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Article

Science rules! A qualitative study of scientists' approaches to grant lottery

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Abstract

Using peer review to assess the validity of research proposals has always had its fair share of critics, including a more-than-fair-share of scholars. The debate about this method of assessing these proposals now seems trivial when compared with assessing the validity for granting funding by lottery. Some of the same scholars have suggested that the way grant lottery was being assessed has made random allocation seem even-handed, less biased and more supportive of innovative research. But we know little of what researchers actually think about grant lottery and even less about the thoughts of those scientists who rely on funding. This paper examines scientists' perspectives on selecting grants by 'lots' and how they justify their support or opposition. How do they approach something scientifically that is, in itself, not scientific? These approaches were investigated with problem-centered interviews conducted with natural scientists in Germany. The qualitative interviews for this paper reveal that scientists in dominated and dominating field positions are, more or less, open to the idea of giving a selection process by lots a try. Nonetheless, they are against pure randomization because from their point of view it is incompatible with scientific principles. They rather favor a combination of grant lottery and peer review processes, assuming that only under these conditions could randomly allocated funding be an integral and legitimate part of science.

Key words: research funding; peer review; scientific ethos; grant lottery; qualitative research; scientific field

1. Introduction

Currently, the majority of scientific research depends on external funding. Moreover, scientists and funding organizations are confronted with a growing number of applications but only small increases in financial resources. Dropping success rates for grants leads to more competition among researchers and overheated peer review processes which are the standard procedures to assess scientific quality of grant proposals (Chubin and Hackett 1990; Lamont 2009). In addition, the peer review process is further limited by the fact that journal editors and funding program officers require ever more evaluations and additional fine-tuning of equally qualified proposals. This procedure, in turn, offers only a restricted ability to predict scientific potential (Bornmann and Daniel 2005; Danthi et al. 2014; Fang, Bowen and Casadevall 2016), shows a low level of agreement between reviewer's judgments (Bornmann 2011) and undervalues novel ideas (Luukkonen 2012; Boudreau et al. 2016).

It is against this background that Greenberg (1998) contended that allocating grants comes close to being a lottery and therefore one might just as well try gambling to find a sensible way of distributing research funding. Shortly after, Brezis (2007) offered a feasible procedure of focal randomization (lottery only for differently assessed proposals) and various scholars pursued the idea of playing dice to distribute funding. In various comments (Ioannidis 2011; Barnett 2016; Fang and Casadevall 2016a; Adam 2019) and systematic overviews (Guthrie et al. 2013; Gillies 2014; Avin 2019; Osterloh and Frey 2019; Roumbanis 2019), scholars pointed to weaknesses in peer review and highlighted the advantages of randomization as a process that is fair, efficient, unbiased, and supportive of innovative research. However, they also discussed possible drawbacks such as the fact that it might attract more applications of lesser quality, discontinue existing financial support or lead to more funding of ordinary science.[1] In recent years, these arguments were further tested in simulations, which suggest that selecting grants by lot could actually increase the scientific community's ability to generate impactful research (Avin 2015, 2018) or is more efficient when there are more worthy applications than financial resources available (Gross and Bergstrom 2019). By concentrating on scientists' motivation, Höyla, Bartneck and Tiihonen (2016) also showed that random allocation increased the chance of financially supporting less-skilled scientists. However, it also seems to lower the morale of skilled scientists who produce well-reasoned proposals and to generate frustration among serious researchers who will exit the scientific field.

In a nutshell, most previous studies that have reflected on the strengths of randomization over peer review to allocate funding have focused on the cost and gains of different procedures but paid less attention to the scientists' perspectives on grant lottery. Efficiency and innovative research might be important for funding organizations and research policies but we know little about those who fundamentally rely on funding. Researchers, of course, are not the only stakeholders in the scientific field. However, in contrast to research funders and users of research outcomes, scientists on the one hand depend on financial support to do their research and on the other hand their performances are measured based on the amount of funding they raise and the extent to which their findings are published. Hence, grant lottery not only provides an alternative procedure to allocate money, it affects scientists' way of doing science and therefore should be carefully observed to avoid resistance. For example, despite Fang and Casadevall's (2016b) assumption that randomization enjoys popularity among researchers, some scientists have already made their discomfort explicit (Beattie 2020; Vindin 2020). A recent survey offers a more differentiated picture (Liu et al. 2020) among scientists who applied for the randomly allocated *Explorer Grant* from the Health Research Council (HRC) in New Zealand. The study reveals that the majority of applicants found it an acceptable method for distributing the *Explorer Grant* but they were indecisive regarding other grant types. Based on these findings, the authors suggest that scientists are more supportive of random approval if grants are small and target more risky research. However, participants also disclosed that they are only positive about selecting proposals by lot if certain condition are met, such as that all proposals are 'of equal merit', 'deemed worthy enough' or 'reach the threshold requirements' (Liu et al. 2020: 4). Interestingly, investigators recognized these concerns but did not progress to analyzing them systematically. What do scientists think about randomly allocated grants and what are their concerns? How do they approach the idea of a grant lottery that is not of a scientific standard? This paper will examine scientists' perspectives on grant lottery and how they justify their support or opposition.

The study draws on Merton's (1973[1942]) idea of scientific ethos and Bourdieu's (2004) theoretical concept of a scientific field. While Merton predicts that all scientists internalize scientific norms, according to Bourdieu, scientists in dominating and dominated field positions struggle over, and act in accordance to, field-specific expectations, practices and conventions to generate new knowledge and to gain reputation. Moreover, field-related practices and values are seen to shape scientists' perspectives on how to conduct science. Especially based on Bourdieu's field theory, one could assume that scientists' approaches to grant lottery vary with different field positions.

This paper therefore investigates how scientists reflect on distributing grants randomly and under what circumstances they value randomization as reasonable. To do this I conducted semi-structured interviews with researchers in the field of natural science. Participants reported their experiences of applying for funding and taking part in peer review processes. They also spoke about their thoughts on random grant allocation. The interviews revealed that scientists in different field positions would give random grant allocation a try but, at the same time, they insisted on translating lottery into science by applying scientific rules and norms to the process. Participants reported their suspicions about pure randomization and argued that compliance with scientific norms and conventions would be beneficial. In other words, it seems that even in times of increased pressure on scientists to gain external funding, questioning common scientific principles is not considered. Based on these initial findings, it looks likely that scientists will revolt against procedures of random grant allocation without peer review.

The text of this paper is divided into four sections. The first section starts with Merton's general idea of scientific ethos and Bourdieu's more differentiated concept of field-specific principles, asymmetric power relations and how they might affect scientists' views on grant lottery. The second section reports on data and methods used in this approach to examine the positions of scientists in the scientific field on the issue of random funding strategy. Then there is a short overview of funding initiatives that apply lotteries. Interviewees' arguments and justifications are presented in the results section and are discussed in the final section of this paper.

2. Lottery and the scientific field

Lotteries as a mode of decision making were used historically in various circumstances. Mainly for political purposes, they were employed to select citizens randomly for certain political positions in ancient Greece and in Northern Italy during the Renaissance (Engelstad 1989) or are suggested for deliberative opinion polls in modern democracies (Buchstein 2019). This is not common in the long history of science, where lotteries were rarely applied. Apart from a small number of funding organizations that roll dice, the only examples that Burckhardt (1916) reported was that of selection committee at the University of Basel who appointed professorships randomly from a preselected list in the 18th century. In other cases, random procedures for making decisions hardly became a regulative instrument in the scientific field. On the contrary, the regulative principle of science is heavily equated with the opposite: internal controls and rational assessments by peers. Idealistically, scientists of the same area of research scrutinize and evaluate scientific outcomes and ideas, expressing whether or not they are novel and original contributions.

According to Merton (1973[1938]), 'true' science is based on a set of institutional imperatives which mirror this principle of collectively organized evaluations. Merton (1973[1942]) writes that the ethos of science comprises four 'universal' ideas and ideals, which, on a superficial level, states that scientists' work is detached, methodical and committed to the search for the truth. The first scientific norm, universalism, describes the impersonal characteristic of science. In universalism, truth claims are related to objective data and are independent of researchers' race, nationality, religion, class, and personal qualities. In other words, objectivity precludes any particularism. The second integral element of the scientific ethos is communism or 'communalism' (Ziman 2000). Communism implies that scientific results are a product of social collaborations and should, therefore, be the common intellectual property of the entire scientific community because findings are openly communicated and diffused. The third institutional imperative is disinterestedness and is based on the circumstance that scientific research is 'under the exacting scrutiny of fellow experts' (Merton 1973[1942]: 276) and researchers act for the benefit of a common scientific enterprise. In this regard, scientists are not emotionally or financially attached to their research, rather they seek ultimate acknowledgment of their scientific contributions by their peers. It is not personal interest that drives scientists but the common scientific goal of revealing the truth. All three institutional imperatives are finally interrelated in the fourth element of the ethos of science: organized skepticism. This means that scientific findings and ideas are critically scrutinized in the scientific community before being accepted.

Various scholars (Mulkay 1976; Ziman 2000; Bourdieu 2004) criticized Merton's concept of scientific ethos being universalistic and ahistorical. According to Mulkay (1976), functional interpreters such as Merton only reformulated what leaders of science view as orthodox scientific principles. Hence, there is no normative structure of science but scientists communicate these imperatives to justify and describe their professional actions. Bourdieu (2004), moreover, questioned whether all scientists from different academic and power-related positions in the scientific field conform to these principles. He assumes that these actors in dominated and dominating positions struggle to maintain, let alone change, given field structures. In his work on the scientific field (Bourdieu 1990, 2004) he describes its historical evolution as an outcome of field actors' fighting to control field-specific principles; however, a field is not only shaped by reciprocal and strategic interactions among actors (Fligstein and McAdam 2011, 2012). In Bourdieu's (1990, 2004) theoretical concept it is more important that incorporated field-related rules and practices structure the researchers' action-guiding perspectives. Becoming a scientist thus means one habitualizes the 'principle of scientific practices' (Bourdieu 2004: 41). As a result, fully socialized field actors take the field logic for granted (doxa), orient to it and affirm it in their habits, practices, and assumptions. In turn, scientists who internalized the field logic are successful in the scientific game and seek to consolidate and maintain the currently dominant field logic.

Against this historical and theoretical background, grant lottery as a fact is external to the scientific field and might be challenged from scientists who take the scientific principle for granted. While Merton's scientific ethos predicts that *all* researchers defend scientific norms Bourdieu's field theory suggests that in struggles and debates over adequate scientific procedures, such as peer review, scientists might have *different* views on it depending on their involvement in that field. One could argue that scientists who internalized the principle of scientific practices and master efficiently field-specific expectations are against grant lottery. From their point of view, a lottery would lower their chance to be successful in the scientific game. According to Bourdieu (1990, 2004), those who are equipped with scientific and institutional capital, for example professors at universities, should especially defend the existing field-specific logic. Even those in dominated field positions, such as researchers in postdoctoral positions, might share this view if they pursue an academic career and thus comply to field-specific expectations. Alternatively, novices and those with little scientific and institutional capital, or who have difficulties advancing in the scientific field, might be more open to lotteries because it offers a chance to circumvent the existing field logic (i.e. making accumulated scientific reputation irrelevant). Moreover, doctoral candidates should be content with random procedures of decision making if they have not fully internalized scientific principles and thus are not taking it for granted.

These guiding assumptions are the starting point in this study from which to examine scientists' views on grant lottery and related to different field positions. One could expect to find clearly supportive and oppositional reasonings regarding lotteries to allocate research grants.

3. Research funding and lotteries

Funding organizations are major players in the scientific field. In many circumstances they enable and direct research. However, there are distinct forms of financing research. Funding comes from governmental and private institutions and ranges from open formats to predetermined topics or themes. These schemes of funding stimulate different criteria to support research. This is especially true for sponsorship, which has a strong disciplinary focus, externally defined topics and a tendency to overfund low-risk, incremental or applied inflexible research (Bourke and Butler 1999; Laudel 2006). In contrast, flexible funding schemes with less specifications regarding the research process seem to support unconventional research ideas. According to Heinze (2008) and Laudel and Gläser (2014), flexible funding schemes offer the freedom to define and pursue individual scientific interests. Nonetheless, in all funding programs peer review is considered a standard procedure when allocating research grants.

Currently, there are a very small number of funding organizations that operate lotteries to sponsor research (for a detailed overview see Avin 2019). In 2013, the HRC in New Zealand implemented a randomized selection process for transformative research proposals. After a rigorous pre-selection, which assesses applications' transformative capacity and viability, random choice is employed if there are more fundable applications than financial resources. The Science for Technological Innovation initiative in New Zealand also works with assessments and only proposals that meet minimum fundable standards are selected to go in the ballot. They are randomly drawn until the available funding is fully allocated. Recently, two other funding organizations, which give relatively small amounts, used randomization in funding programs. In the 'Experiment!'-funding program of the German Volkswagen Foundation, a test phase is conducted for five years to compare the outcomes of two different selection processes. In one round, a panel of experts nominates candidates of fundable applications and, in another round, grants are distributed randomly. The Swiss National Science Foundation, in contrast, starts with a scientific evaluation of 'Postdoc mobility' proposals and continues with a lottery for those that were considered equally fundable.

4. Data and methods

4.1 The sample

To study scientists' approaches to random grant allocation, interviews were conducted with researchers who represented different characteristics of the scientific field. First, the sample included researchers in dominated and dominating field positions, because it is assumed that this shapes scientists' perspectives and the actions in the field. The sample represents different academic positions ranging from doctoral candidates to professors. Especially in German academic organizations, most full professors are independent in their

Table 1. List of all interviews and selected interviewees' characteristics

Interview ID	Research position	Academic position	Sex	Branch of science	Applied for funding	Experiences with panels	Won *Experiment! Grant* (randomly allocated)
01	Senior	Professor	F	Physical science	X	X	
02	Senior	Professor	F	Life science	X	X	
03	Senior	Professor	F	Physical science	X		X
04	Senior	Professor	F	Life science	X		
05	Senior	Professor	M	Physical science	X	X	X
06	Senior	Professor	M	Physical science	X	X	
07	Senior	Professor	M	Life science	X	X	
08	Senior	Professor	M	Life science	X	X	
09	Senior	Professor	M	Life science	X	X	
10	Senior	Professor	M	Physical science	X		X
11	Senior	Professor	M	Life science	X		X
12	Senior	Professor	M	Life science	X		
13	Senior	PostDoc	F	Life science	X	X	X
14	Senior	PostDoc	F	Life science	X		X
15	Senior	PostDoc	F	Life science	X		
16	Senior	PostDoc	F	Life science	X		
17	Senior	PostDoc	F	Life science	X		
18	Senior	PostDoc	M	Life science	X	X	
19	Senior	PostDoc	M	Physical science	X		X
20	Senior	PostDoc	M	Physical science	X		X
21	Junior	PostDoc	M	Life science	X		X
22	Junior	PostDoc	F	Physical science	X		
23	Junior	PostDoc	F	Life science	X		
24	Junior	PostDoc	M	Physical science	X		
25	Junior	PreDoc	F	Life science			
26	Junior	PreDoc	F	Physical science			
27	Junior	PreDoc	F	Physical science			
28	Junior	PreDoc	M	Life science	X		
29	Junior	PreDoc	M	Life science			
30	Junior	PreDoc	M	Life science			
31	Junior	PreDoc	M	Life science			
32	Junior	PreDoc	M	Physical science			

research whereas most other researchers at universities are subordinate to others (Kreckel 2010; Waaijer 2015). Interviewees were also chosen to include those who asked for funding, in contrast to scientists who are familiar with both sides of the application process. The latter not only applied for grants, but they also reviewed proposals and were on panels who decided who received financial support. This corresponds with different power relations as well as distinct individual experiences and knowledge regarding research funding procedures. Second, due to disciplinary variations regarding scientific criteria (Guetzkow, Lamont and Mallard 2004; Lamont 2009), I talked to scientists in the physical and life sciences. Finally, this study also approached researchers who successfully applied for the funding program of the Volkswagen Foundation that recently established selection by lottery. I was interested in their viewpoints and accounts after they had been through the process. Unfortunately, less fortunate applicants were not known to me since the Volkswagen Foundation only lists successful applicants and thus the former are missing in the sample.

In total, the author interviewed 32 scientists (see Table 1) between August 2019 and May 2020 in a successive approximation. This sampling strategy basically followed Glaser and Strauss' (1967) idea of theoretical sampling, which aims to formulate empirically grounded assumptions, hypotheses and theories. Searching for meaningful patterns in the data, the sample of the study comprises various minimal and maximal contrasts to identify variations and similarities among interviewees regarding the participants' positions and their views on random grant allocation. The sampling was a process involving interviewing a few scientists at the beginning and going back to the field after analyzing initial interviews. Starting with scientists in postdoctoral positions and with full professorships, further interviews were conducted with doctoral candidates, researchers who also serve on panels and those who received a grant from the 'Experiment!' initiative. In addition, during the study the initial focus shifted from the search of maximal contrasts to interviews with scientists who had similar characteristics. The sample was continuously supplemented until additional interviews offered hardly any further substantial insights on the observed typical relationships between field positions, views on grant lottery and a common belief in scientific principles in different sections of the interviews. Finally, the sample includes eight early researchers working on their doctoral thesis, 12 scientists in postdoctoral positions and 12 professors. Moreover, so far, only 25 of the interviewed scientists have applied for funding, whereas nine are also familiar with the other side of the peer review procedures because they are involved in reviewing and in panel processes for funding and awards. In this article, these interviewees are grouped into junior and senior researchers. Junior researchers (n = 12) include doctoral candidates and postdoctoral scientists who practice research and have, so far, published no, or only a few, scientific articles. The category of senior researchers (N = 20) comprises acknowledged scientists in leading positions (i.e. principle investigators, research group leaders, professors at universities or at universities of applied sciences). The latter, compared to junior scientists, are deeply involved in the scientific field. One can assume that they incorporated the logic of the scientific field because they successfully apply for funding, supervise research projects and groups, publish in leading scientific journals and take part in review processes. In addition, the sample includes twenty participants who are affiliated with life science and twelve with physical science. At last, nine of all the interviewees have recently won an 'Experiment!' grant.

4.2 Data procedures

For this study, semi-structured interviews were conducted with all participants. Applying a problem-centered approach (Witzel and Reiter 2012), interviewees were asked to narrate their personal research history and experiences when applying for funding. This was followed by specific questions on peer review processes and on random grant allocation. In this regard, interviewees presented their view as active scientists in their research areas; they were not consulted as experts about lotteries and peer review. Moreover, problem-centered interviews were used to discuss various topics with the interviewees and confront them with inconsistencies in their accounts, to work out their positions. I carefully read all transcripts, searched for patterns and grouped findings systematically. Additionally and in joint meetings, we deliberated on similarities and differences identified in the sample. This process followed common procedures of qualitative content analysis (Schreier 2012); thereby summarizing individual statements into more abstract categories to understand the scientists' approaches to peer review and the random distribution of research funding. The software MaxQDA was used to support the content analysis. This software package allowed me to mark all relevant accounts and track assigned codes. The tool, Code-Matrix-Browser, was applied specifically to identify what respondents said thematically, where they differed and to register when they shared similar positions.

5. Scientists' approaches to grant lottery

Before scientists thought about the lottery as an alternative to peer review, they were asked to speak about their experiences and views on this evaluation procedure. Interestingly, during the interviews, it was mandatory for all scientists to evaluate scientific proposals and outcomes. They said peer review might not be the ideal procedure to assess scientific quality but it is the best solution science has to offer. In this respect, it seems to be a common position that only scientific peers in the same research field are capable of assessing the originality and viability of research ideas or the significance of scientific findings. The following three quotes are typical:

> 'Well, I think it's just totally necessary, that a person, just, that two people just evaluate what's written here is sound, just to guarantee the quality'. (15, life science, senior researcher, 58)[2]
>
> 'So, I think there are a lot of people who have come to see the peer review process for what it is. That is, a collegial process in which a person tries to make the best out of what's been placed in front of him'. (03, physical science, senior researcher, 50)
>
> 'I do think it makes sense for someone to scientifically review the quality of the proposal. Especially, because there are, of course, examples of people who are able to write really well and to present really great, impressive projects, but if you really look at the details you notice that there's just no substance to it. So, and the, I think, only a scientist or researcher can do that kind of detailed work'. (13, life science, senior researcher, 26)

In spite of the great confidence in the peer review process, interviewees also mentioned the limitations of this assessment procedure. They repeatedly named, for instance, an overload of review requests, ambiguous rankings of grant proposals of comparable quality, a tendency to support incremental research and the fact that peer review is prone to human fallacies such as employed stereotypes, networks and self-interests which can impact on the decision-making process. All of these accounts are in line with critical discussions on peer review and alternative procedures (Guthrie et al. 2013; Fang and Casadevall 2016b; Roumbanis 2019).

To improve peer review procedures, making them less vulnerable to misuse three options were repeatedly discussed in the interviews:

1. providing more non-competitive financing of research;
2. double blind peer review; and
3. open peer review processes.

While double blind conceals both sides of the review process, open evaluation means that reviewers and their assessments are made public. In this regard, young researchers and those in dominated field positions, for example professors at universities of applied science, expected that such modifications would increase their chances. In contrast, senior researchers who currently take part in all processes of evaluation and make decisions related to grant proposals, were more suspicious, arguing that, in their subfields of research, it is often possible to identify authors or applicants known for their approaches, specializations, or assays. Moreover, they argue that a comprehensive evaluation of proposals requires information about the applicants' methodical capabilities and technical facilities. Nonetheless, all interviewees, regardless of their position, favored more financial resources for research and they usually concurred with complaints about decreasing institutionally financed academic positions below professorship in Germany.

However, randomization was still discussed as an alternative. Interviewees, in general, found it reasonable to give the idea of random grant allocation a chance. Often they emphasized the fairness in randomly operated procedures because all proposals have the same chance and decisions are unrelated to applicants' gender, affiliation, research position or track record:

> 'I think it's good and should be supported, because it really gives people the chance, independent of name, independent of field of study, to carry out an innovative research project if they've gone through an initial evaluation'. (11, life science, senior researcher, 42)
>
> 'If you have worked for a long time in Germany and have established those kinds of connections, of course you know all the people in the respective faculties who review the proposals. If you would say, we'll make a basic selection based on quality and after that the decision is made by rolling the dice, of course, it's definitely objectively fairer, because you can't just rely on your connections'. (13, life science, senior researcher, 48)

> 'Even if it sounds wacky, what was just suggested, maybe you'll just roll the dice and yes, I think a lot more people will be included who maybe would otherwise say: There's no point. We have a chance. Why bother applying?' (03, physical science, senior researcher, 62)

Moreover, it was argued that, due to lottery's impartiality, especially risky, speculative and unconventional ideas would have a better chance of being considered:

> 'But it definitely increases the chances for proposals that have a special quality where the leap is just a little speculative'. (10, physical science, senior researcher, 80)
> 'If you had first asked me what I think of rolling the dice, of a random selection process, in a certain sense, I would have said I think it's great, because I believe if you at least in a certain, to a certain extent, yes, also accept crazy ideas or ideas that maybe make you think, is that possible, can they pull it off, or something. I think that this makes it possible to really do innovative things'. (03, physical science, senior researcher, 58)
> 'I think [...] in fact the random selection process can break through structures and that's what science thrives on, that we don't just always think in fixed patterns but that we want to break through structures, that we want to do new things'. (16, life science, senior researcher, 150)

Other statements in favor of randomization mention the potential to save time and resources when writing and reviewing applications: 'It will go faster; it means less effort. Of course, if there's more money to go around that's also something' (24, physical science, junior researcher, 154). Or interviewees argue in line with Lamont's (2009) observation that deliberations on proposals sometimes show elements of randomness. One scientist, in particular, who takes part in panels to allocate funding reported:

> 'Then you have to boil 40 down to 30 and I would say after that it's de facto, for the most part, just a roll of the dice. Even if, as expert commissions, we and the German Research Foundation don't like to admit it, it is arbitrary, there really aren't any good benchmarks [...] it is a little random'. (06, physical science, senior researcher, 42)

While all interviewees were relatively open to the idea of randomly allocating funding in general, they showed reservations against pure randomization. The caution came with scientists' faith in the superiority of peer review within the scientific field. It seems that talking about a lottery in science activated incorporated norms and rules on how to do reasonable science and made it 'necessary' to defend scientific principles. All participating scientists—from doctoral candidates to full professors—presented science more or less as a collective endeavor to generate methodically controlled new knowledge. It included the idea of encouraging scientists to collectively offer their best ground-breaking and viable research ideas and give feedback to others that would improve experimental setups and research designs.

In this regard, and almost without exception, interviewees were against pure random grant allocation because it would lack any quality control. Interviewed scientists also complained that it would not acknowledge scientific merit in the form of well-reasoned and feasible research ideas. With lottery alone, they rather expected that their fellow scientists would spend less time and effort in writing proposals. They assumed that the applicants would be oriented towards minimal requirements to be funded. Moreover, they suggested it might lead to more ideas that lack scientific reasoning:

> 'So, I think a purely random process would really be difficult. I mean, without any quality control, I can't imagine that that would work. Because, I think it would lead to people just pushing qualitatively inferior work through the system and trying, investing less work in the proposal and let's just see if we get lucky, maybe it'll work out'. (16, life science, senior researcher, 140)
> 'The massive number of proposals can be overwhelming, because then everyone is like, wow, it's like a scratch ticket. So, I throw my hat in the ring. And it's not yet clear to me, I mean, I really don't know, how it's even possible to do the work seriously'. (07, life science, senior researcher, 108)
> 'Well, I can say how I, myself, would react. I would immediately submit more proposals with less brainpower. I would submit ten times more proposals. I could easily do it and much less, well I personally would produce a great number of qualitatively bad proposals in order to increase my chances of winning, as I can no longer increase my chances with good proposals'. (06, physical science, senior researcher, 84)

A closer look at these imagined scenarios reveals that interviewees anticipated that only the application of peer review processes would produce well-reasoned and high-quality proposals. Randomization without any assessment measures, in contrast, would lower ambitions, which implied that it is not in the interest of individuals to always apply their best efforts if they write down their research ideas. It suggests that only field-specific institutions and requirements can warrant scientific quality. In other words, they assume that skepticism and assessments must be jointly organized and enforced by scientific players in the scientific field.

This position is also evident in the accounts related to possible settings for random grant allocation. The interviewed scientists may vary as to whether or not quality assessments should be placed in the beginning or at the end of funded research projects but they all stressed that randomization needs assessment procedures:

> 'But I wouldn't support completely abandoning the peer review process'. (11, life science, senior researcher, 44)
> 'Well, people who don't work scientifically would of course not be allowed to take part in a random selection process'. (21, life science, junior researcher, 96)
> 1.'That you, then, simply roll the dice. I can imagine doing it that way. But you probably have to do a certain combination, first you have quality control: are the proposals really good, and then, if you have more worthy proposals than money, then you roll the dice'. (24, physical science, junior researcher, 124)

These accounts indicate that interviewees seem to share a certain idea of doing science correctly and that proposed research should be discussed with and evaluated by peer scientists. Furthermore, the idea seems to include that scientists are a collective of like-minded individuals who trust in their scientific skills and institutions to regulate the production of new knowledge.

This understanding is even more apparent in the criteria mentioned for implementing randomization combined with quality measures. Such criteria are typically employed in the scientific field (Lamont 2009; van Arensbergen and van den Besselaar 2012; Langfeldt et al. 2020) and comprise various anticipations. Among ex ante criteria for passing the threshold are measures such as scientifically viable research ideas and well-reasoned and comprehensible applications, which approach scientifically interesting issues and, in some cases, interviewees also asked for approval of unconventional and risky research ideas:

> 'So, really some kind of intermediate assessment or just generally assessing whether the project is feasible, and then you only evaluate, is it structured well, is it viable in the given amount of time and is it interesting and will it yield a result'. (22, physical science, junior researcher, 68)
> 'But, [so] that the people know on a practical level, I have to make an effort. I have to formulate things in such a way that the person reading it, without being a specialist in my field, will he understand it or know what it's all about'. (12, life science, senior researcher, 74)
> 'So, a hypothesis has to be there or let's say in descriptive research, then there has to be an empty box, what I would like to describe. So, it has to have a clear objective, it also has to have certain dimensions and pursue interests, so that I expect that insights will be achieved'. (08, life science, senior researcher, 72)

Other scientists in contrast favored ex-post assessments. They would request that funded scientists report their research to qualify for further funding. Criteria ranged from reports to the funding organization to articles in highly acknowledged scientific journals.

From the interviewees' point of view, one could say, lottery in science only works if it is collectively tamed through organized skepticism such as peer review. In other words, they suggest that random grant allocation has to comply to scientific norms and rules. The interviewed scientists expected that randomization might reduce confusions and tensions but that it would be harmful to science if there was not any quality control. They thought that at least minimal evaluation mechanisms should be applied using criteria which are commonly operated in the scientific field.

This impact of field-specific rules and norms on scientists' attitudes is also evident in the accounts of interviewees who had personal experience of randomly allocated grants. For instance, they said, without being asked, that officers of the Volkswagen Foundation's funding initiative 'Experiment!' concealed the decisions as to which proposals were selected by chance and which by panel members. In this respect, some interviewees showed their interest of knowing whether they were chosen or drawn:

> 'But, of course, I personally would want to know at some point as far as my proposal whether it was chosen randomly or selected'. (20, physical science, senior researcher, 92)
> 'But then I would want to hear afterwards that it wasn't an inherent technical problem but that I just didn't have any luck in the random selection'. (16, life science, senior researcher, 128)

Such accounts can be read as a hint that these scientists wished to be acknowledged for their research ideas. It is similar to statements of other scientists saying that pure lottery would negate and diminish their performance:

> 'I would find that personally insulting if we actually do good work and are then rejected, because we didn't roll the right number. That would be really frustrating for us. I think we wouldn't even apply in that case. I would have the feeling, under those circumstances I would, I wouldn't want to do it, rather I want to make a good impression with our group and with our thematic focus, with such things, and I want to submit a strong project. And either we're good enough together for the insane amount of funding or [. . .] we're just not'. (15, life science, senior researcher, 64)

These accounts demonstrate that researchers usually seek and gain reputation for their significant ideas and findings in their scientific fields. Top-ranked funded research proposals are one way to gain scientific merit. In contrast, a lottery considers all proposed ideas equally and a lucky draw is no sign of excellence. This might produce discomfort among scientists, as some have reported.

6. Discussion and conclusions

While in the current debate most scholars (Ioannidis 2011; Guthrie et al. 2013; Gillies 2014; Fang and Casadevall 2016a; Adam 2019; Avin 2019; Roumbanis 2019) discuss the advantages of lotteries compared to peer review to make decisions, this study examined scientists' views on the random allocation of funding. Surprisingly, when I intentionally varied contexts according to the sampling strategy, it appeared that the interviewed researchers more or less shared similar positions. Neither differences in research position, disciplinary socialization nor gender strongly corresponded with clearly supportive or opposing positions with regard to grant lottery. Based on Bourdieu's (1990, 2004) theoretical concept of an incorporated and habitualized principle of scientific practices, which enables scientists to achieve a reputation and that serves the interests of dominant groups, it was expected that successful scientists (and those in dominant field positions) would be against grant lottery. Contrarywise, it was assumed that novices to the scientific field who still internalize scientific practices and those who have difficulties in achieving scientific reputation would be open to randomly allocated funding. However, interviewees in different field positions agreed that they would give grant lotteries a try. They only varied by small degrees in other respects. One variation was that junior researchers and those in a dominated field position indeed favored randomization suggesting that it would increase their own chances and that of unconventional ideas to get funded. In contrast, senior researchers and those in dominating field positions were less concerned with improved chances for marginalized scientists. Rather, they spoke about the limited capability of peer review procedures to sort out arbitrary proposals and assumed that randomization could abolish ambiguous rankings of similarly qualified proposals and might save time in review processes. These findings could be read as an indication that researchers take in accord with Merton's and Bourdieu's theoretical concepts the principles of scientific practice for granted but not—as Bourdieu's field theory also suggests—that those with scientific and institutional capital who benefit from established field-specific rules defend the status quo and reject modifications in the scientific field. Of course, they are not willing to throw over the existing field logic but it seems senior researchers are open to probe alternative regulative procedures.

Present debates and studies on grant lottery suggest that it can repair defects in the peer review processes (Brezis 2007; Gillies 2014; Avin 2015, 2018, 2019; Fang and Casadevall 2016b; Roumbanis 2019). Interviewed scientists also named shortcomings in current peer review procedures such as making biased decisions and supporting primarily incremental research. Against this background, some assumed that random grant allocation might increase the chances of marginalized scientists and unconventional approaches to attain funding. At the same time, however, almost all interviewees were against pure randomization suggesting incompatibility with scientific principles. Science, from their point of view, is based on the critical discussion of research ideas and scientific findings among researchers with similar specializations and expertise. They suggest that if proposed approaches and outcomes are critically scrutinized and reviewed, the process will be constructive and advance science. In this regard they argue that lottery alone threatens science due to its lack of quality control and, if implemented, one needs to tame it. In accordance with this position, most interviewed scientists favor a combination of grant lottery and peer review processes. Only the latter would allow the sorting out of unscientifically reasoned proposals and the support of scientifically interesting and promising approaches. In other words, only under these conditions would the random allocation of funding be an integral and legitimate part of science.

Apart from any considerations regarding a scientifically suitable implementation of the grant lottery, interviewed scientists justified their positions related to certain scientific principles. Interestingly, in line with Mulkay's (1976) observation, they defended their professional positionings based on imperatives that Merton (1973[1942]) described as essential to the scientific ethos: collectively organized skepticism to unravel the truth. Scientists might not follow these rules to their full extent, and at all times, but it seems that these rules are taken for granted and are seen as constitutional parts in professional representations when scientists are confronted with something external to the scientific field. This assumption is supported by similar positionings which can be observed in contexts where scientists have to deal with external expectations and measures. It began in the 19th century when scientists stressed that scientific knowledge was valuable in its own right; instead of solving material problems, pursuing the truth became the ultimate value (Daniels 1967). However, even today, apart from highly acknowledged research organizations that concentrate on basic research (e.g. German Max Planck institutes), there are research departments in companies and governmental agencies that provide scientifically grounded services. Usually, external expectations direct and constrain their research because entrepreneurs, administrators and politicians need knowledge to build new products or to make political and regulatory decisions. Confronted with these external demands, latter research organizations emphasize their compliance with scientific practices and rules (Philipps 2013). On the one hand, it justifies their services as scientific and, on the other hand, it presents them as legitimate players in the scientific field. Moreover, scientists who work in research and development are also interested in being recognized for their scientific findings by their peers (Mallon, Duberley and Cohen 2005). Apart from other motivations, gaining scientific reputation might be a strategy of making explicit that they are also accountable actors on the scientific stage. Otherwise, if they openly orient towards non-scientific expectations and rules, they risk being seen as outsiders of science.

Methodologically, studying how scientists think about grant lottery requires a qualitative approach. Only a close analysis of researchers' accounts offers insight into the way that scientists rationalize and justify their views on randomly funded research. To find typical and distinct views, this study operationalized a constant comparative sampling strategy to analyze interview accounts. The goal was to formulate empirically grounded assumptions rather than present an exhaustive representation of all the possible approaches of scientists to grant lottery. As a consequence, the number of cases is restricted and allows no projection about proportions. Based on the sample, for instance, one cannot say that all scientists are open to the idea of grant lotteries. In fact, the study of Liu et al. (2020) shows there are scientists who oppose the idea of dice-playing decision making. Also, in this study, not all interviewees were supporters to the full extent but they were positive about considering and testing the distribution of funding by lots. Researchers who emphatically reject the idea of randomly allocated funding are maybe among those who refused to be interviewed. In total, among 110 scientists I asked for an interview, only 32 agreed to participate in the study. Nonetheless, and apart from these limitations, this study, on the one hand, indicates that variations in field positions do not typically correspond with being clearly supportive or opposing views of lottery as a procedure to select proposals and, on the other hand, it suggests that scientists' approaches to lottery are closely related to their comprehension of conducting science. Further research might build on these findings and investigate, through standardized surveys, the correspondences between certain characteristics of researchers and their acceptance of grant lottery. Research in this direction might provide a different picture on scientists' approaches to grant lottery than Liu et al. (2020) offered with their survey among applicants of the HRC's *Explorer Grant*.

In addition, cultural differences might also influence scientists' experiences with, and their positions towards, research funding and randomization. This investigation concentrated on German scientists, which may overemphasize reservations against grant lottery if we consider that German scientists are less open to innovative research (Wilhelm Krull as cited in Abbott 2017; Yair 2019). Moreover, an interviewed scientist (23, life science, junior researcher, 98), who was trained and received her PhD in the USA, favored grant lottery with almost no preselected review procedures, apart from being affiliated with a university or equivalent, arguing that 'in the US, the competition, I think, is much higher so you accept on some level that it is always random'. Hence, comparing different research settings that is less competitive vs. highly competitive funding systems, might disclose varied approaches to random grant allocation.

Nevertheless, this study claims to be empirically and politically relevant, because it offers a detailed analysis of scientists' accounts on the anticipated strengths and weaknesses of implementing random grant allocations in the scientific field. It becomes apparent that such a procedure touches on the very ethos of science and, thus, requires more attention than discussing potential advantages and disadvantages of the lottery when compared to other funding schemes from the perspective of governing science. It is especially important to consider the unnoticed scientific viewpoints that might evoke resistance to grant lottery.

Conflict of interest statement. None declared.

Notes

1. Recently, Osterloh and Frey (2020) started a discussion on lottery to select journal papers with supportive (Oswald 2020) and more skeptical comments (Wooding 2020; Yaqub 2020).
2. All quotations include readable accounts and information about the interviewee. In the round brackets one finds the interview number, the interviewee's affiliated branch of science, his or her research position and the position, the paragraph number, of the account in the interview transcript.

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References

Abbott, A. (2017) 'The Secret to Germany's Scientific Excellence', *Nature*, 549: 18–22.

Adam, D. (2019) 'Science Funders Gamble on Grant Lotteries', *Nature*, 575: 574–5.

Avin, S. (2015) 'Funding Science by Lottery'. In: Mäki U., Ruphy S., Schurz G. and Votsis, I. (eds.) *Recent Developments in the Philosophy of Science: EPSA13*, pp. 111–126. Helsinki, Cham: Springer.

Avin, S. (2018) 'Policy Considerations for Random Allocation of Research Funds', *RT. A Journal on Research Policy and Evaluation*, 6: 1–27.

Avin, S. (2019) 'Mavericks and Lotteries', *Studies in History and Philosophy of Science Part A*, 76: 13–23.

Barnett, A. G. (2016) 'Funding by Lottery: Political Problems and Research Opportunities', *mBio*, 7: e01369.

Beattie, A. (2020) 'Grants: Lottery is Laziness', *Nature*, 577: 472.

Bornmann, L. (2011) 'Scientific Peer Review', *Annual Review of Information Science and Technology*, 45: 199–245.

Bornmann, L. and Daniel, H. D. (2005) 'Selection of Research Fellowship Recipients by Committee Peer Review: Reliability, Fairness and Predictive Validity of Board of Trustees' Decisions', *Scientometrics*, 63: 297–320.

Boudreau, K. J., Guinan, E. C., Lakhani, K. R. and Riedl, C. (2016) 'Looking across and Looking beyond the Knowledge Frontier', *Management Science*, 62: 2765–83.

Bourdieu, P. (1990) *Homo Academicus*. Cambridge, UK: Polity Press.

Bourdieu, P. (2004) *Science of Science and Reflexivity*. Cambridge, UK: Polity Press.

Bourke, P. and Butler, L. (1999) 'The Efficacy of Different Modes of Funding Research: Perspectives from Australian Data on the Biological Sciences', *Research Policy*, 28: 489–99.

Brezis, E. S. (2007) 'Focal Randomization: An Optimal Mechanism for the Evaluation of R & D Projects', *Science and Public Policy*, 34: 691–8.

Buchstein, H. (2019) 'Democracy and Lottery: Revisited', *Constellations*, 26: 361–77.

Burckhardt, A. (1916) 'Über Die Wahlart Der Basler Professoren, Besonders im 18. Jahrhundert', *Basler Zeitschrift für Geschichte Und Altertumskunde*, 15: 28–46.

Chubin, D. E. and Hackett, E. J. (1990) *Peerless Science: Peer Review and U.S. Science Policy*. New York: State University of New York Press.

Daniels, G. H. (1967) 'The Process of Professionalization of American Science: The Emergent Period, 1820–1860', *ISIS*, 58: 150–66.

Danthi, N., Wu, O.C., Shi, P., and Lauer, M. (2014) 'Percentile Ranking and Citation Impact of a Large Cohort of National Heart, Lung, and Blood Institute-Funded Cardiovascular R01 Grants', *Circulation Research*, 114: 600–6.

Engelstad, F. (1989) 'The Assignment of Political Office by Lot', *Social Science Information*, 28: 23–50.

Fang, F. C., Bowen, A., and Casadevall, A. (2016) 'NIH Peer Review Percentile Scores are Poorly Predictive of Grant Productivity', *eLife*, 5: e13323.

Fang, F. C. and Casadevall, A. (2016a) 'Grant Funding: Playing the Odds', *Science*, 352: 158.

Fang, F. C. and Casadevall, A. (2016b) 'Research Funding: The Case for a Modified Lottery', *mBio*, 7: e00422.

Fligstein, N. and McAdam, D. (2011) 'Toward a General Theory of Strategic Action Fields', *Sociological Theory*, 29: 1–26.

Fligstein, N. and McAdam, D. (2012) *A Theory of Fields*. Oxford: Oxford University Press.

Gillies, D. (2014) 'Selecting Applications for Funding: Why Random Choice is Better than Peer Review', *RT. A Journal on Research Policy & Evaluation*, 2: 1–14.

Glaser, B. G. and Strauss, A. L. (1967) *The Discovery of Grounded Theory: Strategies for Qualitative Research*. New Brunswick and London: AldineTransaction.

Greenberg, D. S. (1998) 'Jabs and Jibes. Chance and Grant', *The Lancet*, 351, 686.

Gross, K. and Bergstrom, C. T. (2019) 'Contest Models Highlight Inherent Inefficiencies of Scientific Funding Competitions', *PLoS Biology*, 17: e3000065.

Guetzkow, J., Lamont, M., and Mallard, G. (2004) 'What is Originality in the Humanities and the Social Sciences?', *American Sociological Review*, 69: 190–212.

Guthrie, S. et al. (2013) 'Alternatives to peer review in research project funding: 2013 Update. Santa Monica, CA: RAND Corporation, 2013. https://www.rand.org/pubs/research_reports/RR139.html.

Heinze, T. (2008) 'How to Sponsor Ground-Breaking Research: A Comparison of Funding Schemes', *Science and Public Policy*, 35: 302–18.

Höyla, T., Bartneck, C., and Tiihonen, T. (2016) 'The Consequences of Competition: Simulating the Effects of Research Grant Allocation Strategies', *Scientometrics*, 108: 263–88.

Ioannidis, J. P. A. (2011) 'Fund People Not Projects', *Nature*, 477: 529–31.

Kreckel, R. (2010) 'Karrieremodelle an Universitäten im Internationalen Vergleich'. In: Borgwardt A. (ed.) *Der Lange Weg Zur Professur*, pp.33–44. Bonn: Friedrich-Ebert-Stiftung.

Lamont, M. (2009) *How Professors Think: Inside the Curious World of Academic Judgement*. Boston: Harvard University Press.

Langfeldt, L. Nedeva, M., Sverker, S., and Duncan, A. T. (2020) 'Co-Existing Notions of Research Quality: A Framework to Study Context-Specific Understandings of Good Research', *Minerva*, 58: 115–37.

Laudel, G. (2006) 'The Art of Getting Funded: How Scientists Adapt to Their Funding Conditions', *Science and Public Policy*, 33: 489–504.

Laudel, G. and Gläser, J. (2014) 'Beyond Breakthrough Research: Epistemic Properties of Research and Their Consequences for Research Funding', *Research Policy*, 43: 1204–16.

Liu, M. Choy, V., Clarke, P., Barnett, A., Blakely, T., and Pomeroy, L. (2020) 'The Acceptability of Using a Lottery to Allocate Research Funding: A Survey of Applicants', *Research Integrity and Peer Review*, 5: 3.

Luukkonen, T. (2012) 'Conservatism and Risk-Taking in Peer Review: Emerging ERC Practices', *Research Evaluation*, 21: 48–60.

Mallon, M., Duberley, J., and Cohen, L. (2005) 'Careers in Public Sector Science: Orientations and Implications', *R & D Management*, 35: 395—407.

Merton, R. K. (1973[1938]) 'Science and the Social Order'. In: Merton R. K. and Strorer N. W. (eds) *The Sociology of Science. Theoretical and Empirical Investigations*, pp. 254–66. Chicago: University of Chicago Press.

Merton, R. K. (1973[1942]). 'The Normative Structure of Science'. In: Merton R. K. and Strorer N. W. (eds) *The Sociology of Science. Theoretical and Empirical Investigations*, pp. 267–78. Chicago: University of Chicago Press.

Mulkay, M. J. (1976) 'Norms and Ideology in Science', *Social Science Information*, 15: 637–56.

Osterloh, M. and Frey, B. S. (2019) 'Dealing with Randomness', *Management Revue*, 30: 331–45.

Osterloh, M. and Frey, B. S. (2020) 'How to Avoid Borrowed Plumes in Academia', *Research Policy*, 49: 103831.

Oswald, A. (2020) 'Rational Randomization by Journal Editors: A Mathematical Derivation', *Research Policy*, 49: 103869.

Philipps, A. (2013) 'Mission Statements and Self-Descriptions of German Extra-University Research Institutes: A Qualitative Content Analysis', *Science and Public Policy*, 40: 686–97.

Roumbanis, L. (2019) 'Peer Review or Lottery? A Critical Analysis of Two Different Forms of Decision-Making Mechanisms for Allocation of Research Grants', *Science, Technology, & Human Values*, 44: 994–1019.

Schreier, M. (2012) *Qualitative Content Analysis in Practice*. London: Sage.

van Arensbergen, P. and van den Besselaar, P. (2012) 'The Selection of Scientific Talent in the Allocation of Research Grants', *Higher Education Policy*, 25: 381–405.

Vindin, H. (2020) 'Grants: Don't Leave It to Luck', *Nature*, 577: 472.

Waaijer, C. (2015) 'The Coming of Age of the Academic Career: Differentiation and Professionalization of German Academic Positions from the 19th Century to the Present', *Minerva*, 53: 43–67.

Witzel, A. and Reiter, H. (2012) *The Problem-Centered Interview*. London: Sage.

Wooding, S. (2020) 'Heuristics, Not Plumage: A Response to Osterloh and Frey's Discussion Paper on "Borrowed Plumes', *Research Policy*, 49: 103871.

Yair, G. (2019) 'Culture Counts More than Money: Israeli Critiques of German Science', *Social Studies of Science*, 49: 898–918.

Yaqub, O. (2020) 'JIFs, Giraffes, and a Diffusion of Culpability: A Response to Osterloh and Frey's Discussion Paper on "Borrowed Plumes', *Research Policy*, 49: a103868.

Ziman, J. (2000) *Real Science: What It is and What It Means*. Cambridge, UK: Cambridge University Press.