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Dark Pathways to Achievement in Science: Researchers' Achievement Goals Predict Engagement in Questionable Research Practices

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Abstract

Questionable research practices (QRPs) are a strongly debated topic in the scientific community. Hypotheses about the relationship between individual differences and QRPs are plentiful but have rarely been empirically tested. Here, we investigate whether researchers' personal motivation (expressed by achievement goals) is associated with self-reported engagement in QRPs within a sample of 217 psychology researchers. Appearance approach goals (striving for skill demonstration) positively predicted engagement in QRPs, while learning approach goals (striving for skill development) were a negative predictor. These effects remained stable when also considering Machiavellianism, narcissism, and psychopathy in a latent multiple regression model. Additional moderation analyses revealed that the more researchers favored publishing over scientific rigor, the stronger the association between appearance approach goals and engagement in QRPs. The findings deliver first insights into the nature of the relationship between personal motivation and scientific malpractice.

Keywords

achievement goals, motivation, values, questionable research practices, incentives in science

Failing to report all study conditions, rounding off p values, stopping data collection earlier than intended—questionable research practices (QRPs) have been a highly discussed topic within the scientific community in recent years. QRPs are strategies that aim to increase the chance to publish at the cost of scientific accuracy. A study by John, Loewenstein, and Prelec (2012) indicated that the vast majority of psychology researchers (94% of the participants) engage in at least one QRP over the duration of their academic career. Although Fiedler and Schwarz (2016) argued that the numbers in the study from John and colleagues (2012) might be exaggerated, the study still sparked fruitful scientific debates on research quality in the psychological sciences and the replicability of results (Open Science Collaboration, 2015; Pashler & Wagenmakers, 2012). Here, we attempt to move from merely describing the magnitude of the problem to a deeper understanding of individual differences that may explain engagement in QRPs. We suggest shifting the research question from “*how often* do psychological researchers engage in QRPs?” to “*what characterizes* psychological researchers who engage in QRPs?” Thereby, we want to move past simplified personality-based explanations claiming that only deeply flawed researchers characterized by sinister personality traits would engage in QRPs (rotten apple hypothesis, see, e.g., Lemaitre, 2017) because these approaches cannot

explain the high prevalence of QRPs found by John and colleagues (2012). Instead, we propose to focus on the role of researchers' personal motivation. More specifically, we suggest that researchers' achievement goals, together with the current incentive system in science, play a crucial role in explaining researchers' engagement in QRPs.

Achievement Goals and Scientific Malpractice

Like all human beings, researchers strive for a feeling of personal competence (Elliot, McGregor, & Thrash, 2002; White, 1959), although they may differ in their personal beliefs about the best way to achieve this. These individual differences in competence striving are described by individuals' *achievement goals*, that is, their personal aspirations in achievement-related

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situations. With regard to the conceptualization of these goals, we believe that the *goal standpoints model* (Korn & Elliot, 2016) is suitable to explain why researchers might be motivated to engage in QRPs. This model defines achievement goals based on the way individuals choose to pursue competence (*goal standpoint*) and whether individuals strive to approach feeling competent or avoid feeling a personal lack of competencies (*goal valence*). With regard to the goal standpoints, Korn and Elliot (2016) differentiate between the general beliefs that competence can be achieved best through skill development (*learning goals*) or through the display of ability (*appearance goals*). While both are not mutually exclusive, individuals will differ in the extent to which they strive for either goal.

For researchers, the strength of work-related learning goals indicates the striving for competence in science through constant skill development. When adopting learning goals, engagement in QRPs likely represents a costly shortcut that hinders true understanding and competence growth through learning. Thus, the adoption of learning goals should be negatively associated with engagement in QRPs. This presumably applies to learning approach and learning avoidance goals as well because QRPs should not be attractive for researchers who fear that they might not be able to develop their skills in the best way possible.

In contrast, the strength of researchers' work-related appearance goals reflects how strongly researchers strive for competence in science by demonstrating scientific abilities. In the current scientific system, this can be achieved by publishing highly relevant and possibly groundbreaking results (Bakker, van Dijk, & Wicherts, 2012). If they successfully produce statistically significant results, researchers with strong appearance goals do not need to engage in QRPs. However, because scientific research aims to explore new boundaries and paradigms, researchers may be unsure whether their research agenda will eventually prove to be fruitful. Researchers with strong learning goals might enjoy this uncertain venture because they may consider failures as learning opportunities. In contrast, appearance goals are likely linked to feelings of anxiety in researchers because failure decreases one's chances to receive praise from relevant peers. In sum, the strength of researchers' appearance goals should be positively associated to engagement in QRPs. We further assume that appearance avoidance goals (i.e., striving to avoid demonstrating a lack of competence) are even more strongly tied to engagement in QRPs than appearance approach goals (i.e., striving to demonstrate competencies). This is because individuals with high appearance avoidance goals often also report a strong fear of failure (Elliot & Church, 1997; Janke et al., 2016) and might use any possible strategy that helps them to avoid failure.

The strength of the described relationship between appearance goals and QRPs might partly depend on personal values regarding the scientific method. In the wake of the replicability crisis, the current climate in psychological science has led to new possibilities to demonstrate one's competencies aside from producing significant results. More specifically, we are

currently experiencing the rise of researchers who warn against the dangers of QRPs and value ethical standards over publishing in high-impact journals (Nosek et al., 2015; Nosek, Spies, & Motyl, 2012; Simmons, Nelson, & Simonsohn, 2011). Researchers who strongly identify with and orientate themselves toward this open science movement may rely on different strategies to display their competence. When these researchers adopt appearance goals, they may aim to appear as rigorous as possible and openly refrain from engagement in QRPs.

The postulated relationships between achievement goals and QRPs would also explain why most researchers report that they have engaged in QRPs at least once but not regularly (John, Loewenstein, & Prelec, 2012). This high prevalence of QRPs makes it unlikely that engagement in such practices is a mere function of the personality of some ruthless researchers characterized by the so-called *dark triad*, consisting of *narcissism*, *Machiavellianism*, and *psychopathy*. The dark triad is highly associated with engagement in antisocial and norm-deviating behavior in general (Paulhus & Williams, 2002) and in the workplace (Jonason & O'Connor, 2017), which makes it likely that it is also positively associated with QRPs. However, the fact that only few researchers seem to engage in QRPs regularly also makes it likely that QRPs can be linked to variables prone to situational influences in the workplace, such as achievement goals (Janke & Dickhäuser, 2018). In sum, we assume that achievement goals will still be associated with QRPs when controlling for variance explained by more stable personality factors such as the dark triad.

Research Questions

In the present study, we investigated the relationship between psychological researchers' achievement goals and their self-reported engagement in QRPs. We assumed that learning goals would be negatively associated with QRPs, regardless of their goal valence. Furthermore, appearance goals should be positively associated with QRPs; with appearance avoidance goals being even more closely associated to QRPs than appearance approach goals. We further expected that achievement goals have incremental predictive power for QRPs beyond the influence of the dark triad (i.e., narcissism, Machiavellianism, and psychopathy) and researchers' current career phase or duration of occupation.¹ Finally, we assumed that personal values (i.e., the ascribed importance of publishing over scientific rigor) would moderate the association between appearance goals and QRPs; insofar that researchers who have strong achievement goals but also strongly favor scientific rigor over publishing will be less likely to engage in QRPs compared to researchers who favor scientific rigor less strongly.

Method

In this section, we report how we determined our sample size, all data exclusions, all manipulations, and all measures in the study. We preregistered our research questions, study design,

and sampling strategy prior to data collection (see the following link: <https://aspredicted.org/3np25.pdf>). The online survey was distributed via scientific mailing lists of the German Psychological Association. Participation was voluntary and informed consent was obtained for all participants. Participants were assured at the beginning of the survey and before reporting their engagement in QRPs that all their responses would remain confidential. No identifying information was obtained.

We only sampled doctoral candidates and postdocs who had not acquired a professorship (i.e., junior researchers); undergraduates and professors were automatically redirected to an end page and could not finish the survey. Doctoral candidates and postdocs typically engage in research and teaching activities in Germany and represent the majority of scientific staff at German universities (with only about 16% of the scientific staff holding a full professorship; Statistisches Bundesamt, 2015). It should be noted that the career paths for German researchers are especially competitive because they must acquire one of the rare full professorships in a restricted time span (usually around 12 years) if they want to remain within the scientific system (for further information on the German higher education system, see Hüther & Krücken, 2018; Jepsen et al., 2014). We specifically focused on these junior researchers for two reasons: (1) junior researchers have to prove their academic capabilities to the scientific community to reach their career objectives (doctorate or professorship) and thus should be especially susceptible to the influence of appearance goals. (2) As junior researchers will possibly be active within the field of psychology for many years to come, the pathways they choose to achieve a doctorate or professorship have a heavy influence on the development of research standards within the field. Identifying factors that are associated with junior researchers taking dark pathways (i.e., engagement in QRPs) might thus ultimately help to gain new important insights into how to prevent them from doing so and benefit the field.

Sample

Prior to data collection, we conducted an a priori power analysis with a sample size calculator for structural equation modeling (Soper, 2017). This sample size calculator is based on an algorithm by Westland (2010) that helps to determine the minimum sample size to detect given associations between latent variables. Assuming medium-sized associations between variables of $\rho = .30$, and a maximum of 8 latent and 39 manifest variables, 177 participants were necessary to detect the effect with a desired power of .80. Rounding up that number, we aimed for at least 200 participants who completed the full questionnaire. We preregistered a specific date after 1 month of sampling time, on which we checked whether we had reached the aspired number of participants. On this date, 310 researchers had started the survey and 217 had completed the full questionnaire. Since no participants had to be excluded (we originally planned to exclude all participants from other research fields than psychology and participants who did not

engage in empirical research), we had thus achieved a sufficient sample and ended data collection.

All participants were German-speaking researchers conducting empirical psychological research (73.3% female, $M = 32.08$ years; $SD = 5.04$ years). Of these, 53% were doctoral candidates (months spent as a researcher in the academic system: $M = 28.80$, $SD = 18.67$), while 47% were postdoctoral researchers (months spent as a researcher in the academic system: $M = 95.90$, $SD = 61.13$). Most participants had at least a master or an equivalent degree (95.4%) and were employed as scientific staff members at universities in Germany or German-speaking countries (88.9%). Further information on the sample can be found in the Online Supplemental Material.

Measures

QRPs were assessed with a questionnaire from John and colleagues (2012), which we translated into the German language. The questionnaire consisted of 9 items indicating QRPs (sample item: "How often have you reported an unexpected finding as having been predicted from the start?") and 1 item indicating scientific fraud ("How often have you falsified data?"). While John and colleagues (2012) mainly relied on a dichotomous scale (have you/have you not) for their main study, they also reported an alternative four-pointed frequency scale ranging from *never* to *frequently*. We used a slightly expanded version of this frequency scale, which also encompassed a fifth scale point titled *very often*. To obtain the overall tendency to engage in QRPs, we intended to aggregate all 9 items into one latent construct. Confirmatory factor analyses showed that a one-factor model (including one freed residual correlation between 2 items,² which was included in all analyses) fitted the data well; $\chi^2(25) = 36.42$, $p = .08$, root mean square error of approximation (RMSEA) = .04, comparative fit index (CFI) = .96, Tucker–Lewis index (TLI) = .95; estimator = weighted least squares means and variance (WLSMV)-adjusted estimator, factor loadings ranging between $\lambda = .44$; $p < .001$, 95% confidence interval (CI) = [0.24, 0.65] and $\lambda = .75$; $p < .001$, 95% CI [0.49, 1.00]; $\omega = .82$.

Achievement goals for research were assessed with the German achievement goal scale for university scholars (Daumiller, Dickhäuser, & Dresel, 2018) that we adapted slightly to the research context. Based on the item stem, "In my current research activities . . .," we used four subscales measuring researchers' learning approach (sample item: . . . it is my goal to expand my professional and methodological knowledge as much as possible; $\omega = .93^3$), learning avoidance (sample item: " . . . it is my goal to avoid failing to take full advantage of the potential of developing my own competences"; $\omega = .94$), appearance approach (sample item: " . . . it is my goal to be perceived as competent"; $\omega = .90$), and appearance avoidance goals (sample item: " . . . it is my goal to avoid being perceived as incompetent"; $\omega = .96$). Each subscale consisted of 4 items. The items were measured with a Likert-type scale (1 = *total disagreement*; 8 = *total agreement*). We also assessed normative approach and normative avoidance goals (see

preregistration). As the scales were assessed for exploratory reasons only and were unrelated to the present research question, we do not report any analyses here but included the data on these goals as an Online Supplemental Material.

The dark triad was measured with the German version of the “Dirty Dozen” scale (Küfner, Dufner, & Back, 2014), measuring narcissism (sample item: “I tend to want others to admire me”; $\omega = .79$), psychopathy (sample item: “I tend to lack remorse”; $\omega = .59$), and Machiavellianism (sample item: “I tend to manipulate others to get my way”; $\omega = .76$). Each subscale consisted of 4 items (Likert-type scale; 1 = *total disagreement*; 9 = *total agreement*).

To measure *personal values regarding scientific rigor*, participants reported whether it was more important to them to adhere to scientific standards or to publish in high-impact journals. We operationalized this single-item question as a semantic differential with 11 scale points between the two poles.

Analyses

In a first step, we aimed to detect the hypothesized association between achievement goals and QRPs and thus focused on the raw correlations. We calculated manifest correlations of composite scores and correlations with latent factors⁴ (to eliminate measurement error) using structural equation models with Mplus Version 7.2 (Muthén & Muthén, 1998–2012). When conducting structural equation models, we used the WLSMV-adjusted estimator. This estimator is robust to multivariate nonnormality and allows the inclusion of variables as indicators for latent factors that are characterized by a severe restriction of range (Flora & Curran, 2004).⁵ Latent variables were identified by fixing one factor loading to a value of one. Our data set did not include missing data on any variables. We interpreted misfit (RMSEA) and fit indices (CFI, TLI) to evaluate the respective model fit. Our interpretation relied on the rules of thumb by Schermelleh-Engel, Moosbrugger, and Müller (2003), distinguishing an acceptable model fit ($RMSEA \leq .08$, $CFI \geq .95$, $TLI \geq .95$) and a good model fit ($RMSEA \leq .05$, $CFI \geq .97$, $TLI \geq .97$).

In a second step, we conducted stepwise structural equation models to investigate whether achievement goals could explain variance beyond the influence of the dark triad and duration of occupation in academia. In a first model, we included the dark triad and career phase (postdoc vs. PhD) and duration of occupation in academia as predictors for QRPs. The facets of the dark triad were included as latent variables, whereas career phase and duration of occupation in academia were introduced as manifest scores. In a second model, achievement goals were included as additional (latent) predictors to the model. We then investigated whether the introduction of achievement goals led to an increase in explained variance compared to the original predictor set. We allowed for correlations between all latent variables in both models.

In a third step, we investigated whether personal values on the importance of scientific rigor moderated the relationship between appearance goals and engagement in QRPs in

additional moderation analyses. We conducted these analyses with manifest variables and the PROCESS macro for SPSS Version 24 (Hayes, 2012) because the respective procedure with Mplus was only calculable with the maximum likelihood estimator, which potentially produces biased results (Flora & Curran, 2004; Rhemtulla, Brosseau-Liard, & Savalei, 2012). Thus, we chose a more robust approach by focusing on the manifest composite scores.

Exploratory analyses on the relevance of motivation and personality for engaging in fraud were not possible because of the low number of researchers who reported having conducted fraud at all (less than 1%, a similarly low percentage as indicated by the findings of John et al., 2012). The data set and all relevant syntax files are provided in an open access repository (link: <https://osf.io/9ut4k/>). Here, we only report standardized scores. Unstandardized values and detailed factor loadings can be found in the output files also provided in the open access repository.

Results

Frequencies of Engagement in QRPs and Raw Correlations

Engagement in most QRPs was less frequent in our sample than in the sample reported by John and colleagues (2012) as Table 1 shows. Overall, 85.71% of the participants reported that they had relied on one or more of the provided QRPs at least once (John et al., 2012; 94%). However, some QRPs were more frequent in our sample, most notably the tendency to report unexpected findings as having been predicted from the start. Most participants who had engaged in QRPs indicated that they had only done so once or twice (44.6–100%, depending on the respective QRP, $M = 70.48\%$).

We provide the manifest correlations between composite scores and latent zero-order correlations alongside descriptive statistics of all scales in Table 2. The structural equation model that we conducted to estimate the latent associations fit the data well; $\chi^2(687) = 863.07$, $p < .001$, $RMSEA = .03$, $CFI = .96$, $TLI = .96$.⁶ We will mainly focus on the associations between latent factors because the increased power through suppression of measurement error enhances the chance to detect existing correlations. As hypothesized, QRPs were negatively associated with learning approach goals, $\rho = -.14$, $p = .039$, 95% CI $[-0.03, -0.26]$. In contrast, QRPs were positively associated with appearance approach goals, $\rho = .20$, $p = .014$, 95% CI $[0.33, 0.07]$. Descriptively, learning avoidance goals were negatively associated with QRPs, $\rho = -.11$, $p = .168$, 95% CI $[0.02, -0.23]$, although the correlation was not statistically significant. The association between performance avoidance goals and QRPs was very close to zero with $\rho = -.05$, $p = .493$, 95% CI $[-0.17, 0.07]$. In an exploratory analysis, we found that appearance goals in particular were moderately associated with narcissism, while associations of achievement goals with psychopathy and Machiavellianism were nonsignificant and near zero.

Table 1. Frequencies of Questionable Research Practices.

QRP	Engagement in Total (%)	Comparison (%; John et al., 2012)	Mean Frequency of Engagement
In a paper, failing to report all of a study's dependent measures	55.8	63.4	2.03 (SD = 1.14)
Deciding whether to collect more data after looking to see whether the results were significant	22.6	55.9	1.31 (SD = 0.66)
In a paper, failing to report all of a study's conditions	23.5	27.7	1.29 (SD = 0.59)
Stopping collecting data earlier than planned because one found the result that one had been looking for	3.7	15.6	1.04 (SD = 0.19)
In a paper, "rounding off" a <i>p</i> value (e.g., reporting that a <i>p</i> value of .054 is less than .05)	7.8	22.0	1.11 (SD = 0.41)
In a paper, selectively reporting studies that "worked"	43.3	45.8	1.66 (SD = 0.88)
Deciding whether to exclude data after looking at the impact of doing so on the results	41.5	38.2	1.61 (SD = 0.85)
In a paper, reporting an unexpected finding as having been predicted from the start	40.6	27.0	1.58 (SD = 0.82)
In a paper, claiming that results are unaffected by demographic variables (e.g., gender) when one is actually unsure (or knows that they do)	7.8	3.0	1.12 (SD = 0.47)

Note. Questionable research practices (QRPs) were measured with a scale ranging from *I never engage in this behavior* (1) to *I very often engage in this behavior* (5). Engagement in total shows the percentage of participants who answered that they had at least once engaged in the QRPs in question (scale value > 1). This makes our frequencies comparable to the ones reported by John et al. (2012) who mainly reported dichotomous findings (have/have not engaged in this behavior in the past).

Stepwise Latent Multiple Regressions

To investigate the incremental predictive power of achievement goals for QRPs, we computed two structural equation models. In the first model, we included the dark triad facets, career phase and duration of occupation in academia as predictor set for QRPs. The respective model achieved an acceptable model fit; $\chi^2(182) = 295.06$, $p < .001$, RMSEA = .04, CFI = .95, TLI = .94 (further details on the model and the obtained path coefficients can be found in the open access repository). The predictor set explained about 19% of the total variance of engagement in QRPs; $p = .004$, 95% CI [.08, .31]. In a second step, we included the investigated achievement goals into the predictor set. The model fitted the data well: $\chi^2(672) = 839.85$, $p < .001$, RMSEA = .03, CFI = .96, TLI = .96. The whole predictor set explained about 29% of the variance of engagement in QRPs; $p = .004$, 95% CI [.15, .43]. Thus, the inclusion of goals increased the explained variance by $\Delta R^2 = .10$ compared to the first model.⁷ All direct effects of the predictors are depicted in Figure 1. The paths of three achievement goals and one facet of the dark triad reached conventional two-tailed significance when we simultaneously accounted for all predictors. More specifically, appearance approach goals: $\beta = .38$, $p = .009$, 95% CI [.14, .62], and Machiavellianism: $\beta = .55$, $p = .005$, 95% CI [.23, .88], positively predicted engagement in QRPs, while learning approach goals: $\beta = -.22$, $p = .032$, 95% CI [-.39, -.05], and appearance avoidance goals: $\beta = -.30$, $p = .010$, 95% CI [-.50, -.11], proved to be negative predictors. Furthermore, duration of occupation in academia positively predicted QRPs with $\beta = .28$, $p = .003$, 95% CI [.12, .44].

Moderation Analysis: Personal Values and Engagement in QRPs

We investigated whether personal values moderated the effects of appearance goals on engagement in QRPs and found a

statistically significant moderation for appearance approach goals: $\beta = .14$, $p = .032$, 95% CI [.01, .26], but not for appearance avoidance goals: $\beta = .10$, $p = .075$, 95% CI [-.01, .21]. Simple slope analyses indicated that the more strongly researchers favored publishing over scientific rigor, the stronger the relationship between appearance approach goals and engagement in QRPs ($\beta_{SD-1} = .01$, $p = .870$, 95% CI [-.15, .18]; $\beta_{SD+1} = .29$; $p = .004$, 95% CI [.10, .49]; see Figure 2 for a graphical depiction).

Discussion

In this study, we investigated associations between researchers' achievement goals and reported QRPs. In particular, striving to display competence to others (appearance approach goals) positively predicted engagement in QRPs, while striving to expand one's own competencies (learning approach goals) negatively predicted engagement in QRPs. Furthermore, we observed an unexpected negative association of appearance avoidance goals with QRPs when both appearance approach and appearance avoidance goals were included in the respective model. Potentially, this negative effect could reflect the fear of being exposed when engaging in QRPs, which may become especially threatening when researchers are unsure about their ability to cover up their tracks. Achievement goals explained variance beyond personality, measured via the dark triad, and duration of occupation in academia. However, Machiavellianism also explained a fair part of the variance in QRPs. In addition, narcissism was particularly associated with achievement goal striving. The duration of one's occupation was also positively associated with QRPs, possibly reflecting increasing opportunities to engage in QRPs over time. Finally, the strength of the relationship between appearance goals and engagement in QRPs depended on personal values. Individuals valuing scientific rigor over publishing were less inclined to report QRPs even if they reported high appearance approach goals.

Table 2. Descriptive Statistics and Raw Correlations.

Scale	M	SD	Scale Range	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
(1) Appearance approach goals	6.21	1.37	1-8											
(2) Appearance avoidance goals	6.39	1.67	1-8	.55**										
(3) Learning approach goals	7.26	0.94	1-8	.25**	.23**									
(4) Learning avoidance goals	6.02	1.78	1-8	.15*	.36**	.50**								
(5) Machiavellianism	2.55	1.27	1-9	.07	.09	-.02	.04							
(6) Narcissism	4.19	1.65	1-9	.46**	.32**	.14*	.12	.41**						
(7) Psychopathy	2.50	1.23	1-9	-.01	-.05	-.13	.01	.52**	.22**					
(8) QRP	1.41	0.37	1-5	.16*	-.05	-.12	-.09	.20**	.16*	.05				
(9) Personal values ^a	3.04	2.01	1-11	.13	.02	-.21**	.00	.22**	.22**	.03	.28**			
(10) Duration of occupation ^b	6.34	48.84	—	.06	-.10	-.09	-.08	-.08	-.21**	-.06	.18**	-.08		
(11) Career phase ^c	—	—	—	.11	-.06	-.02	-.09	.01	-.09	-.05	.08	-.05	.69**	

Note. Means and standard deviations refer to the manifest composite scores. Range refers to the theoretical minimum and maximum of the scale and not to the empirically observed scale range. Values under the diagonal refer to associations between manifest variables, while values above the diagonal refer to associations between latent variables and to associations between manifest variables and latent variables (gray columns).

^aHigh values indicate a preference of publishing over scientific rigor. ^bIn months. ^c0 = PhD; 1 = postdoc.

* $p < .05$. ** $p < .01$.

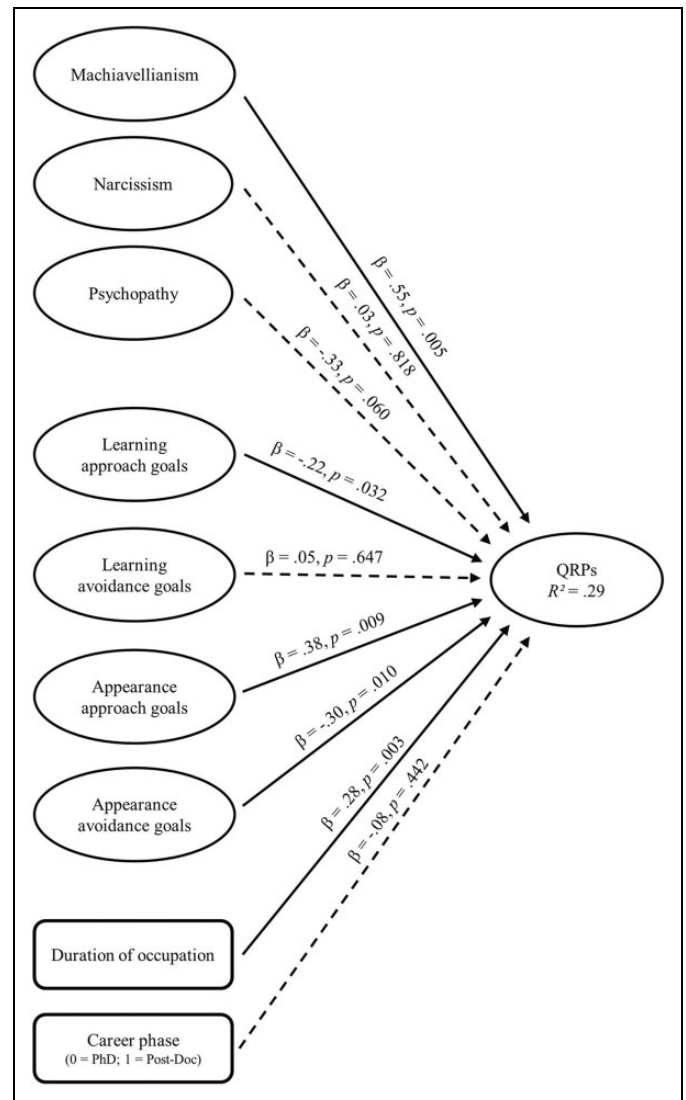


Figure 1. Direct effects of the predictor set in the second structural equation model on questionable research practices with exact p values. Dashed lines indicate path coefficients that did not reach the conventional threshold for statistical significance of $p < .05$. We did not depict factor loadings and unstandardized scores for better comprehensibility. The correlations between the predictor variables (also not depicted) mirrored the zero-order correlations depicted in Table 2. All factor loadings and correlations are also accessible through the respective Mplus output file in the open access repository.

Motivation and the Appeal of Dark Pathways

Taken together, the findings demonstrate the importance of considering researchers' motivation in the current debate on QRPs. While from a theoretical perspective, a causal effect of achievement goals on QRPs would be plausible, the cross-sectional design is not sufficient to clearly address issues of causality. Consequently, the obtained relationships could be a result of third variables or reflect bidirectional causation. For instance, engagement in QRPs could foster researchers' motivation to demonstrate competence as a means to cover up their

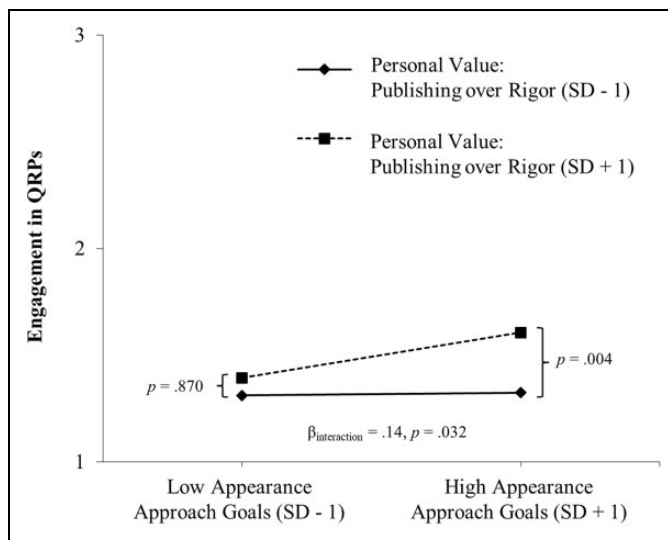


Figure 2. Depiction of the moderation effect of personal values (publishing vs. scientific rigor) on the relationship between appearance approach goals and engagement in questionable research practices (QRPs). The scale measuring QRPs ranged from *I never engage in this behavior* (1) to *I very often engage in this behavior* (5).

transgressions. This explanation, however, appears unlikely given that empirically, we found no significant zero-order correlation between achievement avoidance goals and QRPs (and even a negative one when the other achievement goals were also included in the model). In addition, prior empirical studies suggest that achievement goals are more likely to influence malpractice and cheating than vice versa (Anderman & Midgley, 2004; Murdock & Anderman, 2006; Van Yperen, Hamstra, & van der Klauw, 2011). When we embed our study in this larger body of research, we can at least speculate whether measures aiming to induce certain achievement goals could also have an effect on the frequency of conducted QRPs. Because of their negative association with self-reported QRPs, fostering learning approach goals in researchers might prove especially fruitful. This could be done by providing a working environment that supports the basic psychological needs for autonomy, competence, and relatedness (Janke & Dickhäuser, 2018; Janke, Nitsche, & Dickhäuser, 2015). The results of the conducted moderation analyses further suggest that it might be possible to weaken the positive association of appearance approach goals with QRPs by strengthening personal values inherently linked to research purity. Even though this is an interesting result, we think that additional research is needed regarding the strength of this moderation effect because researchers had to choose between two values (rigor vs. publication) that should not be mutually exclusive in an ideal research system.

Limitations

We observed a severe restriction of range when measuring the frequency of QRPs. This might partly be a result of self-

preservation because even in anonymous questionnaires researchers may be motivated to downplay the frequency of QRPs in their work to uphold the integrity of their identity as good researchers. The restriction of variance in QRPs limits possible associations with achievement goals, which may lead to an underestimation of the obtained effect and, subsequently, smaller associations than originally assumed ($p < .30$). Using self-reports to measure both engagement in QRPs and predictor variables could, however, also have led to overestimations of effect sizes due to shared-method bias. Nevertheless, we still think that anonymous self-reports are highly important when investigating frequencies and correlates of QRPs. Given that QRPs are disrespected scientific behavior, any observational methods would have drastically decreased both the behavior per se and the ecological validity. Furthermore, we do think that the fact that over 80% of the participants admitted that they had engaged in one or more QRPs makes it apt to assume that they tried to be honest in questionnaire.

Conclusion

Overall, we consider our research as the starting point of an important debate on the role of personal motivation for engagement in QRPs. Since our study is likely but a first data point in this debate, we think it is necessary and worthwhile to engage in more (longitudinal or even experimental) research that can explain the causality behind the observed relationships between achievement goals and QRPs. Insights from such research may help to get a better understanding on what can be done to reduce scientific malpractice.

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Supplemental Material

The supplemental material is available in the online version of the article.

Notes

1. We considered two possible opposing hypotheses regarding the association of these variables to questionable research practices (QRPs): On the one hand, QRPs might become more frequent over time, which might be due to a decline of idealism, frustrating experiences, and cognitive dissonance after using QRPs for the first

- time. On the other hand, QRPs might become less frequent over time, which might be associated with a decrease of self-doubt, a sense of accomplishment after the attainment of the PhD, and the increasing irrelevance of the results from singular studies.
- The residual correlation was included for the items “How often have you failed to report all of a study’s dependent measures in a paper?” and “How often have you decided whether to collect more data after looking to see whether the results were significant.” Input and output files for the conducted confirmatory factor analyses are in the open access repository.
 - We calculated the internal consistency of this subscale and all other reported internal consistencies by conducting confirmatory factor analyses, which included only the items of the respective subscales indicating a single factor.
 - We allowed for the residual correlation of 2 items indicating QRPs (see Method section) when estimating the respective latent factor in all following analyses. Additionally, we neither included further residual item correlations in any of the models nor excluded any items when estimating the respective latent factors.
 - The items measuring QRPs were particularly asymmetrically distributed. Responders primarily used the three lowest answer options of the 5-point Likert-type scales, which poses a problem for estimators such as the maximum likelihood estimator that requires more evenly distributed functions (Rhemtulla et al., 2012). Most items indicating Machiavellianism, psychopathy, and learning approach goals were also strongly asymmetrically distributed. Therefore, we relied on the weighted least squares means and variance-adjusted estimator and treated the items of the mentioned scales as categorical variables (further information on the item distributions can be found in the Online Supplemental Material).
 - Further details on latent means, factor loadings, unstandardized coefficients, and the respective covariance matrix on all reported structural equation models are included in the Mplus output files provided in the open access repository. No apparent signs of misspecification (error variances < 0; factor loadings > 1) were found for any of the models.
 - As a response to a reviewer remark concerning the ratio of parameters to sample size, we also conducted a manifest stepwise multiple regression analysis. The result pattern is robust for this change in methodology, both with regard to significant predictors and the fact that goals increased the explained variance ($\Delta R^2 = .07$).
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