The Wage of Fame

How Non-Epistemic Motives Have Enabled the Phenomenal Success of Modern Science[*]

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Abstract

The paper ventures an economic view of modern science. It points out how science works as a closed economy of attention where researchers invest their own attention in order to get the attention of fellow researchers. Attention thus enters economy in two properties: 1. as a scarce resource energising scientific production and 2. as a means of gratification rewarding the effort of the working scientist. Economising on attention as a scarce resource is another expression of thought economy. The income of expert attention is what gives rise to reputation, renown, prominence and eventually fame. By its being conceived as a closed economy of attention, science shows to be capable of self-organising a tendency towards overall efficiency and thus of collective rationality.

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Epistemic and Non-Epistemic Motives of Doing Science

What are the motives of embarking on a scientific career? Over and above a plethora of individual motives there are two general ones: curiosity and vanity. Since the organisational goal of science is the collective advancement of knowledge, it seems obvious that curiosity, or thirst of knowledge, is the legitimate motive whereas vanity, by being the ego's desire for attention, is prone to misuse the collective endeavour for egoistic purposes. In contrast to curiosity, whose concern are discoveries only, vanity promises to be mainly concerned with selling one's findings in so-called scientific communication. Scientific communication is a misnomer insofar as it is far from being just an exchange of information. In fact it is a market where information is exchanged for expert attention. Since taking attention is the main concern of vanity, scientific communication repeatedly is called a vanity fair.[1]

The pejorative tone of 'vanity fair' refers to forms of market failure endemic in scientific communication. Salesmanship und marketing, plagiarizing and downright fraud are ways of circumventing the fair exchange of information for attention. Tricky politics such as forming citation cartels or the playing off of one's power as editor or referee are again ways of steeling attention, thus furthering vanity but impeding research. Hence, is it not out of question that vanity is the wrong motive of doing science?

In fact it is far from clear whether we have to do with a vice or a virtue. Criticising vanity for excessive self-regard and overblown pride tends to overlook its social ramifications. Vanity's main concern is self-esteem, which eminently depends on what others think of one's person. The self-esteem we can afford is a question of the income we earn of appreciating attention.[2] By virtue of this connection of self-esteem and received esteem, self-regard finds itself coupled to empathy. It pays to pay attention to the attention others pay. Hence, the search for attention, far from being a mere vice, is what first turns us into pleasant-natured fellows.

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[1] See Franck 1999.

[2] Cf. Franck 1993.

What, then, is the morally pejorative undertone in the meaning of vanity due to? We need a minimum income of attention to entertain an intact self-esteem. The higher, however, the income of attention, the bigger the ego can grow. The growth of the ego knows no organic limits. The appetite for attention, accordingly, knows no saturation. Hence, there is a constant excess demand for attention. This means two things. First, self-regard gives rise to competition for attention. Second, this competition is shot through with temptations to excessiveness. This is what the moral reservations rightly refer to. This is too what makes vanity fairs so iridescent, lively and entertaining. This however might be the reason, too, why scientists hesitate to take vanity fairs as seriously as these need to be taken for understanding modern science.

The Rise of the Knowledge Industry

In early modernity, science underwent a fundamental change. In the textbook theory of science, this change is attributed to methodological innovations such as experimentation à la Bacon and problem analysis à la Descartes. There is a change in social organisation, however, which is no less remarkable. The crowd of migrant scholars, populating medieval science, started to self-organise into what later should be called an industry. To no lesser degree than to those methodological innovations, modern science owes its phenomenal success to this organisational change.

What does industrialisation mean? It means division of labour in two tiers. It means, on the micro-level, to decompose complex operations into simpler and simpler manipulations in such a way that the single manipulations become susceptible to mechanisation if not capable to be delegated to machines. Industrialisation means, on the macro-level, differentiation of specialised lines of production that produce inputs for other lines of specialised production, which, in turn, are re-integrated through markets that connect exchange with valuation of the output.

Historically, the industrialisation of knowledge production did not follow but rather precede the industrialisation of material production. In terms of scientific production, the decomposition of complex operations into simpler and simpler manipulations amounts to what René Descartes named the *rational method* (Discours de la méthode, 1637). The problems scientific investigation finds itself confronted with are much too complex for being dealt with in their undivided entirety. The bandwidth of our capacity of consciously processing information is downright ridiculous compared to the amount that the professional handling of research questions has to do with. Before being able to deal with scientific questions, the content has to be sequenced, i.e. cast into the form of a description. Description as such is not enough, however. In order to be dealt with operationally, the description of the complex problem has to be broken down into components of manageable size. The rational method is the instruction of how the complex problem can be decomposed into simpler and simpler ones in such a way that the solution of the complex problem can be re-composed out of the solutions of the simpler ones. Decomposition of problems is what analysis means, re-composition of the solutions of the decomposed problems is what synthesis means. In analogy to physical work, the division of cognitive work exploits the economies of routinisation not only, but allows also the use of mechanisms. The mechanisms supporting the mind's mechanics are of conceptual nature. Analysis means description. Language itself is the first and most fundamental way of translating complex ideas into series of simpler components down to the level of elementary units repeating themselves. The mechanisation of conceptual work started with the transformation of words into concepts through the application of language onto itself by way of definition. Concepts are words with precisely described and thus sharply demarcated meaning. Mechanisation advanced when mathematics was utilized as a language of description. The use of mathematical symbolism opens up the possibility of calculation, i.e. of problem solving by way of the mechanic manipulation of symbols. Mechanisation turns into automation as soon as formalisation makes use of algorithmic languages. Eventually, cognitive labour harnesses external sources of energy by running algorithmic languages on digital machinery.

Progress in science remains poorly understood if seen as an accumulation of discoveries only. Progress in science has always involved progress in *thought economy*. Thought economy economises on the energy used in cognitive labour, i.e. on attention. Thought economy is that part of the economy of attention that deals with attention as a scarce resource. Demonstrating how to economise attention as a scarce resource is thus what Descartes' contribution to the methodology of modern science amounts to. In modern science, economising attention is not restricted to the micro-level of cognitive labour, however. It is continued on the macro-level by differentiating the overall process of knowledge production into specialised lines of production. It is not before the overall process is thus organised as an industry that the advantages of the division of labour are fully exploited.

Taken as such, differentiated lines of knowledge production are much older than modern science. They are called disciplines and seem to have subdivided the field of systematic research since its beginning. What did not exist in ancient and medieval science, however, was the regular exchange between producers, the exchange that we today call *scientific communication*. Since information is power, there is a constant temptation to monopolise it. Why communicate it, why share it with other researchers if you can sell it to some ruler or patron in order to earn your living? Up to the seventeenth century, scholars, even in mathematics and astronomy, were pre-eminently concerned with protecting their claims to priority through secretiveness and mystification.[3] Only through the emergence of new means of information sharing, such as academies and learned societies with their meetings and published proceedings, could modern science embark on secure and steady growth.

Modern science relies on experiment. By performing experiments, science adopted a superior means of testing hypotheses not only, but entertainment value as well. The meetings of the academies and learned societies could be used for presenting experiments like circus tricks to an audience that was interested in challenging kinds of entertainment. Not everybody, of course, was admitted to the meetings. It was for reasons of the entertainment of noblemen that the academies could acquire considerable funds from early on. The

[3] Cf. Rescher (1989), p. 34.

selective admission of noblemen had a decisive side effect. Aristocrats were supposed to observe a code of conduct different from that of ordinary scholars and businessmen. Noblemen will be free of the temptation of selling tomorrow as their own discovery what they learnt today in a scholarly lecture. The scientist, accordingly, did not risk to be stolen his right of authorship and priority. As long as there were reliable witnesses around, this risk was minimal even when other researchers were in the audience. Testimony of a noble audience was, in contrast, the first step to what later came to be called intellectual property. By publishing your findings thus in the right place you could acquire intellectual property of it. In particular, the publication in written form of the proceedings of the meetings proved an effective and productive system for the authentication and protection of the stake of the creative scientist in the intellectual property created by his innovative efforts.[4] Publication puts intellectual property at the disposal of the general public under the sole condition that its processing into the user's intellectual property is credited by *citation*.

The measurement of scientific information

Efficiency, as important it is on the individual level of work, as important is it on the collective level of cooperation. As an industry, science is no longer the business of isolated persons or research units, but a social organisation that combines the work of specialists who collaborate with other specialists in producing inputs for other lines of specialised production. From a collective point of view, it is only through an efficient division of cognitive labour and an efficient exchange of pre-processed information that science can function rationally. There is, however, no centralised agency planning the distribution of talent and effort over the various lines of investigation. The division and collaboration of scientific work must organise itself.[5]

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[4] Cf. Ravetz (1971), p. 249.

[5] This does not mean that there are no central agencies influencing the distribution of talent and effort among the various lines of investigation. Governments fund certain areas more than others, military interests massively influence research in certain areas, industrial funding is easier to get for certain projects rather than others. However, these influences are not indispensable to organising science as distributed production. Nor do they inherently favour the collective advancement of science. They are, at best, neutral with respect to the overall efficiency of public knowledge production. Assuming that science is self-organised means

How does science organise itself? Does it self-organise in a way that allows or even secures optimality? Or does the self-organisation of distributed scientific labour prevent overall efficiency? These are the basic questions in considering the *collective rationality* of science. As long as the available talents and efforts go into occupations that are socially sub-optimal, resources will be wasted, as hard as the individual scientist may ever be working.

One may object that the measurement of efficiency, as necessary as it may seem for organising science rationally, cannot be applied operationally to scientific work. Efficiency concerns the output into which used resources are transformed. The output of scientific work consists of scientific information. How is one to define scientific information operationally? Scientific information is semantic in nature, which means that it must be understood before any measurement can be attempted. Information theoretic measures, by being applicable to syntactic information only, fall short of measuring scientific value. The output of scientific work, however, is the input of subsequent stages of knowledge production, which means that it can assume pragmatic value after being understood semantically. The pragmatic value of scientific information depends on the productivity it enhances when used as a means of production. Who, however, is competent to understand scientific information? Only those who themselves are working in the field. How do those working in the respective field express the value they attribute to the theorems, hypotheses and scientific facts they understand? The measuring rod of economic value is the preparedness of those interested in a particular item to pay for it. Yet, the output of scientific production is not sold for money, but published and thus delivered free of charge.

If the assessment of efficiency should turn out to be impossible without a comparison of inputs and outputs in terms of money prices, measurement of the economic performance of knowledge production is bound to fail. In this case, the question of whether there is a tendency towards efficiency in self-organised division of scientific labour would remain without answer.

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taking the claim of its autonomy seriously. The most clear-cut way of substantiating the autonomy of science is to show that it performs best when it is financed lump sum by the society making use of the knowledge produced. (Cf. Franck 2002, footnote 1.)

In order to get an answer we have to ask whether citation is free of cost. Even though scientific information is published and thus delivered free of charge, it must not be used as a means of production without acquiring a licence to do so. The licence is acquired by marking the information used as a citation. Hence, is this licence free of cost?

Acquiring the licence of using pre-processed information as a means of scientific production would be free of cost if curiosity were the only motive of doing science. Why bother who else makes use of my findings if it is only the progress of knowledge that matters? Things change, however, if we account for the fact that a piece of information assumes scientific value only if finding the attention of fellow scientists. Only the findings recognized in the scientific community count as scientific feats. Even the greatest discovery remains irrelevant matter if it does not attract the attention of other researchers working in the field.

Attention, accordingly, plays a two-fold role in scientific production. It features, firstly, as a scarce resource, as the energy economised by thought economy. It features, secondly, as an income remunerating successful research. The income of expert attention lies at the base of the reputation you enjoy as a scientist. It would be hard to find a scientist not caring of her or his reputation. Accordingly, income of attention is as important an incentive for doing science, as are the epistemic motives.

In terms of attention, citation is not free of cost. It means, rather, transfer of a part of the attention that the citing author earns for his or her work to the cited author. Citation thus tests the preparedness to pay on the part of the scientists looking for per-processed information as a means of production. Citation, moreover, tests the preparedness to pay on the part of those who are competent to understand and thus to judge the value of the information in question. The account of the citations a theory or a theorem earns measures how often it is used as a means of production, hence its productivity. By thus measuring productivity, the process of citation amounts to a measuring process of the pragmatic value of scientific information.

Even though it seems at first sight impossible to measure scientific information, we discover that there is a measurement of scientific output. Moreover, we face a regular market doing the job. The introduction of the open scientific literature can be seen as the emergence of a producer's market for scientific information. Scientists offer their own product as a means of production for subsequent stages of knowledge production. The product is sold not before its re-use is documented by way of citation.[6]

For the piece of information, being cited means to show to be productive. For the author, being cited means to earn attention. It is only through being amply cited that you can grow rich in terms of expert attention. On the other hand, there is nothing you can do better for the collective advancement of science than being productive in the eyes of those competent to judge the value of cognitive work. Hence, scientists are doing exactly what they are supposed to do when maximising citations in the way entrepreneurs maximise profits. The collective progress of knowledge is maximised in the eyes of those capable of judging it when the ruling motive of the working scientist is the maximisation of the attention he or she receives from his or her fellow scientists.

Scientific Communication: A Vanity Fair?

Strong appetite for attention is commonly called vanity. Since this appetite knows no organic limit or saturation it has an inbuilt tendency towards excessiveness. This tendency is that makes vanity have the connotation of excessive self-regard and overblown pride. However, it is in virtue of this

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[6] It may be even rational for the scientist to bear the money cost of publication by publishing her or his output in 'open access' media that offer it free of cost on the Internet. By thus enhancing accessibility on the part of potential users, the money costs born are an investment into the prospects of attention returns. We have to do thus with what in other contexts is called outlay on sales promotion.

tendency, too, that vanity proves an almost inexhaustible source of energy and a reliably strong motive for competition. Competitions for attention are called vanity fairs.

Scientific communication is not an exchange of information in the first place, but a well organised competition for attention. As a scientist, you cannot help to participate in this competition even though you may shy back from confessing that you work for the 'wage of fame'. Of course you do, unless your professional career has ended already in bitterness and resignation. And to be sure, there is competition in scientific communication, competition that would be irrational if the so-called communication were just an exchange of information. This competition, moreover, does deserve to be called a vanity fair even when accounting for the pejorative undertone in the meaning of vanity.[7] By being capable to address vanity even in its derogatory meaning, science has something to offer to the excessively ambitious and slightly megalomaniac. Might it not be that one or the other brilliant head lured away was by this offer from a better paid or a more power honoured career?

When describing scientific communication as a vanity fair, it suggests itself that we have to with a market not only, but with a shadow market also. It would be naïve to expect that professional pride in science is strong enough to simply exclude crooked tours. Why not build citation cartels, why not fake data, why not plagiarize, why not play off one's power as an editor or referee when it promises to pay in attention income? From a purely epistemic point of view, misconduct of these sorts is simply irrational. Since misconduct and downright crime are notorious in scientific communication, there must be non-epistemic motives prevailing. In a vanity fair, cheating will only vanish when it becomes too risky for the prestige that the competition is about. Crime is risky in science, to be sure. The risk of being detected depends, however, on the tightness of social control. Social control in markets is a question of competition. Social control is watertight under conditions only of so-called perfect competition. In reality, competition is never perfect, but strongly differing in effectiveness. In science, fortunately, competition grows the more effective, the more is at stake

[7] See Franck 1999.

regarding attention income. This means that social control grows with the temptations to unfair play.

Describing scientific communication as a vanity fair thus accounts for both its functional and dysfunctional roles. It accounts for the unleashing of productivity in early modernity and for the sustained high level since then. It provides evidence of a tendency towards efficiency that organises itself in the working of the knowledge industry by showing the catalyst that enables the self-organisation. The catalyst is the two-fold use of attention in both its property as the scarce resource energising intellectual effort and its property as a means of rewarding cognitive achievements.

Conclusion

In antiquity and the Middle Ages, there were eminent scientists – think, e.g. of a mathematician such as Euklid, a physician such as Archimedes or a logician such as Ockham – but there was no cultural leadership of science in those times. Both the world view and the life world prevailing were dominated by religion. It was only by the revolution that knowledge production underwent in the 16th and 17th centuries that science could grow into a rival to the established religious superpower. In this revolution, methodology played a crucial role, to be sure. It played this role for reasons of efficiency, however. Research is a resource consuming activity. Inefficient use of resources consumed by knowledge production is as detrimental to the collective advancement of knowledge as are deficiencies in method. Economic inefficiency even encompasses methodological inadequacy. Methods are inadequate if they tend to misallocate time and effort. The grand answer to the widespread misallocation of time and effort in artisan knowledge production was the overall industrialisation of science.

In an industry where cognitive work, on the individual level, is organised according to the rational method and where, on the collective level, the specialised lines of information production are re-integrated by competitive markets, a tendency towards overall efficiency is free to organise itself. It depends on circumstances, of course, how powerful this tendency can grow. Key conditions, however, are strong incentives and effective competition. Earning expert attention is a strong incentive indeed. It is an almost inexhaustible source of energy, it motivates enduring efforts and ample frustration tolerance, it is particularly well suited to attract brilliant heads. Strong incentives are functional in connection with social control. Social control is expensive and unpleasant when exerted by personal surveillance. It is cheap and much more agreeable when exerted implicitly in social exchange. That is why competition is a superior means of social control. Though far from perfect, competition on the market of scientific information is effective. It cannot strictly prevent plagiarism and downright fraud, but it ensures that violations are risky. Wherever there are markets, there are shadow markets as well. It depends on the proportions whether social control can be said to work. If you have an eye for proportions you should agree that social control works in scientific communication.

When describing science as a closed economy of attention, where scientists invest their own attention in order to get the attention of others, we face an industry where a tendency towards efficiency organises itself. It even seems safe to say that we face a social organisation that tends to allocate the attention it disposes of efficiently. The organisational goal of science is the collective advancement of knowledge. The advancement of knowledge cannot be measured from without science itself. It can be judged only from within. The crux regarding performance measurement in science is how those competent to judge are made to utter their considered judgement overtly. By the requirement that the use of foreign output as a means of one's own production is marked by citation, the preparedness to pay is queried on the part of those working in the field and thus competent to judge the value of the means of production. Citing means to transfer a part of the attention earned by one's work to the cited author. It is rational in the average to be honest in citing. If you cite too much you forego an income that is rightfully yours. If you cite too little you risk of being convicted of plagiarism. Hence, there is reason to assume that the judgement works reasonably from within.

Insofar as intelligence means the efficient use of one's attention, it seems even fair to attribute collective intelligence to the knowledge industry into which modern science has developed. It seams reasonable to assume that a self-organised tendency towards efficiency manifests itself in the scientific economy of attention. Assuming that such a tendency prevails does not mean to suppose that the overall efficiency of scientific production is particularly high. It rather means that cases of serious malfunctioning and gross misallocation are probably *not* due to the search for attention. Instead of being suspicious of the self-organised exchange of information for attention, we should focus on the ways science is financed and organised from outside when looking for remedies against its major defects.

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