A century of research on conscientiousness at work

Michael P. Wilmot[a,1,2] and Deniz S. Ones[b]

[a]Department of Management, University of Toronto Scarborough, Toronto, ON M1C 1A4, Canada; and [b]Department of Psychology, University of Minnesota, Minneapolis, MN 55455

Edited by Susan T. Fiske, Princeton University, Princeton, NJ, and approved September 17, 2019 (received for review May 24, 2019)

Evidence from more than 100 y of research indicates that conscientiousness (C) is the most potent noncognitive construct for occupational performance. However, questions remain about the magnitudes of its effect sizes across occupational variables, its defining characteristics and functions in occupational settings, and potential moderators of its performance relation. Drawing on 92 unique meta-analyses reporting effects for 175 distinct variables, which represent $n > 1.1$ million participants across $k > 2{,}500$ studies, we present the most comprehensive, quantitative review and synthesis of the occupational effects of C available in the literature. Results show C has effects in a desirable direction for 98% of variables and a grand mean of $\bar{\rho}_M = 0.20$ (SD = 0.13), indicative of a potent, pervasive influence across occupational variables. Using the top 33% of effect sizes ($\bar{\rho} \geq 0.24$), we synthesize 10 characteristic themes of C's occupational functioning: 1) motivation for goal-directed performance, 2) preference for more predictable environments, 3) interpersonal responsibility for shared goals, 4) commitment, 5) perseverance, 6) self-regulatory restraint to avoid counterproductivity, and 7) proficient performance—especially for 8) conventional goals, 9) requiring persistence. Finally, we examine C's relation to performance across 8 occupations. Results indicate that occupational complexity moderates this relation. That is, 10) high occupational complexity versus low-to-moderate occupational complexity attenuates the performance effect of C. Altogether, results suggest that goal-directed performance is fundamental to C and that motivational engagement, behavioral restraint, and environmental predictability influence its optimal occupational expression. We conclude by discussing applied and policy implications of our findings.

conscientiousness | personality | meta-analysis | second-order meta-analysis | occupations

For more than 100 y, industrial-organizational psychologists have endeavored to understand the psychological determinants of individuals' occupational performance. Although cognitive ability has emerged as the most powerful predictor of performance (1, 2), evidence of substantial group differences in ability levels (3) has stimulated investigations for noncognitive constructs that are predictively potent, yet display smaller group differences (4). Promising early constructs included achievement motivation and employee reliability (5), whereas more recent constructs include self-control (6) and grit (7, 8). However, cumulative evidence indicates that all of these noncognitive constructs, among others (9), overlap substantially with a common higher-order personality construct—conscientiousness (C).

C refers to individual differences in the tendency to be hard-working, orderly, responsible to others, self-controlled, and rule abiding (9). Meta-analyses show C is a potent predictor of consequential life outcomes, including academic performance (10), physical health and mortality (11), work performance (12), marital stability (11), and subjective well-being (13). Although the importance of C for health and flourishing is beyond dispute, questions remain about its relations to occupational variables: specifically, the magnitudes of its effects; its defining characteristics and functions for occupational variables; and the potential moderating role of variable categories, career domains, and occupations. However, these questions are difficult to answer because C findings are vast and widely scattered throughout the literature. Consequently, what is needed is a comprehensive, quantitative review and synthesis of C's effects in occupational settings, which summarizes what industrial-organizational psychologists have learned in a century of research.

Accordingly, we quantitatively review effects of C for occupational variables as reported in extant meta-analyses. We identify 92 unique meta-analyses reporting effects for 175 distinct variables, which represent $n > 1.1$ million participants across $k > 2{,}500$ studies. We update meta-analytic estimates using a common set of corrections, which address statistical artifacts similarly across variables (14). When multiple, non-overlapping meta-analyses report effects to the same variable, we combine them by second-order meta-analysis (15). With this evidence in hand, we answer 3 research questions: What are the effect sizes of C for occupational variables? What are the key themes that characterize the functioning of C for occupational variables? And what roles do different variable categories, career domains, and occupations play on the effects of C?

We organize our paper as follows. First, we briefly review C's theoretical underpinnings. Second, we describe our meta-analytic database. Third, we report the distribution of C's effects for occupational variables, followed by its effects across conceptual categories, career domains, and occupations. We conclude by synthesizing themes and describing implications of our results.

Theoretical Foundations

Constructs associated with C are central to most major theories and descriptive models of personality (9). Competing models and

Significance

Conscientiousness (C) is the most potent noncognitive predictor of occupational performance. However, questions remain about how C relates to a plethora of occupational variables, what its defining characteristics and functions are in occupational settings, and whether its performance relation differs across occupations. To answer these questions, we quantitatively review 92 meta-analyses reporting relations to 175 occupational variables. Across variables, results reveal a substantial mean effect of $\bar{\rho}_M = 20$. We then use results to synthesize 10 themes that characterize C in occupational settings. Finally, we discover that performance effects of C are weaker in high-complexity versus low- to moderate-complexity occupations. Thus, for optimal occupational performance, we encourage decision makers to match C's goal-directed motivation and behavioral restraint to more predictable environments.

Author contributions: M.P.W. and D.S.O. conceptualized research; M.P.W. designed research; M.P.W. performed research; M.P.W. analyzed data; and M.P.W. and D.S.O. wrote the paper.

The authors declare no competing interest.

This article is a PNAS Direct Submission.

[1]Present address: Human Resources Research Organization, Minneapolis, MN 55401.

[2]To whom correspondence may be addressed. Email: mp.wilmot@utoronto.ca.

This article contains supporting information online at www.pnas.org/lookup/suppl/doi:10.1073/pnas.1908430116/-/DCSupplemental.

measures notwithstanding, C scores correlate moderately across scales (16) and occasions (17) and follow a trajectory of increase from adolescence up to age 60 y (18). Evidence indicates that C is partly heritable (19) and genome-wide association studies are beginning to explicate its genetic underpinnings (20). Concerning neural correlates, C is linked to brain networks that facilitate prioritization of multiple goals (21). From an agentic perspective, C helps to protect individuals' nonimmediate goals and associated behaviors from disruption (22). From a social and organizational perspective, C helps individuals regulate their impulses to comply with social norms (23) and promotes a disciplined striving for achievement in workplace settings (24). Concerning assessment, most prior work treats C as unidimensional. A growing body of findings shows the value of modeling C as a multidimensional construct (11, 12, 25), which has a hierarchical structure of mesolevel aspect traits (26) and microlevel facet traits (9) (for a compendium, see ref. 27). Nevertheless, because the meta-analytic evidence is sparser for these lower-order traits, our paper focuses exclusively on overall measures of C.

Meta-Analytic Database

Altogether, 175 occupational variables reported in 92 meta-analyses met the criteria for inclusion in our quantitative review (for details on search and inclusion criteria and analyses, see *Materials and Methods*). Given the considerable number of variables, we used an organizing framework (28) consisting of 5 conceptual categories of variables: motivations, values, and interests (i.e., internal forces that influence direction, intensity, and persistence of occupational affect, cognitions, and behavior); interpersonal (i.e., behavior involving interpersonal interaction with or influence of others to pursue shared goals, as well as outcomes of successful interaction or influence); attitudes and well-being (i.e., emotional or cognitive evaluations of occupational phenomena and their influence on individuals' psychological well-being); counterproductivity (i.e., behavior reflecting social or moral impairment that detracts from occupational goals, as well as outcomes of misbehavior); and performance (i.e., behavior that contributes to occupational goals, as well as outcomes of successful contribution). This framework also includes 4 major career domains that individuals encounter across their working lives: education, job application, on the job, and career/lifespan, which subdivide findings in each of the conceptual categories (for descriptions and meta-analytic sources of all occupational variables, see *SI Appendix*, Table S1).

In addition, 8 occupations reported in 9 meta-analyses met criteria for inclusion in our quantitative review of occupation-specific performance: customer service, healthcare, managerial, military, police, professional, skilled/semiskilled, and sales. We arranged these occupations by the complexity associated with their technical work demands. To do so, we used occupational complexity ratings provided in the *Dictionary of Occupational Titles* (29), which is a catalog of occupations reported in the United States (for details, see *SI Appendix*, Table S2).

Distribution of Effect Sizes for Occupational Variables

Table 1 presents the distribution of meta-analytic effects of C for occupational variables. Before computing descriptive statistics, we rekeyed effects for variables with a negative valence (e.g., counterproductivity) or a neutral valence (e.g., vocational interests) in a positive direction (e.g., avoiding counterproductivity). Overall, C relations to occupational variables range from $\overline{\rho} = -0.25$ to 0.77, and 98% of these effects are in a desirable direction. Respective effects at the first, median, and third quartiles are $\overline{\rho} = 0.11$, 0.18, and 0.26. The grand mean effect of $\overline{\rho}_M = 0.20$ (SD = 0.13) shows that C confers a potent, pervasive influence across occupational variables. This effect of C is medium in magnitude (30), exceeds those of other personality constructs (1, 28) (for details, see *SI Appendix*, Table S3), and compares favorably to the average individual differences effect across comparable variables (i.e., $\overline{\rho}_M = 0.21$) in occupation-relevant meta-analyses (31).

Table 1. Distribution of effect sizes of C for occupational variables

Conceptual category by career domain	n_{var}	$\overline{\rho}_M$	SD_ρ
Overall	175	0.20	0.13
Motivations, values, and interests	44	0.22	0.17
Education	5	0.33	0.27
Job application	3	0.23	0.05
On the job	13	0.31	0.08
Career/lifespan	23	0.15	0.16
Interpersonal	27	0.12	0.08
Education	0	—	—
Job application	9	0.09	0.05
On the job	6	0.13	0.07
Career/lifespan	12	0.15	0.10
Attitudes and well-being	40	0.23	0.13
Education	7	0.37	0.10
Job application	3	0.14	0.04
On the job	25	0.18	0.09
Career/lifespan	5	0.34	0.16
Counterproductivity	18	−0.20	0.14
Education	1	−0.22	—
Job application	1	0.25	—
On the job	9	−0.25	0.10
Career/lifespan	7	−0.19	0.06
Performance	46	0.17	0.10
Education	8	0.25	0.07
Job application	9	0.12	0.11
On the job	20	0.17	0.07
In-role	9	0.20	0.09
Extra-role	4	0.20	0.02
Change oriented	7	0.11	0.02
Career/lifespan	9	0.16	0.13

n_{var}, total number of variables per category; ρ_M, mean estimated population correlation across variables; SD_ρ, between-variables standard deviation in population correlations.

Characteristic Themes of Occupational Functioning

Having answered our question about the overall effects of C for occupational variables, we now examine findings across our organizing framework of conceptual categories and career domains. Although space limits a full presentation of effects, Fig. 1 presents a summary of meta-analyses of C and occupational variables in the top 50% of effect sizes (i.e., $\overline{\rho} \geq 0.20$), which are sorted by magnitude in each category (for complete results, see *SI Appendix*, Tables S4–S8).* We also identify themes that characterize C functioning in occupational settings. To do so, we focus mainly on the top 33% of effects (i.e., $\overline{\rho} \geq 0.24$; cf. ref. 28), which represents C's most potent effects.

Motivation for Goal-Directed Performance and Preference for More Predictable Environments. Table 1 summarizes meta-analyses of C and motivations, values, and interests variables. C has effects in a desirable direction for 43 of 44 variables (98%), with a mean of $\overline{\rho}_M = 0.22$ (SD = 0.17). Breaking out results by career domain, C displays moderate-to-strong effects in education ($\overline{\rho} = 0.33$), job application ($\overline{\rho} = 0.23$), and on the job ($\overline{\rho} = 0.31$) contexts, but a

*Actual estimates for academic procrastination ($\overline{\rho} = -0.77$) and procrastination ($\overline{\rho} = -0.74$) were trimmed to format Fig. 1.

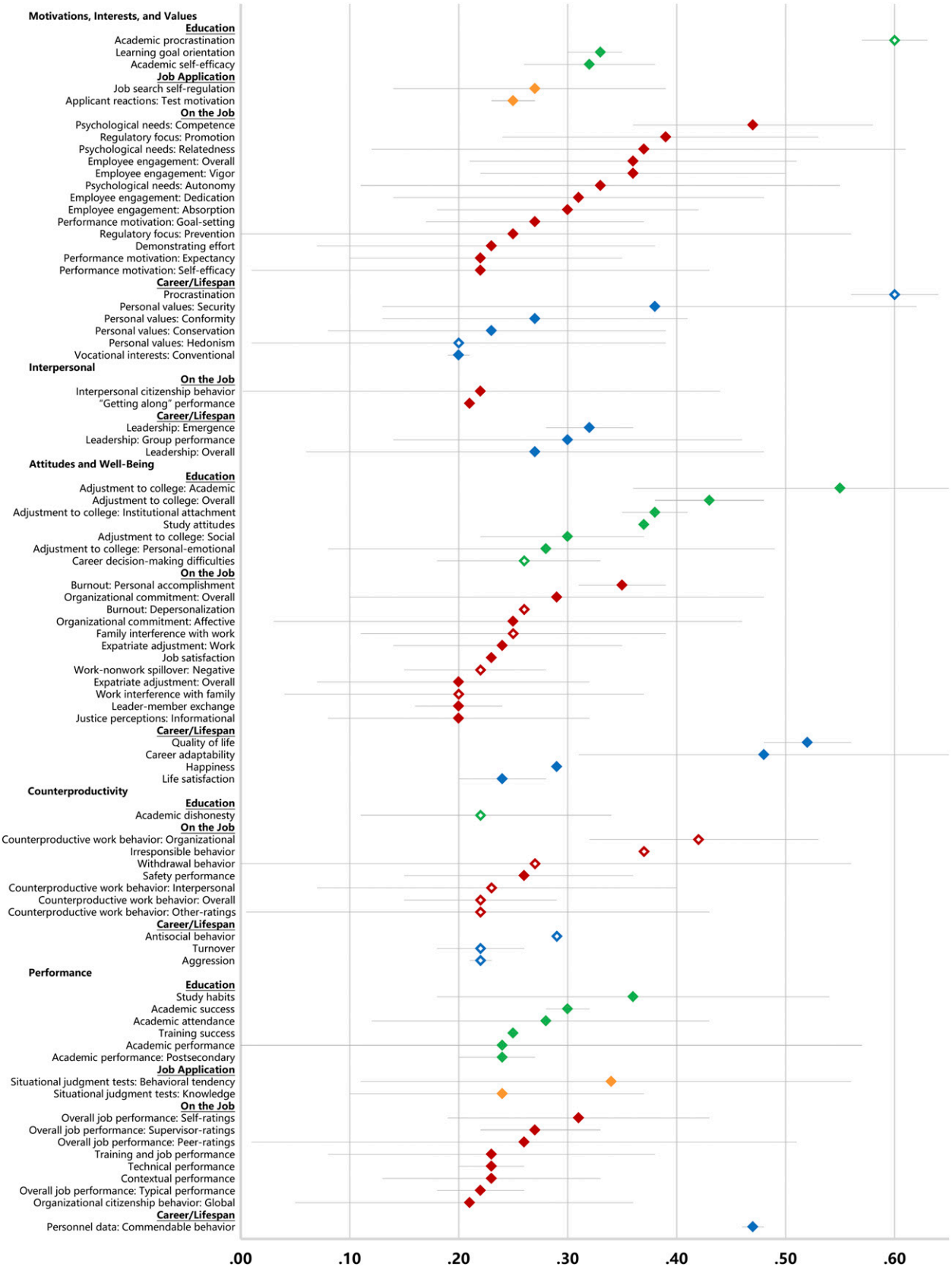

Fig. 1. Summary of meta-analyses of C and occupational variables in the top 50% of effect sizes (i.e., $\bar{\rho} \geq 0.20$). Effects are organized across conceptual categories (boldface type) and career domains (underlined) and sorted by magnitude. Solid diamonds represent estimated population correlations corrected for unreliability; open diamonds indicate that the estimate was reversed for graphical display. Horizontal bars are 80% credibility intervals around each population correlation. The colors green, orange, red, and blue distinguish the career domains of education, job application, on the job, and career/lifespan, respectively (for relations to specific variables, see *SI Appendix*, Tables S4–S8).

smaller career/lifespan effect ($\overline{\rho} = 0.15$). Overall, C has potent effects for motivations, values, and interests variables.

To better understand C's functioning for these variables, Fig. 1 includes 18 effects in the top 33%, which we use to synthesize 2 themes that characterize its functioning in occupational settings. The first theme is that C has notable links to variables reflecting a motivation for goal-directed performance. Learning goal orientation, promotion regulatory focus, and goal-setting performance motivation supports the neurological evidence that setting and prioritizing goals are fundamental to the expression of C (22). Goal setting has a galvanizing and focusing effect on the performance motivation of C, as well as on subsequent efforts to competently execute goal-relevant occupational tasks with vigorous and absorbing engagement. Goal prioritization and engagement not only enable the performance of C, but also offer protective benefits against the self-regulatory failure represented by procrastination in academic and occupational settings.

The second theme is a preference for more predictable environments. Relations of C to personal values of security and conformity suggest that C functions best in orderly and secure occupational contexts that provide clear expectations and social norms. Relatedly, interests of C in conventional vocations (i.e., activities involving manipulating data, records, and/or systems) reflect inclinations for work tasks requiring adherence to rule-based procedures and structures. Values of and vocational interests in more predictable environments pair well with C's goal-directed motivation, key themes that facilitate focused engagement in attaining occupational ends (for relations to specific motivations, values, and interests variables, see *SI Appendix*, Table S4).

Interpersonal Responsibility for Shared Goals. Table 1 summarizes meta-analyses of C and interpersonal variables. C has effects in a desirable direction for all 27 variables (100%), with a mean of $\overline{\rho}_M = 0.12$ (SD = 0.08), which is the smallest effect across the conceptual categories in our framework. Breaking out results by career domain, C has a weak job application effect ($\overline{\rho} = 0.09$) and small effects on the job ($\overline{\rho} = 0.13$) and across the career/lifespan ($\overline{\rho} = 0.15$). Overall, C shows moderate potency for interpersonal variables.

To better understand the functioning of C for these variables, Fig. 1 includes 3 effects in the top 33%. A characteristic theme of C functioning is interpersonal responsibility for shared goals. On the job and across the career/lifespan, C has stronger effects for variables involving helping coworkers, effective teamworking, emerging as leader, and leading others to accomplish shared goals. Overall, C is distinguished by reliable execution of socially prescribed interactions and willingness to collaborate with and lead others to accomplish collective ends (for relations to specific interpersonal variables, see *SI Appendix*, Table S5).

Commitment and Perseverance. Table 1 summarizes meta-analyses of C and attitudes and well-being variables. C has effects in a desirable direction for 39 of 40 variables (98%), with a category mean of $\overline{\rho}_M = 0.23$ (SD = 0.13). Breaking out results by career domain, C has a sizable education effect ($\overline{\rho} = 0.37$), more modest job application ($\overline{\rho} = 0.14$) and on the job ($\overline{\rho} = 0.19$) effects, and an appreciable career/lifespan effect ($\overline{\rho} = 0.26$). Overall, C displays potent, if somewhat varying, effects for attitudes and well-being variables.

To better understand the functioning of C for these variables, Fig. 1 includes 17 effects in the top 33%. Two major themes characterize C functioning. Positive attitudes toward studying, decisiveness about career decision making, and overall organizational commitment are indicative of strong goal commitment. Goals, especially goals that are amenable to self-regulatory control, appear to foster the will to perform goal-relevant tasks in academic and occupational contexts.

The second theme is perseverance. C is marked by the ability to adjust to novel contexts in education (e.g., educational adjustment), on the job (e.g., expatriate adjustment), and career/lifespan domains (e.g., career adaptability). Perseverance appears to confer protective benefits against occupational stressors that diminish individual well-being or perceptions of others (e.g., burnout dimension of depersonalization). Finally, the pairing of commitment and perseverance contributes to the inevitable achievement of occupational goals, producing a sense of personal accomplishment and higher appraisals of happiness, life satisfaction, and quality of life (for relations to specific attitudes and well-being variables, see *SI Appendix*, Table S6).

Self-Regulatory Restraint to Avoid Counterproductivity. Table 1 summarizes meta-analyses of C and counterproductivity variables. C has effects in a desirable direction for 17 of 18 variables (94%), with a mean of $\overline{\rho}_M = -0.20$ (SD = 0.14). Breaking out results by career domain shows minimal differences for education, on the job, and career/lifespan contexts (range of $\overline{\rho} = -0.19$ to -0.25).[†] Overall, C has potent and strikingly consistent effects for counterproductivity.

To better understand the functioning of C for these variables, Fig. 1 includes 6 effects in the top 33%. Results suggest that self-regulatory restraint to avoid counterproductivity is a key C theme. Remarkably, counterproductivity avoidance is largely invariant across career domains and displays salutary effects for the individual (e.g., safety performance), for others (e.g., lack of antisocial, irresponsible behavior), and for organizations (e.g., lack of organizationally directed counterproductive work behavior). Findings parallel other evidence that C relates negatively to risky health, addictive, and deviant behaviors (6, 11) across multiple domains of life (32). It also supports the theory that C helps to protect nonimmediate goals and behaviors from the disruption of hedonistic impulses, as well as the external distractions that detract from occupational objectives (21, 22, 24) (for relations to specific counterproductivity variables, see *SI Appendix*, Table S7).

Proficient Performance—Especially for Conventional Goals Requiring Persistence. Table 1 summarizes meta-analyses of C and performance variables. C has effects in a desirable direction for 45 of 46 variables (98%), with a mean of $\overline{\rho}_M = 0.17$ (SD = 0.10). Breaking out results by career domain, C has a strong effect for education ($\overline{\rho} = 0.25$), moderate effects on the job ($\overline{\rho} = 0.17$) and across career/lifespan ($\overline{\rho} = 0.16$), and a smaller effect for job application settings ($\overline{\rho} = 0.12$). Given the larger number of contributing variables, we divided the on the job domain into 3 subcategories of performance: in-role (i.e., performance that is mandatory), extra-role (i.e., performance that is discretionary, but encouraged), and change oriented (i.e., performance that is directed at making or advocating change); their respective effects are $\overline{\rho} = 0.20$, 0.20, and 0.11. Overall, C is certainly characterized by proficient performance, but 2 other themes are notable.

To better understand C's functioning for these variables, Fig. 1 includes effects for 12 variables in the top 33%. First, C has stronger effects in well-structured contexts (i.e., education) and for variables that involve following socially prescribed behaviors (e.g., situational judgment tests, commendable behavior). As Table 1 shows, despite differing in terms of compulsory and voluntary behaviors, in-role and extra-role effects are much stronger than the change-oriented effect, a subcategory that comprises variables reflecting greater ambiguity, imagination, and an advocacy of counter-normative change. Although C does offer some change-oriented benefits, its effects are more

[†]Although job application appears to be an exception, the effect for its associated variable, "applicant faking," is not a function of C, but rather reflects evidence that job applicants self-report higher levels of C than job incumbents.

profitably directed toward more conventional goals and social expectations.

Second, C has stronger effects for variables requiring persistent, long-term performance (e.g., academic performance) than it does for variables requiring intense, short-term performance (e.g., assessment center performance). This persistence theme explains the relatively weaker job application effect, which mainly includes variables demanding maximal performance versus the typical performance over time that is more characteristic of C. Finally, proficient performance of C, especially for conventional goals requiring persistence, is recognized in occupational contexts (e.g., overall job performance as rated by supervisors, peers, and the self; for relations to specific performance variables, see *SI Appendix*, Table S8).

Having answered our questions about the key themes that characterize the functioning of C for occupational variables and the roles that conceptual categories and career domains play on C effects, we now turn to the effect that specific occupations have on occupational performance.

Moderating Role of Occupational Complexity on Occupational Performance

Fig. 2 shows meta-analyses of C and occupational performance across 8 occupations, which are organized according to the complexity of their technical work demands. Effects range from $\bar{\rho} = 0.13$ to 0.33, with a mean of $\bar{\rho} = 0.22$ (SD = 0.06). Overall, C displays potent performance effects that generalize across available occupations; however, complexity moderates this relation.

C has strong effects for occupations that are low to moderate in occupational complexity (e.g., skilled/semiskilled, customer service), but weaker effects for occupations that are high in occupational complexity (e.g., professional). High-complexity occupations require the ability to detect and solve novel, ill-structured, and atypical problems. However, these requirements are asymmetrical with the themes that characterize the functioning of C: specifically, motivation to engage in persistent, goal-directed performance on conventional tasks in more well-structured, predictable environments (for relations to specific occupations, see *SI Appendix*, Table S9). In short, high occupational complexity attenuates the relation of C and occupational performance.

Discussion and Implications of Findings

Drawing on 92 unique meta-analyses reporting effects for 175 distinct variables, which represent $n > 1.1$ million participants across $k > 2{,}500$ studies, we presented the largest, most comprehensive quantitative review and synthesis of the occupational effects of C available in the literature. Our paper makes 3 important contributions. First, we reported the distribution of C effects for a plethora of occupational variables—a compendium that is unavailable elsewhere. C has effects in a desirable direction for 98% of variables and a grand mean of $\bar{\rho}_M = 0.20$, indicative of a potent, pervasive influence across occupational variables. Second, we identified key themes that characterize the occupational functioning of C. Focusing on the top 33% of effect sizes ($\bar{\rho} \geq 0.24$), we synthesized 10 themes: 1) motivation for goal-directed performance, 2) preference for more predictable environments, 3) interpersonal responsibility for shared goals, 4) commitment, 5) perseverance, 6) self-regulatory restraint to avoid counterproductivity, and 7) proficient performance—especially for 8) conventional goals, 9) requiring persistence. Third, we examined the role that different occupations have on C's relation to occupational performance. Although C shows potent, generalizable effects for performance across available occupations, complexity moderates this relation. That is, 10) high occupational complexity attenuates the relation of C and occupational performance.

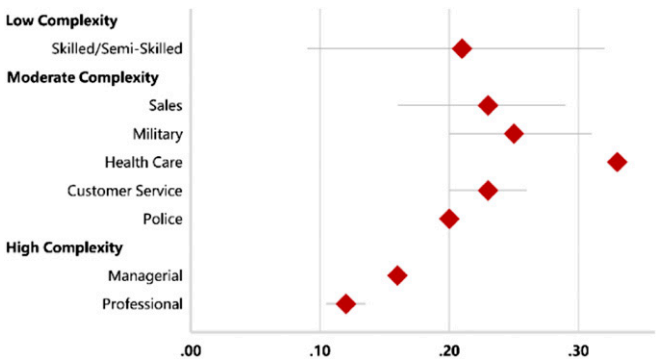

Fig. 2. Summary of meta-analyses of C and occupational performance across 8 occupations. Diamonds represent estimated population correlations corrected for unreliability. Horizontal bars are 80% credibility intervals around each population correlation (for relations to specific occupations, see *SI Appendix*, Table S9).

The preceding paragraph suggests that goal setting and prioritization are essential to C expression (21, 22). Occupational goals activate the motivational engagement and behavioral restraint that are required for C's proficient performance. Goals constrain the scope of possible behaviors by demanding commitment to a specific end, which channels and focuses motivational engagement toward accomplishing that objective. Associated characteristics of perseverance and persistence increase the likelihood that that goal will be achieved. Further, it is noteworthy that C effects are as potent for individual goals as they are for interpersonal responsibility for and collaboration on shared goals. However, that is only one part of it. Goals activate requisite self-regulation to avoid external distractions, hedonistic impulses, and general counterproductivity that can detract from, or even undermine, goal-relevant performance. Finding that C's counterproductivity avoidance is largely invariant across time and career domains is remarkable. It attests to the importance of C for adherence to behavioral norms and societal rules (9, 23). Finally, motivational engagement and behavioral restraint have strong theoretical links to C's lower-order aspect traits (22, 26), which represent a promising way to advance future occupational research.

Motivational engagement and behavioral restraint stemming from goals contribute to C's performance effects, but a third consideration is the need for more predictable environments. C behaviors are not context independent, but rather are subject to certain boundary conditions. C shows its most potent effects in orderly and well-structured occupational settings that have clear social expectations. C effects are most profitably aligned to tasks that specify conventional goals and are low to moderate in complexity. Environmental predictability presumably serves to hone C's persistent, goal-directed motivation, which would otherwise be diluted through diffusion by more ill-structured, ambiguous, or complicated circumstances. For occupational contexts or tasks that do not match these characteristics, C would benefit from the compensatory effects of domain-specific knowledge or skills, cognitive ability (the effect of which increases with high occupational complexity) (1, 2), or other noncognitive constructs (e.g., extraversion) (28) that support high-complexity functioning.

Our findings have applied and policy implications. Motivational engagement, behavioral restraint, and environmental predictability are 3 major considerations for C's goal-directed performance. What is more, they correspond to fundamental human needs for status, acceptance, and predictability (33). Organizations can harness the potent effects of C for their

employees by including quality measures and indicators of C in their selection and talent management systems. Individuals can benefit by considering their own C levels in making vocational choice and career plans. Societally, it would be more profitable to invest in interventions and programs that target C development in educational systems, rather than focusing on C failures after they manifest in adulthood. To be both equitable and useful, intervention efforts should be broadly based (i.e., not limited to specific groups or students with lower C levels) and balanced, to avoid the unintended consequences of promoting extremely high C levels (e.g., obsessive compulsive tendencies) (34).

Conclusion

Few individual differences variables have occupational effects as potent and pervasive as C. Based on evidence from more than a century of occupational research, the vast treasure trove of findings presented here should motivate every individual, organizational, and societal decision maker to better understand, develop, and apply the valuable human capital resource that is C.

Materials and Methods

Literature Search and Inclusion Criteria. Several search strategies were used to locate C meta-analyses appearing between January 1990 and December 31, 2018. To qualify for inclusion, a record had to meet 4 criteria. It had to be 1) a meta-analysis, 2) published, 3) in the English language, and 4) reporting the zero-order relation of C to at least one work-relevant variable. Records were disqualified following the first missed criterion. Likewise, to qualify for inclusion, a variable had to meet 5 criteria. It had to 1) report sufficient data for analysis, 2) use C self-reports, 3) relate to a consequential work or educational variable, 4) permit its inferences to the general working population, and 5) come from an independent meta-analysis (i.e., only one effect per variable included). Variables were excluded after the first missed criterion. A variable had to meet the same criteria, except for 4), to qualify for inclusion in the review of occupation-specific performance. For variables reporting multiple, nonindependent effects, the estimate from the more comprehensive meta-analysis was used. Variables reporting multiple, independent effects were combined using second-order meta-analysis. Altogether, 175 variables reported in 92 meta-analyses met inclusion criteria, including effects from 8 occupations. We systematically extracted descriptive data from the qualifying meta-analyses, including the name, source, and operational description of the focal variable; the total number of independent samples; total sample size; mean sample-size weighted observed effect size; and an index of between-studies variability. Several records did not report complete descriptive data, so some estimation and transformations were required (for details, see *SI Appendix, Supplementary Methods*).

First-Order Meta-analyses. We did not conduct any new first-order meta-analyses in this review. Instead, we used methods from psychometric meta-analysis (14) to update the estimates from all qualifying meta-analyses with a common set of statistical corrections, which similarly addressed sampling error and measurement error across contributing records. To correct for measurement error, we used frequency-weighted artifact distributions (for details, see *SI Appendix*). Because of sporadic reporting, we did not correct for range restriction. Meta-analyses included in our review had a common set of statistics: first, descriptive statistics (i.e., k, N, mean sample-size weighted observed $\bar{r}$, and its SD, SD_r) reported in, or estimated from, their source meta-analysis. Corrections were used to estimate the mean population correlation ($\bar{\rho}$) and its SD (SD_ρ). Next, we calculated confidence and credibility intervals. Confidence intervals (CIs) estimate the boundaries wherein the observed correlation is expected to fall based on the SE of between-study effects. Credibility intervals (CRs) estimate the between-studies heterogeneity in population effects and are calculated using SD_ρ. Estimates with 80% CRs that exclude zero are interpreted as generalizing across contexts (14) (for first-order meta-analyses to specific variables and occupations, see *SI Appendix*, Tables S4–S9).

Second-Order Meta-analyses. Several meta-analyses reported findings from multiple, nonoverlapping meta-analyses, which were combined using second-order meta-analysis procedures. Second-order meta-analysis extends the procedures of psychometric meta-analysis by enabling the cumulation of effects from independent meta-analyses, which helps refine population parameter estimates and also accounts for second-order sampling error (15). Second-order meta-analysis uses basic input (i.e., k, N, $\bar{r}$, and SD_r) and mean population correlations ($\bar{\rho}$) from 2 or more first-order meta-analyses and had a common set of statistics. First, m summarizes the number of contributing first-order meta-analyses. Next, the grand mean correlation ($\bar{\rho}_M$) and its associated variance (VAR_{True}) are estimates of second-order population parameters, having accounted for measurement error and second-order sampling error. Confidence and credibility intervals are also calculated (15) (for details, see *SI Appendix, Supplementary Methods*). Overall, we conducted 47 second-order meta-analyses (22% of included variables; for second-order meta-analyses to specific variables, see *SI Appendix*, Tables S10–S15).

Evaluations of Publication Bias and Sensitivity Analyses. Publication bias and questionable research practices may influence the scientific record. Meta-analyses are not immune from these influences and methods have been proposed to test for their effects (see ref. 35 for a review). Accordingly, we conducted evaluations of publication bias and sensitivity analyses for meta-analyses contributing to our review and sensitivity analyses for our second-order meta-analyses (for details, see *SI Appendix*, Tables S16–S20). Findings provided no evidence of publication bias or questionable research practices that threaten the validity of our meta-analytically derived conclusions (cf. ref. 36). We conclude, therefore, that results represent accurate estimates of the effects of C for occupational variables.

ACKNOWLEDGMENTS. We thank Jingyuan (Sarah) Tian for extracting and coding data from meta-analyses contributing to this work. This paper was based, in part, on M.P.W.'s doctoral dissertation under the direction of D.S.O.

1. F. L. Schmidt, J. E. Hunter, The validity and utility of selection methods in personnel psychology: Practical and theoretical implications of 85 years of research findings. *Psychol. Bull.* **124**, 262–274 (1998).
2. F. L. Schmidt, J. A. Shaffer, I.-S. Oh, Increased accuracy for range restriction corrections: Implications for the role of personality and general mental ability in job and training performance. *Person. Psychol.* **61**, 827–868 (2008).
3. P. L. Roth *et al.*, Hispanic and Asian performance on selection procedures: A narrative and meta-analytic review of 12 common predictors. *J. Appl. Psychol.* **102**, 1178–1202 (2017).
4. H. J. Foldes, E. E. Duehr, D. S. Ones, Group differences in personality: Meta-analyses comparing five U.S. racial groups. *Person. Psychol.* **61**, 579–616 (2008).
5. P. R. Sackett, F. Lievens, C. H. Van Iddekinge, N. R. Kuncel, Individual differences and their measurement: A review of 100 years of research. *J. Appl. Psychol.* **102**, 254–273 (2017).
6. D. T. de Ridder, G. Lensvelt-Mulders, C. Finkenauer, F. M. Stok, R. F. Baumeister, Taking stock of self-control: A meta-analysis of how trait self-control relates to a wide range of behaviors. *Pers. Soc. Psychol. Rev.* **16**, 76–99 (2012).
7. M. Credé, M. C. Tynan, P. D. Harms, Much ado about grit: A meta-analytic synthesis of the grit literature. *J. Pers. Soc. Psychol.* **113**, 492–511 (2017).
8. J. M. Jachimowicz, A. Wihler, E. R. Bailey, A. D. Galinsky, Why grit requires perseverance and passion to positively predict performance. *Proc. Natl. Acad. Sci. U.S.A.* **115**, 9980–9985 (2018).
9. B. W. Roberts, C. Lejuez, R. F. Krueger, J. M. Richards, P. L. Hill, What is conscientiousness and how can it be assessed? *Dev. Psychol.* **50**, 1315–1330 (2014).
10. M. Richardson, C. Abraham, R. Bond, Psychological correlates of university students' academic performance: A systematic review and meta-analysis. *Psychol. Bull.* **138**, 353–387 (2012).
11. T. Bogg, B. W. Roberts, Conscientiousness and health-related behaviors: A meta-analysis of the leading behavioral contributors to mortality. *Psychol. Bull.* **130**, 887–919 (2004).
12. T. A. Judge, J. B. Rodell, R. L. Klinger, L. S. Simon, E. R. Crawford, Hierarchical representations of the five-factor model of personality in predicting job performance: Integrating three organizing frameworks with two theoretical perspectives. *J. Appl. Psychol.* **98**, 875–925 (2013).
13. P. Steel, J. Schmidt, J. Shultz, Refining the relationship between personality and subjective well-being. *Psychol. Bull.* **134**, 138–161 (2008).
14. J. E. Hunter, F. L. Schmidt, *Methods of Meta-Analysis: Correcting Error and Bias in Research Findings* (Sage, Thousand Oaks, CA, ed. 3, 2014).
15. F. L. Schmidt, I.-S. Oh, Methods for second order meta-analysis and illustrative applications. *Organ. Behav. Hum. Decis. Process.* **121**, 204–218 (2013).
16. V. L. Pace, M. T. Brannick, How similar are personality scales of the "same" construct? A meta-analytic investigation. *Pers. Individ. Dif.* **49**, 669–676 (2010).
17. B. W. Roberts, W. F. DelVecchio, The rank-order consistency of personality traits from childhood to old age: A quantitative review of longitudinal studies. *Psychol. Bull.* **126**, 3–25 (2000).
18. B. W. Roberts, K. E. Walton, W. Viechtbauer, Patterns of mean-level change in personality traits across the life course: A meta-analysis of longitudinal studies. *Psychol. Bull.* **132**, 1–25 (2006).
19. T. Vukasović, D. Bratko, Heritability of personality: A meta-analysis of behavior genetic studies. *Psychol. Bull.* **141**, 769–785 (2015).
20. M. H. M. de Moor *et al.*, Meta-analysis of genome-wide association studies for personality. *Mol. Psychiatry* **17**, 337–349 (2012).

21. A. R. Rueter, S. V. Abram, A. W. MacDonald, 3rd, A. Rustichini, C. G. DeYoung, The goal priority network as a neural substrate of Conscientiousness. *Hum. Brain Mapp.* **39**, 3574–3585 (2018).
22. C. G. DeYoung, Cybernetic big five theory. *J. Res. Pers.* **56**, 33–58 (2015).
23. O. P. John, S. Srivastava, "The big five trait taxonomy: History, measurement, and theoretical perspectives" in *Handbook of Personality: Theory and Research*, L. A. Pervin, O. P. John, Eds. (Guilford Press, New York, NY, ed. 1, 1999), pp. 102–138.
24. M. R. Barrick, M. K. Mount, N. Li, The theory of purposeful work behavior: The role of personality, higher-order goals, and job characteristics. *Acad. Manage. Rev.* **38**, 132–153 (2013).
25. N. M. Dudley, K. A. Orvis, J. E. Lebiecki, J. M. Cortina, A meta-analytic investigation of conscientiousness in the prediction of job performance: Examining the intercorrelations and the incremental validity of narrow traits. *J. Appl. Psychol.* **91**, 40–57 (2006).
26. C. G. DeYoung, L. C. Quilty, J. B. Peterson, Between facets and domains: 10 aspects of the big five. *J. Pers. Soc. Psychol.* **93**, 880–896 (2007).
27. K. C. Stanek, D. S. Ones, "Taxonomies and compendia of cognitive ability and personality constructs and measures relevant to industrial, work and organizational psychology" in *The SAGE Handbook of Industrial, Work and Organizational Psychology*, D. S. Ones, N. Anderson, C. Viswesvaran, H. K. Sinangil, Eds. (Sage, Thousand Oaks, CA, ed. 2, 2018), pp. 366–407.
28. M. P. Wilmot, C. R. Wanberg, J. D. Kammeyer-Mueller, D. S. Ones, Extraversion advantages at work: A quantitative review and synthesis of the meta-analytic evidence. *J. Appl. Psychol.*, 10.1037/apl0000415 (2019).
29. US Employment Service, *Dictionary of Occupational Titles* (Superintendent of Documents, US Government Printing Office, Washington, DC, ed. 4, 1977). https://www.occupationalinfo.org.
30. D. C. Funder, D. J. Ozer, Evaluating effect size in psychological research: Sense and nonsense. *Adv. Methods Pract. Psychol. Sci.* **2**, 156–168 (2019).
31. T. A. Paterson, P. D. Harms, P. Steel, M. Credé, An assessment of the magnitude of effect sizes: Evidence from 30 years of meta-analysis in management. *J. Leadersh. Organ. Stud.* **23**, 66–81 (2016).
32. K. C. Stanek, D. S. Ones, M. McGue, Counterproductive behaviors: Relations across life domains, etiology, and implications for applied practice. *Int. J. Sel. Assess.* **25**, 111–124 (2017).
33. R. Hogan, B. W. Roberts, A socioanalytic model of maturity. *J. Career Assess.* **12**, 207–217 (2004).
34. N. T. Carter, J. D. Miller, T. A. Widiger, Extreme personalities at work and in life. *Curr. Dir. Psychol. Sci.* **27**, 429–436 (2018).
35. E. C. Carter, F. D. Schönbrodt, W. M. Gervais, J. Hilgard, Correcting for bias in psychology: A comparison of meta-analytic methods. *Adv. Methods Pract. Psychol. Sci.* **2**, 115–144 (2019).
36. D. R. Dalton, H. Aguinis, C. M. Dalton, F. A. Bosco, C. A. Pierce, Revisiting the file drawer problem in meta-analysis: An assessment of published and nonpublished correlation matrices. *Person. Psychol.* **65**, 221–249 (2012).