Workforce Assessments for the 21st Century:

What do we actually measure?

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To our Workforce Development Colleagues:

The Center for Curriculum Redesign (CCR) is an international convening body and research center whose goal is to expand humanity's potential and improve our collective prosperity by redesigning education standards for the 21st century – from preK through Lifelong Learning. CCR brings together non-governmental organizations, corporations, jurisdictions, academic institutions, and nonprofit organizations, including foundations, to respond to the question, "What should students (and workers) learn for the 21st century?" and to openly propagate recommendations and frameworks on a worldwide basis.

We are delighted to offer this landmark research describing the state-of-the-art of assessments as used in the corporate world, to the attention of CLO and senior L&D/T&D decision-makers.

Best regards,

Charles Fadel, *Founder*

Chair of Education Committee

nominated by:

Senior Fellow at
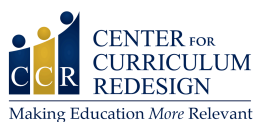
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EXECUTIVE SUMMARY

Workforce assessments are the product of a history and constraints that are distinct from those that have shaped assessments in education. Candidate selection, not knowledge gain, is the primary goal of most assessments designed for workforce use. Consequently, employer testing reflects the broad array of skills and character qualities deemed desirable in future employees. These are not always the same elements that are assessed in education. For example, schools do not routinely test for the honesty of their incoming students, but integrity testing is a common practice among employers. That is not to say that education does not value honesty, but for employers, it is an imperative, given the substantial revenue lost annually due to fraud.

Similarly, the kinds of assessments used in most school settings – the typical Language and Mathematics competency exams – are comparatively rare amongst employers. That is not to say that employers don't value competency in these subjects. They do. However, in the USA, a series of legal rulings beginning with *Griggs v. Duke Power* has made it very difficult for employers to use generic literacy and numeracy tests as a competency screen. Thus, they have defaulted to using the school or university Degree as a substitute for direct assessments of literacy and numeracy. The degree also serves as a proxy for higher order thinking skills, such as critical thinking and problem solving, which face similar regulatory constraints with regard to pre-employment testing. More on this topic can be found in this report's section on Critical Thinking assessments.

Because of the difference in motivations and legal constraints, employer testing has proceeded on a different track than scholastic assessment. In general, there is more emphasis on personality testing. This is largely due to the fact that personality testing is non-discriminatory and therefore can be freely deployed without legal issue. There are well-developed correlations (though they are distressingly modest) between certain personality archetypes and success in certain occupations, and these form the basis of personality screening tests.

The purpose of this report is to explain what kinds of assessments are prevalent in the workplace, and why, so that the disconnect between the bars that education has set for its graduating students, and those employers are setting for their incoming employees, can be made clear. Using the Center for Curriculum Reform's Skills, Character, and Meta-Learning framework to organize the discussion, a direct comparison can be made between these same elements in the workforce context, and in the education context discussed previously in "*Four-Dimensional Education*"

It is also hoped that this report will help employers express more clearly to Higher Education and schools the outcomes they care about, as sometimes they are not completely consistent with themselves or as a group (as all humans are).

Employer requirements must be educated and enhanced too: many of the parameters they do not measure (in particular, in Meta-Learning) should matter to them as well. This realization will come over time as the disruptions of the modern age take an increased toll.

Lastly, it is a falsehood to think that the needs of humanity and employers are not matched: the 12 competencies described in this analysis demonstrate that it is a question of relative emphasis, and evolution of understanding. What makes a great human also benefits their employability.

Below is a table summarizing all of the findings of this paper. Each of the 12 competencies is tabulated with its importance to employers, most commonly used assessment methods for the workforce, and summary of findings.

Competencies	Importance to Employers	Most Commonly used Assessment Methods in Workforce	Summary of Findings
SKILLS			
Creativity	Low to Negative at lower levels	Game, Make-a-List Idea Fluency Exercises, Big 5 personality assessment (Likert scale/multiple choice self-report)	Given that pre-hire personality tests screen for conscientiousness, they automatically screen against creativity, since these two personality traits are anticorrelated in most of the population. On the other hand, it has been rated as the #1 factor necessary for future success in a global CEO study. The discrepancy might be explained by different characteristics being desired for different levels in the hierarchy.
	High at leadership level		
Critical Thinking	High	Situational judgment tests such as the Watson-Glaser. However, this test ‐ and others like it ‐ is rarely used at the present time.	Ranked in the top 3 of requested skills by major employer surveys. Disproportionately little testing of this construct in the US due to legal challenges arising from large score differentials between majority and minority ethnic/racial groups.
Communication	High	Degree (and	Also a "top 3" skill in employer surveys, communication is predominantly

		personal interview, cover letter, writing sample, etc.) is most common. Reading, Writing, Listening and Speaking tests are less common.	assessed by proxy - assuming that a college or high school degree equates to an acceptable level of reading, writing, and speaking skill. Secondarily, these skills are assessed via informal in-person means: review of resume and cover letter (to judge writing skill), job interview conversation (gives some indication of oral communication skill), and response to written instructions during the application process (reading skills). A few niche markets, e.g., employees needing to conduct international businesses, take part in explicit and rigorous communications testing.
Collaboration	High	Stevens-Campion Teamwork KSA test and/or individual personality traits the employer feels probably relate to teamwork, from Big 5 personality assessments	The last of the "top 3" in-demand skills from employer surveys, this skill has a bewildering array of conceptual models available, but little in the way of workplace-validated assessments.
CHARACTER			
Mindfulness	Low, but growing	Psychology self-assessments of the type used in medical and	Attention to Eastern mind-body practices such as yoga, transcendental meditation, etc. is increasing among employers, after a few CEOs championed the practices for themselves personally, and then also saw significant health, wellness, and productivity improvements among

|		academic research.	employees when the employees were offered mindfulness training. Corporate assessment of mindfulness is generally conducted in a research context (e.g., does this employee mindfulness program decrease employee absences?), using research tools.
Curiosity	Low	Specialized personality test, under development	A mixed relationship between curiosity and job performance has left employers not terribly interested in this construct. However, not much work has been done with this element, and it may be that higher level jobs require curiosity in larger measure than low-to-mid level jobs. Curiosity does appear to play a strong role in employees' job satisfaction.
Courage	Low	Big 5 based personality assessment	Not commonly assessed. Most prehire personality tests could easily be designed to look for courage (valid psychological test items for courage/bravery/valor exist in the public domain), but no major testing company that we could find, had such a category in its employer-side offerings. This implies a lack of market interest from employers with regard to testing for courage.
Resilience	High	Big 5 based personality assessment	Very commonly assessed via pre-hire personality tests, resilience is a known contributor to job performance in virtually all occupations.
Ethics	High	Self-report integrity questionnaires, using either overt or covert questions about counterproductive work behaviors (theft, dishonesty, attendance, verbal	Ethics is primarily assessed via a dedicated "integrity test," taken during the job application process. Employers use these tests to look specifically for so-called counterproductive work behaviors: theft, fraud, dishonesty, sick leave abuse, cyberloafing, on-the-job substance abuse, verbal harassment, sexual harassment, sabotage, disregard for safety procedures, etc. Integrity testing is a mature industry with extensively validated tests. The assessments are popular with employers because the alternative is grim: theft alone costs a typical companyabout 7% of its revenue every year.

		harassment, sexual harassment, sabotage, etc.)	
Leadership	High, but situational	Assessment Centers, Structured Behavioral Interviews, Big 5 personality assessments	Corporate leadership tests are designed to assess whether an individual will perform well in a management position. They are therefore role-specific occupational assessments and not assessments of generic leadership ability. In addition to computerized tests, assessment centers - a physical space with trained observers - are used in testing leadership, one of the few instances in which their expense is justified.
		META-LEARNING	
Metacognition	No metacognition assessment. Instead, two assessments of "learning agility." One is multi-rater (and used to assess personal or executive development), and the other is self-report (used to screen candidates for managerial positions).		No instruments measuring metacognition in the workplace could be found to date. However, learning agility is a separate concept used to explain the same end result - namely the ability of some individuals (workers) to come up to speed quickly in new situations, or to be able transfer learning from one context to the next.
Growth Mindset			Other than a single research study involving Carol Dweck and the Dweck instrument, there has been no visible work assessing growth mindset in corporations.

INTRODUCTION

Education systems across the globe have been well tuned to the demands of the past Industrial Age, and are now struggling to ready students for success in a rapidly transforming, present and future, Innovation Age. The last major changes to curriculum were effected in the late 1800s as a response to the sudden growth in societal and human capital needs. As the 21st century bears little resemblance to the 19th century, education curricula are overdue for a major redesign, emphasizing depth of understanding and versatility, to meet the needs of our global society, **including employability**.

So far, curricula have been adjusted over time, but have never been deeply redesigned to address all dimensions of education: knowledge, skills, character, and meta-learning. As a non-partisan, globally inclusive, and independent global organization, CCR is strategically partnering with international and national organizations to build a global consensus on each of the dimensions and elements of a new framework of goals, measures, and practices that will ready all learners for careers, citizenship, family and community life in the 21st century. Below is CCR's Four-Dimensional framework, created through a synthesis and analysis of research and existing frameworks. More details can be found in CCR's book, *Four-Dimensional Education*.[1]

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[1] http://www.bit.ly/4DEdu
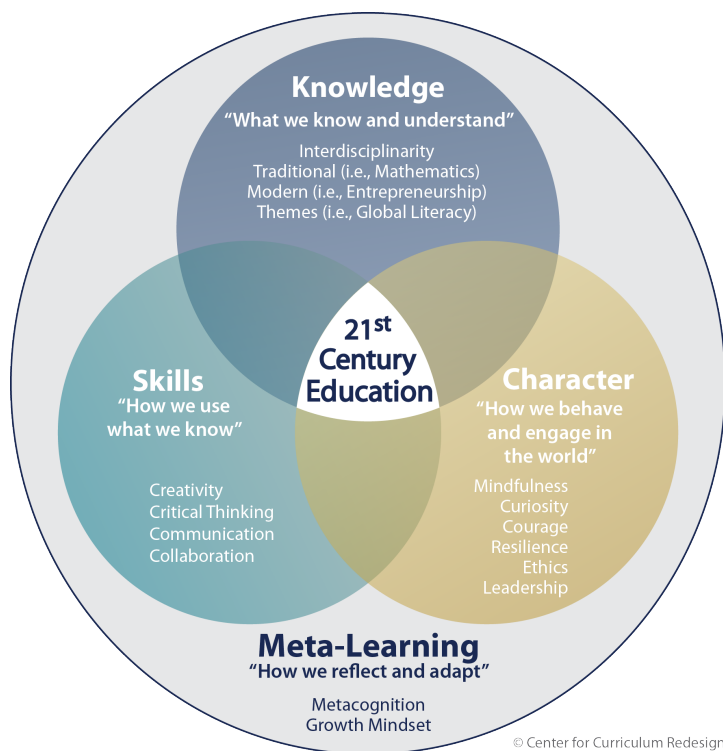
The Assessment Research Consortium

In 2015, the CCR established an Assessment Research Consortium, a pre-competitive R&D consortium dedicated to developing the science of assessing competencies. Modelled after similar consortia such as Sematech (semicondcutors), Sage Biosystems (Biotech) etc. it federates and reinforce understanding of how to better assess "hard-to-measure" Skills, Character and Meta-Learning dimensions.

Workforce Development

An advisory panel conducted an initial survey of the state-of-the-art in assessment of the 12 competencies in the CCR framework. ARC also recognizes the preparation and matching of students to jobs after graduation as an important function of educational systems. Methods of selection used in the employment sector were reviewed across the 12 competencies of the CCR framework. Below we provide a summary of the state-of-the-art assessments, and suggestions for future work for each competency in each dimension.

SKILLS: What do we actually measure?

CCR Element	Importance to Employers	Most Commonly used assessment approaches in Workforce	Explanation
Creativity	Low to Negative at lower levels / High at leadership level	Game, Make-a-List Idea Fluency Exercises, Big 5 personality assessment (Likert scale/multiple choice self-report)	Creativity has been rated as the #1 factor necessary for future success in a global CEO study. On the other hand, it has been ranked dead last by employers on a major survey on what's important to them in hiring. Also, given that pre-hire personality tests screen for conscientiousness, they automatically screen against creativity, since these two personality traits are anticorrelated in most of the population. The discrepancy might be explained by different characteristics being desired for different levels in the corporate hierarchy.
Critical Thinking	High	Situational judgment tests such as the Watson-Glaser. However, this test – and others like it – is rarely used at the present time.	Ranked in the top 3 of requested skills by major employer surveys. Disproportionately little testing of this construct in the US due to legal challenges arising from large score differentials between majority and minority ethnic/racial groups. College degree (also racially discriminating) is used as a proxy.
Communication	High	Degree (and cover letter, writing sample, etc.) is most common. Reading, Writing, Listening and Speaking tests	Also a "top 3" skill in employer surveys, communication is predominantly assessed by proxy – assuming that a college or high school degree equates to an acceptable level of reading, writing, and speaking skill. Secondarily, these skills are assessed via informal in-person means: review of resume and cover letter (to judge writing skill), job interview conversation (gives some indication of oral communication skill), and response to written instructions during the application process (reading skills). A few niche markets, e.g., employees needing to conduct international business, take part in explicit and rigorous communications testing.

		Stevens-Campion Teamwork KSA test and/or individual personality traits the employer feels probably relate to teamwork, from Big 5 personality assessments	The last of the "top 3" in-demand skills from employer surveys, this skill has a bewildering array of conceptual models available, but little in the way of workplace-validated assessments.
Collaboration	High		

Table 1. Summary table of the Advisory Panel's findings on the current state of assessment of each skill in the Four-Dimensional framework in the workforce

The following sections provide a brief overview of each of these competencies, and suggest directions for future work.

Creativity

- Importance to Employers: Low to Negative for lower levels; high for leadership level.
- Most Commonly Used Assessment Approaches: Game, Make-a-List Idea Fluency Exercises, Big 5 personality assessment (Likert scale/multiple choice self-report)

Discussion

At the CEO level, creativity has been touted as the #1 factor of success.[2] However, while employers will cite creativity as an important skill for executives, it is not one of their top priorities in hiring the majority of their workers. In a survey deployed by the National Association of Colleges and Employer*s*, employers reported creativity as being 15th out of 15 attributes they look for in the resumes of college graduates [1].

One of the challenges with creative individuals is that they tend to score poorly on the conscientiousness scales of personality tests. Using Big 5 personality test data, one can show that individuals scoring high on "openness to experience," (the dimension that includes creativity) score consistently low on the "conscientiousness" dimension: the two scores are anticorrelated to r=-0.38 to -0.5 [2]. Unfortunately, the traits under conscientiousness, such as dependability and reliability, are among the strongest predictors of positive job performance [3] [4] [5] and are highly desirable to employers. When prehire testing is set up to screen *for* individuals with high conscientiousness scores, it automatically screens *against* individuals with high creativity scores. By this filtration, creativity falls out of the corporate hiring funnel. As a specific example, of the three major indices used by the Hogan Select test to make hiring decisions, the Hogan Dependability index is highly negatively correlated to Creativity, and the other two indices are not at all correlated [6].

Given the lack of corporate enthusiasm for creativity in their employees, it is not surprising that classic creativity tests, such as the *Torrance Tests of Creative Thinking*, are rarely, if ever, used in the corporate environment. Nevertheless, there a few instances where creativity receives a nod. In one *Virtual Job Tryout* [7] exercise, candidates are asked to generate as many ideas as possible to handle a situation that has arisen with a coworker [8]. This exercise is reminiscent of the idea fluency exercises within the Torrance tests, and in particular, the situations task, in which examinees are asked to generate as many solutions to a common problem as they can.

Knack, another assessment company that has worked with large employers, has folded creativity into its model for predicting which individuals will be successful at garnering internal corporate funding for their new proposal ideas. Obviously, creativity is just one of many elements involved in submitting and successfully shepherding a new idea through a corporate system, but it is *an* element. For their model, Knack used game-play data that measured not only cognitive indicators (e.g., mental processing speed, spatial optimization, facial recognition

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[2] IBM, Leading Through Connections' 2012. [Online] http://www.ibm.com/common/ssi/cgi-bin/ssialias?subtype=XB&infotype=PM&appname=GBSE_GB_TI_USEN&htmlfid=GBE03535USEN&attachment=GBE03535USEN.PDF

of emotions) but also Big 5-based personality indicators (Openness, Conscientiousness, Agreeableness). Recall that openness is the psychological dimension containing creativity.

Approximately 200 scientists and engineers playing two games apiece (one of which, Wasabi Waiter, is publicly available) generated enough data for Knack to predict which individuals would turn out to be successful in the new idea proposal approval process. Among the sample population of proposal submitters, 30% were ultimately successful in getting funding for their ideas. The top 50% of the Knack list consisted 58% of successful proposal submitters, roughly doubling the odds of predicting who would be the company's next innovators [9] [10].

Along similar lines, the Founder Institute has developed a proprietary assessment that has an r>0.2 relationship to entrepreneurship, specifically startup success [11] [12][3]. While the assessment's form factor is not a game, the primary attributes being probed in the Founder Institute assessment also include openness (the psychological dimension associated with curiosity) and fluid intelligence (an attribute whose dominant component is mental processing speed [13]).

Suggested Future Work

Expanding the ability to assess and predict entrepreneurship/innovation would be a major achievement, if deployed on a public platform, rather than held on current privately-held platforms. Many countries' governments place a premium on new business creation within their borders and would benefit from an assessment that indicates the readiness of their populations to innovate. In the US, nearly 100% of net new job creation, and 20% of total job creation, can be attributed to companies less than a year old [14].

Summary of the State of the Art

Creativity is not a highly sought after dimension to test. In Big-5 based assessments meant for employee selection, creativity is typically screened *against*. In a few places, curiosity appears incidentally as a small factor in tests primarily designed to assess other behaviors or skills.

Test Name	Form Factor for creativity portion of the assessment	Overarching Workplace Purpose
Virtual Job Tryout	Make-a-List	Prehire screening (creativity is screened for in a few isolated occupations)
Hogan Select	Multiple Choice Self-Report	Prehire screening (creativity is screened against)

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[3] (r=0.45 for the relationship between assessment score and entrepreneurship course completion, and then r=0.45 for the relationship between and entrepreneurship course completion and successfully founding a company) [11]

| Wasabi Waiter (with a companion game, now discontinued) | Gameplay | To predict success in an internal funding competition designed to support innovation |
| Founder Institute Assessment | Unknown | To identify future successful entrepreneurs |

Table 2. Summary of workforce Creativity assessments

Critical Thinking

- Importance to Employers: High
- Most Commonly Used Assessment Approaches: Situational judgment tests such as the Watson-Glaser. However, this test – and others like it – is rarely used at the present time.

Terminology

Critical thinking and problem-solving are used interchangeably in the corporate environment to mean "advanced thinking skills," with little distinction. In other environments, these terms have slightly different meaning.

In the testing realm, critical thinking tests[4] utilize complex narrative passages as their prompts, while problem-solving tests[5] tend to use graphical prompts (e.g., a series of buttons one has to push in the right order to solve a puzzle). In the scientific literature, one also sees the term cognitive ability tests, though this covers critical thinking tests, problem-solving tests, and any test requiring mental thought, including subject matter (English, Math, Science, History) tests. The term *cognitive ability* also encompasses the entire range of the mental ability scale, high cognitive ability, however, is seen as synonymous with critical thinking.

Discussion

Relationship Between Critical thinking and Job Performance

The importance of critical thinking/problem-solving is underscored by the fact that variations on these two terms show up near the top of virtually every report documenting employers' skill

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[4] Examples of critical thinking tests, which are largely used in academia, include the California Critical thinking Skills Test [232], Cornell Critical thinking test [233] Collegiate Assessment of Academic Proficiency (CAAP) [234], and the Measure of Academic Proficiency and Progress (MAPP) Critical Thinking test (now called the ETS Proficiency Profile [235]), among others.

[5] Examples of problem-solving tests, most of which appear to have seen only one-time use in national or international research studies, include NAEP's 2007 Problem Solving in Technology-Rich Environments Test [230], PISA 's 2012 Creative Problem-Solving Test [231], PIAAC 2013 problem-solving in technology-Rich Environments Test [237], ETS and PISA's 2015 Collaborative Problem-Solving Test [236].

needs [15] [16] [1] [17]. Employers' conviction that critical thinking is essential to job performance is not unfounded. Indeed, it is borne out by literally hundreds of studies linking employees' scores on cognitive skill tests to supervisor's ratings of those same employees' performance [18] [19] [20]. For example, a study of 84 government analysts showed the Watson-Glaser test of critical thinking to correlate to job performance at r=0.4 [21]. An uncorrected r = 0.4 is unusually high and falls in the highest category of criterion validity recognized by the Department of Labor for employer hiring tests [22].

Legal Challenges to Employers' Use of Critical Thinking/Cognitive Ability Tests

If critical thinking is essential to job performance, particularly in higher level occupations, why are critical thinking tests or cognitive skills tests not used more broadly in the corporate world? The answer lies in the racial divide that exists in their test scores: minorities score ¾ to one full standard deviation below Caucasians [20] [23].

In 1971, the Supreme Court decision in *Griggs v. Duke Power Co.* [24] set the stage for dismantling the use of cognitive skills tests in hiring; the intent of the Court was codified in the *Uniform Guidelines on Employee Selection* subsequently issued by the Equal Employment Opportunity Commission in 1978 [25].[6] The federal government, which had been using its own highly predictive civil service exams (the FSEE, then the PACE) as a cognitive ability screen, dropped them as part of the *Luevano v. Campbell* consent decree in 1981 [26] [27]. The hope of everyone involved was that was by eliminating the tests as a barrier, more minorities would be hired. The reality did not meet the hope.

The Emergence of an Alternate Credential: The College Degree

What happened instead was that employers, seeking an easy sorting mechanism for their voluminous applicant pools, resorted to using college degrees as a proxy for cognitive skill (and, arguably, some intrapersonal skills as well). From 1978 onwards, the wage premium placed on a college degree rose precipitously, as documented by the Pope Center for Higher Education Policy [28]. The abandonment of one racially biased metric (scores on cognitive skill tests) led to the adoption of another (rate of 4 year degree attainment).

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[6] The 1978 *Uniform Guidelines* serve as employers' primary reference for candidate selection via testing, to this day.
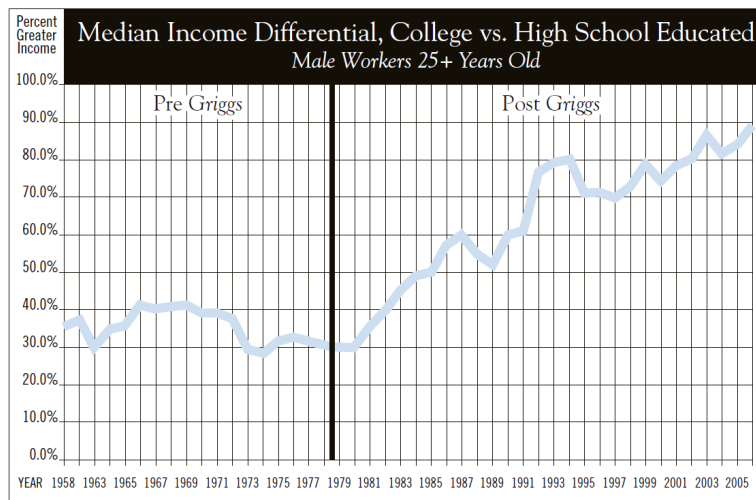
Figure 2. Steep climb in the value of a U.S. college degree after Griggs v Duke Power. Reproduced from [28]

Current Status of Critical Thinking/Cognitive Ability Testing in the U.S. Workplace

Currently, for a U.S.-based employer to use a generic critical thinking or cognitive skills test in its hiring process, it must either prove that the test does not create a bias in favor of majority applicants or prove that the results of the test, if they do create a bias, uncontrovertibly lead to improved workforce performance. Either criterion necessitates an expensive in-house research project, valid only for that particular job title in that particular company, at that particular geographic site. For large employers, their multiple work sites and hundreds of job titles makes the burden of proof financially unsupportable. Small employers might need only one or two research projects but can't afford even the one or two.

The work-around for some employers is to use cognitive skills tests but blend them with other decision criteria that are less discriminatory (but also less predictive) so the adverse impact felt by minorities is lessened [20]. Personality tests and personal interviews are used for this purpose [20]. Note that the restrictions placed by the 1978 Uniform Guidelines on US employers are fairly unique to the US and do not appear to be replicated in other countries.

Job Content-Related Critical Thinking Tests

Instead of a generic critical thinking test, some US employers have embraced job content knowledge tests. For example, a software company might give a prospective applicant a programming test. This test probes applicant's critical thinking skill, but does so in a context more aligned with specific job duties. The closer the test content, format, and environment resemble that of the job, the more protection a U.S. employer is afforded under the Uniform Guidelines' [25] [22] [29]. Unfortunately for employers, most companies cannot claim their employees' daily job responsibilities involve taking multiple-choice tests. If discrimination can be argued based on disparate test result outcomes, the multiple choice test format can further be argued to be irrelevant to job duties, providing scant employer protection under the law [30].

Future Work

A number of papers have lamented the grievous "diversity-validity dilemma" described above. One future project the CCR may decide to undertake is the creation of a critical thinking test that does not result in racially biased score outcomes and therefore could be freely adopted by US employers. It is fairly clear from the literature (argument to follow) that the primary obstacle for minorities with respect to critical thinking tests is the vocabulary and sentence structure these tests use to pose their problems – not the decision-making process that comes afterwards, which is the intended focus of the test.

The root of the problem appears to be a vocabulary gap that stems from differential use of vocabulary in the home. Children raised in impoverished households (which, in the US, are minority-dominated) suffer a 30 million vocabulary word gap relative to children of affluent parents, by the time they are three years old – and this differential is not remediated by formal education [31] [32]. Vocabulary taught in school is forgotten within a year; vocabulary used at home is constantly being reinforced [32].

Because critical thinking tests tend to use long, convoluted narrative passages with advanced vocabulary, it becomes impossible to separate reading skill from thinking skill in their scores. The literature is rife with examples showing critical thinking test scores have extraordinarily high correlations with reading test scores: MAPP[7] reading scores correlate with CAAP[8] critical thinking scores to an r=0.71 [33], and CAAP reading scores correlate with MAPP critical thinking scores to an r=0.76 [33]. Similarly, the correlation between individual student performance on the Watson-Glaser critical thinking test and the reading part of the TOEFL[9] test was found to correlate to an r=0.8 at a significance of p<0.01 [34]. These kinds of correlations are what one would expect if the same individual were simply taking the exact same test, on the exact same topic, twice in a row.

Intelligence tests are yesterday's primitive versions of today's critical thinking tests. They, too, were designed to measure "advanced thinking skills." In 2002, Fagan and Holland published a landmark series of experiments showing that, if only one gave both the minority and Caucasian students a dictionary during an intelligence test, the large score differential between these groups disappeared [35]. Alternatively, replacing words typically known only by the majority classwith nonsense words, and then teaching both groups the new words, also worked in erasing the "intelligence gap" [35].

Modern-day intelligence tests, such as the Siena Reasoning Test [36], have substituted nonsense words for sophisticated English words, otherwise keeping the problems the same. The result is

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[7] MAPP=Measure of Academic Proficiency and Progress, a K-12 test designed and delivered by ETS.

[8] CAAP=Collegiate Assessment of Academic Proficiency, a K-12 test designed and delivered by ACT.

[9] TOEFL=Test of English as a Foreign Language, a test designed and delivered by ETS. It is used primarily for testing the English capability of foreign graduate students applying to colleges in the US.

an "intelligence" test that predicts work performance as accurately as prior tests but has zero score differential between minority and Caucasian students (although still some remaining racial differential among working adults) [36]. From this historical antecedent, it stands to reason that if one were to erase the vocabulary-dependency of critical thinking tests, one might arrive at the holy grail of a critical thinking test that did not exhibit racial bias. The emerging crop of "problem-solving" tests, where intellectual challenges are posed as exercises with diagrams, shapes, game exercises, or computer menus – rather than narrative passages – may be a first step in the right direction.

Summary of the State of the Art

In summary, while employers almost unanimously agree critical thinking is crucial to employee performance, and while the literature backs up this assertion with high statistical correlations between cognitive skill and job performance, testing for critical thinking is not legally straightforward. Because of the large achievement gaps on critical thinking/cognitive ability tests, most U.S. employers are not legally allowed to test critical thinking as a generic skill, and the few that can assess it as job-related skill, must do so using a form factor that replicates the form factor of the job itself.

Since few jobs involve taking multiple-choice tests, there is a challenge in coming up with a critical thinking exercise that is mass-producible and mass-gradable, yet mimics the daily job duties to the point where it easily passes regulatory compliance. At least one test, Virtual Job Tryouts [7] [8], has attempted to bridge this gap by including contextual video and dedicated, branded, interactive, company-specific exercises in its job content test offerings. In other words, it tries to replicate the workplace environment as faithfully as possible. However, the expense of this approach has limited it a few large retail employers.

Test Name	Form Factor	Overarching Workplace Purpose
Watson-Glaser Critical Thinking Test	Situational judgment (multiple choice)	Research on relation of critical thinking to job performance. Also, managerial development.
Job content tests (e.g., programming test, accounting test)	Computer or paper and pencil	Prehire screening
Virtual Job Tryout	Multimedia, interactive job content test (+ integrated personality test)	Prehire screening

Table 3. Summary of workplace Critical Thinking assessments

Communication

- Importance to Employers: High
- Most Commonly Used Assessment Approach: Use college/high school degree as proxy
- Other Commonly Used Assessment Approaches:
  - Reading – multiple choice test evaluating the employee's comprehension of written passages
  - Writing – resume and cover letter OR test with fill-in-the-blank, short response, and multiple choice items probing word choice and sentence construction (no essays) OR a writing sample submitted to, and evaluated by, the employer
  - Listening – multiple choice test assessing the employee's comprehension of audio files
  - Speaking – commercial third party evaluation of speaking skills during a conversation with standardized prompts from live human speaking partners. Judging is done via an evaluation rubric.

Discussion

Communication is often divided into four separate skills: reading, writing, listening, and speaking. With respect to reading and writing skills, employers often use a high school or college diploma as proof of basic competency. A submitted resume and cover letter are then used as additional evidence of writing skill. In some exceptional cases, an employer might request an additional writing sample (e.g., applying for a magazine editorial position). For those employers using any kind of standardized prehire tests, reading skill is defacto assessed , since these tests are nearly always in written form. Oral communication is indirectly assessed in a personal interview, though generally it is not the overarching purpose of the interview. For professional or managerial hires, a public presentation can be a part of the interview day activities; during the performance, the candidate is judged informally on oral communication skills, as well as on the content of the talk.

Altogether, employers use a variety of informal and largely non-reproducible methods to assess communication skill. Standardized, reproducible communications tests do exist for reading, writing, listening, and speaking, as shown in Table 3, however they are seldom used for everyday hires. On the other hand, there are two market niches where such assessments prosper: entry level workers and international professionals.

Assessing Communication Skills in Entry-Level Workers

If no diploma is available, or if a candidate's reading and writing ability are so far below average they cannot get a job, then that individual – at least in the US – will likely end up in a government workforce training center. It is within these centers that the vast majority of entry-level reading and writing tests are used.

Because they are not regulated as employers, US-based workforce training centers can freely use standardized assessments to measure literacy skills. Moreover,U.S.-based workforce

training centers need such tests to prove their students are progressing up the literacy ladder: this proof is required to continue to receive government funding. The tests need to cover the lowest levels of literacy, and they must be able to be administered multiple times to the same individual. Finally, the tests have to be certified by the National Reporting System for Adult Education (NRS, part of the U.S. Department of Education), in order for their costs to be reimbursable. This last criterion greatly limits

Paper	Content	Purpose
Reading and Use of English (1 hour 30 minutes) 📖 See sample paper	**7** parts/ **53** questions	Shows you can deal confidently with different types of text, such as fiction and non-fiction books, journals, newspapers and manuals.
Writing (1 hour 30 minutes) 📖 See sample paper	**2** parts	Requires you to be able to write a variety of text types, such as essays, reports and reviews.
Listening (about 40 minutes) 📖 See sample paper	**4** parts/ **30** questions	Requires you to be able to follow and understand a range of spoken materials, such as lectures, speeches and interviews.
Speaking (16 minutes per pair of candidates) 📖 See sample paper	**3** parts	Tests your ability to communicate effectively in face-to-face situations.

Figure 2. Exam formats for the Cambridge English Proficiency test, showing all 4 communications skills and the format by which each is assessed. This quadripartite structure is typical for communications tests; however the subtests can often be purchased separately as well. Figure obtained from [37]

the tests that are used. Approved tests for reading and writing include the Comprehensive Adult Student Assessment System (CASAS) [38], the Test of Adult Basic Education (TABE) [39], the Massachusetts Adult Proficiency Test (MAPT) [40], and the Basic English Skills Test (BEST) [41]. A complete list of approved tests can be found at Ref [42].

From the above websites, it can be seen that the reading tests involve reading short passages and responding to multiple-choice questions on comprehension. The writing tests rely on multiple choice or fill-in-the-blank questions; a typical task might be to choose the best word or phrase to fill out a sentence. Very limited free writing is involved in the entry-level tests, typically 1-2 sentences to describe a picture, or fill in a form, for example. The listening tests require listening to a recording and answering multiple-choice comprehension questions. The speaking tests are one-on-one conversations with a trained examiner; however, the questions tend to be very straightforward ("What is the man in the picture doing?").

For higher-level communication skills, the market is dominated by assessments for global companies whose professionals need English for work but are not themselves native English speakers.

The Cambridge English Proficiency test (CPE) [43] is targeted to executives, government officials, members of the press, translators and other professionals in the humanities. It has reading, writing, listening, and speaking sections that test for understanding of scenarios common to global politics, business, and literature. The questions can be very subtle – for example, probing the user's understanding of the difference between such similar concepts as "slouch," "slump," "droop," and "sag."

The ETS' Test of English for International Communication (TOEIC) [44] is widely used by businesses (Asian businesses in particular) that are engaged in technology and commerce. The individuals taking this test include technical salespeople, flight attendants, customer service personnel, English language teachers, and the like. The exam content typically revolves around the individual's ability to conduct business overseas. There is a strong (r≈0.5, uncorrected) correlation between TOEIC speaking and writing test scores and one's self-reported ability to perform, or not, 40 specific business speaking tasks and 29 specific business writing tasks (write a letter of introduction, write a technical proposal, etc.) [45].

The Test of English as a Foreign Language (TOEFL) [46] is another ETS product, but it is targeted to foreign nationals wishing to study for a university degree abroad. Here, the prompts and scenarios revolve around typical academic situations, e.g., discussing a school absence with one's advisor. TOEFL cutoff scores are often a deciding factor in graduate school admission. In a nod to the increasing globalization of education, the TOEFL now offers its listening test with British, American, New Zealand, and Australian English [47].

In all the above cases, the professional exams are far more rigorous than those used for workforce development. The writing test asks for an essay, the reading test involves complex passages, the oral prompts (for listening comprehension) are typically several minutes (rather than seconds) long, and the speaking tasks are more like an extended personal interview than a one sentence response. Most components of these test are machine-graded, except for the interview (and sometimes the written essay), which is/are rubric-scored by a human evaluator.

Future Work

The vast majority of commercially available communications tests are straightforward language tests. They measure whether one's language skills are sufficient to understand and to be understood. The implicit end goal is giving/receiving information. In some cases, this may be all that is needed. However, in the workplace, contextual communication can be extremely important. In sales, it is not enough to tell the customer what features a product has; the salesperson has to convince the customer to buy it. In training, it is again not enough just to give subordinates the information they need; one has to ensure the instructions are sufficiently clear,

and the context sufficiently motivating, for the subordinates to actually complete the tasks on their own, once instruction is complete. Because workplace communication often has a goal that extends beyond just providing raw information, new tools are needed that assess whether an individual has the right communication strategies in place, to accomplish the communication goal.

Communication Strategy Assessments

One can envision, for example, communication assessments of the future that assess the language strategies needed for persuasion and instruction. In sales, such an assessment might look for such behaviors as establishing rapport by engaging in small talk, addressing a person by his/her name to further the rapport, restating another person's point to show one agrees with him/her – and then moving from there to a point in opposition[10], using anecdotes to make a story memorable, couching complex ideas in simple slogans (the "3 C's" or "November to Remember") to keep the audience from questioning the premise, and many more. Expertise in these communications strategies comes with practice, and assessments could be used to determine whether that expertise has been achieved. At least one small-scale publisher has attempted to devise a communications strategy test for sales personnel [48]; however, the concept has not been widely replicated.

A major hurdle to developing language strategies assessments is simply determining which language strategies work, and under what conditions. This is a research agenda. How important is it, for example, for a customer service representative to speak with the same intonation and pace as the individual s/he is talking to? Should a new product presentation to a 300 person audience include a PowerPoint or not? Does the answer depend on whether the audience is comprised of engineers or congressmen? Does the answer depend on whether the goal is to instruct or to persuade? Some language strategy issues (such as the impact of accents on passing a job interview [49] [50] [51] [52] [53]) have been researched but with no clear answer; many appear not to have been researched at all.

Immersive Communication Tests

A more advanced form of listening (and speaking) test may be in its infancy. In 2005, the University of Southern California created an interactive game, "Tactical Iraqi " for military use [54] . The 3-D game is structured as a branching (multiple choice) set of scenarios in which the student utilizes his Arabic listening and speaking skills in order to effectively navigate to an end goal of extracting vital information from tribal leaders. The simulation uses avatars and acquaints the student with both the verbal and nonverbal communication norms of the region. It is a teaching and assessment tool combined, with both the situational inputs and the examinee's "correct choices" dependent on local culture and end goal. For example, for the goal of

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[10] In phone sales, a classic example is to use "That's exactly why I'm calling" in response to any stated objection by the cold-called client.

obtaining initial information on the whereabouts of the tribal leader, the user has to choose how to introduce himself to a shopkeeper. Should he accept the invitation to sit down for tea, spend an hour or so talking, then ask for directions -- or should he not waste so much time, ask directions directly and get briskly on with business? The outcome of each of these choices is vastly different. This is perhaps the first example of situational context and goal driving language choices – in other words, a language "test" that involves language strategy decisions. The game has become the launchpoint of a company, Alelo [55], dedicated to situational language-based training via avatar. The incorporation of nonverbal communication cues via avatar, along with situationally specific language choices, is a unique offering.

Adapting Global Literacy Assessments to Employer Use

In addition to creating new tests that probe for communication strategies, future work could focus on better adapting current communications tests to employer use. The PIAAC examination [56], prepared by the OECD, is an extremely well-crafted assessment of reading skill that is now available globally in online form. However, there are two obstacles that prevent it, or assessments like it, from being used by employers for everyday hiring. The first is that the alternative method of assessing literacy – asking if the recipient has a degree – costs the employer nothing. To overcome this objection, one would have to show that the literacy test results have a much stronger correlation to eventual job performance than the metric of having a degree or not (or whatever other informal criterion the employer is using). If the validity tests bear out, one could argue that the employer might be paying for a test up front, but the employer will save money in the long run by avoiding unfruitful hires. A few econometric projections will assist in making this argument in the assessment's favor.

The second objection arises from the fact that it is relatively impossible for employers to interpret raw scores; does a score of 280 mean this person is qualified to be a welder or not? To make existing literacy tests useful to employers, the results have to be aligned to the literacy requirements for specific occupations. This is also possible to do. For example, the score reporting system could provide benchmark values for the different occupations using data already gathered on tested populations. These data would allow the employer to see, upon receiving the applicant's test results, that an individual scoring 280 would be (using a fictitious example) in the top quartile of welders in his region. This is the level of specificity needed to make generic literacy assessments useful tools for employers. In the US there is an additional hurdle, namely ensuring the assessment does not discriminate between racial and ethnic groups in violation of the so-called 80% rule [29]. This is a major hurdle that, to date, has limited literacy testing to workforce development centers and other quasi-educational institutions. Whether a given test meets the legal non-discrimination criterion can be determined through analysis of existing test data, as long as the assessment collects demographic information up front from all examinees.

Summary of the State of the Art

For the most part, employers use ancillary information from the hiring process to get a sense of the applicant's communication skills: a college/high school degree connotes overall literacy, a cover letter and resume shed light on written communication specifically, and an in-person interview gives a sense of oral communication skills. Communications assessments that explicitly measure reading, writing, speaking, and listening are relegated primarily to two well-established markets: entry level workers in government workforce training programs and international professionals who need to prove they have a second language proficiency adequate to their intended work overseas. The scale of these markets is large, however. The TOEIC test, for example, is taken by over 5 million people annually [57]; the CPE is taken by about 4 million people annually [58]. The existing tests align their vocabulary and content somewhat to occupational domains as shown below. The assessments are largely computer-delivered and computer-graded, with the exception of speaking, which typically demands a human evaluator. The professional-level writing tests are also hand, rather than computer, graded.

Test Name	Primary Market	Overarching Workplace Purpose
Comprehensive Adult Student Assessment System (CASAS)	Government workforce training (assistance) programs	Ensure the individual's communication skills are adequate for an entry level job.
Test of Adult Basic Education (TABE)	Government workforce training (assistance) programs	Ensure the individual's communication skills are adequate for an entry level job.
Massachusetts Adult Proficiency Test (MAPT)	Government workforce training (assistance) programs	Ensure the individual's communication skills are adequate for an entry level job.
Basic English Skills Test (BEST)	Government workforce training (assistance) programs	Ensure the individual's communication skills are adequate for an entry level job.
Cambridge English Proficiency (CEP)	International executives, diplomats and others in humanities-oriented occupations	Certify the individual can communicate fluently in a second language (English) at a professional level
Test of English for International Communication (TOEFL)	International students	Certify the individual can communicate fluently in a second language (English) at a professional level
Test of English for International Communication (TOEIC)	International technical and business professionals	Certify the individual can communicate fluently in a second language (English) at a

| Tactical Iraqi/other Alelo products | Military and business persons needing to engage with another culture | Prepare the individual for communicating in a foreign culture. |

Table 4. Summary of Workplace Communications Assessments

Collaboration

- Importance to Employers: High
- Most Commonly Used Assessment Approaches: Stevens-Campion Teamwork KSA test and/or individual personality traits the employer feels probably relate to teamwork, from Big 5 personality assessments

Discussion

Collaboration vs. Teamwork

In survey after survey, collaboration and/or teamwork are consistently cited as major skill needs amongst employers [15] [16] [1] [17]. The two terms, collaboration and teamwork, are often used interchangeably, but to employers, there are subtle differences. A recent, unpublished survey [59] of 51 corporate supervisors asked for opinions on the differences between these two terms. Twenty-eight percent of the supervisors thought the two terms were the same, but 72% thought that they were different. Asked to explain, the results were summarized as follows [59]:

- **Collaboration**: a joint planning or ideation phase, with people free to give opinions and obtain feedback as near-equals.
- **Teamwork**: a joint execution phase, typically involving hierarchical power structures, assigned tasks, deadlines, etc.

The following overview of workplace assessments focuses primarily on measuring concepts closer to the definition relating to "teamwork," above.

The Stevens and Campion Teamwork KSA Test

One of the earliest and most influential tests for group work in corporate environments was the Stevens and Campion Teamwork KSA Test [60]. This test consists of 35 multiple choice situational judgment items. The items are designed to cover the 5 facets of teamwork that make up the Stevens and Campion teamwork model, shown below:
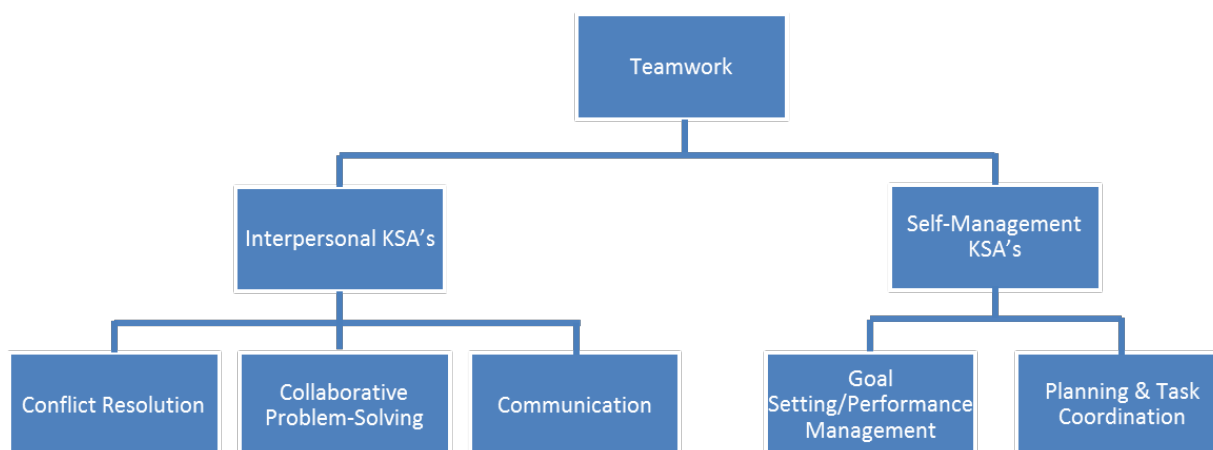
Figure 2. Stevens and Campion's proposed structure for Teamwork, as described in [60] and [61].

While eminently reasonable and highly influential, the assessment and its associated model have not stood up to extended scrutiny. A recent review [62] lamented the lack of subscales with poor internal reliability, a factor structure that did not hold up when real assessment data were analyzed, and a poor ability to predict individuals' teamwork performance. To make matters worse, the assessment's own authors discovered, quite to their surprise, that the results of the teamwork test correlated extremely strongly (r=0.81) with cognitive skills tests – in particular, reading and vocabulary test scores [61]. Thus, it was not clear whether the test was measuring teamwork skills, or just an ability to read and understand written questions about teamwork.

A later iteration by Morgeson et al. [63] recast the Stevens and Campion test as just a "teamwork knowledge" test. That same study was able to show that augmenting the original Stevens and Campion test with a Big 5 personality test and a Structured Behavioral Interview (designed to rate social skills such as listening, speaking, social perceptiveness, etc.– see Ref [63] for a list), one could predict employer ratings of teamwork performance to R=0.48, which qualifies as "high" predictive validity according to the CCR rubric. For comparison, the Stevens Campion test by itself predicts teamwork between r=0.2 and r=0.56 [64], with typical values around r=0.3 [61] [65]. Taken together, the results suggest that cognitive skill (which is what the test by itself appears to be primarily measuring) is the dominant factor in teamwork, but personality traits and behaviors contribute secondarily.

Following in the same vein as the Stevens and Campion situational judgment test, ACT Inc. has also produced a teamwork test consisting of multiple choice situational judgment items. Unfortunately, no validity data on this test appears to exist [66], so it is currently unknown how well this test predicts or measures teamwork.

Big 5 Contributions to Teamwork

While the Stevens and Campion test demonstrated the link between cognitive skill and teamwork, substantial research has also linked specific Big 5 personality traits to teamwork

success. Much of the Big 5-based research has been conducted at the team level, rather than the individual level. For example, a meta-analysis [67] concluded that higher mean levels of Conscientiousness and Agreeableness within a team resulted in higher supervisor's ratings of the overall team's effectiveness, almost universally. Depending on the specific work environment and/or occupation, one or more of the other Big 5 dimensions can emerge as a strong contributor as well [68] [69]. One fascinating finding is that having one or two individuals on the team with very low levels of conscientiousness (work shirkers) tends to spell disaster for the team as a whole [67] [69] [70].

Given the Stevens and Campion-inspired research and the Big 5 inspired research, it seems odd that no commercial vendor has simply blended a cognitive skills test with a Big 5 personality test to arrive at teamwork assessment that was more comprehensive than either component alone. Certainly Morgenson's work [63] showed this approach was possible, even if the Morgenson assessment suite itself was too daunting to deploy outside of a research context. However, a quick review of major Big 5 test producers (DDI [71], SHL [72], Berke [73], Caliper [74], Hogan [75]) show none are displaying a teamwork rating on the reporting side of their commercial instruments. The one exception appears to be Kenexa/IBM [76], which technically has an entire teamwork indicator assessment, but little information on that assessment is publicly available, other than the fact that a trademark for it has been registered [77]. Without their preferred instruments offering them a direct teamwork score, employers are left to associate the closest-sounding category that *is* reported on a Big 5 or Big 8 test (e.g., "supporting and cooperating" on the SHL assessment [78]) with teamwork potential. Unfortunately, these other categories do not necessarily contain the same mix of personality traits and cognitive skill the literature shows as belonging to teamwork.

Future work

The need for a validated model and a validated commercial teamwork assessment

Since the original Stevens and Campion work, at least 8 major theoretical approaches [79] and 180 separately named skills [80] have been proposed to define teamwork. Many of the models listed in [79] (e.g., the Salas model [81]) are conceptual and are not yet at the stage where they have an assessment associated with them. On the other side of the coin, there are existing assessments (e.g., ACT, Kenexa) that could be used in part to measure teamwork, but they lack validation and a clear unifying model.). An obvious approach would be to assume teamwork requires at least some blend of cognitive skill with Big 5 conscientiousness and agreeableness, blend these two assessment schools into a combined cognitive + Big 5 tool , then validate and refine the blended assessment against supervisor ratings of teamwork skill. However, at the moment, the field is wide open for a validated model of teamwork, and a validated commercial assessment to go with it.

Borrowing assessments from the academic community

Future paths to assessment may also be provided via the academic world, which has been busily constructing many different assessments of collaboration. Collaboration is the close cousin of teamwork –in fact, identical, according to 28% of supervisors [59]. Bringing academic instruments into the corporate environment and testing their psychometric qualities in the new context would seem a fruitful area for future work. Two assessments that stand out as particularly worthy of corporate validity studies include a not-yet-realized ETS assessment using avatars to diagnose collaboration skills [82], and the CATME assessment [83] [84]. If it proves valid, the ETS assessment's unique form factor should be welcome in U.S. corporate environments, where computers are readily available, and companies could replace the text-heavy assessments that have historically led to adverse impact concerns.[11]

The CATME assessment is interesting for a different reason: it appears to have high predictive validity for peer ratings of teamwork in an academic setting [85], which could be further verified against supervisor ratings in a corporate setting. Also, the CATME assessment is unique in actually changing the teamwork behaviors of 40% of those who use it [86]. If this feature can be maintained in a corporate culture, the CATME assessment could be used to not only measure, but actually improve, individual contributions to team performance.

Developing a genuine after-action review process

One final area for future work in teamwork is an intentional incorporation of the military's after-action review process into corporate project management. A pillar of US military practice, this protocol for layering formative and summative assessments with immediate retraining exercises, ongoing revision of standard operating procedures, and dynamic reallocation of roles and responsibilities, is designed to optimize team performance during and after an operation [87] [88] [89]. It is the perfect example of "assessment as learning." Unfortunately, in collegiate and corporate use, the after-action review has been emasculated to a one-off post-mortem meeting or report [90] [91]. Everyone gathers around the table, reviews the mistakes made, vows to do better next time, and moves on. The lack of systematized and rigorous follow-on implementation -- such as holding immediate retraining exercises -- drastically reduces the ability of the review to make a lasting difference [90] [91]. Consultants (e.g., Signet Consulting Group [92]) do exist to help bridge the military-to-corporate implementation gap for after-action reviews and might be useful for organizations wishing to improve team performance by this approach.

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[11] Adverse impact = gap in the success rate between minority and majority job applicants. For an explanation of legal issues related to this testing phenomenon, see the discussion under the Critical Thinking section.

Summary of the State of the Art

Despite the fact that teamwork is a highly desirable corporate trait, there seems to be a gaping hole at the nexus of theory, assessment, and validity. There are teamwork assessments that work but whose core model has been invalidated (Stevens and Campion KSA test), theoretical models of teamwork that have no accompanying assessment (nearly all the models described in [79]), teamwork assessments that have no proof/validity studies to back them up (e.g., the ACT WorkKeys Teamwork test [93][12]), and ad-hoc formulas derived from existing assessments that have predictive validity, but poor or no models (e.g., the composite assessment used by Morgeson et al. [63]). The holy grail of a clear model, an assessment aligned with the model, and proof that the assessment works (correlates with supervisor/peer/objective ratings of teamwork performance or work product quality), is currently nowhere to be found.

Test Name	Deficiency	Overarching Workplace Purpose
Stevens and Campion Teamwork KSA test	Poor psychometrics; appears to inadvertently measure cognitive ability	To predict individual's performance in a team
Big 5 personality tests (various)	No individual-level model or individual-level teamwork predictions available.	Research on the applicability of personality traits to group-level work performance.
Composite test battery used by Morgeson [63]	An incredibly long and difficult assessment suite. Underlying model is conceptually muddy.	To predict individual's performance in a team
ACT-WorkKeys Teamwork Test	Commercially available test but no documented validity studies.	To predict individual's performance in a team
Kenexa Teamwork Indicator Assessment	No publicly available information other than the fact a trademark has been registered.	To predict individual's performance in a team
After Action Review	Organizations outside the military succeed in having the structured discussion, but fail at committing to changed practices.	To improve team performance from one operation to the next.

Table 5. Summary of Workplace Collaboration (Teamwork) Assessments

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[12] Requests to ACT, Inc. to provide validity data for this test resulted in no one being able to locate any. Apparently the test is fairly old and has not been updated or revalidated in recent memory.

CHARACTER: What do we actually measure?

CCR Element	Importance to Employers	Most Commonly used assessment approaches in Workforce	Explanation
Mindfulness	Low, but growing	Psychology self-assessments of the type used in medical and academic research.	Attention to Eastern mind-body practices such as yoga, transcendental meditation, etc. is increasing among employers, after a few CEOs championed the practices for themselves personally, and then also saw significant health, wellness, and productivity improvements among employees when the employees were offered mindfulness training as well. Corporate assessment of mindfulness is generally conducted in a research context (e.g., does this employee mindfulness program decrease employee absences?), using research tools.
Curiosity	Low	Specialized personality test, under development	A mixed relationships between curiosity and job performance has left employers not terribly interested in this construct. However, not much work has been done with this element, and it may be that higher level jobs require curiosity in larger measure than low-to-mid level jobs. Curiosity does appear to play a strong role in employees' job satisfaction.
Courage	Low	Big 5 personality assessment	Not commonly assessed. Most prehire personality tests could easily be designed to look for courage (valid psychological test items for courage/bravery/valor exist in the public domain), but no major testing company that we could find, had such a category in its employer-side offerings. This implies a lack of market interest from employers with regard to testing for courage.
Resilience	High	Big 5 based personality assessment	Very commonly assessed via pre-hire personality tests, resilience is a known contributor to job performance in virtually all occupations.

Ethics	High	Self-report integrity questionnaires, using either overt or covert questions about counterproductive work behaviors (theft, dishonesty, attendance, verbal harassment, sexual harassment, sabotage, etc.)	Ethics is primarily assessed via a dedicated "integrity test," taken during the job application process. Employers use these tests to look specifically for so-called counterproductive work behaviors: theft, fraud, dishonesty, sick leave abuse, cyberloafing, on-the-job substance abuse, verbal harassment, sexual harassment, sabotage, disregard for safety procedures, etc. Integrity testing is a mature industry with extensively validated tests. The assessments are popular with employers because the alternative is grim: theft alone costs a typical employer about 7% of its revenue every year.
Leadership	High, but situational	Assessment Centers, Structured Behavioral Interviews, Big 5 personality assessments	Corporate leadership tests are designed to assess whether an individual will perform well in a management position. They are therefore role-specific occupational assessments and not assessments of generic leadership ability. In addition to computerized tests, assessment centers - a physical space with trained observers - are used in testing leadership, one of the few instances in which their expense is justified.

Table 6. Summary of workforce measures of Character qualities

The following sections provide a brief overview of each of these competencies, and suggest directions for future work.

Mindfulness

- Importance to Employers: Low, but growing
- Most Commonly Used Assessment Approaches: Psychology self-assessments of the type used in medical and academic research.

Discussion

Mindfulness in the Workplace

The state of mindfulness is defined as "a mental state achieved by focusing one's awareness on the present moment, while calmly acknowledging and accepting one's feelings, thoughts, and bodily sensations. [94]" The 2007 National Health Interview Survey documented 15% of all US workers as having engaged in mindfulness activities at some point in their lives, with deep breathing exercises as the most popular practice (15%), followed by meditation (13%) yoga (10%) and a variety of other methods [95]. More and more frequently, this exposure is coming through work. Brand-name adopters of in-house mindfulness training now include Google, General Mills, Target, Apple, Nike, Procter & Gamble, the Huffington Post, AOL, Glaxo-SmithKline, ebay, Barclays, Deutsche Bank, Lloyds Banking Group, Goldman Sachs Group, Bank of America and many more [96] [97] [98] [99] [100].

The corporate rush to embrace mindfulness training is spurred partly by the personal experiences of successful corporate leaders who have themselves experienced mindfulness training: Bill George of Honeywell and later Medtronic [101] , Steve Jobs of Apple [102], Mark Bertolini of Aetna [103], and Manish Chopra of McKinsey & Company [104], to name a few. However, the staying power of the practice can be attributed to mindfulness' bottom line impact on workplace stress-related illnesses and absences.

Impacts on Stress, Health, Absenteeism, Productivity

Aetna, a major US provider of healthcare insurance, documents stress as the top risk on the health assessments of those it covers [105]. Aetna's in-house data confirms a $2,000/yr. spread in the healthcare costs of highly stressed vs. non-stressed employees [105]. Mindfulness interventions directly address stress [106] [107], apparently by reducing the levels of cortisol in the body [108]. The ripple effects extend outwards to all other illnesses that are aggravated by stress. For example, in one randomized controlled trial, transcendental meditation reduced death rates in hypertensive patients by 23%, with deaths due to cancer dropping by 49% and deaths due to heart attacks dropping by 30% [109]. Medical studies using objective task performance measures have shown mindfulness training will also increase workers' task focus and short-term memory [110] – another plus for the bottom line. These claims are corroborated by employee self-report surveys [105] [107], which document decreased stress, increased focus, and increased productivity after mindfulness training. It is no surprise, then that corporations that

have adopted mindfulness training as part of their efforts to improve their bottom line. As one example, Transport for London reports its mindfulness training workshops reduced employees' overall absenteeism by 50%, and stress-related absenteeism by 70% [111]). Aetna saw a 3% decrease in its employee healthcare costs, though it is not clear which of several health-related initiatives it launched simultaneously (mindfulness training was one), was the primary contributor to that number [98].

Mindfulness Assessments Used in Corporate Settings

Assessments for mindfulness in the corporate world are used primarily for research and not prehire screening, promotion, or other high-stakes decisions. Typically, the assessments are used in studies monitoring the impact of mindfulness intervention programs on corporate employees' well-being or performance [106] [110] [107]. For this purpose, corporations and/or their academic collaborators have used one of several research-caliber psychological instruments: the Five Facet Mindfulness Questionnaire (FFMQ) [112] [113], the Mindful Attention and Awareness Scale (MAAS) [114] [115], and the 12-item Cognitive and Affective Mindfulness Scale–Revised [116] [117]. An excellent summary of these tools can be found at David Vago's Harvard Medical School website [118]. All are self-report instruments.

The first tool (FFFMQ) assumes mindfulness is a composite of 5 factors and dedicates multiple items to each of these factors (observing, describing, acting with awareness, non-judging of inner experience and non-reactivity to inner experience). This allows subscale scores to be produced for each factor, along with an overall score. The second tool (MAAS) assumes mindfulness is a single concept, attentiveness, and uses examples from day to day life to measure how attentive individuals are to the world around them (e.g., "I drive places on 'automatic pilot' and then wonder why I went there."). This is probably the most user-friendly of the three instruments. The last tool, CAMS-R, includes items addressing attention, awareness, present-focus, and acceptance/nonjudgment, but contains fewer items per concept than the FFMQ, so only a single factor (concept) can be extracted from the instrument as a whole.

Future Work

Mindfulness is very much a watch-this-space phenomenon in the corporate world. It is trendy and new at the moment, but it has the potential to become more widely accepted and increasingly well quantified and assessed if it continues to meet the very real corporate needs of keeping healthcare costs down, reducing absenteeism, and improving worker productivity. At present, there are a few notable research studies, but not so many that they have captured mainstream thinking.

A key gap in the mindfulness work is any quantitative research linking corporate leaders' mindfulness states or practices to the improved bottom lines of their companies. Conferences on mindfulness and leadership abound (Mindful Leadership Summit [119], Wisdom 2.0 Conference [120], Mindful Leadership Global Forum [121], Mind & Matter [122] etc.) as do

consulting companies ready to show corporate leaders how to become more mindful [123] [124] [125] [126] [127]. However, other than personal anecdotes from a handful of visible CEO champions, a substantive link between mindfulness at the top, and profits at the bottom line, has yet to be established.

Summary of the State of the Art

Mindfulness Assessments are currently used in a few corporations for research studies involving employees' well-being and/or productivity. Consequently, research-grade psychology tools are the norm. The following assessments all have a self-report multiple-choice format, and have been well validated.

Test Name	Distinguishing Feature	Overarching Workplace Purpose
Five Facet Mindfulness Questionnaire (FFMQ)	5 subscales allows more in-depth analysis of an individual's progression in mastering various aspects of mindfulness.	For research linking mindfulness levels in employees to productivity, stress, and health.
Mindful Attention and Awareness Scale (MAAS)	Simple daily life questions for probing individuals' general state of mindfulness.	For research linking mindfulness levels in employees to productivity, stress, and health.
12-item Cognitive and Affective Mindfulness Scale–Revised (CAMS-R)	Captures the flavor of the FFMQ but in a shorter instrument. Shorter length means no ability to extract different components of mindfulness.	For research linking mindfulness levels in employees to productivity, stress, and health.

Table 7. Summary of Workplace Mindfulness Assessments

Curiosity

- Importance to Employers: Low
- Most Commonly Used Assessment Approaches: Curiosity-specific personality test, but still under research

Discussion

Components of Curiosity

Curiosity appears to have two major components [128] [129]. The first, called epistemic, interest, or exploration curiosity, refers to an appetite for exploring a wide range of new things.

The second, called deprivation or absorption curiosity, characterizes a desire to delve ever more deeply into a particular subject or phenomenon to learn more about it. (This kind of curiosity is called deprivation curiosity because of the accompanying feeling of annoyance at not understanding a problem, that drives individuals to engage further with it [130].) These two components come from factor analysis of completed surveys asking for self-reports of curiosity-related behaviors and seem to be relatively independent of the specifics of the survey questions used [128] [129] [131].

The German Work-Related Curiosity scale [131] is a survey designed explicitly for workplace use, utilizing questions that reflected the role of curiosity in the workplace e.g., "I carry on seeking information until I am able to understand complex issues," or "I enjoy developing new strategies." It is currently at a research stage of development only. This questionnaire was designed to be limited to epistemic curiosity; however, factor analysis showed that several of the items intended to speak to epistemic curiosity, were starting to form a second cluster of questions that seemed to speak more to deprivation curiosity [131].

Impact of Curiosity on Job Performance

Research with the German Work-Related Curiosity scale showed almost no correlation between curiosity and job performance for financial services employees [131]. However, for a broader-based swath of occupations, the correlation exhibited a respectable $r=0.36$ with peer ratings of job performance and $r=0.31$ with how sophisticated[13] an occupation the individual had attained in life [131]. More recent research with the same scale appears to indicate an $r=0.33$ (uncorrected) relationship to supervisor's ratings of job performance for occupations within a large auto manufacturer; this nearly qualifies as "high" predictive validity according to the rubric used in this report [132]. Further deployment and testing of the instrument would seem warranted.

Impact of Curiosity on Job Satisfaction

The impact of curiosity on job performance is still quite uncertain, as curiosity is not a prominent feature of most Big 5-based prehire assessments and hence only a few small studies exist. The impact of curiosity on job *satisfaction* appears to be more substantially supported. Using the Values in Action (VIA) Character Strengths survey, Peterson and coworkers have shown correlations as high as 0.37 between curiosity and job satisfaction, with the correlation strongest in homemakers and professionals, and lowest (around $r=0.23-0.24$, i.e., still notable) in blue collar and clerical workers [133].

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[13] "sophistication" = a number equivalent to the job's O'Net Job Zone category

Big 5 Personality Tests and Curiosity

Because Big 5 personality tests are a mainstay of employer prehire screening, it is worth understanding how curiosity plays out in a typical prehire personality-based assessment. Curiosity appears to load exclusively [128] or primarily [131] [2] on the Openness dimension of the Big 5 and secondarily on other dimensions [131] [2]. However, because Openness is the smallest contributor to job performance amongst the Big 5 [3], and Curiosity is a minor component of Openness, Curiosity plays a non-existent to minimal role in most Big 5-based assessments designed for prehire screening. In the SHL instruments, which are centered on the "Great Eight"[14] [134], curiosity does not appear explicitly [78]. In the Hogan Select instrument, curiosity is counted as contributing positively to Hogan's dependability scale but not to other scales [6]. Only in Big 5-based assessments designed for personal exploration and growth, does an explicit, reported measure appear for curiosity: Knack, the game-based assessment company, calculates a curiosity "superknack" from a composite of gameplay data [135]. The Values in Action (VIA) assessment [136], the iconic assessment for the Positive Psychology movement, features curiosity as one of its 24 basic character strengths [137].

Future Work

There appears to be fertile ground still available for basic research on the role of curiosity in the workforce. The German Work Related Curiosity Scale found curiosity demonstrated a moderately strong correlation to one's progression up the occupational ladder, even though its relationship to job performance was mixed [131]. This suggests that curiosity may be important to the more sparsely populated, higher level occupations typically ignored by Big 5-based prehire screening tests. However, there appears to be no work (as yet) identifying exactly which occupations these might be, and it is unclear how these will change over time. The existing research with the German Work Related Curiosity Scale aggregates multiple occupations into a single data analysis [131] [132]. Thus, one area of future work is to take occupations that might be likely candidates – those requiring in-depth analysis or wide-ranging exploration – and determine the importance of curiosity to these specific occupations, thereby establishing an as-yet-unused screening dimension for higher level work.

In addition, it would seem that curiosity is ripe for a game-based assessment dedicated primarily to uncovering this trait. The two components of curiosity, exploration and absorption, are naturally accessible from gameplay behaviors. Recording how many new chapters, characters, or lands a gamer explores and experiments with, is likely to be a valid measure of exploration or interest-driven curiosity. Monitoring how long and deeply a gamer delves into each new challenge or experience could be a measure of absorption-based curiosity. Thus, gameplay behavior or player lists from existing turn-based strategy games or expansive virtual worlds

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[14] The Great Eight is a personality framework alternative where the original factors were derived primarily from occupational preference questionnaires, rather than personality questionnaires. These eight factors can mostly be crosswalked to the Big Five, plus cognitive skill.

(games in which it is possible to spend a lot of time exploring the content and delving into strategy complexity) could be resold to firms looking for high curiosity-driven individuals to recruit.

Summary of the State of the Art

At least one assessment has been developed to measure curiosity in the workforce explicitly; however it is still in the research phase of development [131]. For most of the Big 5 based assessments currently used in prehire selection, curiosity is an extremely minor or non-contributing component [6] [78], because the dimension in which it is based, Openness, is the least important Big 5 dimension to job performance in most jobs [3]. However, curiosity is important to job satisfaction [133] and life satisfaction [137] (if not job performance in entry level jobs), and so it appears far more prominently in assessments used primarily for personal growth, such as the VIA assessment [136].

Test Name	Form Factor	Overarching Workplace Purpose of Test
German Work-Related Curiosity Scale	Likert Scale (Multiple Choice)	Research to determine whether curiosity impacted work performance
VIA	Likert Scale (Multiple Choice)	Research to determine whether curiosity impacted job satisfaction
Hogan Select	Likert Scale (Multiple Choice)	Prehire selection. Curiosity is a minor component of Hogan's Dependability scale.
Knack (Wasabi Waiter, MetaMaze)	Game	Career and self exploration

Table 8. Summary of Workplace Curiosity Assessments

Courage

- Importance to Employers: Low
- Most Commonly Used Assessment Approaches: Big 5 Personality Assessment

Discussion

Personal Courage

To the author's knowledge, courage does not appear as an explicit measure in any of the major prehire assessments. That is not to say it is not a personality trait, just that it is not one with enough demand to be worth designing commercial instruments around as of yet. The VIA character strengths assessment, from the positive psychology movement, does have a bravery/valor subscale [136] [137] [138]. It has been used primarily in research; however some

of that research has been on the topics of job satisfaction and performance [139] [133]. The results indicate that personal bravery contributes to an employee's job dedication and organizational support [139]. In higher management, bravery is positively related to subordinates' ratings of the executive's job performance, although the link is not as strong as that between the executive's integrity and her job performance [140].

The VIA survey's bravery (valor, courage) items include such agree/disagree statements as:

- Have taken frequent stands in the face of strong opposition.
- Don't hesitate to express an unpopular opinion.
- Call for action while others talk.
- Can face my fears.
- Speak up in protest when I hear someone say mean things.

When a factor analysis is attempted on all of the VIA survey's 24 different personality traits [136], the traits grouped with bravery/valor come out differently from one study to the next (e.g., compare the factor analysis in [139] with that in [141]). This suggests the concept of bravery is either not strongly defined or it is highly variable as a character quality. A recent University of Colorado study [142] on workplace courage suggests that part of the problem is that one's level of courage/bravery/valor depends in a large part on context. Based on 94 worker interviews, Schilpzand, Hekman, and Mitchell concluded there were four categories of courageous behavior in the workplace.

- standing up to authority
- uncovering mistakes
- structuring uncertainty, or taking a stance on a problem that has no clear solution and possibly serious repercussions.
- protecting those in need

However, the decision to act in any one of them was related to the situation at hand – specifically, how strongly the potential actor felt an injustice had been perpetrated and how highly placed the actor was in the corporate hierarchy (those with more power felt freer to act). In the end, bravery seems as much or more conditional on the situation as on the personality. If this is the case, then a proper assessment for bravery would include not just a personality test, but also an organizational climate test, probing whether the environmental conditions for bravery exist.

Organizational Courage

Such an organizational climate assessment for courage is the Kilmann Organizational Courage assessment [143]. It is internally self-consistent, and its results correlate reasonably well with personal reports of workplace satisfaction, particularly feelings of burnout or lack thereof [144]. However, the tool has yet to be validated against external performance measures such as sales, stock growth, employee turnover, employee promotion rates, etc. The Kilmann assessment is a

multiple-choice test for employees, allowing them to situate their organization in a 4 quadrant courage schema, as shown below.
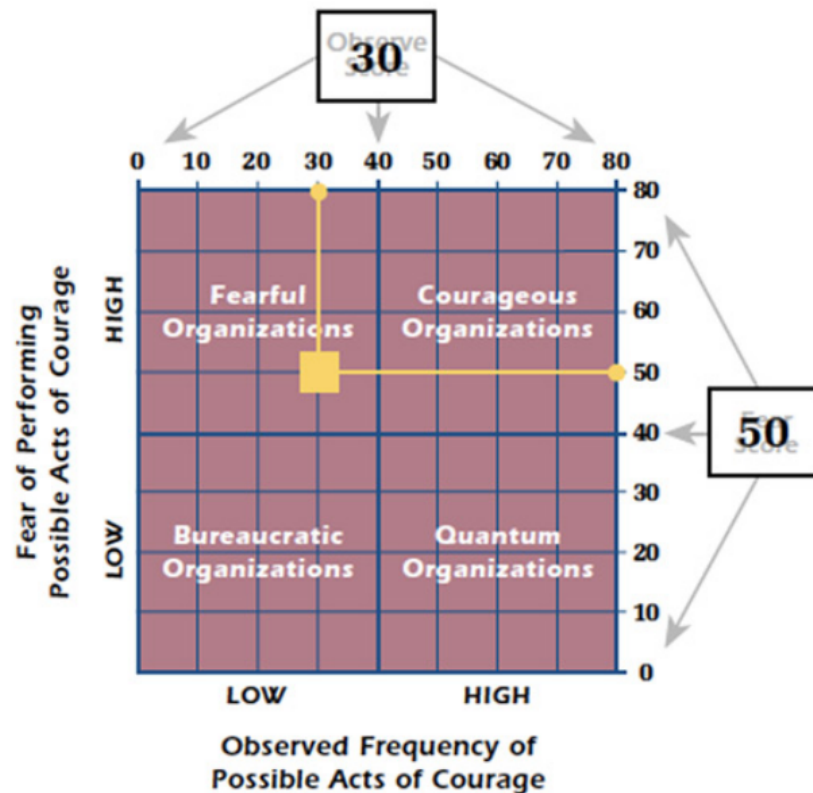

Figure 3. Four-quadrant representation of Kilmann's Organizational Courage model, in which organizational courage is defined by how fearful the employees are, on the one hand, vs. how frequently they perform acts of courage regardless, on the other. Figure reproduced from [143].

The format of the test is to present 20 courageous workplace asks, then ask the respondent how frequently he has observed those acts in his own workplace and how afraid people would be of receiving negative consequences for each act.

Future Work

The concept of bravery at work is just barely beginning to be explored in the research literature, with few (if any) commercial instruments designed to assess personal workplace bravery. However, what little we do know suggests that an appropriate next step would be to combine personality test assessments with a corporate climate assessment, then try to develop a model containing the results of these two surveys to predict the frequency with which an individual in an organization is likely to commit a "qualified brave action" within a specified time period. Gathering data on the actual frequency of brave workplace actions would then allow the model – and by extension, the measures contributing to the model – to be validated.

Summary of the State of the Art

One individual-level (VIA [136] [138]) and one corporate-level ([143] [144]) assessment of courage have been used for research purposes. While both are readily available, neither appears to be used for typical corporate end uses such as employee screening, training, or development.

Test Name	Form Factor	Overarching Workplace Purpose of Test
VIA (Values in Action)	Likert Scale/Multiple Choice	Research to determine whether being courageous impacts personal job satisfaction or performance
Kilmann Organizational Courage	Likert Scale/Multiple Choice	Corporate self-exploration. Also, research on whether a courageous corporate climate impacts employee satisfaction.

Table 9. Summary of Workplace Courage (Bravery) Assessments

Resilience

- Importance to Employers: High
- Most Commonly Used Assessment Approaches: Big 5-based Personality Assessment

Discussion

Resilience in the Workplace

Resilience is exhibited when individuals bounce back from stressful incidents and continue to perform. In sports and business vernacular, this same trait is sometimes called mental toughness [145]. Resilience is a positive attribute for employees, given the stress associated with many jobs and the undesirable fallout when resilience is not present: stress-related health problems and absences, emotional outbursts, defensive behaviors, moodiness and unpredictability [6] [146]. Resilience and its synonyms (see Table 8) bear notable (r>0.2) correlations with observer ratings of workers' emotional maturity, ability to persuade others, negotiation skill, entrepreneurial acumen, maintaining optimism, showing interpersonal understanding, showing concern for quality, demonstrating business acumen, and effectiveness in delegating and monitoring assignments [6] [2]. Not surprisingly, resilience is positively correlated to job performance in virtually every occupation tested [6] [2].

Resilience and the Big 5

In the Big 5 personality framework, resilience is composed primarily of the emotional stability dimension, with minor amounts of extraversion, openness, and conscientiousness [147] Therefore, Big 5-based assessments designed to elicit resilience hew fairly closely to emotional

stability concepts (or its negative, neuroticism[15]) in designing their questions. It should be noted that while self-report resilience-only assessments do exist, they appear to have no more or better ability to account for human variation in this quality than a composite of self-reported Big 5 measures, heavily weighted towards emotional stability/neuroticism [148]. Consequently, the multitude of Big 5-based employer screening tools available from major vendors (Kenexa/IBM [76], DDI [71], SHL [72], Berke [73], Caliper [74], etc.) can be presumed to adequately capture resilience as a concept.

Future Work

None proposed at present.

Summary of the State of the Art

Resilience is predominantly assessed via the neuroticism (emotional stability) dimension of Big 5-based personality tests.[16] Using Likert scales, individuals respond to self-report questions as, "seldom feel blue," "rarely get irritated," "am not easily bothered by things," "remain calm under pressure" [149]. While these questions may seem to relate more to happiness, the individual who bounces back from stress quickly, or who doesn't let things distress him overmuch, will actually be in a calmer, happier, state much of the time, which these questions will detect. The difference between a neurotic and emotionally stable person is not the frequency of bad things that happen to them, but how they respond to life's perpetual annoyances and grievances.

While the trait is called different things by different test vendors, it is possible to tell whether a given trait is resilience or not, by whether it falls out in the neuroticism category during factor analysis of the test results, or by comparing sample test questions to those listed above. Many of the vendors offering Big 5-based personality tests feature resilience-specific data report-outs; a few such tests are summarized below, along with what they call this trait.

Test Name	Name of Trait Corresponding to Resilience	Overarching Workplace Purpose of Test
Kanexa/IBM, Leadership Preference Assessment	Emotional Orientation	To help identify candidates for promotion to leadership positions.
Hogan Select, Hogan Personality Inventory	Composure, Adjustment	Prehire selection. This trait is included for suitability

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[15] Neuroticism and emotional stability are the negative and positive ends of the same axis in five-fold personality space.

		matching against virtually all job families.
SHL Occupational Personality Questionnaire	Coping with Pressures and Setbacks	Prehire selection, promotion and/or re-assignment of incumbents
Caliper Profile	Ego Strength/Resilience	Prehire selection; this trait is included for suitability matching against virtually all job families.

Table 10. Summary of Workplace Resilience Assessments

Ethics

- Importance to Employers: High
- Most Commonly Used Assessment Approaches: Self-report integrity questionnaires, using either overt or covert questions about counterproductive work behaviors (theft, dishonesty, attendance, verbal harassment, sexual harassment, sabotage, etc.)

Discussion

Counterproductive Work Behaviors

In the corporate environment, ethics is interpreted as "corporate ethics" rather than personal ethics. Workplace tests for ethics are looking primarily for counterproductive work behaviors (CWB's): theft, fraud, dishonesty, sick leave abuse, cyberloafing, on-the-job substance abuse, verbal harassment, sexual harassment, sabotage, disregard for safety procedures, etc. In short, workplace assessments on ethics are looking for any deviant behavior that might result in either financial loss or legal liability for the company. Personal ethics – whether one engages in premarital sex, cheats on one's spouse, regifts Christmas presents, grossly undertips, or belongs to a demonic cult – are not a formal part of this testing.

Because of its impact on the bottom line, employers take ethics testing quite seriously. Take the financial damage caused by employee theft alone: In 2008, the Association of Fraud Examiners estimates U.S. employers lost on average about 7% of their annual revenue to theft or fraud [150].[17] Extrapolated across the US GDP, this suggests employee theft is a $994 billion "industry" of its own [150]. Globally the situation is only slightly better, at 5% of annual corporate revenues disappearing due to fraud [151]. Obviously, any improvement in the current state of the art in ethics testing would represent a major financial windfall for employers.

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[17] For more fascinating statistics, see http://www.statisticbrain.com/employee-theft-statistics/

Integrity Tests

At present, the primary form of ethics testing is through integrity tests. These are multiple-choice or true/false self-report tests that that can either be overt or covert (more on this distinction below). In addition, structured behavioral interviews can be used to elucidate a candidate's (un)ethical behaviors. At one time, lie detector tests were used by employers to probe for unethical behavior, but the Employee Polygraph Protection Act made such tests illegal in 1988 [152]. They have not been used by US employers since. Background checks of criminal records are, of course, still used to supplement pre-employment tests, including integrity tests.

Overt Integrity Tests

Overt integrity tests either ask the candidate directly if they have engaged in CWB's or probe the candidate's attitudes towards others engaging in these same behaviors. The overt questions are along the lines of, "I have stolen merchandise within the past 3 years (yes/no)" or "Do you think someone who has stolen office equipment should be fired?" Surprisingly, enough job candidates answer these questions accurately to give overt integrity tests an overall r=0.3 (uncorrected) correlation with CWB's[18] [153]. This operational validity of r=0.3 *includes* the results from those who have faked their answers, and still remains a healthy, moderate, validity. It appears applicants do not fake their answers to these obvious questions as much as one might think.

Two explanations have been given for this result. First, applicants genuinely believe their own behavior – whatever it is – is completely normal/justified, and therefore they do not hesitate to report it [154] [155] [156]. Secondly, some applicants believe an "integrity test" is measuring how honestly they answer questions about their past, and so they attempt to "beat the test" by answering as brutally honestly as they possibly can [154]. Despite the apparent lack of widespread faking, the literature is clear that the answers to an overt integrity test can be faked, if applicants desire to do so. Individuals explicitly instructed to fake an overt integrity test are able to increase their scores by 0.8-0.9 of a standard deviation [157] [158]. Various methodologies to reduce faking, such as response latency measurements and forced choice formats, have been attempted, but the impact of these approaches on improving validity is still being debated [159].

One subclass of the overt tests are conditional reasoning tests, the archetype of which is the Conditional Reasoning Test of Aggression (CRT-A) [160]. This multiple-choice test asks respondents to choose between pairs of responses that reflect multiple ways of viewing the same situation. For example [159]:

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[18] The correlation is much stronger between the integrity test's estimate of CWB's and self-reports of CWB's, than it is between the integrity test's estimate and CWB's that have actually been logged or filed by the employer [153]. It appears that the vast majority of CWB's are known to the perpetrator only, and are never seen by the employer.

"15 years ago American carmakers knew less about building reliable cars than their foreign counterparts."

vs.

"Prior to the introduction of high-quality foreign cars, American car makers purposely built cars to wear out so they could make a lot of money selling replacement parts."

The second option reflects the more cynical, hostile worldview commonly held by those who engage in CWB's. Eleven validity studies show an average r=0.44 (uncorrected) for the CRT-A [159] with reported incidents of CWB's. This places the CRT-A at the highest level of validity in the CCR rubric.

Overall, a large number of overt integrity tests exist. A few examples are the London House Personnel Selection Inventory, now called the Personnel Selection Inventory [161], the Reid Report [162], the Stanton Survey [163], and the Certifinder Applicant Review [164], along with the Conditional Reasoning Test of Aggression (CRT-A) mentioned earlier [160]. Almost uniformly, these are all well-established, well-characterized tests.

Covert Integrity Tests

Covert integrity tests are Big 5-based personality tests tuned to detect individuals high in Conscientiousness, high in Agreeableness, and low in Neuroticism [165] [159]. Such individuals tend to be less prone to CWB's [165]. Although covert tests are far more difficult to fake [157], their validity ends up being the same or less than overt tests (r=0.23 vs. r=0.30, uncorrected [153]). The reason for this is the indirect nature of the measurement. The results of covert tests require an additional translation, from personality to behavior, that is not required for an overt test (which uses past behaviors to predict future behaviors and thus stays entirely within a behavioral framework). Thus, the fact that covert integrity tests are less easy to fake, is counterbalanced by the fact that they require more extrapolation to interpret correctly.

Any existing Big 5 item inventory can be used to produce predictions of integrity using a weighting formula for Conscientiousness, Agreeableness, and Neuroticism, or specific facets of these traits. Big 5 assessments that have explicitly been used for integrity testing include the California Psychological Inventory [166], The Personnel Reaction Blank [167], Giotto [168], the Inwald personality Inventory-2 [167], and the Hogan Personality Inventory [169] [170].

Structured Behavioral Interviews

A detailed description of structured behavioral interviews (SBI's) is given in the Leadership section of this report. They are mentioned briefly here because, of the myriad things one can detect via a structured behavioral interview, it turns that the candidate's ethics/integrity/moral values is one of the traits that is detected most strongly and accurately by the interviewers, to a validity of about r=0.32 (uncorrected) [171].

Future work

Looking forward, the paper and pencil integrity test may end up being augmented by physiological measures. Experimentation with facial recognition technology has produced facial action coding software capable of detecting many of the facial tics that often accompany lying [172]. With this, interviewers may be able to ask questions about an individual's past and determine more accurately whether the answers given are honest ones. A replacement for the old and unreliable lie detector may be on its way.

In the medical research arena, MRI scans now provide insight into the mental structures associated with lying and other forms of deviant behavior, and several companies are beginning to experiment with the feasability of using MRI for lie detection [173], although neuroscientists are skeptical of the validity of this measure at the present moment. Currently, the structure of ethics tests (for the covert tests, at least) has no relationship to neural processing and is based instead on hypothetical factors that exist primarily in the data patterns of assessment answer sheets.

Summary of the State of the Art

Of all the CCR elements, ethics probably has the best developed workforce assessments. Paul Barrett's recent summary of existing commercial integrity assessments lists 26 current commercial integrity tests alone [174], along with detailed instructions on how to evaluate different assessments for purchase [175]. Research has shown that some of the existing assessments can reach high levels of validity – for example, the CRT-A conditional reasoning test is exhibiting validities in the $r=0.44$ range [159], and structured behavioral interview questions are showing $r=0.32$ [171] with ethical behaviors. A list of some of the current instruments is given below. All except the structured interview are self-report true/false or self-report multiple-choice tests.

Test Name	Form Factor	Overarching Workplace Purpose
Personnel Selection Inventory	Overt Integrity Test (True/False)	Predict counterproductive work behaviors (CWB's) of job applicants
Reid Report	Overt Integrity Test (True/False)	Predict counterproductive work behaviors (CWB's) of job applicants
Stanton Survey	Overt Integrity Test (True/False; some Multiple Choice)	Predict counterproductive work behaviors (CWB's) of job applicants
Certifinder Applicant Review	Overt Integrity Test (format not disclosed)	Predict counterproductive work behaviors (CWB's) of job applicants

Conditional Reasoning Test of Aggression (CRT-A)	Overt Integrity Test (Multiple Choice)	Predict counterproductive work behaviors (CWB's) of job applicants
California Psychological Inventory	Covert Integrity Test (True/False)	Predict overall job performance of job applicants, of which counterproductive work behaviors (CWB's) are a part
The Personnel Reaction Blank	Covert Integrity Test (Multiple Choice)	Predict counterproductive work behaviors (CWB's) of job applicants
Giotto	Covert Integrity Test (Forced Choice)	Predict counterproductive work behaviors (CWB's) of job applicants
Inwald personality Inventory-2	Covert Integrity Test (True/False)	Predict counterproductive work behaviors (CWB's) of job applicants
Hogan Personality Inventory	Covert Integrity Test (True/False)	Predict overall job performance of job applicants, of which counterproductive work behaviors (CWB's) are a part
Structured Behavioral Interviews	In-person interview with questions designed to elicit specific examples of ethical/unethical behavior from the interviewee's past. Answers evaluated by an evaluation team via a rigorous rubric.	Predict overall job performance of job applicants, of which counterproductive work behaviors (CWB's) are a part

Table 11. Summary of Workplace Ethics Assessments

Leadership

- Importance to Employers: High, but situational
- Most Commonly Used Assessment Approaches: Assessment Centers, Structured Behavioral Interviews, Big 5 personality assessments

Discussion

Leadership vs. Management

In the corporate testing domain, "leadership" is often conflated with "management," because the instruments termed "leadership assessments" are designed to predict management task performance. Charismatic leadership, the topic of many inspirational leadership books, is not a part of this skill set. Similarly, no dictionary definition of leadership includes the ability to

prioritize an inbox, lead a group discussion, or give a sales presentation. However, these are the some of the abilities that corporate leadership assessments will be looking for.

Because the volume of managerial applicants is much smaller than that of entry-level employees, corporations will use techniques more expensive than multiple-choice tests when it comes to assessing leadership/management skill. Two popular techniques for ascertaining the leadership potential of future managers are the assessment center and the structured behavioral interview.

Assessment Centers

Assessment centers are physical facilities with staged office environments and trained observers. Management job applicants are assigned tasks that are similar to what they might encounter in their new management job. As a candidate is conducting her assigned tasks, trained observers fill out a rubric evaluating the candidate's performance. Typical assessment center tasks might include prioritizing an inbox of tasks, leading a group discussion (often the fellow discussants are the other candidates vying for the same position), delivering a public presentation, or conducting a sales call with a client [176].

Assessment centers have been shown to produce selection results that are more racially equitable than most other methods [177], a major selling point in their favor. Their ability to predict managerial performance and promotion is reasonable, at $r=0.25$ with supervisory ratings of performance and $r=0.3$ for career advancement [178]. This places the assessment center at medium predictive validity, according to the CCR rubric. A downside of assessment centers is that the choice of tasks will greatly affect the relative candidate rankings, leading psychometricians to question whether the assessment center process really measures "leadership" as a distinguishable trait, or is instead measuring specific task performance abilities [179]. Presumably, if the chosen tasks mirror actual job responsibilities, then the practical distinction – from a hiring standpoint – is moot.

Methods known to optimize the quality of assessment center ratings can be found in Refs [180] [181]; these include rater training, using psychologists rather than managers as raters, etc. Assessment centers are gradually moving to the online arena; products such as DDI's People Leader© [182] take the same tasks but deploy the job simulation virtually, allowing the candidate to participate from one location, while remote DDI assessors evaluate the candidate's performance from another.

While assessment centers are used primarily for candidate selection, they can also be used for coaching and training – and, in some cases, for deciding whom to retain and whom to dismiss during a mass layoff. In this last context, they are known (with some dark humor) as "assassination centers" [183] [184].

Structured Behavioral Interviews

Structured behavioral interviews are another approach. In its most complete form, the process runs as follows:

- A formal job analysis is conducted to determine the critical skills required to do the job.
- A set of interview questions is developed by the interview committee around the top few skills identified by the job analysis.
- The questions are phrased so as to elicit an example of the desired behavior or skill from the candidate's past. For example, if a critical skill is managing an organization through financial uncertainty, then a question might be, "Describe an occasion in your past when you had to deal with a major and unexpected budget cut. What did you do?"
- Note that asking a candidate what he thinks he *would* do, given a hypothetical situation in the future, as opposed to what he *actually did* do in the past, completely destroys the validity of the structured interview process. The validity of the approach drops from r>0.3 to r≈0.09 [185].
- A scoring rubric is developed, through consensus by the same committee, that assigns points for different sought-for features of the candidates' answer.
- The questions and scoring are pilot-tested with current job incumbents. This dry run allows interviewers to experience the potential range of answers, establish better benchmark answers, and refine the evaluation rubric.
- During the actual candidate interview, the same reviewers/evaluators who developed the rubric are all present.
- Each question is asked in exactly the same order of each candidate. The same rubric is used for evaluating all candidates.
- Each evaluator fills out the rubric for each candidate; results are averaged.

In addition to the above, some organizations will spend time creating an interviewers' guide and documenting the instrument design process, so that the same structured interview questions can be reused in future hiring for the same job title.

While they are extremely time consuming to set up, structured behavioral interviews so vastly outperform unstructured interviews (the typical job interview most candidates are exposed to), that many organizations have embraced them, including such major employers as Google [186], Intel [187], and the federal government [188]. Structured behavioral interview ratings correlate with job performance (as measured by supervisor ratings) in the range of r=0.3 to r=0.57 [189] [190]. By comparison, an unstructured job interview correlates with job performance to around r=0.14 to r=0.2 [190] [191]. Moreover, the structured interview erases 50-100% of the racial bias in interviewer ratings that occurs as a matter of course in unstructured interviews [171]. This places structured behavioral interviews in the "high" validity range and the "high" racial equity range set forth in the CCR technical criteria rubric.

Structured behavioral interviews are the only hiring assessment known to achieve both of these lofty goals simultaneously. Even companies known for their multiple-choice testing products (e.g.,DDI [192], Kenexa/IBM [193]) will offer a bank of structured interview questions to their clients alongside their standardized tests, as a way to add quality to the final stage of the selection process.

Multiple choice tests – Cognitive Tests and Big 5 Personality Tests

While more sophisticated companies will use assessment centers and structured behavioral interviews to fill top management positions, standardized test vendors still have a healthy market for low cost managerial screening tools. Standardized tests purporting to predict leadership skills in prospective management candidates can contain non-cognitive personality items (e.g., SHL [78] and Hogan Worldwide [194]), or both cognitive and "non-cognitive"[19] items (e.g. Berke [195]). In most cases, the items used for managerial screening are identical to the items used for pre-hire screening in other occupations. However, the weighting formula, and/or the accompanying narrative is changed to render the interpretation more aligned to a managerial hire. These same assessments can be used in a developmental context also, e.g., given to current or prospective managers to take as a formative assessment during a leadership training class, in order to make managers aware of their own personality-based strengths and weaknesses.

Research supports the claim that both cognitive ability (in the CCR taxonomy, Critical Thinking) and Big 5-based personality measures contribute moderately and separately to leadership skill. On the cognitive side, a European meta-analysis examined the relationship of cognitive test scores to job performance ratings of 783 managers across 6 studies and concluded a moderate r=0.25 relationship was warranted [196]. This is not terribly surprising, given that cognitive skill is the strongest predictor of performance across virtually all jobs [191]. An internal study by DDI [197] isolated a few of the specific management competencies dependent on cognitive skill. Foremost among them were establishing strategic direction and to exhibiting financial acumen [197]; it is unclear if these are truly leadership qualities or simply managerial qualities.

Judge's meta-analysis on the relationship between Big 5 personality dimensions and leadership performance show most of the Big 5 dimensions are also moderately important to leadership, correlating |r|=0.16-0.22 (uncorrected) to job performance [198].[20] Extraversion plays a special role in attracting enough notice to get appointed to a managerial position in the first place [198], but it continues to contribute to managerial performance afterwards. Interestingly, agreeableness is the one personality dimension not associated with management performance [198]. Managers do not have to have an innate need to please others to succeed. Judge did isolate some personality patterns by sectors. Conscientiousness was important only to government managers, while Openness was important only to corporate managers [198]. One could conclude that government managers need to be diligent about completing their work; corporate managers need to look for and embrace new ideas.

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[19] CCR prefers the term socio-emotional skills or character qualities, as "non-cognitive" and "soft skills" have the connotation of being less serious than cognitive skills.

[20] The absolute value of r is used because neuroticism correlates negatively with leadership, though at the same level of strength as Conscientiousness, Extraversion, and Openness.

Future work

Assessing Leadership Rather than Management

None of the existing assessments was designed to detect a future Ghandi or Nelson Mandela or George Washington. While many popular books have been written about leadership, invoking such mantras as "start with why [199] " or "inspire ownership [200]," those books do not come with validated assessments to make their motivational concepts operational and measurable. Thus, we have a set of management assessments that is not designed to predict leadership in any other sphere, and a set of inspirational leadership treatises that do not have a corresponding assessment.

One assessment that exists largely in the academic sphere, but has displayed astonishing (perhaps unbelievable) psychometrics when deployed in one study with corporate managers is the *Student Leadership Practices Inventory* [201] [202]. What sets this assessment apart are two attributes. First, its five categories of questions hew much more closely to the sense of "leadership" found in leadership books: "model the way," "inspire a shared vision," "challenge the process", "enable others to act", and "encourage the heart." These vague-sounding categories are demonstrably real and distinct: they separate out as 5 separate concepts in factor analysis of respondents' answers to the questions in the survey [203]. Secondly, the ability of this instrument to predict a separate, summary leadership score is extremely high. In a study with 708 managers, the subordinates' assessment of their managers' overall leadership ability was correlated to the *Leadership Practices'* 5 pillars score (as filled out by the same subordinates) R=0.76[21] [203]. While this is a corrected value of R, it is still unheard of.

The *Leadership Practices* instrument thus appears to capture what an average subordinate might think of as "leadership." What remains to be seen is whether a manager's self-assessment, using the same *Leadership Practice*s instrument, would still correlate to a subordinates evaluation of his leadership ability. How much does the self-view of managers, differ from their employees' views?

When it is used as a self-report questionnaire, *Leadership Practices* is better used as a formative self-development tool (e.g., for leadership training), than as a high stakes prehire selection tool. However, the fact that the instrument has shown such high validity, using an entirely different underlying paradigm – one not based on personality or tasks – is a compelling reason to examine the feasibility of developing new leadership assessments using this new 5 pillar paradigm.

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[21] The "others" doing the evaluating were subordinates of the managers themselves. There were typically 3 subordinates evaluating each manager, for a total of 2168 managerial evaluations across the 708 managers.

Summary of the State of the Art

At present, most corporate assessments for leadership are testing specifically for management skills. In assessment centers, the assessment tasks are managerial tasks. In situational interviews, the questions are designed around managerial tasks extracted from a job analysis. Candidates are asked for examples from their own past that demonstrate they have successfully overcome typical challenges associated with those tasks. In personality testing, an overview of the individual's personality is obtained, but when that profile is compared to the boundaries of "acceptable" personalities for leadership roles, it is in fact comparing the candidate to high performing (or even standard performing) corporate managers. Thus, the existing assessment approaches are all designed to find the best corporate manager, not the best world or religious leader. It is not even known whether top-level corporate talent – such as Steve Jobs or Jack Welch – would fit within the confines of existing assessments.

Of the three approaches to determining the best future manager, the situational interview has the strongest predictive validity, as well as racial equity. Nevertheless, the methodology is time-consuming and therefore best used when the position to be filled is of critical importance (so that the extra effort is warranted), or when there will be multiple hires into the same job title (in which case the effort is split amongst the multiple hires). The assessment center is the next best choice, in terms of predictive validity and ability to custom match the assessment to job tasks. The least accurate and least expensive choice – though still adequate – is mass screening via cognitive and/or psychological multiple-choice test items.

Test Name	Form Factor	Overarching Workplace Purpose
DDI Assessment Center	Physical space with simulated management tasks and trained observers	Prehire selection - To rate individual's generic management potential
DDI People Leader	Web-based tasks with remote evaluators assessing candidate's behavior during task performance.	Prehire selection - To rate individual's generic management potential
OPM Structured Behavioral Interview	In-person interview with questions designed to elicit specific job task performance examples from the interviewee's past. Answers evaluated by an evaluation team via a rigorous rubric.	Prehire selection - to rate individual's match to a specific job opening
Berke Assessment	Online multiple choice test containing cognitive items (e.g., vocabulary, spatial visualization) and personality items	Prehire selection -to rate individual's generic management potential
Hogan Select – High Potential	Multiple choice tests with self-reports of personality traits	Prehire selection-to rate individual's generic management potential
HoganLead	Multiple choice tests with self-reports of	Self-development

	personality traits	
SHL Occupational Preference Questionnaire	Multiple choice tests with self-reports of personality traits	Prehire selection - to rate individual's generic management potential
Leadership Practices Inventory	Web-based multiple choice self-report that can be corroborated with 360 reports from others.	Research and self-development

Table 12. Summary of workplace leadership assessments

META-LEARNING: What do we actually measure?

Growth Mindset

- Importance to Employers: None (currently)
- Most Commonly Used Assessment Approaches: None

Discussion

To the author's knowledge, there has been one research study using a growth mindset instrument in a corporate setting. Specifically, a variation on Carol Dweck's famous tool was used by Dweck and her colleagues to evaluate whether corporate cultures have a growth or fixed mindset [204]. In the corporate version of the test, the underlying growth vs. fixed mindset dichotomy was re-cast as a "culture of development" vs. a "culture of genius" for the company as a whole. The results indicated corporations with a culture of development engendered higher levels of employee trust and ownership, led employees to be more innovative and collaborative, and lowered unethical behavior. [204]

Aside from the one research study, however, there is little on growth mindset in the corporate testing literature. Dweck has argued that those with a growth mindset will exhibit superior perseverance through obstacles or tasks, compare to those with a fixed mindset [205]. If this so, then perseverance traits could serve as a proxy for growth mindset. As it turns out, perseverance is a facet of the Big 5 personality dimension, Conscientiousness [206]. Thus, the supposed outcome of a growth mindset is already being probed via any one of the many commercially available Big 5-based personality tests (e.g., Kenexa/IBM [76], DDI [71], SHL [72], Berke [73], Caliper [74], Hogan [75], etc.). However, the Big 5-based assessments are framed assuming perseverance is the consequence of a personality trait rather than the outcome of a mental belief system. The strongly agree — strongly disagree Likert scale questions in the Big 5 assessments are along the lines of "I complete tasks successfully [149]" (this is who I am) rather than the Dweck assessment's "to be honest, you can't really change how intelligent you are [207]" (this

is how I believe the world works). Ironically, the most common corporate probes for a growth mindset outcome (perseverence) end up being a set of fixed-mindset-framed questions.

Future Work

Growth mindset related assessments do not appear to be utilized in the workplace at this time, but one could argue that they be adopted. In order to be useful to human resource officers, a growth mindset assessment would have to outperform existing assessments for prehire selection. Specifically, the growth mindset assessment score would need to be positively correlated to some aspect of job performance at a level r>0.2 (a typical correlation between Big 5 personality traits and job performance [208]) and, moreover, the assessment scores would need to be minimally different between minority and Caucasian applicants. Alternatively, one could target Chief Learning Officers as potential adopters – perhaps using growth mindset assessments to diagnose slow learning progress during in-house training or identify the candidates most likely to benefit from employers' tuition reimbursement programs. However, even in this case, one would need stronger validity evidence. The correlation of growth mindset scores to learning *gains* and expended effort is solid [209] [210], but their correlation to absolute academic performance (GPA, standardized test scores) is far weaker and often negative [211] [210] [212]. This is because an individual's final level of academic achievement depends not only on the interim gain, but on his/her pre-existing level of achievement, which in turn depends far more strongly on variables other than effort, such as socioeconomic status [210] [213]. It may also be useful to expand on measures of a corporation's "culture of development" vs. "culture of genius," not for pre-hire purposes but for organizational improvement.

Summary of the State of the Art

No growth mindset tests are currently being used in corporate settings, and there appears to be no current demand for them.

Metacognition

- Importance to Employers: None
- Most Commonly Used Assessment Approach: No employer assessment for metacognition. Two multiple choice assessments (one multirater, one self-report) for learning agility.

Discussion

Metacognition

In the context of the CCR framework, metacognition is the process of "thinking about thinking." The hoped-for outcome is stronger transfer of knowledge between domains and more effective self-directed learning. This conceptualization of metacognition does not have an exact analogue in the workplace. However, the ability to "learn how to learn" and transfer lessons

learned from one context to the next, is important to employers. The military has an entire protocol devoted to learning transfer, the After-Action Review, which is described in more detail in this report's section on Collaboration. In the After-Action review, lessons from past mistakes on the field are extracted via roundtable discussion, current assumptions and practices are updated, and the team redeploys with better situational understanding and more effective protocols the second time around.

Learning Agility

At present, the ability to quickly learn in new contexts, or learn from old mistakes, is a hot topic in discussions on corporate leadership [214] [215] [216] [217] [218] [219] [220]. In these discussions, employers are embracing a concept different from metacognition – "learning agility," [214] [215] [216] [217] [218] [219] [220] – to describe the skillset needed to learn efficiently in a rapidly changing job. The learning agility terminology has also crept into a plethora of job board advertisements e.g., advertisements for a software engineer at MyUS.com [221], a business analyst at Takeda [222], a content editor at Thomson Reuters [223] a Junior Systems Engineer at Orbital ATK [224], to name a few. Sample wording is shown below, taken from the Takeda advertisement [222]:

> <u>Candidate Must Possess the Following Skills:</u>
> - Ability to work in support of a system engineering team
> - **High learning agility** for addressing a wide variety of complex analytical tasks
> - Good written and verbal communications skills

Learning Agility, Defined

The Center for Creative Leadership (CCL) defines learning agility as the ability to "give up skills, perspectives, and ideas that are no longer relevant, and learn new ones that are" [220]. Deloitte's Bersin arm declares [215],

> Learning Agility is not necessarily an academic skill, rather it describes a person's ability and passion to quickly study a new problem and use their own learning process to gain deep understanding before making a decision.

Thus, learning agility is considered to be achieved through a positive attitude towards learning, rather than an introspective mental awareness and analysis of one's own learning process. However, the end goal of learning agility – to learn better, to learn faster, and to be able to apply old lessons to new situations – is the same.

Learning agility is presumed to be born from a specific combination of personality traits. As explained by the leadership consulting firm LDN [217]:

> Learning agility is an indicator of adaptability rather than intelligence. Although intelligence influences the ability to learn from a traditional perspective, learning

agility is a different and distinct trait that is not significantly correlated with intelligence.

As a result of this personality-oriented view of learning agility, the dominant assessments have been developed by psychologists.

Learning Agility Assessments

The iconic learning agility assessment is the Choices[TM] tool based on the research of Lombardo and Eichinger [225]. This tool attempts to assess four supporting constructs, all of which are presumed to contribute to learning agility: mental agility, people agility, change agility, and results agility. The consulting firm Korn-Ferry adopted and revamped the Choices[TM] tool, adding a fifth concept, self-awareness, to result in a final suite of tested concepts as listed below [226]:

- Mental agility—comfortable with complexity
- People agility—skilled communicator who can work with a diversity of people
- Change agility—like to experiment and comfortable with change
- Results agility—deliver results in first-time situations
- Self-awareness—the depth to which an individual recognizes skills, strengths, weaknesses, blind spots, and hidden strengths

The Korn-Ferry toolset [216] seems to be the primary commercially available tool for learning agility at present.

Predictive Validity of Learning Agility Assessments

Much of the excitement surrounding learning agility results from some initial validation work showing high correlations between scores on learning agility assessments and outcomes such as job performance or promotion. The work of Connolly, for example, showed that scores on the original Choices[TM] tool could predict a supervisor's opinion of whether an individual should be promoted (r=0.4), and also supervisors' opinions on that person's job performance (r=0.37) [227]. These validity levels are unusually strong for a psychology-based instrument. Later, the consulting firm Korn-Ferry conducted some internal studies showing that executives who scored as "highly agile" on Korn-Ferry's learning agility instrument had 25% higher profit margins than their peer group [216], were promoted twice as fast [228] [216], and were are 5 times more likely to be highly engaged [216].

Despite their strong showing, these results are not without their critics. DeRue [229] has pointed out that the Choices[TM] instrument contains a few items that directly ask about performance, rather than agility per se (meaning its score would automatically correlate with other instruments that ask about performance) Moreover, since Choices[TM] was designed as a 360[o] assessment, the strong correlations may be due more to the same person (typically a supervisor) filling out both the learning agility questionnaire and the job performance questionnaire, than a genuine relationship between learning agility and on-the job performance [229]. Due the limited

amount of validation work in existence, there is not yet an expert consensus on the predictive ability of learning agility assessments.

Learning Agility and the Big 5 Personality Dimensions

Although learning agility is promoted as a personality construct, it is not clear that it is one. Work by Connolly [227] showed that only two of the Big 5 dimensions had even a small correlation to learning agility scores (r=0.13 ; Openness and Conscientiousness). There was additionally no relation (r=0.08) to cognitive skill [227]. The lack of straightforward alignment to Big 5 concepts was confirmed by De Meuse et al in their comparison of Korn-Ferry's viaEdge learning agility tool to the Hogan Personality Inventory [228]. This may indicate that rather than being a trait, learning agility comes from a learned competency such as metacognition. The technical manual for the viaEdge [228] contains at least one additional surprise: high learning agility individuals generally are not detail oriented, planful, or methodical [228], which may cause learning agility to correlate negatively with academic performance.

Future Work

Given the potentially different views between academia and employers on what makes for a fast, efficient, and adaptive learner (innate subconsciou trait vs. learned conscious competency), it would be interesting to compare the measures of these two constructs directly. The same individuals could be given assessments for both metacognition and learning agility, then given unfamiliar tasks to master. One set of tasks could be more academic in nature; the other set of tasks could be more job-oriented. Task performance (using a quality per unit time metric) would serve as the final arbiter of the ability to learn new things quickly. Back-correlating to the assessment scores for metacognition and learning agility would allow researchers to see which concept predicted new task mastery the best – or at least isolate which kinds of tasks each concept was most relevant to.

Summary of the State of the Art

At present, metacognition has little conceptual buy-in from employers. For example, googling "metacognition" and "job" or "work" results in not a single work-related hit; all the hits are from the student /academic domain. On the other hand, learning agility is a hot topic in consulting and executive blogs devoted to corporate leadership [214] [215] [216] [217] [218] [219] [220]. The terminology also appears regularly in corporate job advertisements, as noted earlier. To date there have been two major assessments for learning agility. Both are now available from only one commercial source (Korn Ferry), which has since harmonized the two tests to reflect the same 5 constructs.

Test Name	Test Features	Overarching Workplace Purpose

ChoicesTM, Choices ArchitectTM	Multirater tool with 81 items	Personal or executive development
Via Edge	Self-report tool with 116 items, including items designed to detect faking	Screening candidates for managerial positions

Table 13. Summary of Workplace Learning Agility Assessments

CONCLUSION

As the world continues to change and evolve, education must adapt and keep up,continuing to prepare learners for the competencies they will need to succeed personally and economically. To this end, , it is important to make sure that expectations of students are in line with the interests of employers, particularly as the education system undergoes massive redesign This paper is the first step of the Assessment Research Consortium of the Center for Curriculum Redesign in the workforce space.

Between academia and industry – but also withhin each sphere – there are numerous assessment efforts that are disconnected from each other. As a result critical mass is not reached, and progress is stymied. This consortium, the Assessment Research Consortium of the Center for Curriculum Redesign, aims at harmonizing the very many disparate research efforts, and providing a critical mass behind assessment research by sharing the costs and the outputs on a pre-competitive basis. Once the foundational research, standards, and exemplary practices are firmly in place and shared among all consortium members, a more productive "thousand innovative flowers" can bloom, collaboratively and competitively, in the global "coopetition" market for assessment services and products.

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