



## Landmark article

# Science as collaborative knowledge generation

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The COVID-19 pandemic points to the need for scientists to pool their efforts in order to understand this disease and respond to the ensuing crisis. Other global challenges also require such scientific cooperation. Yet in academic institutions, reward structures and incentives are based on systems that primarily fuel the competition between (groups of) scientific researchers. Competition between individual researchers, research groups, research approaches, and scientific disciplines is seen as an important selection mechanism and driver of academic excellence. These expected benefits of competition have come to define the organizational culture in academia. There are clear indications that the overreliance on competitive models undermines cooperative exchanges that might lead to higher quality insights. This damages the well-being and productivity of individual researchers and impedes efforts towards collaborative knowledge generation. Insights from social and organizational psychology on the side effects of relying on performance targets, prioritizing the achievement of success over the avoidance of failure, and emphasizing self-interest and efficiency, clarify implicit mechanisms that may spoil valid attempts at transformation. The analysis presented here elucidates that a broader change in the academic culture is needed to truly benefit from current attempts to create more open and collaborative practices for cumulative knowledge generation.

In 2018, *Nature Human Behavior* published a focus issue on the ‘cooperative human’. Here, insights from a range of scientific disciplines were drawn together to highlight the biological, evolutionary, environmental, and cultural mechanisms that foster cooperation among humans as a social species (The cooperative human; see also <https://www.nature.com/collections/gvmywthghh>). The editorial argued that human societies cannot thrive or even survive global challenges without cooperation. It concluded that in the long run, selfish, and competitive behaviour may not be as logical or rewarding as is often thought. This is equally true for scientists and their communities. Clearly cooperative efforts are needed to understand and address the current COVID-19 pandemic and its far-reaching implications ranging from public health, to economy and politics. This is not different for other major societal challenges associated with global climate changes, interethnic conflicts, poverty, or mass migration. In all cases, development of constructive responses and effective policies requires collaboration between researchers and research groups, including those who represent different disciplines and are located in different

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institutions across the world (see also Keenan et al., 2012; Oey, Destefano, Brockbank, & Vul, 2020).

Granted, the current pandemic has sparked hopeful examples of cross-laboratory and cross-national scientific collaboration where information about characteristics of the virus, risk factors, and medical treatments were shared. The sense of urgency has prompted many researchers to pool their efforts in finding a resolution for this problem. At the same time, ambitions of individual politicians, national safety concerns, and commercial interests also prevent such free sharing of knowledge and resources as each party pressures ‘their’ scientists to be the first in finding a vaccine or antiviral therapy. Highlighting the ambition of ‘getting there first’ in a competitive endeavour thus also has its downsides and even raises concerns about the scientific quality of insights gathered under extreme time pressure. For example, in the spring of 2020, leading medical journal ‘The Lancet’ had to withdraw a study it had published on the effectiveness of Chloroquine as a possible treatment for patients with COVID-19. Only after the scientific community started expressing concerns about the reliability of the data that were reported, did the journal realize that they could not verify the actual existence of these data or check the accuracy of the analyses that were reported (see [https://www.thelancet.com/journals/lan/article/PIIS0140-6736\(20\)31324-6/fulltext](https://www.thelancet.com/journals/lan/article/PIIS0140-6736(20)31324-6/fulltext)).

The channelling of resources to areas of science where high profile breakthroughs are most likely to be expected raises additional concerns. This neglects the multi-faceted nature of many of the social issues that need to be addressed. Prioritizing medical and technical solutions to address large-scale social problems neglects the fact that successful implementation of such solutions only is possible by incorporating broader insights into human behaviour captured by the social sciences and humanities. For instance, the hopeful message that a working vaccine is within reach raises many new questions – relating to practical and technical aspects of its distribution as well as problems of moral choice and public trust. More generally, it has been argued that curbing the impact of COVID-19 pandemic on public health requires research on psychology and human behaviour covering a large variety of topics ranging from stress and coping, motivation and close relationships to political psychology, intergroup relations, and social inequality (Jetten, Reicher, Haslam, & Cruwys, 2020; Rosenfeld et al., 2020).

There are various indications that putting a premium on finding quick solutions has important side effects. First, it seems to elicit the (self-)selection of subgroups of researchers who can most easily make time available at short notice. This counters the likelihood that a broad representation of scholars contributes different perspectives and viewpoints to the debate. As an example, initial indications suggest that female researchers present in the field are underrepresented in research initiatives addressing the COVID-19 pandemic, due to their greater involvement in home schooling and caretaking responsibilities (Myers et al., 2020). For instance, in the ‘race for publication’ in the medical and health sciences during the spring of 2020, the ratio of female to male (co-) authors was significantly lower than during the same months of other years (Squazzoni et al., 2020). The relative absence of female researchers (co-)authoring studies on COVID-19 indicates a more general pattern that has been observed regardless of the number of women present in the field, for instance in economics as well as psychology (Amano-Patiño, Faraglia, Giannitsarou, & Hasna, 2020; Puthillam, 2020). This illustrates how competitive pressures can impact on visibility of researchers and productivity rates – in ways that are unrelated to the quality of their ideas.

Likewise, the competition for being the first to publish results on this topic may lead researchers to prioritize data collection among easily accessible populations (so-called

WEIRD samples; Henrich, Heine, & Norenzayan, 2010). For instance, examinations of the psychological impact of the worldwide COVID-19 pandemic focused on US populations in 70% of the research samples recruited (Puthillam, 2020; see also Rad, Martingano, & Ginges, 2018). Highlighting the competition of getting there first seems to be warranted by the urgency of problem to be solved. However, it also has these undesired side effects that call into question the high quality and long-term value of knowledge generated as well as the broader validity of the evidence-base for policy measures developed (Ruggeri et al., 2020).

The example of COVID-19 illustrates, on the one hand, that there is broad recognition of the importance of cooperation between different types of scientists, urging them to contribute their disciplinary views and research approaches, and to pool resources from multiple laboratories to address complex issues. On the other hand, it demonstrates that the primary basis for allocating resources and opportunities for research or to publicize research findings is the competition between individual scientists or between groups of researchers at most. Why is this the case, and what are the consequences? Does the reliance on competition to elicit high-quality research really promote scientific progress and excellence? Or might there be unintended or even perverse effects of competitive systems when these crowd out more cooperative aspects of knowledge accumulation, or even undermine the validity and impact of resulting insights?

The scarcity of resources for doing science makes it necessary to choose between ideas and scientists pursuing them, depending on their promise in progressing knowledge. However, in the philosophy of science, it is broadly acknowledged that improving the understanding of important phenomena not only depends on scientists competing with each other to develop the best ideas. Scientific progress also requires cooperation in sharing knowledge and building on each other's insights. The competition between theories and their predictions is useful when this helps design studies that might separate correct from incorrect interpretations. At the same time, cooperation is needed to define shared rules on how to conduct science and to benefit from the exchange of emerging insights for the advancement of knowledge. This requires a *balance* of system variables and incentives, in eliciting and sustaining cooperative as well as competitive efforts.

In this contribution, I argue that the current scientific reality is out of balance, because of its increasing reliance on competition as the model of choice – also when this is not relevant to the scientific debate, or even clearly inappropriate. Relying on competitive models for all tasks and contributions in science makes cooperation seem inefficient and irrational and impedes cumulative knowledge generation. Over the years, science institutions have increasingly highlighted competitive approaches to science, while denouncing more cooperative efforts. Theory and research in social and organizational psychology clarify how such characteristics of current institutional and incentive infrastructures communicate implicit assumptions about work motivation and high performance – also when these are unwarranted or even dysfunctional. The singular focus on competition as the key mechanism to motivate scientists neglects cooperative aspects of science that may be equally important. Recent efforts to transform science with initiatives aiming for open access to publications and data, methodological improvement, and diversity of knowledge generated, do not have the intended impact as long as the competitive climate and reward structure remain.

These insights are also relevant to the current 'crisis in psychology'. Research efforts and intellectual choices that are influenced by the prioritization of competitive concerns foster distrust about the motives and abilities of other researchers. As long as the underlying competitive research climate is not addressed, there is a risk that alternative

'solutions' (e.g. focusing on transparency, different statistics, public commitment to predictions) will only generate unproductive debates about right vs wrong ways of doing science that are likely to introduce new problems (see also Ellemers, Fiske, Abele, Koch, & Yzerbyt, 2020).

In the following sections, I first highlight that metaphors from sports and games are often used to characterize how scientific progress should be made. Reliance on these competitive narratives to create scientific institutions and reward structures neglects the importance of creating a context in which scientists can collaborate successfully. I then turn to theory and research from social and organizational psychology to elucidate that models of 'science as a sports contest' communicate implicit assumptions about human motivation and goal achievement that only capture part of the effort that is needed to achieve scientific excellence. Subsequently, I present evidence revealing that competitive systems used to define and reward research excellence do not result in better science. In fact, the singular focus on competition has been found to have harmful effects for individual researchers and undermines cumulative knowledge generation. Finally, I consider the problem that the competitive context and climate in science makes it difficult to benefit from new initiatives and attempts at transformation and improvement such as the movement towards open science.

### **Science as a sports competition**

University administrators, policymakers, and academic leaders often invoke sports and gaming metaphors. Presumably, this is intended to motivate researchers to invest their best efforts and not to give up. They emphasize the importance of 'getting there first' and admonish researchers they should do 'anything to win', explaining these requests by claiming that doing research is like competitive sports. This resonates with a broader tendency in public management to use market incentives and competitive systems to increase productivity and policy relevance (Gibson & Tesone, 2001; Hicks, 2012). Over time, the widespread use – and uncritical adoption – of such metaphors as adequate characterizations of academic reality impact upon the way key goals are shaped, as well as the implicit understanding academics develop of viable strategies to achieve these (Dasgupta & David, 1994). Portraying research progress in science as a competition between rivals implicitly signals that all is allowed to defeat others and winning is the only viable option (Hamington, 2009; see also Morgan, 1986).

#### ***Individual and system level costs of competition in science***

It is true that highlighting competition and rivalry can enhance effort and performance, for instance in sports (Pike, Kilduff, & Galinsky, 2018). Yet, there also is a downside to this. Even in sports, interpersonal competition undermines cooperative thinking and sharing of important information (Landkammer, Winter, Thiel, & Sassenberg, 2019). This is especially problematic where people need to work together in teams to address broader issues – as is the case in science (Heffernan, 2014). There are other drawbacks to the reliance on game/sports metaphors as a way to enhance motivation and prioritize a focus on important outcomes. It implicitly conveys that the added value of contributions to science is immediately visible and can be assessed unambiguously. Further, once a few winners have been declared this apparently implies that all others have lost, without allowing for the possibility that they make other types of contributions or excel in a

different way (Lamont, 2012). These implicit messages and assumptions are problematic because of the scientific context in which it is very difficult if not impossible to unambiguously define and measure performance excellence, especially when doing this across different domains of science (Lamont, 2009).

It should therefore not come as a surprise that a recent investigation reveals important drawbacks of highly competitive approaches to science (Welcome report, 2020). A survey among over 4,000 researchers located in different countries, combined with interviews among nearly 100 researchers in the UK, revealed that these researchers perceive the current competitive performance climate as undermining cooperation and cross-disciplinarity. A majority feels the high competition and lack of job security define aggressive work conditions in which bullying and harassment have become common experiences. Assessing research productivity by highlighting quantity instead of quality, combined with high pressure to demonstrate impact, stifles creativity, according to three-quarters of researchers examined in this study (Welcome report, 2020).

There are additional drawbacks of the increasing tendency to rationalize academic activities in terms of measurable outputs. One important side effect is that the system of allocating and accounting for research funding is becoming ever more complicated and burdensome, to the extent that costs may clearly outweigh benefits (Martin, 2011). The pressure to perform well in the provision of desired goods and 'selling' non-academic aspects of scientific ideas (e.g. to acquire external funding and highlight impact) raises tensions with ideals of scholarship and academic integrity where truth seeking should be the desired outcome (Chubb & Watermeyer, 2017). Thus, the focus on narrowly defined performance criteria easily undermines other key academic values that support novelty and intellectual diversity (Hicks, 2012).

Perhaps even more problematic is the evidence showing that the focus on workplace competition elicits a state of mind that invites unethical behaviour. Documented effects of induced rivalry include deception for self-gain, over-reporting of own performance, and the sabotage of co-workers (Duffy, Scott, Shaw, Tepper, & Aquino, 2012; Kilduff, Galinsky, Gallo, & Reade, 2016). In fact, situational pressures to compete have been found to overrule personal moral guidelines, resulting in rule violation and other forms of unethical behaviour that people would normally disapprove (Kilduff & Galinsky, 2017; Tzini & Jain, 2018; Vardi, 2001).

In science, researchers report that the pressure to publish and acquire funding is a cause of stress. This not only leads to increasing levels of anxiety and depression among young scholars, for instance revealed in *Nature's* annual PhD survey (Woolston, 2019). It also invites misconduct and lowers probability of detecting or reporting misbehaviour (Holtfreter, Reisig, Pratt, & Mays, 2019). Indeed, competition in science is seen as eliciting strategic game playing that prevents open sharing of information and methods. These are all factors that facilitate misconduct and violations of research integrity while undermining advancement of creative thinking and truth seeking (Anderson, Ronning, De Vries, & Martinson, 2007). Lack of access to important resources, lack of open communication, and pressure to publish or acquire external funding have been identified as aspects of competitive research climates that inhibit ethical research conduct (Martinson, Thrush, & Crain, 2013).

Thus, while competition in science is generally seen as a way to enhance efficiency and productivity in the use of scarce resources, it also has a dark side. Interviews with US scientists reveal this results in a lack of open sharing of information and research methods and other forms of careless or questionable research conduct. Competitive pressures also damage networks of knowledge exchange as these lead researchers to actively sabotage

the ability of others to use their work and to interfere with the process of peer-review (Anderson et al., 2007). Survey data suggest this is much broader than formal definitions of scientific misconduct that are contained to fabrication, falsification, or plagiarism. Researchers surveyed report on a range of undesirable behaviours which they see as directly related to competitive pressures – such as changing the design or results of a study in response to pressure from a funding source, inappropriate assignment of authorship credit, and inadequate record keeping (Martinson, Anderson, & De Vries, 2005). Other examples of ethically questionable behaviours invited by competitive pressures include inappropriate self-citations, the formation of citation networks, and strategic journal citation practices.

### **Competitive knowledge generation**

Many transformative discoveries in the history of science occurred without being prompted by competition (Fang & Casadevall, 2015). True discovery requires assurance of correct research procedures, which is easily undermined by publication pressures and incentives for productivity depending on research findings (Cunningham, Van Bavel, & Sommerville, 2020). In fact, an important drawback of using zero-sum competition as a scientific incentive is that it impedes resource sharing and creativity and can damage research integrity. Evidence obtained under controlled circumstances corroborates these concerns. For instance, an experiment examined how the introduction of a competitive context influenced the way in which individuals tried to solve a complex problem. Introducing a reward for being the first to offer a solution did not increase individual effort. Instead, this simply caused people to collect less information before offering their solution. Thus, the competition mainly caused them to rely on guesswork and reduced the accuracy of solutions offered (Tiokhin & Derex, 2019). Further, a study using an experimental game with multiple rounds found that cooperation was disrupted once performance rankings were introduced (Chambers & Baker, 2018).

To some extent, competition is inherent to the process of scientific discovery, where the value of ideas also depends on their priority. In the philosophy of science, this has been acknowledged as a factor that contributes to the ‘race for benefits and rewards’ that matches the sports metaphor (Strevens, 2003). At first sight, this may seem to elicit an efficient division of cognitive labour, where researchers diversify their efforts into different disciplines and sub-disciplines to pursue new discoveries (Kitcher, 1990). Unfortunately, the singular focus on new discoveries makes other key goals of science seem less relevant or valuable. The pressure to publish ‘original’ insights incentivizes each researcher or research group to carve out their own ‘theory’. Hence, researchers are implicitly discouraged from building on existing insights, for instance by investing time in replication studies with larger and more diverse samples to examine the robustness of new discoveries. Instead, they are prompted to ‘invent’ new phenomena, even if these are insights that have already been documented before or in other disciplines, resulting in the dispersion instead of the accumulation of knowledge (Ellemers, 2013).

Attempts to specify how progress in science is made highlight the importance of combining different strategies – instead of focusing on priority alone. A study modelling different ways to navigate the landscape of scientific inquiry found the best results were obtained when using a mix of different strategies, allowing for the division of research tasks. Populations where some individuals focused on discovering new territories while others filled in the details and examined the boundaries of new discoveries, were most efficient and successful (Weisberg & Muldoon, 2009). A system where only new

discoveries are rewarded, while efforts to build on or extend existing insights are devalued will not retain such a healthy mix of strategies where cognitive labour can be divided. Thus, cumulative knowledge generation requires a balance between competition for priority in exploring new theories, and cooperation in exploiting existing theories for their utility (De Langhe, 2014; Muldoon, 2013; Strevens, 2003).

### **Rewarding research excellence**

Academic evaluations and incentive systems hoping to identify and reward research excellence and productivity tend to focus on competition alone. Systems such as the UK Research Excellence Framework and the Australian Research Assessment are used to rank research groups, departments, and universities from best to worst, and assign research funding on this basis. The general aim of such systems is to offer more resources to individuals or institutions that 'perform' well, and to stimulate those who perform less well to increase their efforts. Notably such performance incentives are not only defined in relation to the scientific mission for education and research but also reflect government attempts to draw attention to specific policy issues or to enhance the innovativeness of national economies (Hicks, 2012). This practice leads many academic institutions to prioritize efforts and outcomes that can contribute to a higher position in this rank order as a valid goal in its own right. This is the case even when some criteria that are used capture policy relevance rather than research quality, while the metrics aiming to assess research quality may not be valid (e.g. Sivertsen, 2017).

Comparisons of different national systems that are used to award research funding based on ratings of scientific excellence do not reveal performance benefits of more competitive versus less competitive systems (Sivertsen, 2017). In fact, sources of competitive advantage can be quite peripheral to the quality of the researchers and departments examined. The realization of high scores may be facilitated by the amount of wealth accumulated by the institution, the way departments are clustered, or the types of publications that are assessed (Curran, 2008). Thus, instead of increasing excellence and productivity, competitive rewards and incentives systems mainly make people focus on particular types of activities, causing them to prioritize research that is likely to generate specific types of output. The reverse happens too, when those with positions of power in the academic system try to influence the design and choice of metrics used, working the system as a form of 'regulatory capture' (Martin & Whitley, 2010). Indeed, a study examining the revision of Italian and UK systems for research evaluation revealed that these transformations mainly led to increased organizational control rather than offering improved assessments of scholarly performance (Reborra & Turri, 2013).

An attempt to evaluate the merits of different procedures to allocate research funds compared the systems used in eight different countries. These differed significantly in their level of competitiveness (defined by the extent of reliance on external funding and the focus on output in allocating research funds). In this comparison, the UK emerged as exceptionally competitive in its focus on output and external funding for instance compared to Australia or Germany. However, these system features were not demonstrably related to higher efficiency and productivity in terms of scientific publications (Auranen & Nieminen, 2010). In fact, a more recent comparison found that the relation between input (funding awarded) and output (highly cited research publications) is actually less favourable in countries that have highly competitive systems for the allocation of research funds than in less competitive national systems (Sandström & Van den Besselaar, 2018).

In sum, there is very little evidence if any that the singular focus on competition as a way to achieve excellence accelerates scientific progress or leads to higher quality insights. At the same time, there are ample indications that systems set up to compare and rank the performance of researchers do more harm than good. In fact, those favouring sports metaphors as a suitable models to enhance scientific achievement seem to ignore that high stakes competitions in professional sports also resulted in severe problems such as doping, match fixing, and general corruption. Even in amateur sports and children's leagues, win/lose competitions are known to induce foul play, hostility against opponents, and violence against volunteer referees, all stemming from the desire to win.

### **Competitive organizational climates**

The widespread competitive structures implemented to invite and reward research productivity and scientific excellence are built on a particular conception of human motivation. As is the case in other types of organizations, performance incentives and control mechanisms implicitly reflect very specific lay theories about what increases people's efforts and performance. Common assumptions are (a) that people should be rewarded for specific outcomes to make them work hard, (b) that the achievement of success should be prioritized over the avoidance of failure, and (c) that a focus on self-interest and efficiency benefits high performance. Three related strands of theory and research from social and organizational psychology offer a different perspective on these common beliefs and reveal known pitfalls of motivational structures built around such beliefs.

### **Using performance targets and rewards**

The use of performance targets is an effective way to help people set specific goals and understand what they need to do to achieve these goals (Latham & Pinder, 2005). Monitoring progress towards concrete goals motivates people to invest the appropriate amount of effort, to decide between different options to pursue, and to persist in the face of adversity (Pinder, 1998). However, specified performance targets (e.g. SMART goals) typically do not capture the full range of efforts that is needed for complex professional tasks. In specifying desired outcomes, practical considerations easily result in a situation where quantitative goals are prioritized over qualitative goals. Assessing qualitative goals (e.g. teaching quality, importance of research) with quantitative measures (e.g. student evaluations, impact factors) is notoriously difficult and is easily biased by irrelevant criteria or incidental circumstances – such as teacher demographics (e.g. Hoorens, Dekkers, & De Schrijver, 2020). Further, to the extent that people are primarily assessed and rewarded for their personal achievements, this undermines their motivation to invest effort in the collaboration with others (Ellemers, De Gilder, & Haslam, 2004). Finally, it usually is easier to specify and reward people's performance in the task domain (their achievements and outcomes), than to assess and evaluate their efforts and contributions in the relational domain (the nature and contribution of their social interactions). Thus, in principle, the use of performance targets can benefit individual effort and research excellence. However, the requirement that set goals are achieved (realizing a specific number of publications, or obtaining a particular type of grant) to acquire indispensable outcomes (tenure, research opportunities) introduces the risk that other important activities and outcomes that are not incentivized in the same way (research collaboration, good

relations with students and subordinates) are neglected. In fact, the mere act of setting achievement goals can prompt people to loosen their moral standards and invites unethical behaviour (Ordóñez & Welsh, 2015; Schweitzer, Ordóñez, & Douma, 2004).

### ***Prioritizing achievement of success over avoidance of failure***

The nature of the goals that are set and rewarded also influence the strategies people adopt to achieve these goals. By definition, doing scientific research requires creative thinking and the development of innovative solutions. In such a performance context in particular, a balance is needed between developing high-risk new ideas on the one hand and implementing careful checks and controls on the other hand. True innovations are characterized not only by their novelty (offering proof of principle), but also by their feasibility and robustness (testing boundary conditions and applied value; Benner & Tushman, 2002). In practice, however, being the first to come up with a new idea or method makes it easier to stand out and be noticed than spending time to run checks and controls or in testing the broader validity and use of these new ideas and methods. This maps on to the well-known distinction between promotion and prevention strategies for self-regulation, specified by regulatory focus theory (Higgins, 1997, 1998; Molden, Lee, & Higgins, 2008). Highlighting the achievement of important goals and ideals activates a promotion focus, where people are prepared to take risks and experience happiness when they are successful. Emphasizing that negative outcomes should be avoided activates a prevention focus in which people experience stress and anxiety when considering possible risks and failures, causing them to prioritize safety and security (Brockner & Higgins, 2001; Higgins, 2001; Higgins, Shah, & Friedman, 1997). In organizations, the achievement of desired outcomes and end-states that are associated with promotion goals offers opportunities to stand out from others and demonstrate one's potential. Such achievements typically are more visible, celebrated, and rewarded than the successful avoidance of risks and failures. However, the focus on valued outcomes instead of careful procedures discourages people from helping each other and invites them to do 'anything' for success (see also Van Yperen, Hamstra, & Van der Klauw, 2011). Under these conditions, those who make an effort to find and address potential problems run the risk of being under-appreciated or even ignored, especially when they succeed in preventing or averting failures every time. Assigning these responsibilities to specific individuals responsible for quality management or rule compliance is a favoured solution in many organizations. However, it is unlikely to be effective when they are seen as delaying progress towards desired goals, and can even backfire as it seemingly absolves others from the burden of considering possible risks or failures (Pernell, Jung, & Dobbin, 2017). Here, the pitfall is that the balance is lost when too much emphasis is placed on successful achievements rather than safety and security – making novelty and risk-seeking seem sexy while securing continuity or high quality seems dull. Yet, task assignments and incentives that prioritize creativity and productivity over security and safety elicit a focus on promotion among all team members, which has been found to result in the acceptance of incorrect solutions for joint problems (Faddegon, Scheepers, & Ellemers, 2008, 2009).

### ***Focusing on self-interest and efficiency***

Goals and strategies that characterize the way people typically go about their work in an organization can be captured in different types of work climates (Victor & Cullen, 1988; see also Cullen, Victor, & Bronson, 1993; Martin & Cullen, 2006). Theory and research in

this area characterize a so-called instrumental work climate as comprising competitive relations between individuals that invite a focus on self-interest, profit, and efficiency. This is distinct from a work climate that emphasizes care for others and good relations with different stakeholders, as well as a climate that prioritizes procedures and rule adherence. Instrumental work climates indicate a focus on high performance and productivity and have been found to be present in many organizations. However, there are also important downsides to such a work climate. It has a negative impact on work satisfaction, commitment, and other relevant work attitudes, prompting people to look away from problems (Carr, Schmidt, Ford, & Deshon, 2003; Kaptein, 2011; Wang & Hsieh, 2013). Such a climate has been found to overrule personal moral norms and undermine ethical intentions of business people as well as public servants (Gorsira, Steg, Denkers, & Huisman, 2018; Pagliaro, Presti, Barattucci, Giannella, & Barreto, 2018). Across different types of job types, organizations, and cultural contexts, instrumental work climates are associated with rule breaking and misconduct, including lying, stealing, bribery, the falsification of reports, the provision of incorrect performance statements, sabotaging co-workers, and bullying (Simha & Cullen, 2012; Wimbush Shepard, & Markham, 1997; for a review see: Newman, Round, Bhattacharya, & Roy, 2017). In fact, investigations into origins of unethical work behaviours point to factors in the work environment rather than individual-level causes, such as personality factors or adherence to moral principles (Deshpande, George, & Joseph, 2000; Kish-Gephart, Harrison, & Treviño, 2010). Thus, an organizational climate that visibly invites and rewards efficiency in achieving desired outcomes while only paying lip service to the importance of caring for others and rule adherence undermines the work attitudes of its employees and jeopardizes the ethical conduct of organizational members. Citing the title of a publication that has become a classic in the management literature, this is ‘the folly of rewarding A, while hoping for B’ (Kerr, 1975).

In sum, theory and research on goal setting highlight that common procedures used to motivate people to perform well and assess their progress, may unwittingly prioritize quantity over quality, and neglect people’s efforts to optimize interpersonal relations in the workplace while focusing on their task achievements alone. Further insights on different foci in self-regulation clarify that celebrating novelty and prioritizing the achievement of success makes it less attractive for people to invest in the mitigation of risks and prevention of failures. Research on different types of organizational climates further integrates these insights and highlights that an instrumental focus on efficiency in outcome achievement damages important work attitudes and implicitly signals lesser concern for rules and procedures. Yet as we have seen, universities are increasingly becoming such instrumental work environments.

Together, these strands of research attest to the impact of situational cues and organizational demands in steering the nature of people’s efforts and achievements in the workplace. The way goals are set, as well as the types of outcomes that are assessed and rewarded characterize the atmosphere in which people are expected to work together. What seem worthwhile achievements – that can help achieve career success? Which team roles are respected, who are favoured role models, and how do they behave? Which outcomes are rewarded by the organization, and how does this speak to the value attached to quality of work, relations with others, or long-term impact? Research convincingly shows that people’s everyday workplace observations in finding answers to questions such as these overrule individual dispositions, work attitudes, and ethical standards. Thus, the way we organize, define, and reward research efforts has far-reaching implications for

individual researchers, that impact on a range of key outcomes on the team, organizational, and system level.

### **How to transform science?**

Shared frustrations and concerns about competitive aspects of academic systems and their undesired effects have prompted several initiatives to transform current practices in science. Well-known and influential movements include the Open Science Framework (<https://osf.io/>), and the Declaration on Research Assessment (<https://sfedora.org/>). The key mission of the Open Science Framework is to increase openness, integrity, and reproducibility of scientific methods and findings (see also Nosek & Bar-Anan, 2012; Nosek, Spies, & Motyl, 2012). The core aim of the Declaration on Research Assessment is to improve the ways in which outputs of scholarly research are evaluated. Initiatives such as these offer concrete ways to change the infrastructure and business models for scholarly communication. They do this, for instance, by promoting the sharing of research methods and data and by defining performance standards that highlight the quality and societal impact of research outcomes rather than priority of new discoveries or quantitative productivity.

The common ideal such initiatives hope to achieve is to facilitate the cooperation between scientists and to enhance the added value of scientific findings. Unfortunately, the impact of these initiatives is limited by the endurance of performance incentives that reward novelty and successes over robustness and avoidance of failure. As long as the competitive climate focusing on efficiency in the achievement of instrumental outcomes persists, praiseworthy attempts to introduce cooperative systems and alternative performance criteria are likely to have unintended and sometimes perverse effects.

### **Open access publication**

A first transformation suffering from unintended effects is the movement towards offering broad access to published scientific findings. The aim to prevent copyrights of results obtained with public funds to be owned and exploited by commercial publishing companies is widely supported. Nowadays, researchers are requested to make their findings openly accessible to the general public, for instance by national and European funding bodies supporting their research (<https://ec.europa.eu/research/openscience/index.cfm>). A well-known initiative is cOAlition-S, requiring all research that is funded by public grants to be published in Open Access journals or platforms, from 2021 onwards (<https://www.coalition-s.org>).

Unfortunately, to some extent the changes that have been made so far have simply prompted the development of new business models. Publication fees requested by open access journals amount to millions of dollars, paid from public funds distributed by research funders (Moher et al., 2017). Ideally, these payments should cover the costs of production and distribution incurred to allow such journals to exist. However, the movement towards open access has also shifted journal payments from university libraries and institutional representatives to the responsibility of individual researchers.

An example of a perverse side effect is the increasing proliferation of so-called 'predatory' open access journals. This term is used for journals that solicit publications by misleading authors, for instance because they are actually non-existent, or do not uphold common standards for assessing research quality through peer review (Grudniewicz,

Moher, Coby, Moher, & Cobey, 2019; Moher et al., 2017). Some of these commercial initiatives are easy to recognize, for instance when journal representatives aggressively solicit (paid) publications from researchers, even those working in areas not covered by their titles. Others are more difficult to discern from legitimate open access journals. Yet such publications harm the development of cumulative scientific insights in different ways. They mislead the general public by allegedly documenting findings that have not passed the scrutiny of peer review. They allocate public funds meant for research to private business, and they offer apparent evidence for productivity without implementing checks for scientific quality or adherence to ethics guidelines.

Attempts to prevent the abuse of open access publication policies include the development of elaborate author guides. Further, multiple checklists are available to distinguish legitimate from predatory open access journals. The difficulty of making these distinctions offers another business opportunity, where commercial parties request payment for the access to such lists. A recent attempt of 43 expert participants from 10 countries aiming to reach consensus about predatory publications in the biomedical sciences came to the conclusion that even within this specific research area there is 'no list to rule them all' (Grudniewicz et al., 2019). Despite the praiseworthy reasons to promote open access publishing, these drawbacks represent another source of ambiguity to monitor, the burden for which is currently placed on individual researchers.

### **Alternative metrics**

The next challenge relates to the transformation of competitive performance incentives. These include the use of journal impact factors and author citation scores (such as the H-factor) as a way to evaluate and compare individual researchers or groups of scientists in the context of hiring, promotion, and funding decisions. Key concerns reducing the confidence in the use of such proxies is that they are not transparent, their values tend to be field specific, and they can be manipulated relatively easily (Larivière & Sugimoto, 2019). Thus, efforts have been made to find other indicators to more reliably distinguish between the quality and added value of insights offered by particular studies or research strands. This is one of the stated goals of the UK Research Excellence Framework, hoping to assess the economic, social, and cultural impact of scientific research.

Unfortunately, here too the inherently competitive context in which the search for alternative criteria takes place spoils valid attempts at reform. The high stakes invite dissent and debate about what impact means and how to reliably assess this (Penfield, Baker, Scoble, & Wykes, 2014). The use of narrative case studies to illustrate the impact of scientific studies has been criticized because this does not provide 'hard' evidence and typically does not assess how the contribution from science compares against other sources of information (Khazragui & Hudson, 2015). Further, explanations of the added value of research are considered inadequate because these mainly focus on other academics, instead of addressing members of the general public (Pelley, 2020). Finally, it has been noted that the tools and operationalizations offered to assess the broader impact of scientific studies can be strategically used by researchers (Smith, Ward, & House, 2011).

Likewise, the awareness that evaluations of research significance and impact will be used to determine competitive rankings and allocation of resources makes it very difficult to develop new indicators for the value of specific publications that do not suffer from deficiencies of the journal impact factor or the H-factor. For instance, 'Altmetrics' is promoted as a user-friendly and graphically attractive way to capture and portray online attention for research publications in colourful 'badges' (<https://www.altmetric.com/>).

This offers more immediate and continually updated feedback on the extent to which results of particular studies are mentioned in online news outlets, tweets, and blogs. The metric claims to be more nuanced than citation counts, as it indicates the attention, dissemination, and influence of particular findings. Unfortunately, this new indicator of significance and impact also suffers from some of the same issues that plague traditional journal impact factor scores. Here too, the scores are offered by a commercial enterprise that seeks to solicit paid subscriptions to their licensed services. However, the company does not provide transparent evidence on the normalization, reliability, validity, and meaning of the indicators they publish. Further, there are legitimate questions about the data quality of Altmetrics scores, which can be manipulated for instance by robots generating online references to particular studies (Bornmann, 2014; Williams, 2017). Attempts to validate the use of Altmetrics – for instance in the context of data sets generated for the UK Research Excellence Framework – reveal that Altmetrics scores do not correlate with expert evaluations of impact made by reviewers (Bornmann, Haunschild, & Adams, 2019). Thus, claims that this offers a superior way to assess research dissemination and impact so far are not substantiated by data.

### **Replicability efforts**

An important aim of the Open Science Framework is to reduce ‘false effects’ reported in the literature, due to the pressure to publish novel and positive results. Efforts to achieve more open sharing and communication about research methods and findings aim to curb the impact of such perverse publication incentives (Nosek & Bar-Anan, 2012; Nosek et al., 2012). In the past years, concrete steps have been taken towards broader sharing of research data, following recommendations made for instance by the European Association of Research Libraries to make data FAIR: Findable, Accessible, Interoperable, and Reusable (Wilkinson et al., 2016). However, these initiatives also suffer from the competitive climate in science.

In this context, the ‘reproducibility initiative’ in psychology has attracted considerable attention (<https://osf.io/ezcuj/>). The most well-known outcome of this initiative probably is the much publicized effort to replicate results from 100 experiments that had been published in high impact journals in psychology (Aarts, et al., 2015). The disappointing results of this initiative have led to lively debates about possible explanations for the lack of robustness of the initially reported findings (e.g. Bakker, Van Dijk, & Wicherts, 2012; see also the National Academies of Sciences, Medicine, & Engineering, 2019).

These efforts to improve the reproducibility of research findings offer another example where competitive pressures frustrate the scholarly debate. The development of additional guidelines that should prevent inappropriate use and reporting of statistics easily invites the suspicion that study results that are not replicated can only indicate false positives (e.g. Simmons, Nelson, & Simonsohn, 2012; Wicherts et al., 2016). Optimizing statistical reliability of observed effects by conducting direct replications with large samples may be of interest when aiming to obtain accurate estimations of specific effect sizes. However, if the goal is to investigate broader implications and reliability of previously reported effects, a conceptual replication might be more informative (Wilson, Harris, & Wixted, 2020).

This points to the importance of combining explorative and exploitative strategies for scientific inquiry (De Langhe, 2014; Muldoon, 2013; Strevens, 2003), where the replicability of specific experimental *procedures* can be considered independently from the validity and robustness of the *phenomena* examined. Indeed, such a separation may

account for some highly publicized ‘replication failures’ (such as the ‘marshmallow test’ and the ‘ego-depletion’ effect), where recent evidence reveals that the phenomenon still stands, even if the explanatory mechanism is different from what was initially thought (Lin, Saunders, Friese, Evans, & Inzlicht, 2020; Michaelson & Munakata, 2020). Highlighting the competition for priority causes ‘replication failures’ to be seen as undermining the validity of new discoveries that were reported. This viewpoint neglects the possibility that emerging insights into robustness, boundary conditions, and key moderators of previous observations can contribute just as well to scientific knowledge generation.

Indeed, false-negative replications may occur just as well as false-positive results. Legitimate choices made in developing specific research procedures introduce replicator degrees of freedom (Bryan, Yeager, & O’Brien, 2019). Transparency about methods and procedures used does not preclude that some of this information is lacking even from detailed research reports, for instance because of lack of insight in the importance of some situational demands, contextual factors, or boundary conditions that may turn out to be relevant to the study (Klein et al., 2012; Pettigrew, 2018; Walton & Yeager, 2020). These may include relatively subtle and not immediately obvious conditions, that may nevertheless have far-reaching effects for study results, such as research staff demographics (Does et al., 2018).

Hence, it has been noted that especially in psychology and the social sciences, shifts in findings due to social and cultural changes do not necessarily indicate replication failures (Greenfield, 2017; Van Bavel, Mende-Siedlecki, Brady, & Reinero, 2016). Why is it a problem that evidence of biased treatment of racial minorities in the USA cannot be ‘replicated’ when examining bias against religious minorities in Europe? In fact, attempts to standardize responses as a way to optimize replicability have been found to invite the use of artificial research paradigms that limit the range of research questions examined, as well as the richness of responses assessed. Further, the call for the use of larger sample sizes to optimize statistical reliability has resulted in greater reliance on online data collection and self-report measures – at the expense of external validity obtained by including ‘richer’ but more messy observations of real behaviours and social interactions (Sassenberg & Ditrich, 2019; see also Baumeister, Vohs, & Funder, 2007). While this may benefit replicability, it also limits the practical applicability of research findings, for instance when it prompts researchers to examine responses only to ‘raceless genderless strangers’ (Hester & Gray, 2020). Likewise, the persistence in mostly testing predictions among Western, Educated, Industrialized, Rich, and Democratic (WEIRD) populations can help to standardize research procedures but does not benefit further insight into which of these predictions might generalize to other cultures and samples (Rad et al., 2018).

Thus, there are obvious benefits of recent developments in enhancing the transparency, replicability, and robustness of research findings (Nelson, Simmons, & Simonsohn, 2018). Yet the strong focus on replicability and consistency easily induces neglect of other important research goals and data properties that may be equally important, such as discovery, validity (internal, external, construct), consequentiality, and cumulativeness (Finkel, Eastwick, & Reis, 2017; Hussey & Huges, 2020). In fact, ambitions to find methodological solutions to address replicability issues have resulted in behavioural and institutional changes suggesting that exploratory projects demonstrate poor statistical practice. Yet for some of these methodological innovations precise definitions of underlying concepts (e.g. reproducibility rate), as well as careful documentation of their assumptions and limitations are lacking. The impact of such methodological innovations

therefore does not necessarily represent scientific progress and may actually be counterproductive (Devezer, Navarro, Vandekerckhove, & Buzbas, 2020).

In sum, it is difficult to benefit from attempts to improve scientific procedures and to introduce more open and cumulative knowledge sharing as long as the overall academic incentive structure continues to rely on dysfunctional models (LeBel, Campbell, & Loving, 2017). The impact of making such changes mainly seems to shift the attention to other incentives and competitive outcomes. As long as the highly competitive reward system and academic climate remain unchanged, valid attempts at transforming publication practices, indicators of scientific impact, and quality of research conducted only introduce new sets of perverse incentives and competitive struggles. Without broader system and culture changes, transformation attempts may only reinforce existing concerns instead of resolving them (Sousa & Brennan, 2014).

### **Cooperating in a competitive system**

In the rigorous up-or-out university tenure systems, from the very beginning of their career young researchers are socialized to compete with each other for research and travel funds, access to conferences, publication of their work, and of course jobs. Given the ratio of active researchers versus the available resources for doing science, simply being competent, productive, and committed is not enough to succeed. People are continually reminded that their decisions about research topics to pursue, methods to use, and outlets to seek should optimize their chances of ‘winning’ the competition for scarce resources and job openings. They are trained to highlight the novelty of their insights, to demonstrate superior research productivity, to express confidence in their ideas, and to overstate their abilities rather than expressing their doubts and revealing difficulties they encounter.

Potential ‘costs’ of this system have been acknowledged by many. These focus especially on the physical and mental well-being of individual researchers, pointing to the high work pressure, uncertain career prospects, and sacrifices made in the personal domain. Further, the tension between research and academic teaching assignments in terms of available time, resources, and rewards, are highlighted every time university funding and staffing decisions are made. Yet, these tend to be seen as inevitable and hence acceptable costs in the competition for research excellence. However, the costs of maintaining this competitive system may be higher than that.

### **Discouraging diversity**

Attracting and rewarding people who adopt a competitive and outcome-oriented approach to doing science discourages collaborative efforts. It deters those who prefer a more cooperative and caring work environment, including many women (Ambrose, Aranaud, & Schminke, 2008; Callister, 2006; Deshpande, 1996; Sims & Keon, 1997; Wang & Hsieh, 2013). This represents a loss of diversity and a different perspective on doing science that might benefit creativity and innovation (Ellemers & Jetten, 2013; Jetten & Hornsey, 2014). The high pressure on individual researchers to ‘fit in or opt out’ of such a competitive system is also seen as a factor contributing to uncivil workplace behaviour and bullying in academia (Devlin & Marsh, 2018; Keashly & Neuman, 2013). In general, the most committed and conscientious workers are especially likely to suffer from uncivil

conduct, causing them to be the first to leave the organization (Kabat-Farr, Cortina, & Marchiondo, 2018; Taylor, Bedeian, Cole, & Zhang, 2014).

Such mechanisms undermine diversity and work climate change, as documented in a recent survey among nearly 4000 academics in the Netherlands (Van Veelen & Derks, 2020). These respondents characterized the stereotype of a successful researcher as being competitive, self-focused, and self-confident. Young female academics in particular reported lack of fit of their self-views with this model of academic success. As a result, they indicated low engagement with their work and career. The realization that their self-views did not fit the stereotype of a competitive academic also caused them to report more stress and higher intentions to leave academia. If being competitive and self-focused is such an important factor in the (self-)selection of academics, this makes it less likely that alternative contributions to science, relating to team-orientedness, teaching quality, and collegiality are valued and retained.

### **Undermining trust**

Studies in organizations reveal that the exchange of key resources and knowledge needed for innovations crucially depends on levels of trust between workers from different units (De Jong, Dirks, & Gillespie, 2016; Shazi, Gillespie, & Steen, 2015; Tsai & Ghoshal, 1998). Task roles, organizational structures, and power differences all can prevent people from adequately communicating their expertise when this is relevant or sharing their knowledge when it is needed (Sutcliffe, Lewton, & Rosenthal, 2004). Continually pitting individuals, research groups, and disciplines against each other impedes the formation of trust. Instead, it encourages people to adopt and maintain an 'us' versus 'them' mentality. This is a known factor to undermine knowledge sharing across group boundaries while people focus their efforts on protecting and caring for others inside the group (Blader, Patil, & Packer, 2017; Conroy, Henle, Shore, & Stelman, 2017; Stachowicz-Stanusch, & Simha, 2013). It also explains the limited success of attempts at transformation and reform in academia. As long as these negative side effects of the competitive university system are not taken into account, the introduction of alternative considerations and criteria only shifts the competition towards the pursuit of new incentives.

Emphasizing competitive intergroup comparisons can contribute to the persistence of outdated or questionable practices, especially when these seem to distinguish the group from other groups (Ashforth & Anand, 2003; Gino, Ayal, & Ariely, 2009; O'Fallon & Butterfield, 2012). Loyalty to the group, and efforts to protect the group's reputation against external critique can lead people to condone or look away from questionable practices (Leavitt & Sluss, 2015; Pulfrey & Butera, 2013; Pulfrey, Durussel, & Butera, 2018; Umphress, Bingham, & Mitchell, 2010). At the same time, this makes people resistant to outside critique as they distrust the competence as well as the motives of outsiders who 'just don't understand' (Campbell & Göritz, 2014; Esposito, Hornsey, & Spoor, 2013; Hornsey & Esposito, 2009; Hornsey & Imani, 2004). Couching such critique in terms of 'right' versus 'wrong' ways of doing science would seem to instil the urgency of changes that are needed. However, in practice, this will only make things worse, as people generally try to avoid acknowledging their moral failures (Ellemers, 2017). Instead, such critique only increases self-justifying and defensive responses that feed intergroup conflict, instead of motivating people to change (Ellemers & Van der Toorn, 2015; Petriglieri, 2011; Sun & Goodwin, 2020). For other reasons too, right versus wrong rhetoric may not always be appropriate in such discussions. Often it is not so easy to define one best way of doing research, because optimizing some research aspects (standardizing

for replicability) leads to suboptimal choices for other aspects (e.g. diversity of research methods and questions), as we have seen above. In fact, in a competitive environment, eagerness in proclaiming that scholars, research groups, or disciplines use deficient methods and approaches can cause even legitimate concerns to be dismissed as representing just another strategy to win the competition.

### ***Frustrating cross-disciplinary collaboration***

Collaborating with scholars who represent different research traditions, and working together in multidisciplinary teams and consortia, is only possible when people can see the value of using multiple methods, measures, and samples to investigate issues that are of theoretical and practical importance (e.g. Pärnamets, Shuster, Reinero, & Van Bavel, 2020). In a competitive system, it is more difficult to adopt such a view and to use scholarly disagreement in a productive way. Questioning the validity of people's key values – by emphasizing that some approaches are inherently superior to others – generally makes it more difficult to work towards a mutually acceptable solution (Harinck & Ellemers, 2014; Harinck, Ellemers, Scheepers, & Kouzakova, 2018; Kouzakova, Ellemers, Harinck, & Scheepers, 2012; Kouzakova, Harinck, Ellemers, & Scheepers, 2014). Focusing on shared ideals and goals to pursue makes it easier for people to embrace and work towards change and improvement (Does, Derks, & Ellemers, 2011; Does, Derks, Ellemers, & Scheepers, 2012; Van der Toorn, Ellemers, & Doosje, 2015). For instance, instead of emphasizing weaknesses in common ways of conducting and reporting research statistics, it seems more constructive and encouraging to illuminate concrete steps towards responsible data analysis (Fife, 2020).

Aiming to resolve conflicting views by gathering research data highlights another problem in fostering collaborative knowledge generation. The ambition to specify the 'best' methodologies, measures, and statistics to test particular predictions against each other detracts from attempts towards cumulative theory building and initiatives to creatively bridge different areas of science (Ellemers, 2013; Fiedler, 2018; Muthukrishna & Henrich, 2019; Van Lange, 2006). Collaboration between theoretical and empirical adversaries is rare (Kahneman, 2003). Yet some examples show it is possible to create extended and programmatic collaborative efforts between multiple laboratories, that yield novel insights and contribute to theoretical integration and advancement of robust findings (e.g. Abele-Brehm, Ellemers, Fiske, Koch, & Yzerbyt, in press; Cowan et al., 2020; Koch, Yzerbyt, Abele, Ellemers, & Fiske, in press; Park et al., 2009; see also Tierney, 2009).

Unfortunately, such efforts are by no means self-evident. Their success crucially depends on the willingness of researchers to extend respect for each other's competence and to trust each others' good intentions. Specific guidelines to achieve this can be derived from theory and research on negotiation and conflict management. Committing to such rules may imply, for instance, that collaborators decide to accept each other's published evidence – which may reflect different research traditions. Expressing curiosity about possible explanations for diverging results – instead of distrusting the validity of published findings – makes it possible to generate new predictions about likely moderators (Ellemers et al., 2020). Doing this successfully requires an openness to new ideas rather than a focus on the achievement of specifically prescribed outcomes. In larger interdisciplinary projects, there may be a need for people who are able to perform the role of intermediary in such exchanges. This has been equated to the construction of 'trading zones' where scientists can rely on each others' input and expertise, even if they cannot fully understand or what this entails (Muldoon, 2013).

New discoveries in science do not depend on incentives for productivity and impact. Setting up competitions between scientists, disciplines, departments, and universities (and bickering about who gets credit for what) is not the way forward. Instead, productivity and impact result from high-quality research that is driven by intrinsic motivation towards knowledge generation and the desire to address societal problems shared by many academic researchers. Why not highlight these intrinsic sources of commitment and satisfaction by creating a context that supports scientific discovery and basic research? Offering basic security about work conditions and research facilities frees researchers from competing to survive and allows them to collaborate towards cumulative knowledge generation.

## Conclusion

Competitive models and incentives are widely used as a means to enhance productivity in science. However, science is a public good that might be better supported by emphasizing altruistic and ethical outcomes rather than quantitative output (Edwards & Roy, 2017). Encouraging collaborative knowledge generation may require that academic leaders and policymakers refrain from invoking extrinsic rewards and incentivized goals. Instead of increasing the motivation of researchers, these may mainly create an instrumental climate. Examining the validity of competing ideas requires a more careful construction of social and organizational conditions that allow for an open exchange of knowledge, where a diverse array of researchers, skills, and disciplinary insights benefit the context of discovery as well as the context of justification.

Evidence reviewed here suggests that current reward structures in academia and the competitive climates these generate may do more harm than good, for individual researchers as well as the science they generate. Research on organizational performance climates explains that rivalry leads people to question the competence and good intentions of others, drives out those who want to do things differently, and undermines scholarly debate about ideas. This prevents knowledge sharing and valuing the ideas of others, which contribute to the generation of cumulative insights that are necessary to address societal problems. Initiatives towards more open, collaborative, and impactful science suffer, when institutional pressures to 'win' the competition simply shift the outcomes that are pursued, instead of transforming undesirable practices.

Creating a climate that allows for collaborative efforts to thrive requires leadership that instills trust in the competence and good intentions of others, instead of fuelling the competition for superiority in approaches and methods. Different metaphors may be needed to be able to join forces in this way. Recruiting people with different crafts to build and embellish the cathedral of knowledge might be a more appropriate vision than getting there first or winning the game.

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## Conflict of interest

All authors declare no conflict of interest.

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