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Introduction and empirical assessment of executive functioning as a predictor of job performance

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Abstract: The primary purposes of this study were (a) to introduce the concept of executive functioning (higher-level cognitive processes which monitor events, actions, and outcomes) to the employee selection literature and (b) to provide an empirical assessment of executive functioning in relation to key selection variables. Two of the three main components of executive functioning (set shifting and inhibition) appear to have considerable potential for selection because of their unique nature (e.g., self-directed, goal-oriented) and because they appear to be only modestly associated with general mental ability. While our empirical results were inconsistent, there may be underlying reasons for this, such as the unstable nature of the retail job sector. We believe there is considerable justification for continued exploration of this unique and potentially promising construct, and identify a number of directions for future research.

Keywords: employee selection; executive functioning; general mental ability; inhibition; set shifting

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While mental ability is the capability of general information processing, and job knowledge is a cognitive informational database, executive functioning is what sits on top of these and their related functions and directs their use. Specifically, executive functioning monitors events, actions, and outcomes, and makes self-directed strategic decisions such as when to start, when to stop, when to take a different action, and when to take no action (Banich, 2009; Mateer, Sira, & O'Connell, 2005). A good metaphor is a vehicle: The engine provides the horsepower, but it is the driver who decides when and how to use that capability. Executive functioning has a long history in the neuropsychological (e.g., brain impairment) and developmental (e.g., childhood) literature, and has been receiving increased attention in the cognitive literature in relation to normal populations. However, despite its potentially beneficial application within the area of employee selection (Huffcutt, Goebl, & Culbertson, 2012), it has yet to be empirically tested within the domain of industrial and organizational psychology (see Higgins, Peterson, Pihl, & Lee, 2007, for a rare and tangential exception). The current study seeks to address this gap in the psychological literature.

Executive functioning appears to have three primary components (Hedden & Yoon, 2006; Miyake et al., 2000; Wang, Chang, & Su, 2011). The first component is updating, which refers to the ability to keep information current in the short-term memory. Specifically, this component adds new information, integrates and manipulates that information, and removes information that is no longer relevant, a process that seems to be highly important for almost any type of problem solving. Updating appears to be closely related to the concept of working memory, and perhaps for this reason tends to covary highly with general mental ability (Friedman et al., 2006).

The second component is set shifting, which is the ability to switch effectively between different tasks or demands. In order to set shift, a person must disengage from one task and initiate or reengage with a different task. Switching can be

required for broad tasks (e.g., realizing a strategy is ineffective and adopting a new strategy) and may also be required for narrow tasks (e.g., alternating between addition and multiplication problems). Friedman et al. (2006) found that the correlation between set shifting and general mental ability was only moderate, and became negligible when shared variance with updating was partialed out. Other research suggests that the correlation may depend to some extent on the nature of the population. For example, Salthouse and Davis (2006) reported that the relation between a measure of set shifting and general mental ability was strong ($r = .94$) in children, but dropped substantially (to $r = .32$) in university students.

The final component is inhibition, which refers to the ability to self-regulate one's actions to enhance long-term goals and avoid impulsive actions (i.e., inhibit the prepotent response). The ability to inhibit or restrain less desirable responses is necessary to effectively adapt to and manage complicated situations and changing environments (Li, Huang, Constable, & Sinha, 2006). This function also seems to be related to self-control. For example, individuals who are effective at inhibiting seem to be better at suppressing racial biases or maintaining a diet (Hall, Fong, Epp, & Elias, 2008; Stewart, von Hippel, & Radvansky, 2009). Similar to set shifting, the relation between inhibition and general mental ability seems to be only moderate, becomes negligible when updating is partialed out, and seems to vary considerably across different populations (Friedman et al., 2006; Salthouse & Davis, 2006).

Thus, given their more modest association with general mental ability, set shifting and inhibition appear to have the most promise for application in industrial and organizational psychology. One such area is employee selection. A well-established tenet is that all jobs require at least some mental processing (Hunter & Hunter, 1984), and general mental ability is one of the best and most consistent predictors of performance (Hunter & Schmidt, 1996; Ree & Earles, 1992). Yet, there are two limitations of general mental ability. One is that the strength of its correlation with job performance covaries inversely with the complexity of the job (Hunter, 1986; Schmidt & Hunter, 1998), dropping to only modest levels of prediction with less complex positions. As such, it may be possible to incrementally improve on the prediction of job performance for jobs of lower complexity, such as those found in the retail sector. The other limitation is that measures of general mental ability often result in substantial racial group differences (Hough, Oswald, & Ployhart, 2001). Researchers and practitioners alike have sought, and continue to seek, measures of constructs that contribute to the prediction of job performance beyond general mental ability.

We propose that the skills and abilities associated with set shifting and inhibition could represent an important yet largely overlooked predictor of job performance. Many jobs require the handling of a number of tasks or demands, as shown by the construct of "multitasking" in the modern workplace (Pashler, 2000). Employees who are high on set shifting might be more flexible in their approach to using information, be able to see issues from different and perhaps more creative perspectives, and be able to adapt their approach according to the situation to maximize effectiveness. Tests of general mental ability generally do not assess set shifting capability, as test items are typically presented one at a time (e.g., solve a math problem, rotate a spatial figure mentally). Further, items on a general mental ability test typically do not contain the ambiguity and complexities that are often present in executive functioning measures. Rather, set shifting may be grounded conceptually in realms such as judgment and decision-making, which could help explain the only modest association it tends to have with general mental ability.

Like conscientiousness in the personality literature (Barrick & Mount, 1991; Mount, Barrick, & Stewart, 1998), inhibition could represent a set of attributes that are to some degree universally desirable across jobs. Such attributes could include avoiding impulsive actions that are a detriment to the long-term success of an organization and controlling aggressive thoughts and actions (Hoaken, Shaughnessy, & Pihl, 2003; Krämer, Kopyciok, Richter, Rodriguez-Fornells, & Münte, 2011). With regard to the latter point, deleterious outcomes are often associated with workplace aggression, including decreased job satisfaction, lower organizational commitment, diminished performance, and greater turnover intentions (e.g., Hershcovis & Barling, 2010). While executive functioning is traditionally thought of as a cognitive construct, there is potential for it to overlap with personality (Unsworth et al., 2009). Unfortunately, there is very little research on the association between executive functioning and personality.

The purpose of this paper is twofold. The first purpose is to expand the nomological network of executive functioning to include applications in industrial and organizational psychology, specifically to the employee selection literature. We accomplish this purpose through the material provided

above, and in the Method section where we describe the executive functioning measures used in our study. The second purpose is to provide an empirical assessment of executive functioning in relation to key selection variables, including job performance and personality. These variables and the hypotheses derived from them are presented in the following sections. In tandem, these purposes are designed to begin the process of introducing this unique and potentially promising construct to a new body of literature, that of employee selection. We emphasize strongly the tentative nature of such introductions, as it often takes years of follow-up research to develop the constructs and measures to a point where they are truly effective.

Hypotheses

Research on the association between executive functioning and personality in normal populations is virtually nonexistent. Nevertheless, it is possible that inhibition and set shifting share conceptual ground with some personality constructs of interest within the employment selection domain. For example, we propose that inhibition is positively related to the personality construct of prudence, which contains the three facets of self-discipline, responsibility, and conscientiousness. Among personality variables, conscientiousness has consistently been shown to be the best predictor of job performance across all occupational groups and job-related criteria (Barrick, Mount, & Judge, 2001; Mount et al., 1998; Mount, Barrick, & Strauss, 1994).

We propose that the ability to avoid impulsive actions in order to exercise more habitual ones (i.e., inhibition) is naturally intertwined with the personality characteristic of prudence. Being self-disciplined and conscientious involves giving forethought before acting or speaking (Costa & McCrae, 1991). An overly impulsive person is not likely to restrain from acting and speaking without thinking first of the consequences. With this in mind, we hypothesize as follows.

> *Hypothesis 1a*: The executive functioning component inhibition is positively related to the composite of self-discipline, responsibility, and conscientiousness that is exhibited by prudence.

Another construct important in the workplace that may be related to inhibition is interpersonal sensitivity, which includes the three facets of tact, perceptiveness, and the ability to maintain relationships. Few occupations require employees to work alone. Rather, most employees must interact with others (e.g., supervisors, coworkers, customers) on a regular basis and, in order to be successful, a certain level of tact and composure is needed. Furthermore, perceptiveness is key in the workplace, as display rules, or formal and informal expectations regarding emotional expressions (Ekman, 1984), are pervasive, particularly in customer-service professions.

We suggest that individuals who are more effective at self-regulating their actions (i.e., have higher inhibition) are likely better able to maintain relationships, in that they can restrain inappropriate behaviors, emotions, or speech in ways that are appropriate for the situation. As such, we make this hypothesis.

> *Hypothesis 1b*: The executive functioning component of inhibition is positively related to the composite of tact, perceptiveness, and the ability to maintain relationships that is exhibited by interpersonal sensitivity.

Continuing to the executive functioning component of set shifting, we propose that it has a positive relation with the personality construct of adjustment. Adjustment includes facets such as confidence, self-esteem, and composure under pressure, which are important characteristics for succeeding in the workplace (e.g., Pierce & Gardner, 2004). Researchers have theorized, for example, that self-esteem serves as a buffer to workplace stressors that could reduce job performance levels (e.g., Brockner, 1988).

We propose that individuals who have higher self-esteem, who are confident and composed, may not be as rattled when parameters change unexpectedly (a key feature of tests of set shifting, as illustrated later). In contrast, individuals who are low on adjustment, who are more self-critical and overly self-reflective, are more apt to have difficulty shifting between competing demands due to their more negative focus on themselves. With these points in mind, we hypothesize as follows.

> *Hypothesis 2a*: The executive functioning component of set shifting is positively related to the composite of confidence, self-esteem, and composure under pressure that is demonstrated by adjustment.

We further propose that set shifting is positively related to inquisitiveness, which is comprised of the facets imagination, curiosity, and creative potential. Within the workplace, being inquisitive and exhibiting imagination is important for entrepreneurial success (Sarasvathy, 2002), as the ability to

view situations in novel ways is important when attempting to identify new viable products and services.

We posit that individuals who are more inquisitive (i.e., imaginative, curious) are more open to exploring alternative solutions. In this manner, they may be more comfortable and therefore more effective at shifting between a variety of tasks and solutions. As such, we hypothesize as follows.

Hypothesis 2b: The executive functioning component of set shifting is positively related to the composite of imagination, curiosity, and creative potential that is exhibited by inquisitiveness.

At this point, as a caveat, we wish to note that executive functioning is typically considered to be a cognitive construct. The influence that coming from different domains (cognitive vs. personality) has on the associations predicted thus far between executive functioning and personality constructs is unknown. Clearly there are many avenues for research that emerge from the introduction of executive functioning into the selection literature, and this issue is one of them.

Now we turn to the association between inhibition and set shifting and job performance. As noted earlier, research has established the somewhat universal role of general mental ability in job performance (Schmidt & Hunter, 1998). It is possible that these two components of executive functioning are also, at least to some degree, universal across jobs. In fact, it would be somewhat difficult to identify positions for which controlling impulses to maximize long-term objectives and being able to shift effectively between different job demands is not important.

First, and more specifically, we propose that inhibition is related to the performance element of dependability. Inhibition should allow individuals to better protect a particular goal from interruption or from interference caused by other goals (see Hodgetts & Jones, 2006). Further, we posit that individuals with greater inhibition, with the ability to regulate their actions, are more likely to have better time management skills. As such, we make the following hypothesis.

Hypothesis 3a: The executive functioning component of inhibition is positively related to supervisor ratings of dependability.

Second, we propose that inhibition is positively related to supervisor ratings of customer service. For example, inhibition may be necessary to perform emotional labor (Diefendorff & Gosserand, 2003), which involves following the correct emotional display rules in a work setting, including such basic things as smiling and using a friendly tone of voice even if angry or irritated or just in a bad mood. Furthermore, having a higher level of inhibition is likely to make employees refrain from inappropriate behavior, such as arguing with a difficult customer. Finally, those with higher inhibition may help other employees to prioritize handling more important issues first, thereby assisting with customer service overall. With these points in mind, we hypothesize as follows.

Hypothesis 3b: The executive functioning component of inhibition is positively related to supervisor ratings of customer service.

Third, we propose that set shifting is related to supervisor ratings of dependability. In order to be viewed as dependable, an employee must accomplish all of their responsibilities in a proper and timely manner. To do so, they must allocate their time and resources between multiple competing goals (Schmidt, Dolis, & Tolli, 2009). The set shifting ability may enable employees to more efficiently handle these competing demands. Thus, we make this hypothesis.

Hypothesis 4a: The executive functioning component of set shifting is positively related to supervisor ratings of dependability.

Finally, in terms of set shifting and customer service, we propose that the ability to multitask is essential for customer service. That is, employees who are able to effectively and efficiently move between multiple tasks, such as from one customer to the next, are likely to be seen as more effective and customer-oriented than employees who struggle with managing multiple demands. As such, we hypothesize as follows.

Hypothesis 4b: The executive functioning component of set shifting is positively related to supervisor ratings of customer service.

Method

Participants and procedure

A total of 66 participants (24 male, 42 female) were recruited from the Psychology Departments at Bradley University and Kansas State University, both in the central United States. All participants were of normal college age (18–24 years). As a requirement for participation, participants had to hold a position in retail, such as in a department

store, clothing store, or a store that one might find in a shopping center, either currently or within the past 3 months, and had to be willing to have their supervisor provide an evaluation of their performance. We focused on the retail sector because it provided an opportunity to study executive functioning in a job grouping that was representative of the lower complexity spectrum. The participants received extra credit or course credit for their involvement in the study. In accordance with appropriate ethical standards, all participants gave their informed consent prior to participating in the study.

The participants were first given a job performance evaluation form, which they were instructed to have their supervisor complete and mail back using a stamped, preaddressed envelope. At no point did the participants see their evaluation. Once an evaluation was returned, the participant completed a test battery consisting of two executive functioning measures, two mental ability measures, and one personality measure, all of which took approximately 1–2 hr to complete.

Measures

Executive functioning

We administered two measures of executive functioning to assess the components of inhibition and set shifting. Both measures were administered on a computer using the Psychology Experiment Building Language (PEBL) Version 0.5 test battery (Mueller, 2009). The first task, the Tower of London (Shallice, 1982), presents participants with an image showing uniquely colored discs stacked into three columns. The participant can manipulate the discs in a second set of three columns and is instructed to make this second set of columns match the first (target) set. The top disc on any stack can be moved on top of any other stack and only one disc can be moved at a time. An illustration of the Tower of London format is provided in Figure 1. Of theoretical note is that to solve this particular problem, participants must first move *away* from the desired solution. Specifically, although the red ball needs to end up on the peg on the left, one must first move it to the peg on the right in order to clear the way for the blue ball to occupy the bottom position on the middle peg. Thus, the participants must regulate their actions and avoid the impulse to simply move a peg automatically to the "correct" location, because this will ultimately prevent them from achieving the final solution. As such, the Tower of London has been found to be primarily a measure of inhibition (Miyake et al., 2000). Participants are scored based on the number of moves it takes them to complete the task, with lower scores representing a higher level of inhibition.

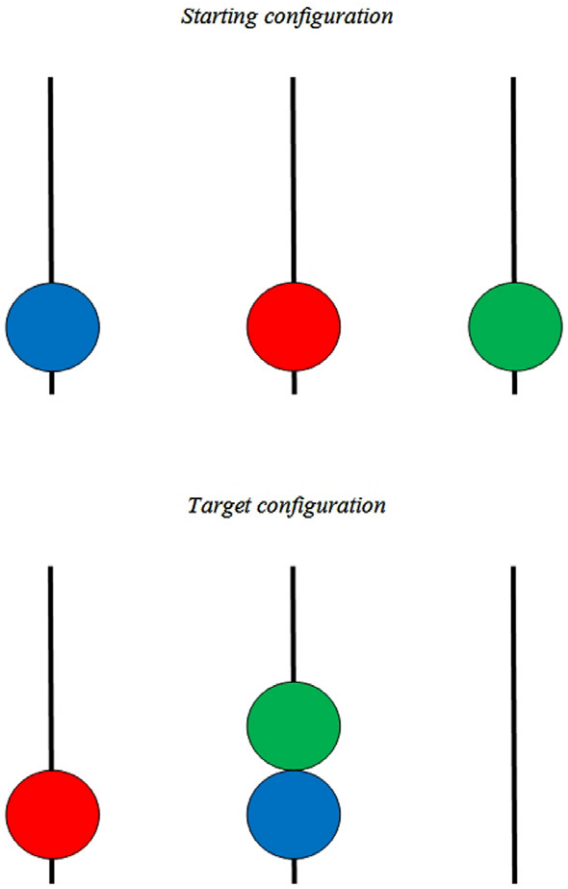

Figure 1. Illustration of the Tower of London Test. Participants move the balls around to match the target configuration.

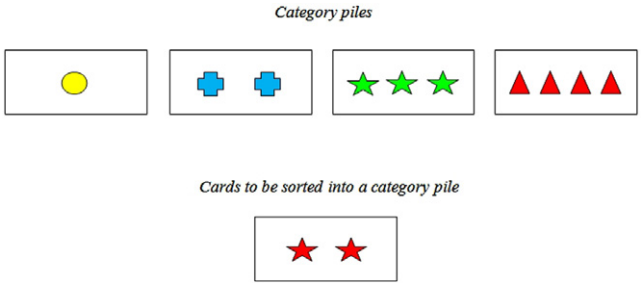

Figure 2. Illustration of the Wisconsin Card Sorting Test. The sorting cards match the category pile cards on one of three criteria: number, color, or shape. The matching criterion changes randomly and without notice.

The second executive functioning task was the Wisconsin Card Sorting Test (Berg, 1948). An illustration of this test is provided in Figure 2. Four cards representing four different piles are shown, each of which has figures of varying shapes, numbers, and colors. Then a series of test cards is presented, which the participant must sort into one of the four piles.

Each test card matches a particular pile based on a single decision rule, either by shape, number, or color. For instance, the test card in Figure 2 would be placed on Pile 2 if the rule were number, on Pile 3 if the rule were shape, and on Pile 4 if the rule were color. Participants discover the initial rule by trial and error, but then each time the participant gets 10 correct matches, the rule changes. This task is scored in two ways: the number of correct matches a participant makes before the deck is depleted and the number of perseveration errors a participant makes. The latter occurs when a participant continues to assign cards using an outdated matching rule. For instance, if the rule changes from color to number, the participant would place the next card based on color because he/she would not know that the rule changed. He/she would then get feedback that the placement of this card is incorrect, but would not be informed what the new matching rule is. If he/she tried to match yet another card based on color, a perseveration error would occur (Krämer et al., 2011). Given the constantly changing rules and the need to correct one's actions based on these changing rules, success on this task reflects the ability to shift effectively between different demands. As such, the Wisconsin Card Sorting Test has been found to be primarily a measure of set shifting (Miyake et al., 2000), with higher correct card placement and lower perseveration errors reflecting a higher set shifting ability. Previous studies estimate the test–retest retest reliability as .94 for perseveration errors and .90 for correct matches (Ozonoff, 1995).

Unlike most psychological measures in which item scores have dichotomous (e.g., true/false) or interval properties, the items in the executive function measures we used were based on count properties. For instance, the possible scores on a typical item of the Tower of London range from three to infinity. Consequently, these measures may produce scores distributed Poissonly rather than normally. When we assessed the degree of skew and kurtosis for the distribution of our executive functioning variables, we found that they all had statistically significant skew and kurtosis. In order to normalize the data, we attempted square-root transformations, logarithmic transformations, and reciprocal transformations (Tukey, 1977). Of the three, logarithmic transformations were the most effective and produced distributions that were adequately normal. Thus in all analyses the executive functioning data used was logarithmically transformed.

In order to minimize the effect of extreme values on our correlations, our decision rule was to remove all outliers that were greater than or equal to three standard deviations from the sample mean. This is a relatively conservative approach to removing outliers that is commonly used by researchers (Seo, 2002). Following these guidelines, one data point was removed from the Tower of London while another data point was removed from each Wisconsin Card Sorting Test metric. Both of the outliers removed from the Wisconsin Card Sorting Test were from the same participant, but that was not the same participant that was removed from the Tower of London data set.

General mental ability

The participants completed two separate mental ability measures. First, the participants completed the Raven's Advanced Progressive Matrices (APM) test, designed to measure fluid intelligence in populations of above-average intelligence (Raven & Raven, 2003). Participants are shown a series of 3×3 matrices in which the last figure is missing. For each item, the participant must select the figure that completes the pattern, from eight choices. The items become increasingly difficult as the test progresses. The short form with 12 questions was administered (Arthur, Tubré, Paul, & Sanchez-Ku, 1999). The split half-reliability for this measure is reported as being .75 (Arthur & Day, 1994).

The second measure of mental ability was the Wonderlic Cognitive Ability Test (formerly the Wonderlic Personnel Test; Wonderlic Inc., 1999). The Wonderlic is a 12-min, 50-question measure that assesses vocabulary, arithmetic reasoning, and spatial abilities. Similar to Raven's APM, the Wonderlic items increase in difficulty such that each item is more difficult than the item that immediately preceded it. The participants completed the online version of the Wonderlic. The scores were calculated as the total number of correct responses provided in the allotted time. The estimated split-half reliability for the Wonderlic is .87 (McKelvie, 1989).

Personality

We assessed personality using the Hogan Personality Inventory (HPI; Hogan & Hogan, 1992). The HPI contains 206 items that are keyed true and false and 13 scales, seven of which are primary. Of these seven primary scales, we used four (Adjustment, Interpersonal Sensitivity, Prudence, and Inquisitiveness). Originally developed for use in personnel selection (Hogan, 1986), the HPI emphasizes the constructs that are relevant to performance at work and within one's career and occupation. The participants completed this

measure online as part of the testing session. The average alpha for the scales has been reported as being .80, with test–retest reliabilities ranging from .74 to .86 (Hogan & Hogan, 1992; Meyer, Foster, & Anderson, 2006).

Job performance evaluation

The evaluation forms were placed in stamped envelopes addressed to the primary researcher and given to the participants with the instruction to give them to their supervisor. The supervisors rated the participants on five dimensions, including dependability and customer service. Their ratings were made on a 7-point rating scale ranging from well below average (1) to well above average (7). These dimensions were derived from a review of hundreds of critical incidents collected from the retail sector and from an analysis of the retail sector listings on O*NET (http://www.onetonline.org). The forms contained instructions for the supervisor to return their evaluations without showing them to the participants. In addition, the forms asked the supervisor for their name and contact information if they wanted a copy of the results at the completion of the study.

Results

Table 1 shows the descriptive statistics (means, standard deviations, and minimum and maximum values) and correlations for the variables of interest. Inhibition (as measured using the Tower of London) was not significantly correlated with either the number of perseveration errors made ($r = .23$, *ns*) or the total number correct ($r = -.04$, *ns*) on the Wisconsin Card Sorting Test. The implication of these results is that, at least within our sample, inhibition and set shifting were distinct and separable aspects of executive functioning. An unexpected finding of theoretical interest is that the number of correct responses on the Wisconsin Card Sorting Test correlated negligibly with the number of perseveration errors ($r = -.09$, *ns*). We return to this issue in the Discussion.

In addition, and of particular importance for the current study, the total correct score for the Wisconsin Card Sorting Test had low overall correlations with both the Wonderlic ($r = -.10$, *ns*) and Raven's APM ($r = .08$, *ns*). However, the correlations for the Tower of London and the number of perseveration errors on the Wisconsin Card Sorting Test with the two measures of mental ability were considerably higher (*r*s ranged from –.19 to –.43). It is important to note here that the negative correlations were actually in the expected direction because of how the Tower of London and the perseveration errors on the Wisconsin Card Sorting Test are scored, with lower scores representing better performance.

Hypotheses 1a and 1b pertained to the relation between inhibition (as measured using the Tower of London) and prudence and interpersonal sensitivity, respectively. As shown in Table 1, the relations between both inhibition and prudence ($r = .04$, *ns*) and between inhibition and interpersonal sensitivity ($r = -.11$, *ns*) were practically and statistically nonsignificant. As such, these first two hypotheses were not supported.

Hypotheses 2a and 2b pertained to the relation between set shifting (as measured using the Wisconsin Cart Sorting Test) and adjustment and inquisitiveness, respectively. Once again, as shown in Table 1, these hypotheses were not supported. Specifically, when using the total number correct, the

Table 1
Descriptive Statistics and Intercorrelations for the Variables of Interest

Variable	N	*M*	*SD*	MIN	MAX	PE	TC	WPT	RAV	ADJ	IS	PRU	INQ	DEP	CS
TOL[a]	118.5	17.64	.23	1.93	2.28	.23	.04	–.19	–.36**	–.13	–.09	–.05	.05	.11	.09
PE[a]	70	14.64	5.63	.7	1.56		.09	–.43**	–.26*	.74	.07	–.15	.18	.09	.31**
TC	70	98.07	9.84	0	1.68			.10	.08	.10	.26*	.02	.06	–.15	–.1
WPT	70	65.06	20.28	14	98				.52**	–.05	–.27*	–.01	.21	–.13	–.07
RAV	68	7.96	2.73	0	12					.18	–.02	.16	.38**	–.2	–.26*
ADJ	71	36.07	26.58	0	98						.46**	.44**	.12	.02	.03
IS	71	55.07	30.83	2	100							.25*	.12	–.02	.11
PRU	71	43.15	28.88	1	99								–.17	.15	–.03
INQ	71	55.54	29.04	3	100									.03	.1
DEP	71	5.31	1.23	3	7										.55**
CS	71	5.23	1.18	2	7										

Note: ADJ = adjustment; CS = customer service; DEP = dependability; INQ = inquisitiveness; IS = interpersonal sensitivity; PE = number of perseveration errors on the Wisconsin Card Sorting Test; PRU = prudence; RAV = short form of the Raven's Advanced Progressive Matrices; TC = total correct on the Wisconsin Card Sorting Test; TOL = Tower of London; WPT = Wonderlic Personnel Test.

[a]On these measures a higher score indicates lower performance.

*$p < .05$. **$p < .01$. (Two-tailed.)

relations between set shifting and adjustment ($r = -.10$, *ns*) and between set shifting and inquisitiveness ($r = -.06$, *ns*) were small and nonsignificant. Similarly, when examining the number of perseveration errors, set shifting showed no meaningful pattern of relations with adjustment ($r = .07$, *ns*) or inquisitiveness ($r = .18$, *ns*).

Hypotheses 3a and 3b were that inhibition is positively related to ratings of dependability and customer service, respectively. These hypotheses were not supported. Inhibition correlated neither with dependability ($r = .18$, *ns*) nor with customer service ($r = .09$, *ns*).

The final set of hypotheses, Hypotheses 4a and 4b, were that set shifting is positively related to supervisor ratings of dependability and customer service, respectively. These hypotheses were also unsupported by our data. All of these correlations were nonsignificant, except for the correlation between perseveration errors and customer service, which was in the wrong direction ($r = .31$).

Discussion

A primary purpose of this study was to introduce the concept of executive functioning to the employee selection literature, which we accomplished. Although there was not consistent empirical support for our hypotheses as a whole, we nonetheless believe there is considerable justification for continued exploration of this unique and potentially promising construct. The two facets of executive functioning that we explored, inhibition and set shifting, represent a set of skills that could be important across a number of (and perhaps most) job families. For instance, controlling the impulse to adopt short-term solutions that do not maximize long-term outcomes and dealing with changing and unpredictable parameters are mainstays in our modern work environment.

Furthermore, there is some empirical evidence (both previously and from our study) that measures of these constructs are not simply pseudo-measures of general mental ability. One can easily envision a job candidate who can solve math, verbal, and spatial problems with relative ease when presented individually, but who is mentally inflexible and struggles when such items are presented in combination and/or when the parameters of a situation change unexpectedly. Once again we emphasize that modern tests of general mental ability do not include test items that cover facets such as short-term versus long-term goal maximization and changing parameters.

With regard to the Wisconsin Card Sorting Test, the lack of a significant relation between the number of perseveration errors and the total number correct is of scientific interest, including that the former was significantly negatively correlated with both of the mental ability measures, while the latter did not correlate significantly with either mental ability measure. These findings suggest very different underlying processes. These two aspects appear to have been kept separate in very early research (Grant & Berg, 1948), but we could not find any recent literature that included both outcomes or even discussed their potential differences. In areas such as neurological assessment and child development, perseveration errors are the outcome of choice for obvious reasons. However, for normal populations (including employee selection), it may be that the total number correct is preferable. Understanding why these two measures are so different is an important avenue for future research, particularly because one may reflect a skill and the other a deficit.

So where should we go from here? Perhaps the best place to begin is with the measures of executive functioning. Existing measures such as the Tower of London and the Wisconsin Cart Sorting Test are sound and have a long history of use, but they are products of the areas in which they emerged, namely developmental and neuropsychological assessment. One possible avenue for future research is to develop new measures that are more oriented towards organizations. Another avenue might be to explore variations of existing measures to see if any might be better predictors of job performance. To illustrate the potential of this line, the most recent update of the Tower of London Test on the PEBL website (http://pebl.sourceforge.net) has nine different variations, many of which have different theoretical underpinnings (Schnirman, Welsh, & Retzlaff, 1998).

Yet another avenue for future research is to develop a stronger conceptual foundation for executive functioning as applied in the workplace. A key question is the degree to which these skills are universal across jobs. General mental ability has been found to be so, under the premise that all jobs require at least some information processing, although its importance tends to decrease with jobs of lesser complexity (Hunter, Schmidt, & Le, 2006). A close scrutiny of occupational information (e.g., that on O*NET) might aid in building a conceptual network for the role of executive functioning.

In a different vein, it could be beneficial to scrutinize the existing organizational literature for concepts and findings that may be related. For instance, self-regulation has been

studied in relation to the effects of goal-setting on motivation (see Vancouver, 2005, for a review) and in relation to personality (e.g., Cervone, Shadel, Smith, & Fiori, 2006). It is possible that the executive functioning element of inhibition is related to self-regulation. Similarly, the decision-making literature could be useful. To illustrate, one study used an aircraft simulation in which the rules for determining the threat level changed periodically and without notice, in order to study adaptability in decision-making (LePine, Colquitt, & Erez, 2000). Such a study could relate to set shifting. The potential benefit of looking at these literatures is that they could not only enhance the conceptual basis of executive functioning, but also provide directions for creating measures better suited to organizations.

Limitations should be noted. First, we used a sample of part-time employees. It is possible that stronger empirical results would emerge with full-time employees, particularly as these employees may be more engaged in their position. Further, employers may expect more and be more critical of full-time employees. Second, our sample came from the entry-level retail sector, which typically is viewed as being of low complexity (Schmidt & Hunter, 1998). As with general mental ability, it is possible that executive functioning skills take on added significance as job complexity increases. In addition, the retail sector has always been plagued by concerns such as absenteeism and high turnover. It may be that the simple attributes of showing up consistently and being friendly are sufficient, in which case executive functioning capabilities may be masked. We note that our mental ability measures did not correlate strongly with the performance ratings, which could support this tenet. Finally, it is possible that some elements of executive functioning (e.g., inhibition) could be more predictive of counterproductive work behaviors (Chang & Smithikrai, 2010), which we did not include in our measure of job performance. In addition, our sample was limited to participants in the United States. Further exploration with participants from other countries is worthy of future study. Finally, it should be noted that this is a single study of the relation between two components of executive functioning (i.e., set shifting and inhibition) with organizationally relevant variables (i.e., personality and job performance). Further work is needed before concluding that executive functioning does not hold promise for employee selection.

Notwithstanding these limitations, we believe that this study represents an important first step in the examination of executive functioning in the industrial and organizational psychology literature. Many important findings and developments in science started from humble beginnings, from which continued exploration helped to unlock their potential. Executive functioning, with continued exploration and development, could very well follow that same pattern.

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