyond papers in the first place? But on second thought, this idea makes perfect sense. Indeed, the whole purpose of writing a paper is that others will read it and use its results. Let us therefore consider the publication process from the viewpoint of this future reader and user.

While a few revolutionary papers provide new solutions to completely new problems, most papers deal with problems which have already been formulated before and for which some solutions exist. The main value of such paper is in providing a new better solution to the previously described problem: it can be a more efficient control, it can be faster algorithm, it can be an application to a slightly different class of problems, etc.

How can the author of a new idea convey it to the readers? Unless the problem is well known to everyone -- which happens rarely --the resulting publication must contain some description of the problem. Since the problem has been formulated before, there exist good descriptions of this problem in the literature. In the current environment, the researcher who invented a better way to solve this problem cannot simply copy this description into his/her paper -- that would be plagiarism. As a result, the researcher selects one of the following two options: he/she either cites the description instead of formulating the problem in detail, or re-phrases the existing description in his/her own words.

This may sound natural to those who are familiar with the current publishing practices, but from the viewpoint of the readers, both options come with limitations. In the first option, the reader must search for and download yet another paper -- or even buy it, if he/she does not have a general access to IEEE Xplore from his/her university. In the second option, instead of the existing well-written, well-designed introduction, the reader gets a worse amateurish re-telling. From the reader's viewpoint, an ideal situation would be if the new paper combines the introduction from the original paper(s) and the new technical part. In other words, from the reader's viewpoint, an ideal situation is when the new author(s) write NOT a completely new paper, but rather a "sub-paper", which could be combined with the already available introduction into a perfect new paper. So why not allow this? Why not explicitly allow publishing sub-papers and "modular" papers which consists of several sub-papers, so that the same sub-paper can be used as part of different papers.

But maybe the new author has a better introduction than what was known before? In this case, from the reader's viewpoint, in the previous paper(s), we should replace the original introduction with the new one.

What if the previous introduction is almost perfect, but can be made even better by a minor editing? In this case, from the reader's viewpoint, it would be better to have this minor edited version -- of course, since a reader is also an author, the reader would like to see a clear indication of who came up with the original text and who made a modification.

The need for such "sub-papers" is not limited to new introductions. Suppose that there is an interesting theoretical paper, where something interesting is mathematically proven -- e.g., stability of a certain non-linear system. Suppose now that someone come up with a new, better proof -- shorter, clearer, and/or more accessible to the general audience. In this case, why write a whole new paper? Why not replace the proof-containing sub-paper with the new proof?

If the new proof has a somewhat more general result, then also, instead of writing everything from scratch, why not make a minor modification of the sub-paper that contains the formulation of the result? And even if there are no modification, if we have only one paper, why not design it in such a way that different audiences can combine the sub-parts in different ways most appropriate for them? For example, if we have a theoretical result with applications to practical problems from different engineering areas, a theoretician would be more interested in the proof of the result and in the brief description of applications, while a specialist in one of the application areas would probably not be interested in proof details but rather in the details of this application. And for novice readers, why not add a tutorial sub-paper that others do not need but which for these readers will be very helpful?

From the current publication process viewpoint, the idea of multi-used sub-papers and modular papers formed from these sub-papers may sound like heresy, but this is exactly how, e.g., software is written. In the very beginning, all programs were written from scratch, but now, such occasions are very rare. In most cases, new software uses part of software designed by others before -- sometimes taken verbatim, sometimes minorly modified.

This idea of modular programming has led to a drastic improvement in programmers' productivity. Why not do the same for publications? If the authors are no longer required to waste time re-wording the motivation part for every single paper, this time will be used for more creative activities -- and thus, further increase their productivity.

In physics terms, a paper is like an atom -- this term originally meant indivisible -- but we all know now that atoms are not indivisible, they are formed of elementary particles, and from the same set of particles, we can form different atoms.

Of course, this vision of sub-papers and modular papers raises many challenges. How do we give credit to authors under the proposed new scheme? If someone publishes a sub-paper, this person gets less credit than the author who publishes the whole paper. Editing a sub-paper is also useful, but should result in an even smaller amount of credit. How much credit should we give? Probably more for technical innovations, less for simply writing a new introduction, but how

much exactly? How do you count credit for citing such a combined paper – which part of the credit should go to the authors of different parts?

How to modify the copyright regulations to allow such free combination of sub-papers -- these regulations currently seem not to allow someone's editing other's work without an explicit permission from the previous author.

There probably are many other challenges, but what new idea comes without challenges? The future of scientific publishing is in our own hands, let us continue brainstorming about it.