THE RELUCTANCE OF SCIENCE TO OPEN UP

I finally had the chance to read Michael Nielsen‘s book ‘Reinventing discovery‘– a must read for anyone interested in scientific discovery. Why? Well, because the closed, individual way in which we organize science today in many ways is hampering progress and may eventually become a thing of the past.

If you are in science, why did you choose a scientific career in the first place? For me, the dream was to make scientific discoveries, to find out about the laws of nature. Being part of a scientific community that works together to achieve common goals. I was fascinated by the scientific discourse, and historical debates. The debate whether light is a wave or a particle.

The scientific arguments between the pioneers of quantum mechanics. The huge collaborative efforts at the particle physics laboratory CERN. But what I never imagined myself doing was to sit alone in room thinking in isolation.

The philosopher Kant might have been great at this, but these days most scientists wouldn’t get far in isolation. That’s because increasingly science is a collaborative undertaking.

It is therefore surprising that the way science is still being conducted is for the most part neither open nor transparent. Instead, science today is based on small research groups doing experiments more or less in secret, only emerging from their 'hiding' once in a while to publish their latest results, but only to go into stealth mode again afterwards.

However, as Nielsen writes, there is a lot to be gained from open collaboration, where data is shared freely. Most of the first half of his book is devoted to the various examples how online collaborations can lead to scientific discoveries that would be very hard to achieve otherwise. The Polymath Project, where mathematicians started an open collaboration on a blog – with everyone invited! – to solve some complex mathematical problems. Or Foldit, a game where the aim is to solve protein structures. And last but not least Galaxy Zoo, where everyone can help classifying hundreds of thousands of galaxies. All of these are very successful projects in their own way that couldn't have happened without large-scale collaboration. If you're one of those scientists not yet in favour of open science, this part of Nielsen's book may make you reconsider.

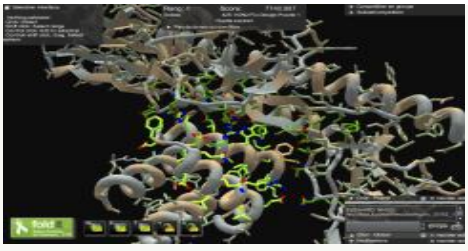
Still, the question is why despite clear successes such open projects remain the exception rather than the rule. And here, Nielsen raises some interesting points, also by analysing some of the failed projects.

One of the issues mentioned is the requirement of dividing a task in small, manageable units to lower the barrier for participants to enter. Important is also the possibility of some reward, whether it is a high score for Foldit players, or the discovery of a new class of galaxies in the Galaxy Zoo project. Notably, both projects are constructed such that non-scientists can take part – an important step for science to break out of its walled garden.

And then there is of course the problem of incentive. Why would anyone share their hard gained data? Well, as Nielsen explains, many of the more successful projects achieve something that scientists wouldn't be able to do by themselves in any case. But the broader issue is that present incentives are optimized for the current research system and are based on the number of scientific papers someone publishes, and the number of citations to these papers. A scientist that co-authors a paper with only a few colleagues shares a large part of the credit for the work. Someone who identifies a handful of galaxies along with thousands others will have much less visibility. But even among the participants of projects such as Galaxy Zoo are some that clearly share more credit than others. What is needed are better schemes for micro attribution of small units of contribution. Martin Fenner's blog has a good introduction to this topic.

Someone adding consistently high-quality contributions to an open project will get more of these microattributions and thus gain visibility. But will this approach be enough in itself? Probably not.

Economic theory might be of help here. The problem could be loosely associated with the tragedy of the commons – when individuals seek a personal advantage even though it is clear to everyone that doing so is against the broader interest of the community. This principle was formulated by Garrett Hardin in 1968 in the context of population growth and the depletion of common resources, although I think one could apply a similar principle here as well. The refusal by scientists to take part openly damages the scientific commons by hampering progress. But how to increase participation? Here, Nielsen mentions Mancur Olson‘s famous 1965 book on The Logic of Collective Action as a valuable first resource to describe the dynamic between the participants of common efforts. According to Olson, collective action of a group requires an adequate management approach and clear incentives for individuals to take part. Microattributions for example, possibly others.



Example of a protein structure in Foldit. Image by 425 marie_s via the Foldit wiki.

Unfortunately, these aspects are mentioned only at the end of Nielsen's book. It would have been interesting to hear much more on the connections to economic theory. Patents and other intellectual property rights for example are a clear obstacle towards openness. Nielsen says that this might mainly be an issue of applied science, and not such much a broader problem of fundamental science. That is true to some degree, although I think the issue is more widespread than Nielsen describes. This is because even researchers whose work may never have a commercial appeal often have the expectation that there is at least the possibility, and act accordingly.

To solve this, we need more successful examples of open collaborations. New ways of using the potential of collaborative efforts to do science in entirely new ways. This is a task for all of us. Think big. Very big. Science is also about grand visions. TheLHC, the Human Genome Project. And then divide such a big problem into small, manageable units that can be addressed by each participant. One should in particular look for approaches that are traditionally done on the research group level. Foldit is a good example, complementing work by protein crystallographers. In condensed matter physics, sadly there seem to be no examples, although there certainly are possibilities. I am wondering, what about the systematic search for new materials… room-temperature superconductivity? Why not have a large number of labs do a systematic search into a gazillion materials combinations.

Not sure if and how this would work, it would need some reasonable incentive for scientists to ‘play’. But one thing is clear – we need to think about such possibilities.

Michael Nielsen’s book serves as a great starting point for any reader interested in scientific discoveries. And even for those who have thought about such issues already, the book will stimulate further thinking. After all, it is in all our interest that we solve the tragedy of the commons in science.

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