The impact of extra-test variables on ecological validity research

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Introduction

- Neuropsychologists are increasingly being asked to predict everyday functioning
- Most neuropsychological tests were developed to identify brain dysfunction, not to predict everyday functioning

Introduction

- Ecological validity:
  - The degree to which test performance reflects behavior in everyday situations
  - Ecological validity applies to the inferences drawn from a test result, not the test itself

Introduction

- Verisimilitude
  - the degree to which the cognitive demands of a test theoretically resemble the cognitive demands in the everyday environment
    - Rivermead Behavioural Memory Test
    - Behavioural Assessment of the Dysexecutive Syndrome
    - Test of Everyday Attention
  - Goal of these tests is to identify everyday impairment, not differentiate diagnostic groups

Introduction

- Veridicality
  - the degree to which existing tests are empirically related to measures of everyday functioning

Introduction

- Which everyday behaviors are used to determine ecological validity?
  - Return to work
  - Activities of Daily Living
  - Everyday cognitive failures

Introduction

- How is everyday functioning measured?
  - Self-report
    - Weakly related to neuropsychological testing
    - May be more related to mood (Banos et al, 2004)
  - Significant other report
    - Easiest and most frequently used
  - Clinician report
    - Limited observation
  - Simulations and observation
    - Time consuming and artificial, but may be best

Introduction

- Multiple Errands Test (Shallice & Burgess, 1991)
  - Assigned several errands to run in a shopping district
  - Rule breaks and inefficiencies recorded by observer
  - Sensitive to frontal lobe damage

Introduction

- Advanced finances and cooking simulations (Heaton et al 2004)
  - Pay bills and balance checkbook
  - 3 step recipe and 1 step recipe to be completed simultaneously

Introduction

- The choice of outcome measure is critical to accurately assessing ecological validity
- There is no agreed upon scope or method of assessing everyday functioning
- All ecological validity research must be evaluated based on the adequacy of the outcome measure utilized

Introduction

- The literature on the ecological validity of neuropsychological assessment has been inconsistent
- It is difficult to compare findings across studies
  - Different tests, different outcomes, different populations

Introduction

- Even in the studies with significant findings, the magnitude of the relationships tend to be moderate, ranging from *r*=.27 to .65
- A large amount of the variance in everyday functioning remains unaccounted for by NPT

Chaytor, N. & Schmitter-Edgecombe, M. (2003). The ecological validity of neuropsychological tests: A review of the literature on everyday cognitive skills. *Neuropsychology Review, 13*(4), 181-197.

Introduction

- What contributes to poor ecological validity of NPT (either over or underestimation)?
  - Best performance
  - Small sample of behavior
  - Temporary conditions (e.g., pain, fatigue, anxiety)
  - Environmental supports/cognitive strengths
  - Physical limitations
  - Premorbid ability level
  - Diagnostic group

Introduction

- Environmental cognitive demands
  - The degree of match between the patient's cognitive ability and what is required by the environment
    - The cognitive deficit and the environment interact to produce behavior
- Compensatory strategies
  - Strategies may be used to compensate for deficits, or fail to be used when they would improve performance
- Depressive symptoms
  - Depression may limit the patient's engagement in activities they could perform from a cognitive standpoint

Study 1: Strategy use and environmental demands

1. Are executive functioning tests related to everyday executive functioning skills?
2. Does assessment of ***environmental cognitive demands*** account for additional variance in everyday executive functioning beyond executive functioning tests?
3. Does assessment of ***compensatory strategies*** account for additional variance in everyday executive functioning beyond executive functioning tests?

Chaytor, N., Schmitter-Edgecombe, M., & Burr, R. (2006). Improving the ecological validity of executive functioning assessment. *Archives of Clinical Neuropsychology, 21*, 217-227.

Method: Participants

- $N = 46$
- General neurological sample
- 18 years or older (*range* = 19-75 years)
- 13.48 years education (*range* = 9-21 years)
- FSIQ = 95.91 (*SD* = 14.23)

Method: Materials

Executive Tests

- WCST
- Trails
- Stroop
- COWAT

Method: Materials Cont.

Everyday functioning (significant other report)

- Modified Dysexecutive Questionnaire (DEX)
  - Environmental demand
  - Compensatory strategy use
- Brock Adaptive Functioning Questionnaire (BAFQ)

Results: Correlations

	DEX	BAFQ
Executive tests		
Trails B	.25	**.33***
COWAT	.28	.24
Stroop	**.35***	**.38****
WCST	.03	-.09

***p* <.05, ****p* <.01

Results: Regression Analyses

Block	Outcome	R^2 *change*	*overall* R^2
Executive Tests	DEX	--	.20
	BAFQ	--	.18
Exec + Demand	BAFQ	.25*	.47*
Exec + Strategy	BAFQ	.15*	.37*
Exec + Dem + Strat	BAFQ	.28*	.51*

Discussion

- Not all executive tests have adequate ecological validity, although as a group they accounted for 20% of the variance in everyday executive functioning
- A significant amount of variance in everyday executive functioning remains unaccounted for if only NPT is utilized
- Assessment of strategy use and environmental demand can significantly improve prediction of everyday executive ability (together account for 50% of variance)

Study 2: Depressive Symptoms

1. Are neuropsychological tests related to everyday functioning?
2. Do depressive symptoms account for additional variance in everyday functioning beyond neuropsychological tests?
3. Do neuropsychological measures administered to patients with depressive symptoms have poorer ecological validity?

Chaytor, N., Temkin, N., Machamer, J. & Dikmen, S. (In Press). The ecological validity of neuropsychological assessment and the role of depressive symptoms in moderate to severe traumatic brain injury. *JINS*.

Method: Participants

- $N = 216$
- Moderate to severe TBI (6 months post injury)
- Average age 29.5 years (*range* = 14-87)
- 11.4 years education (*range* = 6-20)
- eFSIQ = 95.5 (*SD* = 16.6)

Method: Materials

Neuropsychological Tests

- PSI
- Trails A & B
- SRT
- COWAT

Method: Materials Cont.

Depressive Symptoms

- Center for Epidemiological Studies-Depression Scale (CES-D)
  - Cut off $\geq$ 16

Everyday Functioning

- Functional Status Examination (FSE)
  - Interview with significant other
  - Change in functional status secondary to injury

Results: Correlations

	FSE
Trails A	.42*
Trails B	.37*
SRT	.40*
PSI	.50*
COWAT	.35*

***p* <.001**

Results: Regression Analyses

Block	Outcome	R^2 *change*	*overall* R^2
NPT alone	FSE	--	.29*
CES-D alone	FSE	--	.13*
NPT + ***CES-D***	FSE	.05*	.34*
CES-D + ***NPT***	FSE	.22*	.34*

Results: Correlations

	Depressed	Not Depressed
	FSE (N=67-70)	FSE (N=114-117)
Trails A	.44***	.39***
Trails B	.37**	.35***
SRT	.39***	.35***
PSI	.45***	.50***
COWAT	.24*	.40***

***p*<.05, **p*<.01, ****p*<.001

Results: Regression Analyses

Group	Outcome	R^2	*p*-value
Depressed	FSE	.26	.001
Not Depressed	FSE	.30	<.001

Variables in model: Trails A, Trails B, SRT, PSI, COWAT

Discussion

- All neuropsychological tests were moderately related to functional ability, accounting for 30% of variance
- Depressive symptoms account for little additional variance in everyday functioning beyond NPT
- NPT in patients with depression has equivalent ecological validity

Conclusions

- While the ecological validity of test scores combined with extra-test variables is reasonably adequate, the ecological validity of NPT alone is lacking.
- Some extra-test variables may not be as related to ecological validity as we think they are (i.e., depression).
- A comprehensive neuropsychological evaluation should include more than just test scores when predicting everyday functioning.

Future Research

- Concordance across methods of assessing everyday functioning (e.g., simulations vs. questionnaires)
- Determining the ecological validity of neuropsychological *change* (Martin et al. 2006)
  - Reliable change indices
- Agreement on an "upper limit" of ecological validity
- Systematic empirical evaluation of potential extra-test variables