

Higher Validity and Less Adverse Impact! Using “Executive Attention” to Measure Cognitive Ability

Executive Summary

The primary purpose of the present research is to investigate the criterion-related validity and adverse impact potential characteristics associated with more recent measures of cognitive ability from the field of cognitive psychology and neuropsychology reflecting a distinct construct called *executive attention*. Cognitive ability has long occupied a central role in the prediction of employee performance. Researchers assert that it is essential for international competitiveness and even public safety that organizations select employees on the basis of cognitive ability for reasons of high criterion-related validity with a host of outcomes including job performance. Unfortunately, along with their superior validity coefficients, tests of cognitive ability show large score differences across ethnic groups. This pattern of findings has left practitioners in a position of dealing with a trade-off decision among predictors of varying validity and adverse impact potential. According to Campion et al. (2001, p. 150), this trade-off decision “is a choice between a ‘rock and a hard place’ and may be the most perplexing problem facing the practice of personnel selection today.”

Executive attention (EA) represents the underlying mechanism responsible for the ability to manage the allocation of cognitive resources to ongoing processes (Engle, Tuholski, Laughlin, & Conway et al., 1999). Sometimes referred to as executive functioning or executive control functioning, executive attention is mainly located in the brain’s prefrontal cortex. It allows the brain to focus attention, ignore distractions, and flip between multiple pieces of information while problems solving.

A key attribute of EA is that, unlike many common cognitive ability tests that have been criticized for the inclusion of socioeconomic status-sensitive components influenced largely by educational history, measures of EA are relatively uninfluenced by learned knowledge (Kyllonen, 2002). Measures of EA are attention-based tasks that assess the ability to manage the allocation of cognitive resources to on-going simultaneously required mental operations. To the extent that subgroup differences observed with traditional measures of cognitive ability are partially attributable to socioeconomic status-driven differences in learning, education, or acculturation, we expect measures of EA to exhibit smaller group differences and result in reduced adverse impact.

Key Findings and Practical Implications

Key Findings:

- Across samples, EA tended to predict performance as well or better than the Wonderlic Personnel Test (WPT), with performance criteria including simulation games, managerial in-baskets, and supervisor ratings of job performance.
- The predictive advantage of EA relative to the WPT tended to increase as studies moved from the laboratory with undergraduate students to a concurrent validation study with employees of a large financial services firm and supervisor ratings of job performance.
- Across samples, EA tended to exhibit smaller race-based subgroup differences than the WPT.
- The smaller race-based subgroup differences associated with EA were most pronounced in the concurrent validation study with employees of a large financial services firm.
- Across samples and performance measures, EA tended to exhibit less race-based test bias than the WPT.
- EA exhibited no significant race-based test bias with regard to actual supervisor ratings of job performance across both samples with access to supervisor data.

Practical Implications:

- The most important practical implication of these findings is that EA measures may present a partial solution to the validity-adverse impact tradeoff that managers and HR professionals face with regard to using cognitive ability tests for selection. Our findings suggest that EA's validity is at least as high as traditional measures of cognitive ability.
- Another key practical implication is that EA measures may help managers and HR professionals striving to simultaneously achieve and maintain a diverse workforce while making selection decisions that result in high-performing employees. To the extent EA measures exhibit smaller race-based subgroup differences than traditional cognitive ability measures, they may enable the identification of a larger and more diverse high potential applicant pool from which to select.
- Yet another key practical implication is that EA may represent an especially appropriate selection method for 21st century jobs that increasingly require multitasking. Multitasking has become an important job component for many workers, to the extent that almost every job requires some degree of multitasking, and EA measures may be particularly well suited to assessing the ability to perform in such contexts.

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Want to get involved?

- We're looking for organizations willing to provide developmental funding in exchange for long-term usage.
- We're looking for additional research sites.

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International Personnel Assessment Council

July 22-25, Las Vegas, NV

What is “Executive Attention”

(not CEO attention span)

From Neuropsychology



Prefrontal Cortex

Executive attention (also referred to as **executive functioning** or **executive control attention**), is mainly located in the prefrontal cortex.

It allows the brain to:

- Focus attention,
- Ignore distractions
- Flip between multiple pieces of information
- *All while problems solving.*

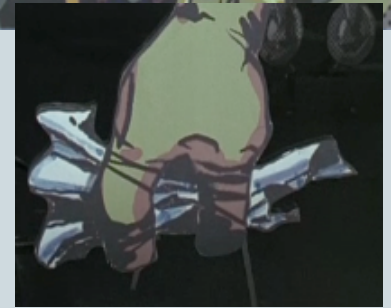
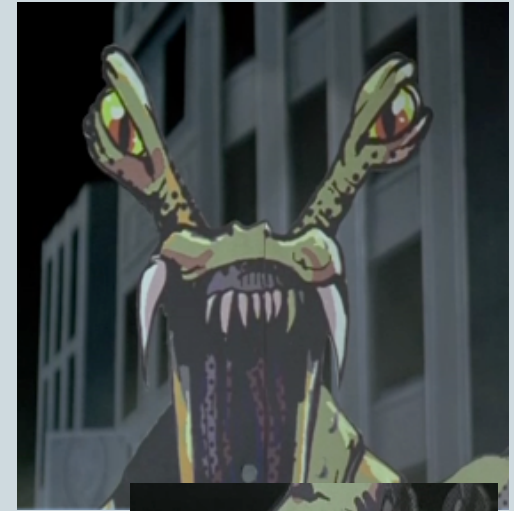
Executive Attention

(“Best of the best of the best”)



MiB Example:

- Focus attention
- Ignore distractions
- Flip between multiple pieces of information
- *All while problems solving*



On-the-Job Intelligence

(Cognitive processing on the football field)

“So I’m thinking coverage; my coverage could go from being a slot safety to a zone, or to someone in the backfield or to someone on the other side of the field....

“It can go from all of that – pre-snap – to [instead] being pass rush. So now you’ve got to think, what’s the down and distance?”
What have they run prior to [this]? What’s the stance, the alignments and the settings of the offensive line? What’s the running back looking at? What did you study in film? What’s the personnel?

“And all of that (Worilds snaps his finger) is split second.” ... You’ve got to make a decision. Not only are the other 10 guys on the field waiting on you to make a decision, the sideline is, the fans are, everybody in the world is...And, if you make the wrong decision, somebody knocks your head off.”

(From Pittsburgh Post-Gazette, 12/17/2011)

Jason Worilds.
3rd year Linebacker,
Pittsburgh Steelers



Executive Attention: Definition



- Neuropsychological measure of mental ability
 - Ability to manage the allocation of cognitive resources to multiple simultaneous cognitive processes (i.e., “multitasking”)
 - ✦ (Engle et al., 1999)
 - Relatively uninfluenced by learned knowledge
- Traditional measures of mental ability
 - Performance in isolation (unlike modern work environment)
 - Heavily influenced by g_C (likely source of ethnicity bias)

A Central Issue for HRM

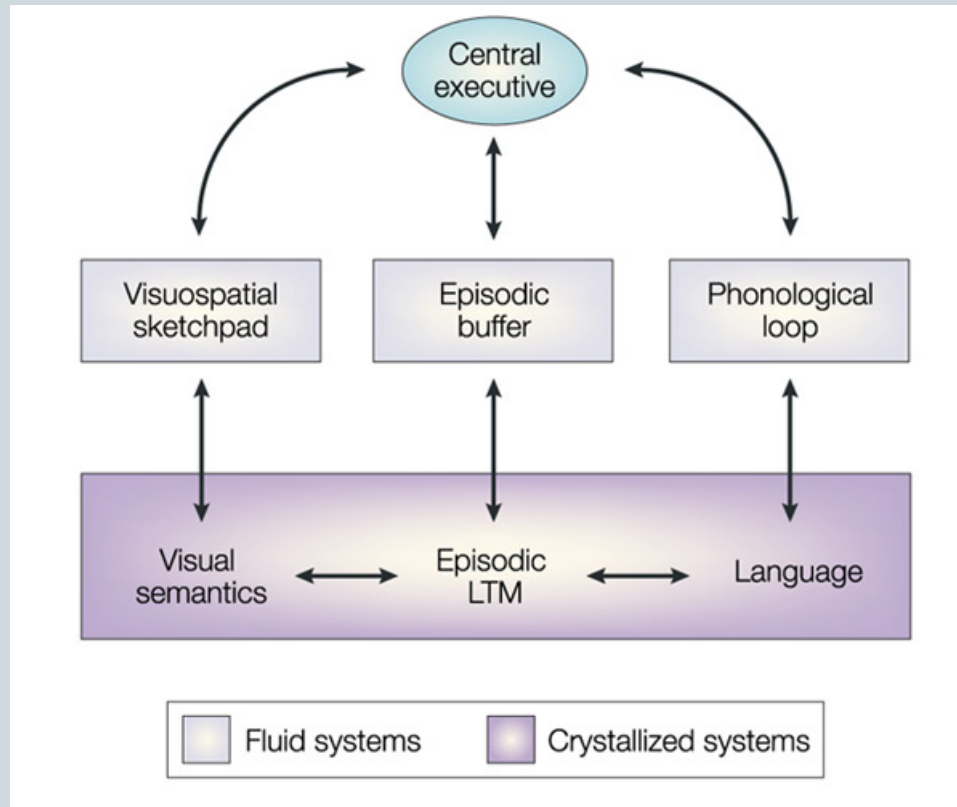


- Mental ability is essential to employee selection
 - There “cannot be a debate” on this issue (Schmidt, 2002: 187)
 - $\rho = .65$ (Schmidt et al., 2008)
- However, mental ability tests → adverse impact
 - $d = 1.0$ (approx.)
 - Also, differential prediction *likely* exists
 - ✦ Slope and/or intercept bias (power issues; Aguinis et al., 2010)
- HR managers often choose between validity and adverse impact
 - “a choice between a ‘rock and a hard place’ and may be the most perplexing problem facing the practice of personnel selection today”
 - ✦ (Campion et al., 2001: 150)

Theoretical Framework of EA



- Baddeley's theory of Working Memory



From: Baddeley, A. (2003). Working memory: looking back and looking forward. *Nature Reviews Neuroscience*, 4, 829-839.

General Research Question



- Will executive attention predict performance as well as traditional measures of mental ability (i.e., Wonderlic), and also serve to remedy the adverse impact problem?
- Three studies were conducted (research funded by SHRM)

General Hypotheses (all studies)



- H1: EA will be positively related to performance.
- H2: EA will exhibit significantly smaller ethnic group differences than the Wonderlic Personnel Test.
- H3: EA will exhibit significantly smaller differential prediction values (slope and intercept bias) across ethnicities compared to the Wonderlic Personnel Test.

Study 1: Method



- **Participants**

- 109 undergraduate management students
 - ✦ 59% male, 53% African-American

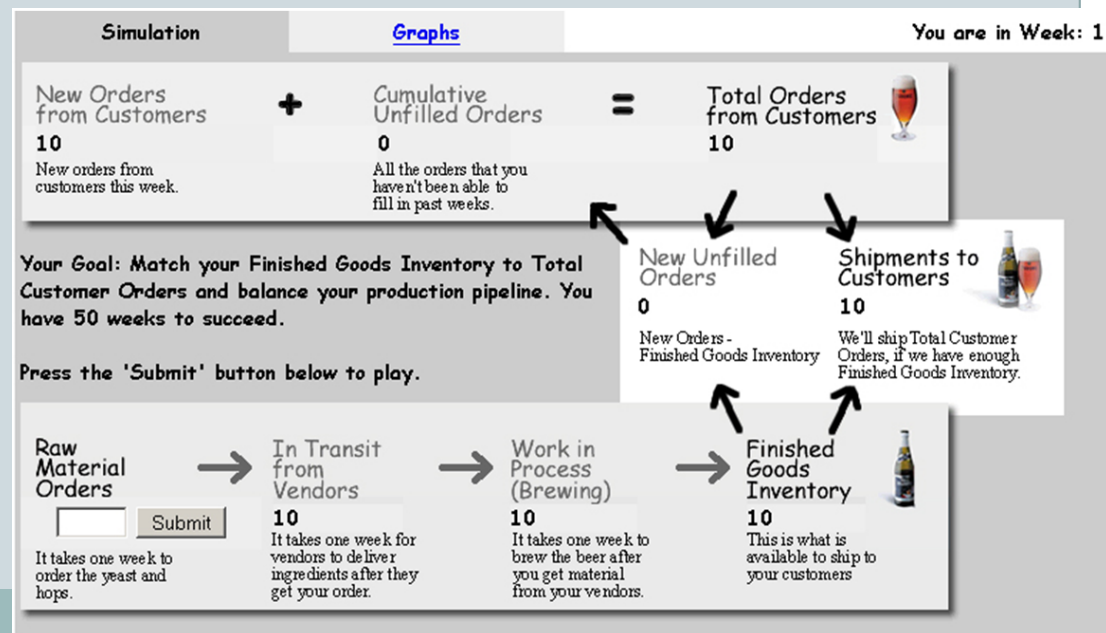
- **Measures**

- **Criterion:**

- ✦ Near Beer Game (→)

- **Predictors:**

- ✦ Wonderlic Personnel Test
- ✦ EA: Operation Span task
- ✦ EA: Reading Span task
- ✦ EA: Arrow Flanker task
- ✦ EA: Antisaccade task



Study 2: Method



- **Participants**

- 106 master's and undergraduate management students
 - ✦ 53% male, 67% Caucasian

- **Measures**

- **Criteria:**

- ✦ Management in-basket (→)
- ✦ Supervisor ratings ($N = 33$)
 - Williams and Anderson (1991)

- **Predictors:**

- ✦ Wonderlic Personnel Test
- ✦ *EA: Operation Span task*
- ✦ *EA: Reading Span task*
- ✦ *EA: Arrow Flanker task*

Sales Manager In-Basket

Welcome to the sales manager in-basket simulation

Situation: You are a district sales manager for a national life insurance company. You have eight salespersons (financial representatives) reporting to you. You are the first person at the office at 7:15 a.m. Your secretary (financial assistant) and all other office personnel are due in at 8:00 a.m. The following is a list of situations that face you this morning. Rank the items by priority (which you would handle 1st, 2nd, . . . 20th) before the end of the day. Also, enter your estimate of the number of minutes each item should require. After ordering the tasks and entering the time estimates, press the "Save and Exit" button. After completing this task individually, you will participate in a small group discussion to defend your responses. Think about your time very carefully!

Move to Top Move Task Up Move Task Down Move to Bottom Help Save and Exit

Priority	Minutes	Task Description
1		You have an e-mail from your IBM salesperson asking for a meeting today to talk about an opportunity that must be acted on immediately.
2		Telephone message on answering machine: Tom Thomson (your boss at corporate headquarters) 'Please call first thing when you get into the office.'
3		Telephone message on answering machine: John Smith (the richest man in town) 'wants to talk about some new insurance.'
4		An article comes out in the local newspaper that is quite unfavorable for your company. You were interviewed for this article, and your statements were greatly misrepresented.
5		You have a telephone message from your teenage daughter to call her because she has to talk to you about a serious matter.'
6		You have a noon lunch appointment at a local restaurant with your director of recruiting and Betty Williams, a senior at State University who is a candidate for a financial representative position at your firm.
7		Email message on your computer: Betty Burke (your assistant) 'Will not be in today because of a sick child.'
8		The new Fortune magazine rated your company as one of the top 10 most respected companies in the United States.
9		You have a 3:00 meeting with your three new financial representatives to review activity and results.
10		Telephone for appointments for the week.
11		You have a 1-hour meeting scheduled with all of your financial representatives at 8:00 a.m. in the boardroom.
12		Telephone message on answering machine: Ted Wilson (a person you do not know) 'wants to talk about some new insurance.'
13		Your spouse is out of town, so you have to pick up your 8-year-old son from school at 2:30 and drop him off to soccer practice at 3:00.
14		You have an e-mail from your top financial representative stating that he got a job offer from a competitor at 25% more than he is making with you.
15		You have a 3:00 meeting with your director of recruiting regarding status of financial representatives who are starting their careers with the company.
16		Prospect for new clients.
17		Telephone message on answering machine: Bruce Williams (your neighbor) 'wants to talk about some additional insurance.'
18		Prospect for new financial representatives.
19		You desperately want to keep up your exercise routine and get to the health club next door for your 30-minute workout.
20		Make coffee for you, your office, and your meeting.

Study 3: Method



- **Participants**

- 121 bank employees
 - ✦ 81% female, 57% African-American

- **Measures**

- **Criteria:**

- ✦ Simulation (Oliva & Sterman, 2001; →)
- ✦ Supervisor ratings (Tsui et al., 1997)

- **Predictors:**

- ✦ Wonderlic Personnel Test
- ✦ *EA: Operation Span task*
- ✦ *EA: Reading Span task*
- ✦ *EA: Arrow Flanker task*

The screenshot shows a software interface titled "Personnel and Production Management Simulation". At the top, there are navigation tabs for "Decisions", "Overview", "Pressures", "Employees", "Financials", and "Production". The "Current Month" is displayed as "1 (out of 60)" and a "Help" button is visible.

The main section is titled "Decisions" and contains three steps:

- Step 1: Hire or Fire Employees**: This step shows "16 employees fired" and a grid of 16 blue human icons, each with a red "X" over it. To the right of the icons are five orange buttons with values: -1, +1, -10, +10, -100, and +100.
- Step 2: Set Goals**: This step includes a "Production Goal" input field with the value "31,250" and a "Quality Goal" slider. The slider is a horizontal bar with a scale from 0 to 5, and a yellow house icon is positioned at the "1.00" mark.
- Step 3: Set Time and Submit**: This step features a large grey button labeled "Advance One Month".

Meta-analytic Results



- Relationships with performance (studies 1-3)

- Wonderlic $r = .28$ (95%CI = .01/.54; $k = 3$; $N = 265$)

- EA Comp $r = .35$ (95%CI = .20/.50; $k = 3$; $N = 265$)

- Relationships with ethnicity (studies 1-3)

- Wonderlic $d = 1.09$ (95%CI = .87/1.35; $k = 3$; $N = 309$)

- EA Comp $d = .65$ (95%CI = .54/.75; $k = 3$; $N = 304$)

Discussion



- Key findings
 - EA predicts performance as well as WPT
 - EA shows significantly smaller subgroup differences
 - ✦ 40% reduction in adverse impact potential

Implications for Practice



- **Key managerial implications**
 - Select on the basis of mental ability while maintaining workplace diversity
 - Select for wide range of jobs requiring on-the-job problem-solving with varying degrees of cognitive complexity



Implications for Theory and Research



- Implications for conceptualizing what “mental ability” means
- Implications for traditional, psychometric-based conceptualization of intelligence and cognitive ability
- Implications for understanding construct validity and mental ability
- Implications for training (and “world knowledge”)
- Links to job analysis (e.g., O*Net)
- Establish norms
- Implications for cross-cultural mental ability, independent of language

Future directions



- Replicate; reduce duration of tasks
 - Internet-based assessment
 - Job analysis development
 - Develop norms
- ***Want to get involved?***
 - *We're looking for funding*
 - *We're looking for additional research sites*

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