



Open source publishing to boost your career

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DATE RECEIVED:

September 08, 2015

DOI:

10.15200/winn.144174.45345

ARCHIVED:

September 08, 2015

KEYWORDS:

ARCS2015

CITATION:

Kevin Moerman, Open source publishing to boost your career, *The Winnower* 2:e144174.45345, 2015, DOI: 10.15200/winn.144174.45345

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When I started my PhD I was rather naïve about the workings of academia, never mind *open* science. This is my story on how I learned that open science, and in my case open source publishing, can not only fast-track science itself but actively stimulate collaboration, maximize impact, and in the process boost your career.

The topic of my PhD (2006-2012 [TCD](#)) was the creation of an experimental and computational framework to study the biomechanical properties of human soft tissue (relevant to the improvement of car safety through simulations of tissue injury during crashes). The basic set of tools I required involved visualization, image processing, 3D modeling, and computational analysis. For each it seemed separate commercial and closed source software was available requiring specific licenses and license servers. Some software was simply not within budget, while others only operated on specific sites on campus and only if enough shared licenses happened to be available. In addition, to perform all the steps I required, I had to manually export/import files between packages. The inefficiency of this process and the costs associated with the commercial licenses frustrated me. It was also frustrating that I could not see how these systems worked *under the hood*. I wanted to understand and validate the software components and expand their capabilities, automate them, and integrate them into a single efficient pipeline. I therefore set out to create a dedicated toolbox within the programming environment [MATLAB](#) capable of performing all steps in a clear and transparent way (see visual examples in Figure 1).

When I started my first post-doctoral position (2012-2015 at the [AMC](#)) it became clear that others were suffering from the same frustrations and I began to informally share codes with colleagues. Keeping track of versions quickly became an issue so I posted the toolbox on the web-based repository [GitHub](#), which offers version management and is free for public projects. So, in my case, posting the codes online stemmed from a necessity to manage the project on a free and web-based platform. I also needed to decide on a type of license. Since I had little experience with publishing open source, I was at first wary of sharing the codes online. Naively, part of me felt that the work would *have little impact*, that people would somehow *steal my work* and that therefore I would *not be credited* for it. I decided to publish the codes with an open source license (to read more about different types of open source licenses see [here](#) and [here](#)), and quickly learned my worries could not have been further from the truth.

As a way to advertise the toolbox I presented it at the international computational methods conference [CMBBE 2013](#) (Kevin M Moerman, Nederveen, and Simms 2013). To give the toolbox a more official feel, I created a [website](#) and named the toolbox GIBBON: The Geometry and Image-Based Bioengineering Add-ON. To further improve visibility I made the codes available on a popular

MATLAB code sharing [site](#) causing the number of downloads to increase significantly. The following year at [CMBBE 2014](#) I organized a free [workshop](#) on GIBBON as well as co-chairing a special session on computational modeling. Through this I was able to attract international users and GIBBON started to receive approximately 50 downloads a month. So by advertising the work I removed the *little impact* worry. Addressing the *not being credited* aspect was even easier since through the research sharing initiative [Zenodo](#) I assigned a DOI to the GitHub project allowing users to start citing my work (Kevin Mattheus Moerman 2014).

By publishing software as open source, researchers can immediately copy and start integrating and customizing the codes for their own use. I have personally enjoyed these aspects by integrating and linking GIBBON with two other powerful open source projects; [TetGen](#), and [FEBio](#). The ease of copying and/or editing should not be seen as threat (i.e. people *stealing my work*), since licenses can be put in place that ensure due acknowledgement and citation, but as a way to facilitate and accelerate the advances in the field of computational science. In addition, web-repositories, such as GitHub, allow users to create feature requests (keeping development on your side), or to feed altered codes back into your project making them potential contributors, thus actively stimulating collaboration.

The [institute](#) where I did my PhD maintains an interest in GIBBON, and my continued collaboration there has led to me being appointed as a visiting research fellow. I have since coauthored several publications with this group (Cooney et al. 2015; Takaza et al. 2012; Gindre et al. 2013).

Another collaboration was kick-started when I was approached by David Sengeh, a PhD student at the [MIT Media Lab](#). David now uses GIBBON for prosthetic socket design optimization for which I added many new features. This fruitful collaboration let me to start co-supervising David. This collaboration led to a job offer and in November 2015 I will start a Post-Doctoral Associate position at the MIT Media Lab. Several journal publications are currently being prepared in relation to this work, and some preliminary results have already been presented by David Sengeh in his TED talks [here](#) and [here](#).

My personal application for GIBBON has mainly been muscle mechanics ((Kevin M Moerman et al. 2011; Kevin M. Moerman et al. 2010; Kevin M. Moerman et al. 2013; Kevin M. Moerman et al. 2012)(Kevin M. Moerman et al. 2010)) however the open source access to GIBBON has meant it is now also finding application in pressure ulcer mechanics (Jagt 2014), image inversion theory (Moosbauer 2015), and soon the study of blood vessel, and bone mechanics.

Publishing GIBBON open source has maximized the impact of my work on an international level, and has resulted in the enhancement of my career through collaborations, citations, co-authored publications, and ultimately, a job at one of the most prestigious institutions for my field of research.

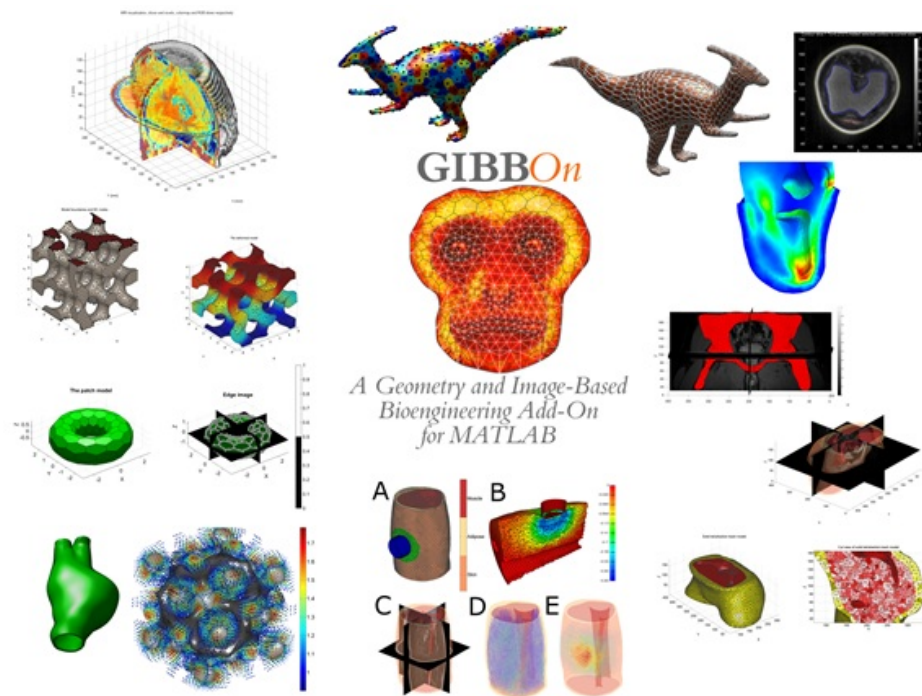


Figure 1 The GIBBON logo (centre) and visualizations for various applications

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