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The Right Job and the Job Right: Novelty, Impact and Journal Stratification in Science

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Introduction

Looking backward, the old times of science are peopled with creative fellows such as the "renaissance man" (Jones, 2009), the "gentlemanly specialist" (Rudwick, 1985), the English "amateur scientist" (Shapin, 2008) or the French "savant". These celebrated characters seem to have gone for ever. Today is a time for communities of professional scientists strongly subsidized by the states and organized through formal peer reviewed vetting procedures for recruitment, funding and publishing. A time of "big science" (Price, 1963) whose outcomes still double every ten to twenty years (Price, 1961; Olesen Larsen and von Ins, 2010), with increasing team size (Jones, Wuchty and Uzzi, 2008) and rising specialization and knowledge complexity (Jones, 2009). Though such a massification and professionalization phenomenon is still contemporaneous, do scientific communities maintain their standards of creativity and originality, which are crucial dimensions of the *scientific ethos* (Merton, 1942)? Who performs new research in today's science, and does it still pay to support or to engage in newer research? Is it risky and which outlets are more likely to publish novel papers? The present paper provides answers to these core questions.

Many observers have recently expressed worries that originality and creativity could be under threat in science (Heinze et al., 2009). In particular, there is rising concern that the professional peer review procedures for funding and publishing are in fact not providing sufficient incentives to sustain innovative research. The peer review is often criticized for its bias against groundbreaking and innovative research (Braben, 2004; Chubin and Hackett, 1990; Wesseley, 1998). A number of scholars have suggested that academic audiences reject novel contributions when they diverge too much from the dominant canon (Trapido, 2015; Shadish et al., 1995). Kolata (2009) quotes a past acting director of the NIH who, after noting that the review system for grant proposals *"works over all pretty well, and is very good at ruling out bad things"*, makes the point that the *"system provides disincentives to funding really transformative research"*. Bias against novelty has also been discussed in other social contexts. In organizations, breaking with existing norms, rules or paradigms by introducing novel ideas creates tensions and paradoxes (Staw, 1995; Mueller, Melwani and Goncalo, 2012). Even in settings where novelty is depicted as a desirable outcome, employees may

decide to “play it safe” and avoid proposing novel ideas to prevent negative social evaluations from their peers (Yuan and Woodman, 2010; Mueller, Goncalo and Kamdar, 2011). As stated by Janssen (2003), novel ideas often challenge the established framework of task relationships by disrupting existing norms and routines, which is likely to be a source of peer conflict in organizations. Further, the uncertainty and questions about the practicality, usefulness and reproducibility of an idea increase with its degree of novelty (Amabile, 1996), thus making it more difficult for highly novel ideas to gain sufficient acceptance, resources and support to be effectively implemented (Baer, 2012).

From a welfare perspective, the social loss due to discouraging scholars from designing innovative research agendas could be very high. It is essentially due to the unexplored or delayed exploration of adjacent research areas (Carayol and Dalle, 2007) or “unconceived alternatives” (Stanford, 2015). As scholars benefit from large autonomy in the selection of research problems (Merton, 1957; Zuckerman, 1978; Ziman, 1987; Carayol and Dalle, 2007; Aghion, Dewatripont and Stein, 2008), that choice is also likely to be driven by its implications for the career path, as it affects the likelihood of getting funded, of being published quickly and in good journals, or of getting tenured. To preserve the individual incentives for undertaking novel research, scholars should be rewarded for the risks they take and the efforts they make toward developing innovative research agendas. Tolerance for early failure is also an important part of the equation (Manso, 2011). Scholars may overly refrain from addressing big and risky problems because of the inherent risks and/or insufficiently high expected rewards.

In this article, we propose a new measurement of novelty based on the frequency of pairwise combinations of author keywords that we apply to the ten million research articles published over 1999-2013 by journals indexed in the Web of Science (WoS). This allows us to document the expansion of scientific inquiry and whether science has kept sustaining its standards of creativity and originality. We look at the relation between team characteristics and novelty. Through several dimensions, we investigate the returns of novel research in terms of forward citations. A specific attention is devoted to the role of journals in the publication of novel research.

Main findings

We find that novelty is not declining in that period and that more novel articles are not likely to be performed with in closed walls, but are more often produced in larger teams that span more institutions and geographical regions. It turns out that novelty is a good predictor of citations, as it increases the probability of being a “big hit” by 42% and the number of citations by 37%. As this correlation is not counterbalanced by a higher risk, that is, a higher variance of citational outcomes of novel articles (provided that papers get published in a referenced journal), these results provide a systematic empirical grounding for agencies to fund research projects that are more novel and disruptive.

We show that science has common traits with finance and “beauty contests”, as publishing an article whose most novel dimension is still active in the following years significantly increases citations. A paper which has an “angle” that is new at the time of publication which itself is still active in the following years has its probability of becoming a citational “big hit” increased by 67% – and up to 72% in the hard sciences. However, there is no

complementarity between present novelty and future commonness, which are in fact positively correlated with each other and are partial substitutes in raising citations.

When we hold constant a number of co-variates, we obtain estimates that become closer to the citational returns on novelty at the individual level. We have found that the impact of novelty on citations remains, but decreases significantly. In particular, when we control for future commonness –as, in fact, it is positively correlated with both present novelty and citations– we find that the odds ratios of high novelty on "big hit" probability become pretty low. This suggests that, though the returns on novelty at the collective level are large, they may actually be very limited at the individual level. As our study does not consider the projects that did not lead to research articles published in referenced journals, and as at the same time, more novel articles are probably much more difficult and costly, thus the rewards for novelty net of their costs may be rather low, and potentially negative.

This raises major concerns about the implicit reward system of science to provide sufficient incentives for undertaking new projects. It also raises questions on why academic researchers engage in novel projects. In fact, we have discovered that engaging in novel research does not correspond to risk taking. The reverse rather holds: avoiding novelty increases risk, in particular the portion of risk which is caused by others no longer being interested in your work –and thus not citing it. In a rapidly changing environment like science, avoiding novelty puts agents at risk, not novelty. Novelty is reducing risk, not increasing it.

We have specifically investigated the role played by journals in novelty. We have used a distributional approach to document the varying role played by academic journals in novelty with respect to their stratification. We have discovered that top journals play a significant role in the publication of most novel articles. Highly novel articles are six times more likely to be published in top journals – and up to fourteen times more likely in the hard sciences and engineering. The publication premium offered by top-journals to novel paper goes significantly beyond what their quality standards should deliver. The role of top journals in publishing more novel articles is not due to a hidden effect of them attracting papers on "trendy" topics. Moreover, everything works as if the most novel papers benefit more (in terms of citations) from being published by top journals, potentially thanks to the higher informational value of passing their selection process. This suggests that a very interesting assortative matching process could be at play, in which highly reputed journals would match more frequently with newer articles as the signaling value of their peer reviews is larger.