Cognitive Testing for the Workplace

Professor Henry Brodaty
Centre for Healthy Brain Ageing (CHeBA)
Dementia Centre for Research Collaboration
University of New South Wales
h.brodaty@unsw.edu.au

UNSW
AUSTRALIA

Never Stand Still · Medicine · Psychiatry

CHeBA
Healthy Brains · Positive Ageing

Why do cognitive screening?

- **Routine eg after certain age**
  - **eg pilots, train drivers, doctors under new APHRA guide judges?, politicians?**

Importance of collateral history

- **Pivotal in clinical practice**
- **More difficult in workplace**
- **Reports from work**

Should we diagnose before symptoms appear?

- **By screening people at risk?**
- **By measuring biomarkers?**

Role of cognitive screening

- **50-80% of dementia are undiagnosed**

- **At least 50% of mild & moderate dementia cases are missed by physicians, improves for moderately advanced dementia**

- **Target of testing should be those with risk factors (age, FH, genotype) & when there are symptoms**
  - **Not just those who present to medical centres for other reasons.. Not universal screening**

Ashford et al. *Alzheimer's & Dementia.* 2006; 2:76-85

Screening: the case for

- **Reversible cause**
- **Start anti-AD Rx earlier**
- **Relief to patient**
- **Relief to family**
- **Legal: enduring POA/ guardianship**

- **Better Mx comorbid Δ**
- **Life decisions**
- **Driving**
- **Work**
- **>attention to life-style**

Screening: the case against

- **No Rxx proven**
- **Lifestyle/ legal should be for all**
- **False positives**
- **False negatives**

- **Cost**
- **Alarm pt/ family**
- **No RCT that earlier Dx improves outcome**

Major objectives of a good screening program

1. **Detection of disease at a stage when treatment can be *more effective* than it would be after pt develops Sg & Sx... *??***

2. **Identification of risk factors to prevent or lessen the disease by modifying the risk factors ... *Possibly but do not need to screen***

Criteria for screening test

1. Disease should constitute a significant public health problem ... √√√

2. Have readily available treatment with potential for cure that increases with early detection .. *x*

3. Test must be capable of detecting a high proportion of disease in preclinical state ... *?*√

Criteria for screening test

4. **Be safe to administer ...** ✓

5. **Be reasonable in cost ...** ✓

6. **Lead to demonstrated better health outcomes** ?

7. **Be widely available, as must the interventions that follow a positive result ...** ?✓

Good screening tools have...

- **High sensitivity = a/ a + c**
- **High specificity = d/ b + d**
- **PPV = a/ a + b**
- **NPV = d/ c + d**

	Disease present	Disease absent	
Test positive	a = true positive	b = false positive	Total test +ve
Test negative	c = false negative	d = true negative	Total test -ve
	Total disease	Total non-disease	Total $populat^n$

CHeBA
Healthy Brains · Positive Ageing
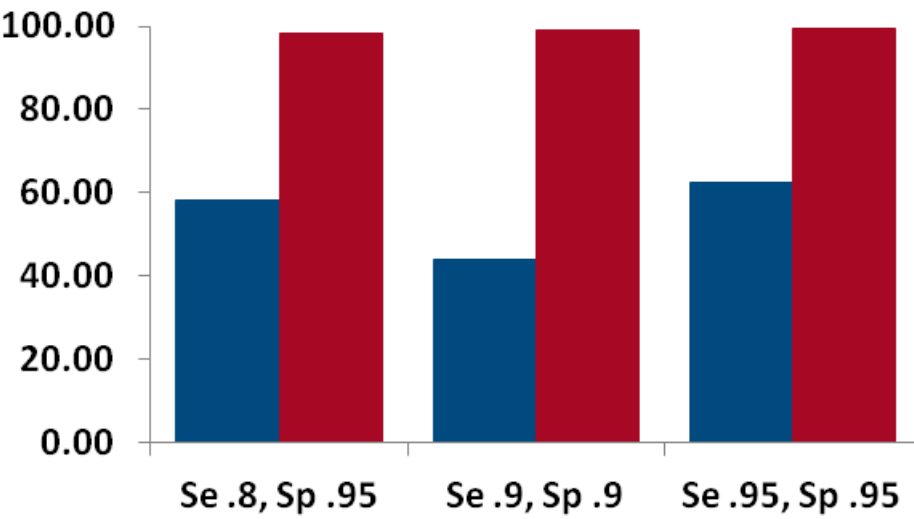
UNSW
AUSTRALIA

Effect of prevalence

- **As prevalence rises**
  - **PPV increases**
  - **PNV decreases**
- **High prevalence populations**
  - **Age: $\geq$75 10%; $\geq$ 80 = 20%+; $\geq$ 90 = 30%+**
  - **Age + hospital: $\geq$ 70 $\geq$ 40%[1]**
  - **RACF: 50 – 70%**
  - **Family history, ApoE4 etc**

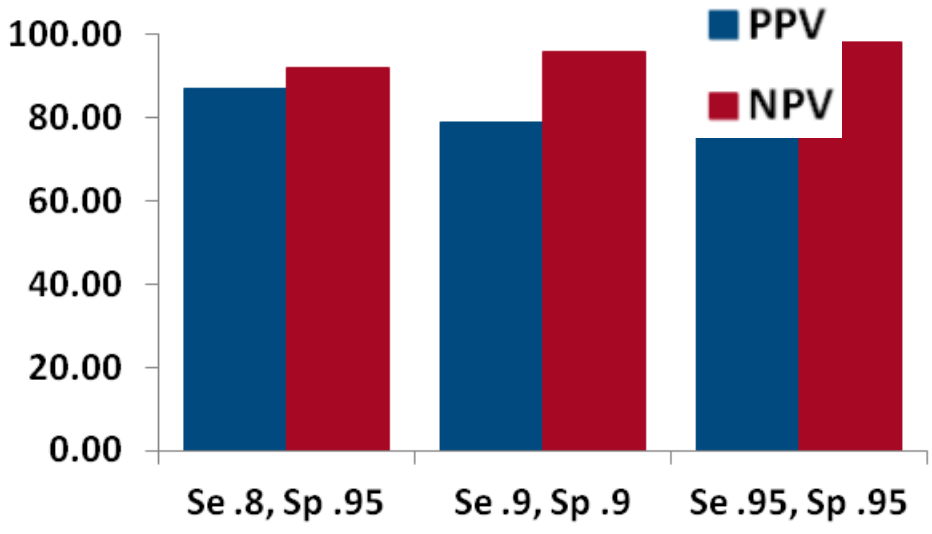**Sampson EL, Brit J Psychiatry, 2009: 191:61-66**

At what age should screening commence?

Age 65+

Age 85+

Test Accuracy

Se = Sensitivity
Sp = Specificity

If screen positive….

- **This is not diagnosis of dementia**
- **False positives - poor cognitive performance 2º to sensory impairment, education, language, developmental disability**
- **Positive screen ≠ dementia, eg acute illness, depression, medication**
- **Desirable to have test with high sensitivity *followed by* second stage assessment**

Screening instruments

Brief

- **MMSE**
- **sMMSE**
- **MOCA**
- **AMTS**
- **GPCOG**
- **Memory Impairment Scale**
- **Minicog**

- **PAS-CDS**
- **RUDAS**
- **KICA**

Longer

- **ACE-R**
- **3MS**
- **Cued recall**
- **ADAS-COG**

DOMS website
http://dementiakt.com.au/doms/

Welcome to DOMS – Dementia K ×

← → C ⌂ ⓘ Not secure | dementiakt.com.au/doms/ ☆

Apps NHMRC Research Gr Google Scholar New Tab BPSDguide Imported From IE Internet Access att.net National Dementia Fi G Google Images

DEMENTIA KT

RESOURCES　　ABOUT DEMENTIAKT　　TOOLBOX　　CONTAC

DOMS

Welcome to DOMS

DOMAINS

Cognition

Staging

Function

Behaviour

Delirium

Quality of life

ABOUT

DOWNLOADS

FAQ

– Dementia KT | DOMS_Cognition_DomainTable.p | Not secure | dementiakt.com.au/wp-content/uploads/2016/10/DOMS_Cognition_DomainTable.pdf

NHMRC Research Gr | Google Scholar | New Tab | BPSDguide | Imported From IE | Internet Access | att.net | National Dementia Fr | Google Images

COGNITION SCALES

Dementia Outcomes Measurement Suite
http://www.dementia-assessment.com.au

	Psychometrics*	User-friendliness#	Time	Cost	Specific strengths
Very brief screening					
GPCOG	orange	green	green	green	Screen plus optional informant measure
MiniCog	orange	green	green	green	Very brief
AMTS	orange	green	green	green	No materials required; long history of use;
FAB	green	green	green	green	Executive dysfunction
Screening					
MoCA	green	green	orange	green	Mild cognitive impairment
3MS	green	green	orange	green	Extension of MMSE with excellent psychometrics
S-MMSE	green	green	orange	red	MMSE with standardised administration
MMSE	orange	green	orange	red	Very widespread use
RUDAS	orange	green	orange	orange	Low literacy; easily translated into different languages
Comprehensive					
ACE-III	green	green	red	green	Differential diagnosis
ADAS-Cog	green	red	red	green	Measuring change in drug

How to do cognitive testing

- **Seek permission, explain purpose**
- **Seating, chairs, lighting, no distractions**
- **Correct vision, hearing if possible**
- **Interpreter if needed**
- **Appropriate test**

Cognitive Ax without testing

At interview

- **Appearance, non-verbal**
- **History**
  - **dates, specificity**
- **Speech**
- **Vocabulary**
- **Anticipation**
- **Humour**

Limitations of testing

Person

- Variable performance
- Motivation
- Psychological
- Physical limitations
- Medications
- Comorbidity

Tester

Test

- Education bias
- Ceiling effects
- Floor effects
- Domains not tested

Context

- Practice effect
- Language

Challenging cases

- **Intellectual disability**
- **Mental illness eg Sz, depression**
- **Physical illness**
- **Malingering**
- **Is it delirium? Dementia? Delirium + dementia?**
- **MCI vs dementia, especially when no informant**
- **Near centenarians and centenarians**

Driving

- **Moderately severe and severe dementia – stop driving**

- **Early- moderate ??**

- **Poor correlation with cognitive testing**

- **Driving assessment required**

Outline of neuropsychology

- **Overview of assessment process**

- **Role of NP Ax in dementia & MCI**

- **What do we test? Cognitive domains & processes**

- **Limitations of NP Ax**

Dr Nicole Kochan

What is neuropsychological assessment?

OBSERVATIONS

Clinical Judgement

Interpretation → REPORT

RAW DATA
NORMS

HISTORY

Adapted from Mitrushina (1999) Handbook of normative data for neuropsychological assessment

Brain & Ageing

CHeBA
Healthy Brains   Positive Ageing

UNSW
AUSTRALIA
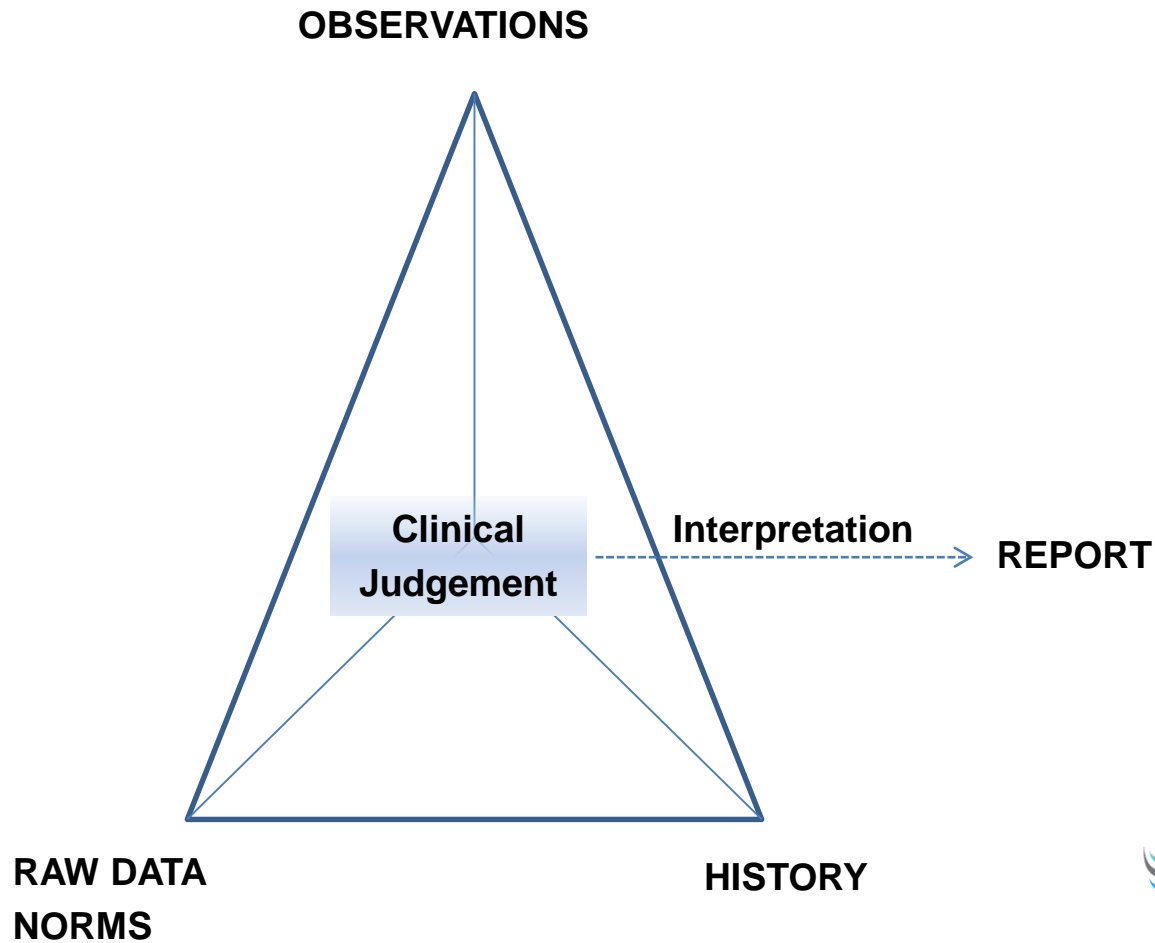
Role of neuropsychological assessment in MCI & dementia

- **Detect cognitive impairment/ decline**
  - **- sensitive to subtle impairment in mild neurocognitive disorders – MCI**
- **Differential diagnosis**
- **Monitor cognitive change**
- **Prognosis**
- **Predicting functional ability**

Cognitive domains

- **Premorbid ability**
- **Attention and working memory**
- **Processing speed**
- **Learning and Memory**
- **Language**
- **Visuo-spatial ability**
- **Executive function**
- **Mood**

Estimating premorbid ability

National Adult Reading Test (NART)

psalm

courteous

drachm

gauche

demesne

Wechsler Test of Adult Reading (WTAR)

gnat

aesthetic

treatise

hyperbole

insouciant

Cognitive domains

- **Premorbid ability**
- **Attention and working memory**
- **Processing speed**
- **Learning and Memory**
- **Language**
- **Visuo-spatial ability**
- **Executive function**
- **Mood**
- **Social awareness**

Tests of Attention and Working Memory

- **Digits forward and backward**

- 'Mental control'/series
- e.g. months backward, serial 7s

Cognitive domains

- **Premorbid ability**
- **Attention and working memory**
- **Processing speed**
- **Learning and Memory**
- **Language**
- **Visuo-spatial ability**
- **Executive function**
- **Mood**

Digit Symbol Coding

Coding

1	2	3	4	5	6	7	8	9
⌐	Ɔ	∧	—	‖	⊢	⊂	⌐	⊣

Demo **Sample**

| 6	8	3	9	5	4	1	7	2	1	4	8	2	7	6	9	3	5

8	3	1	9	2	5	6	4	3	7	2	9	8	1	4	7	6	5

9	1	2	4	7	2	5	6	9	5	8	6	4	3	1	7	8	3

1	3	9	6	3	9	7	5	1	4	2	8	7	2	8	5	6	4

7	6	4	1	3	2	8	1	7	9	2	5	3	4	8	6	5	9

8	1	9	5	1	4	2	6	9	8	7	3	5	6	4	7	2	3

3	6	8	9	1	8	4	7	5	2	9	6	7	1	5	2	3	4

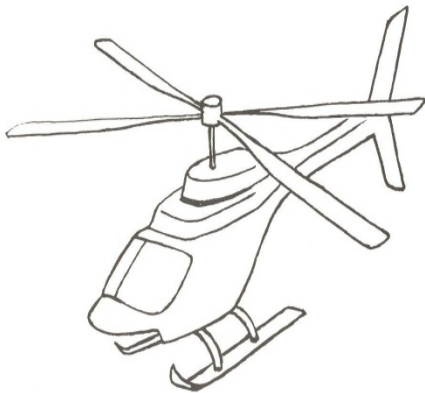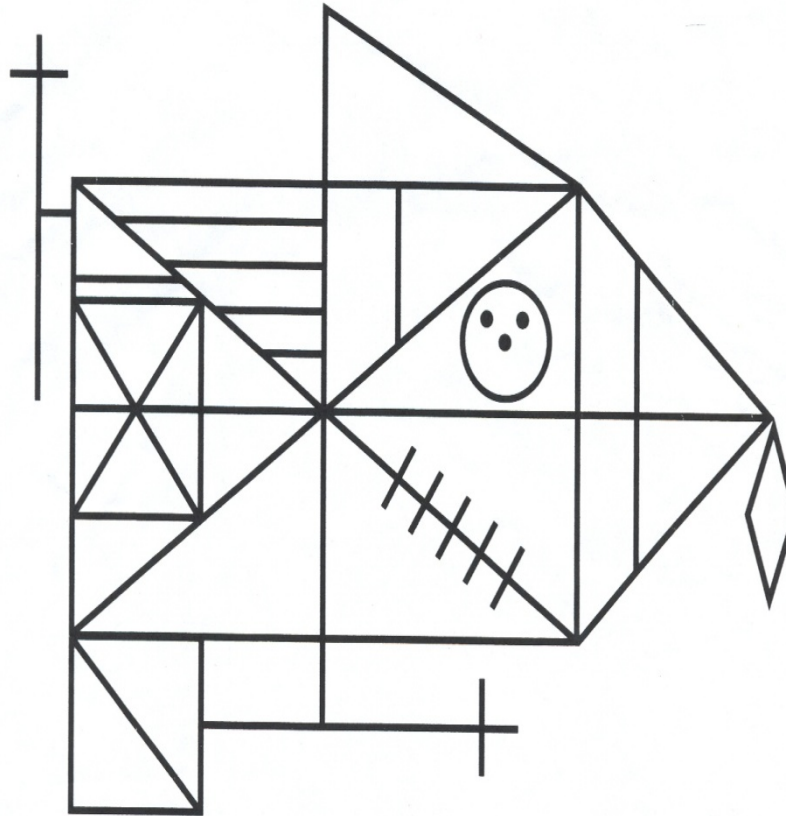| 6	4	1	9	5	7	3	6	8	3	2	7	5	8	4	2	9	1

Cognitive domains

- **Premorbid ability**
- **Attention and working memory**
- **Processing speed**
- **Learning and Memory**
- **Language**
- **Visuo-spatial ability**
- **Executive function**
- **Mood**

Verbal Memory Tests

- **Story recall: "Logical Memory"**
  - **25 elements; Immediate & Delayed recall**
- **Word list learning:**

Rey Auditory Verbal Learning Test (RAVLT)
  - **List A: 15 words (5 repeated presentations)**
  - **List B: 15 words (interference list)**
  - **Immediate recall List A**
  - **Delayed recall List A (20-30' later)**
  - **Recognition words**

drum
curtain
bell
coffee
school
parent
moon
garden
hat
farmer
nose
turkey
colour
house
river

Brain & Ageing

UNSW AUSTRALIA

Visual Memory Tests

- **Simple Designs: Visual Reproduction**
- **less complex**
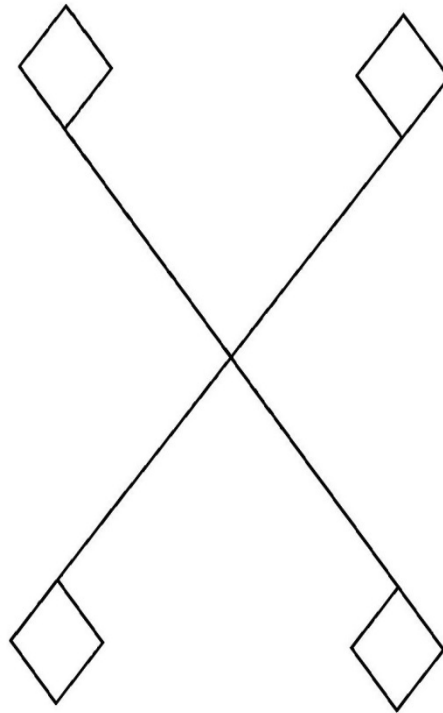
Visual Memory Tests

- **Simple Designs: Visual Reproduction**
- **more complex**
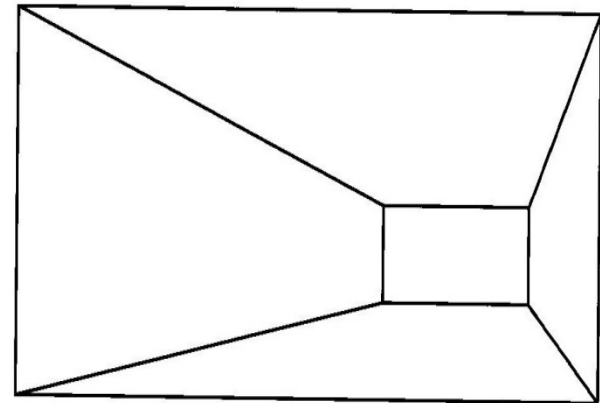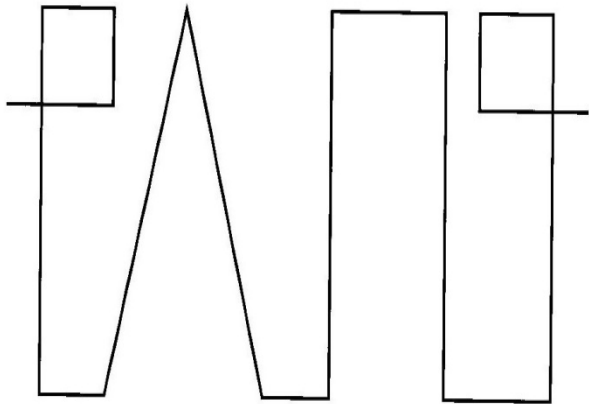
Cognitive domains

- **Premorbid ability**
- **Attention and working memory**
- **Processing speed**
- **Learning and Memory**
- **Language**
- **Visuo-spatial ability**
- **Executive function**
- **Mood**

Language Tests

- **Confrontation Naming: Boston Naming Test**
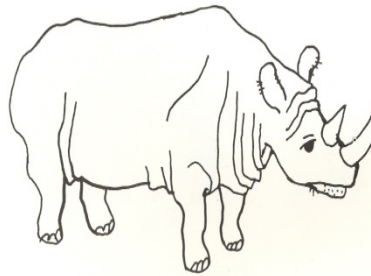
Language Tests

- **Fluency measures:** Semantic or category fluency
-
- **Animals, Fruits, Vegetables, Boy's names, Countries**

Language Tests

- **Fluency measures:**
- **Controlled Oral Word Association Test/ Letter fluency (FAS)**

- **"Test Experience"**

Verbal fluency additional measures

- **Rule breaks and repetitions provide information about attentional control, self-monitoring and perseverative thinking**

Cognitive domains

- **Premorbid ability**
- **Attention and working memory**
- **Processing speed**
- **Learning and Memory**
- **Language**
- **Visuo-spatial ability**
- **Executive function**
- **Mood**
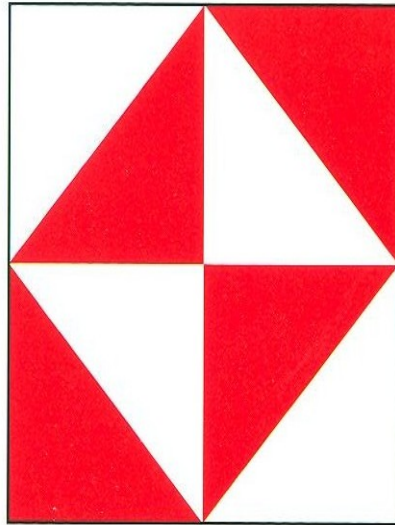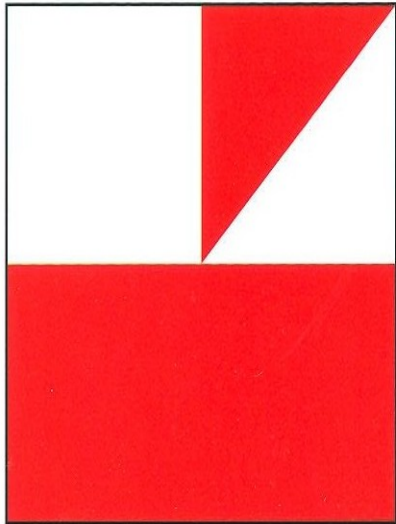
Rey Complex Figure

Case MF

AD, good
planning,
construction
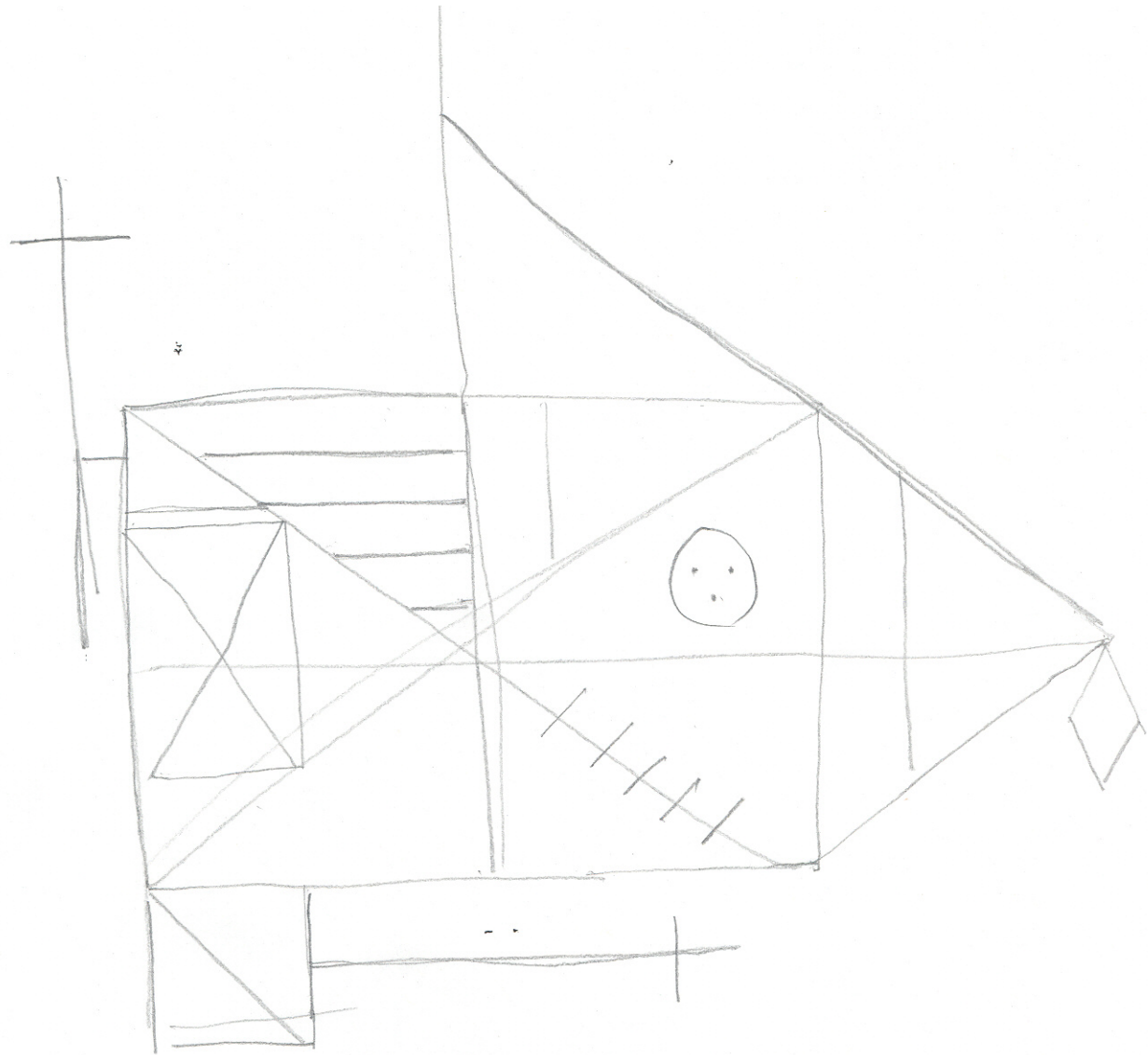
Case AL

AD, mild
problems w
planning
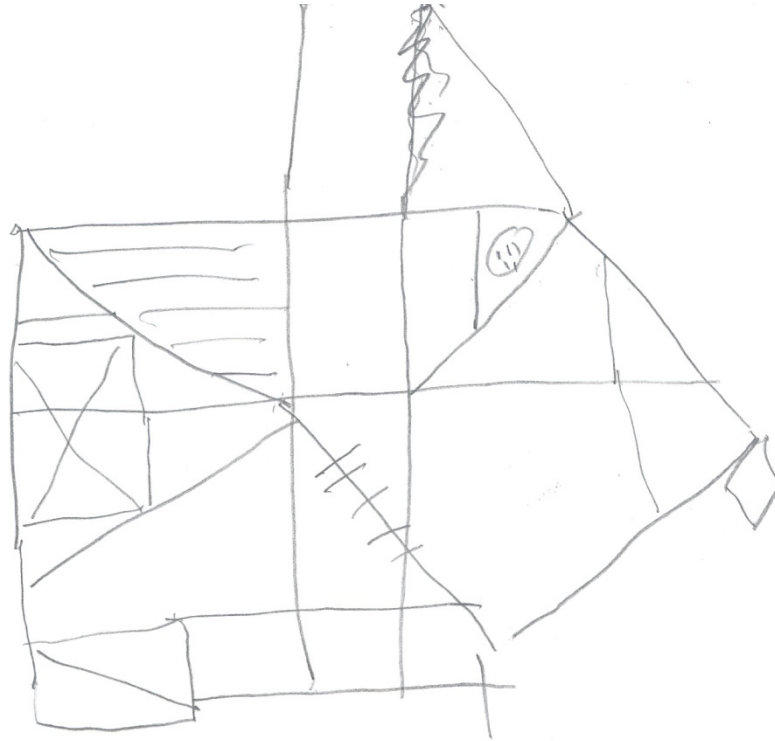
Case JS

vascular dementia, severe
constructional difficulties
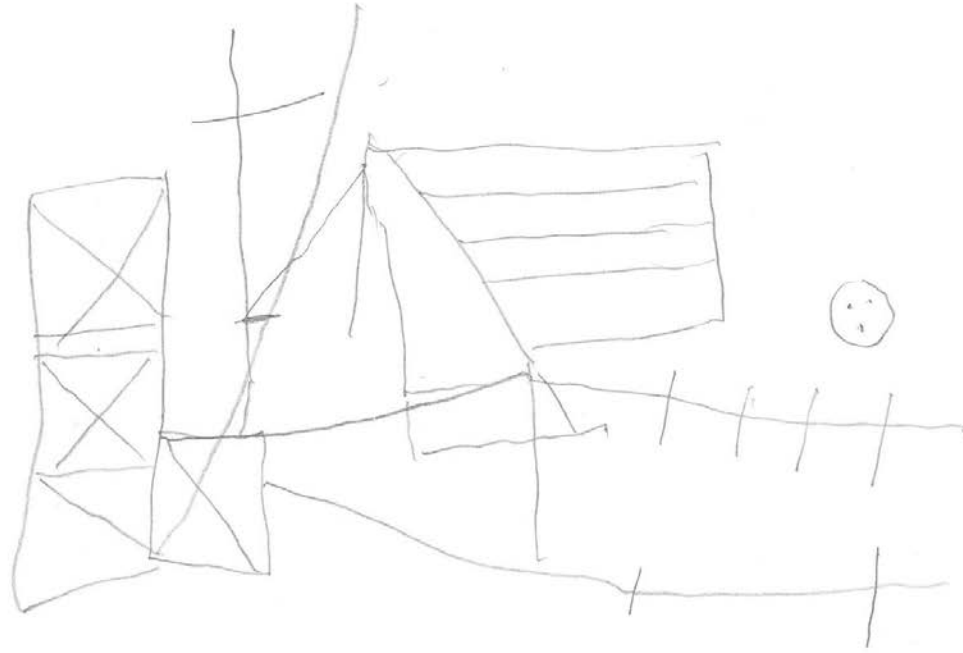
Rey Figure Copy.

Case RB

DLB, severe spatial & construction difficulties

Cognitive domains

- **Premorbid ability**
- **Attention and working memory**
- **Processing speed**
- **Learning and Memory**
- **Language**
- **Visuo-spatial ability**
- **Executive function -reasoning, problem-solving, concept formation, mental flexibility, planning**
- **Mood**

- **Verbal abstract thinking – 'Similarities'**

- **In what way are an orange and a banana alike?**

- **In what way are work and play alike?**

- **In what way are praise and punishment alike?**

Scoring similarities – work & play

- **2 points:**
- **basic human activities, activities valued by society, daily activities we do**
- **1 point:**
- **ways to spend your time, part of life, can get enjoyment from them**
- **0 point:**
- **Keep you out of trouble, play is fun but work is serious, they're opposites**

Trail Making Test A
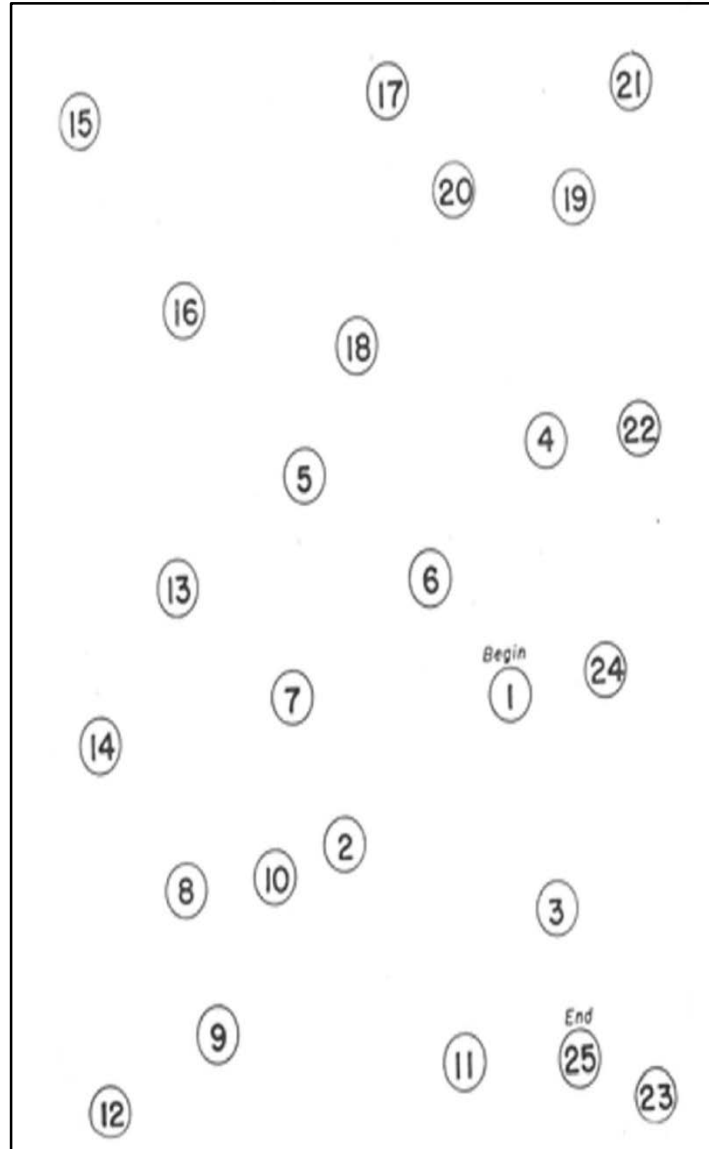
Trail Making Test B
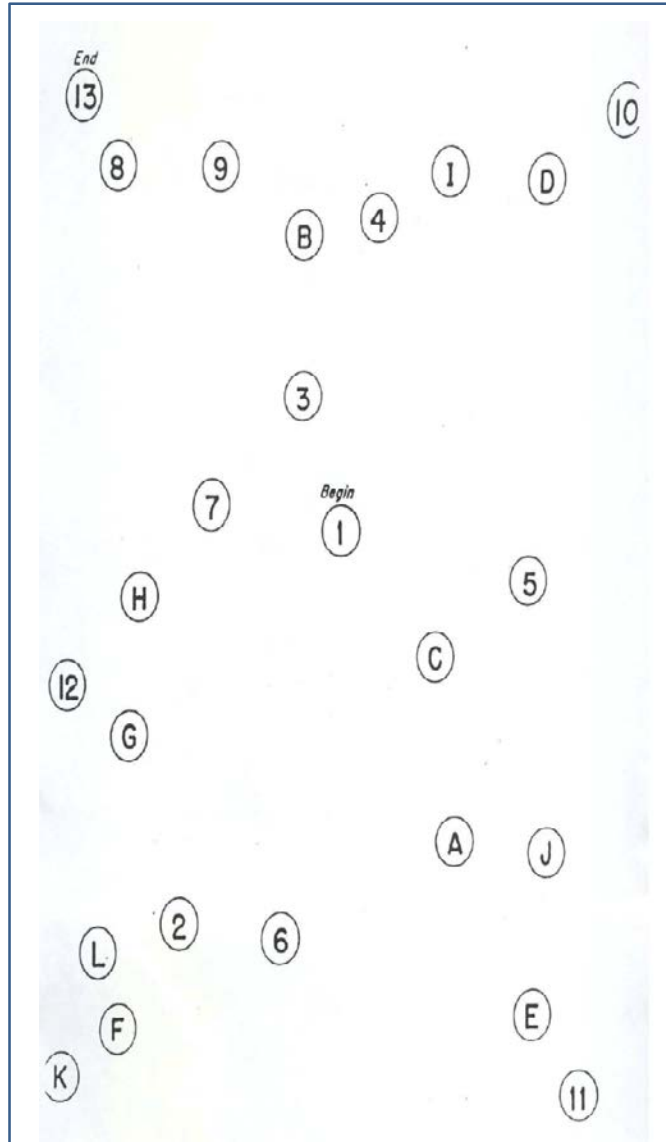
Cognitive domains

- **Premorbid ability**
- **Attention and working memory**
- **Processing speed**
- **Learning and Memory**
- **Language**
- **Visuo-spatial ability**
- **Executive function**
- **Mood**

How normal distinguished from abnormal? Normative data

- **Test data collected on a group of healthy individuals**
- **Comparing performance of an individual to a normative sample provides info about their relative standing in the group**
- **Validity of npsych results depends on match between individual being tested & normative sample, in regards to sociodemographic characteristics**

Limitations of Neuropsychological Ax

- **Problem of base rates**
- **Frequency of low test scores in the normative sample on a particular test battery**
- **1 or 2 impairments on a large test battery may lead to misdiagnosis**
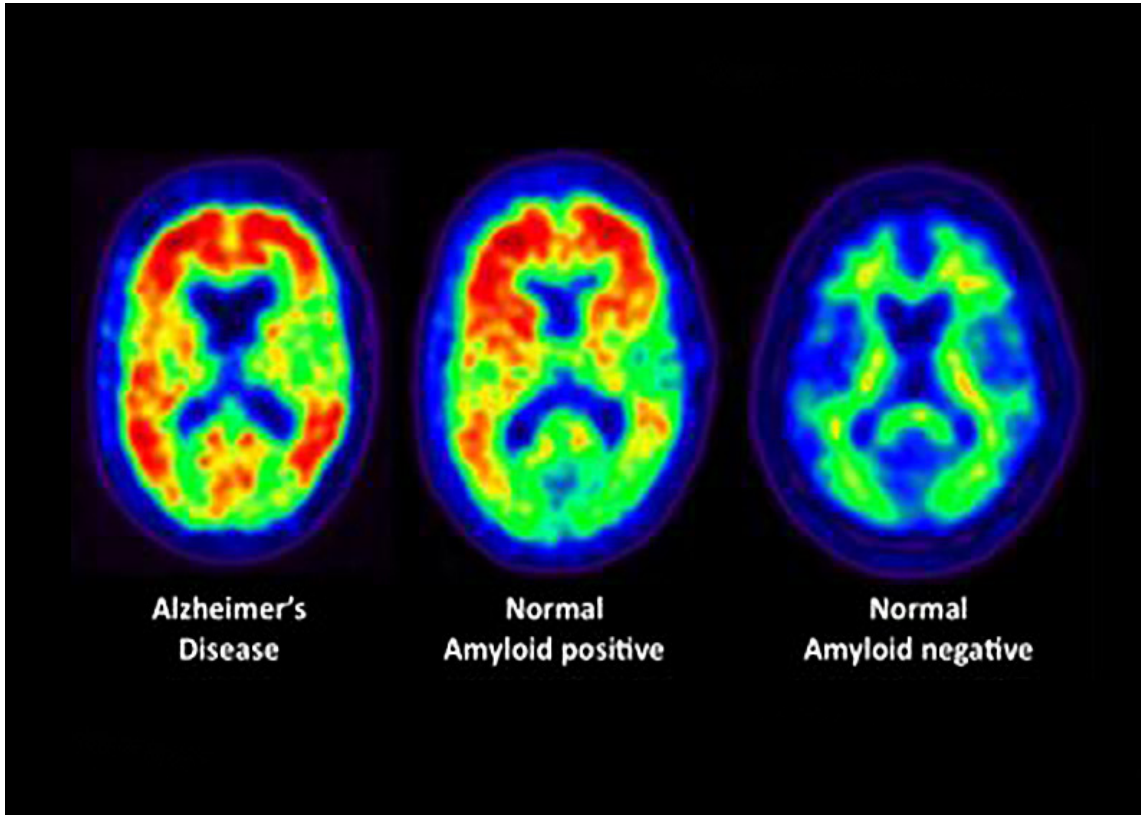- **neuropsych scores cannot be interpreted in isolation**

Biomarkers

- **CT & MRI Scans**
- **ApoE ε4**
- **CSF - $\downarrow$Aβ, $\uparrow$tau and P-tau**
- **PET Amyloid imaging**
- **PET Tau imaging**
- **Dopamine Transporter Imaging SPECT (ligand not available in Australia)**
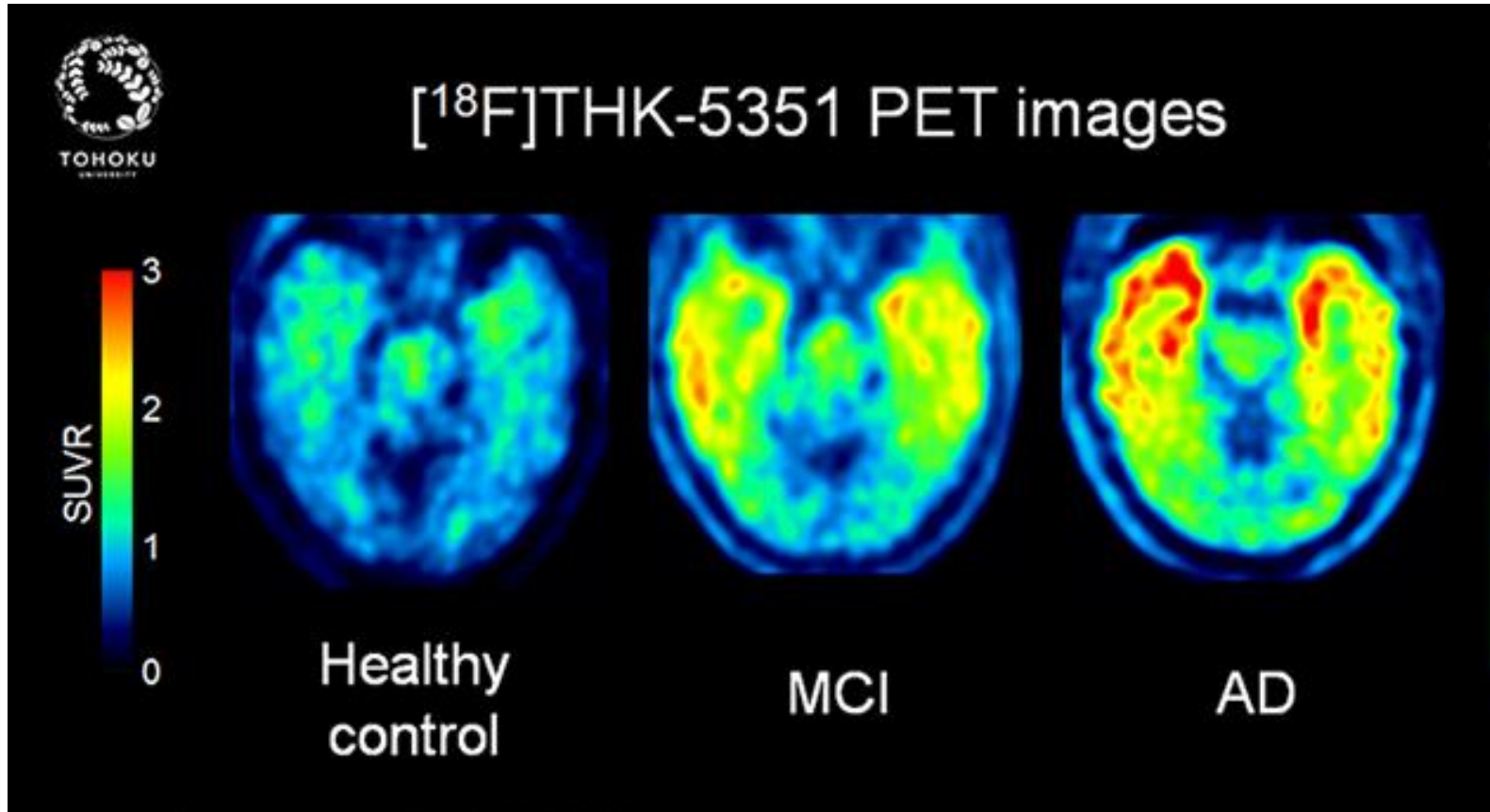
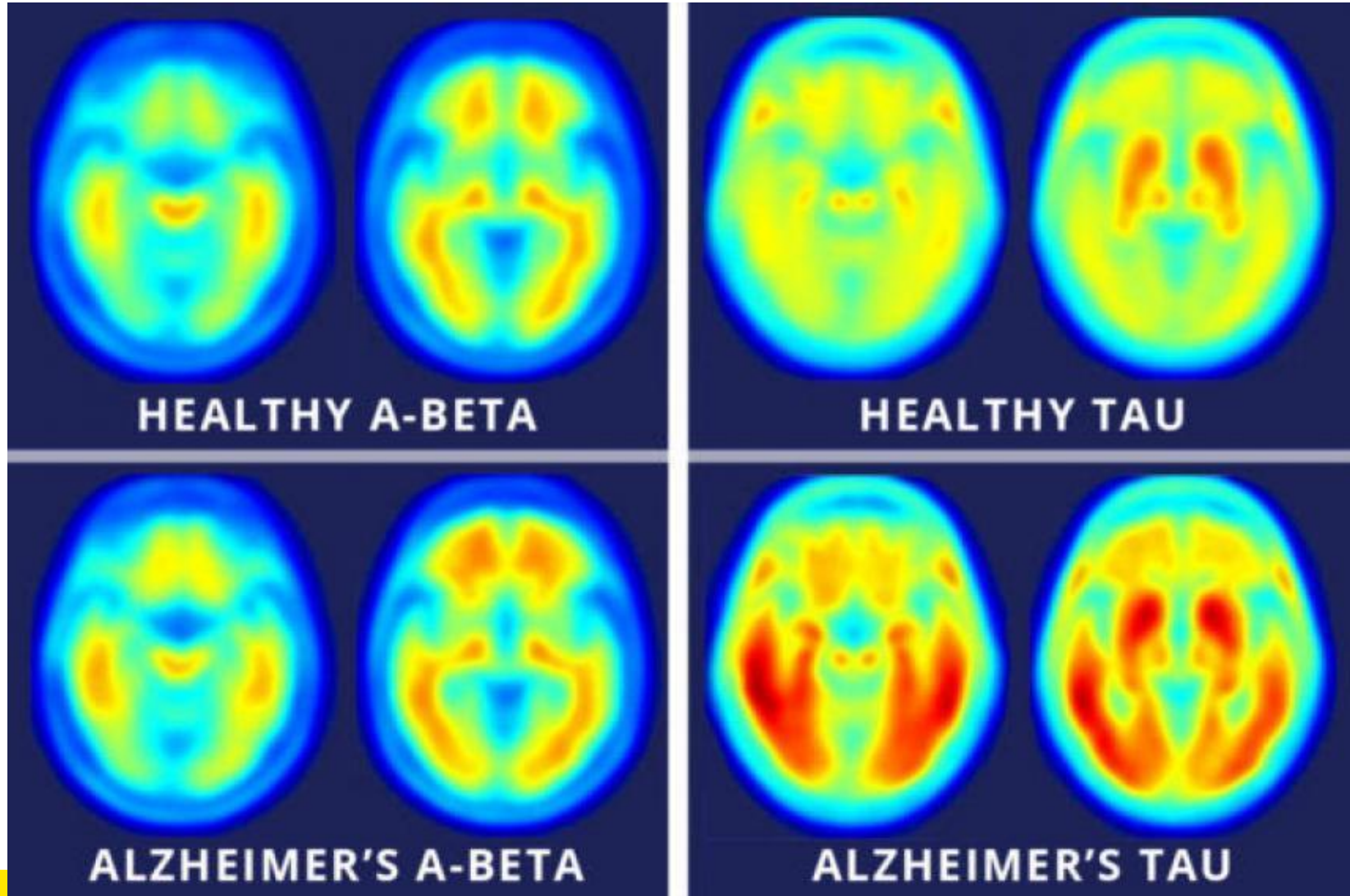# Hippocampal atrophy in Alzheimer's
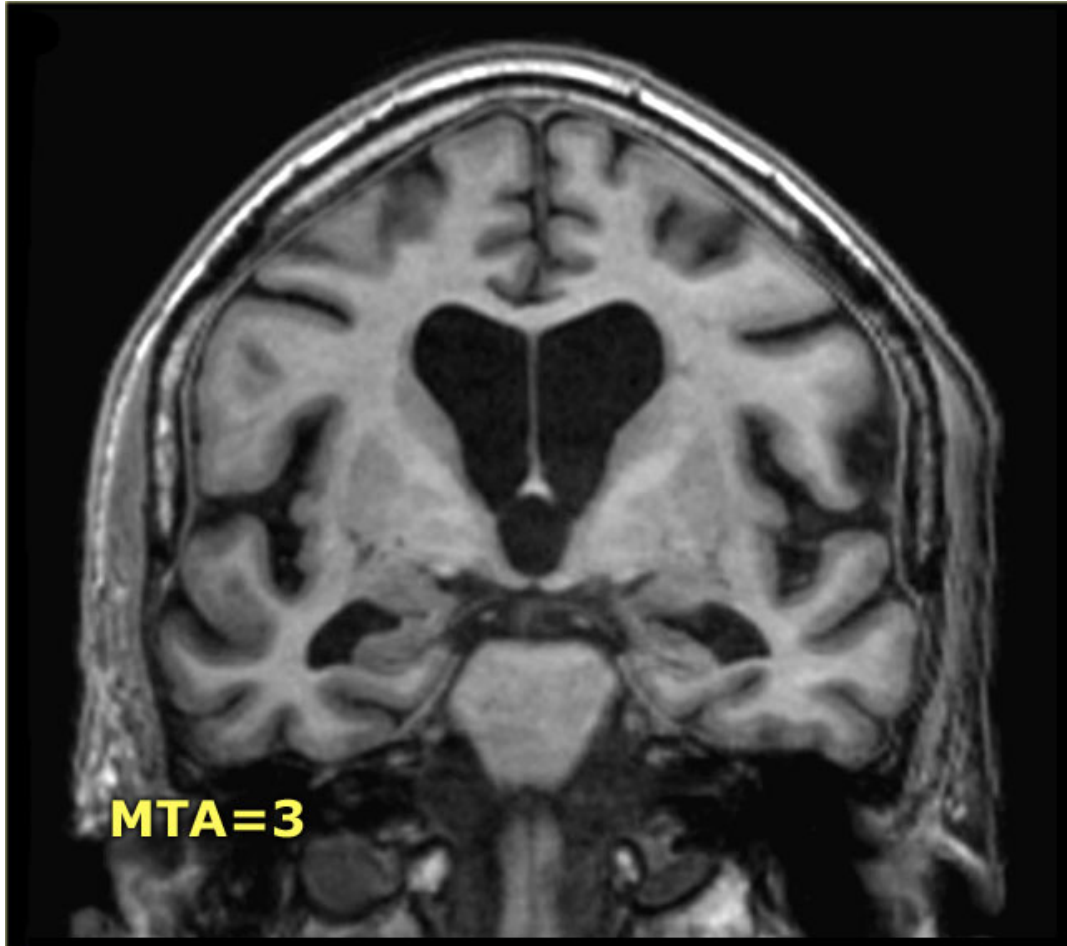
PET amyloid imaging: normal vs AD

Alzheimer's Disease | Normal Amyloid positive | Normal Amyloid negative

Hotter colours = more amyloid

- **35% persons 60+ amyloid+**
- **Amyloid+ → ↑ risk clinical progression**
- **Will all amyloid+ develop AD?**
- **When??**
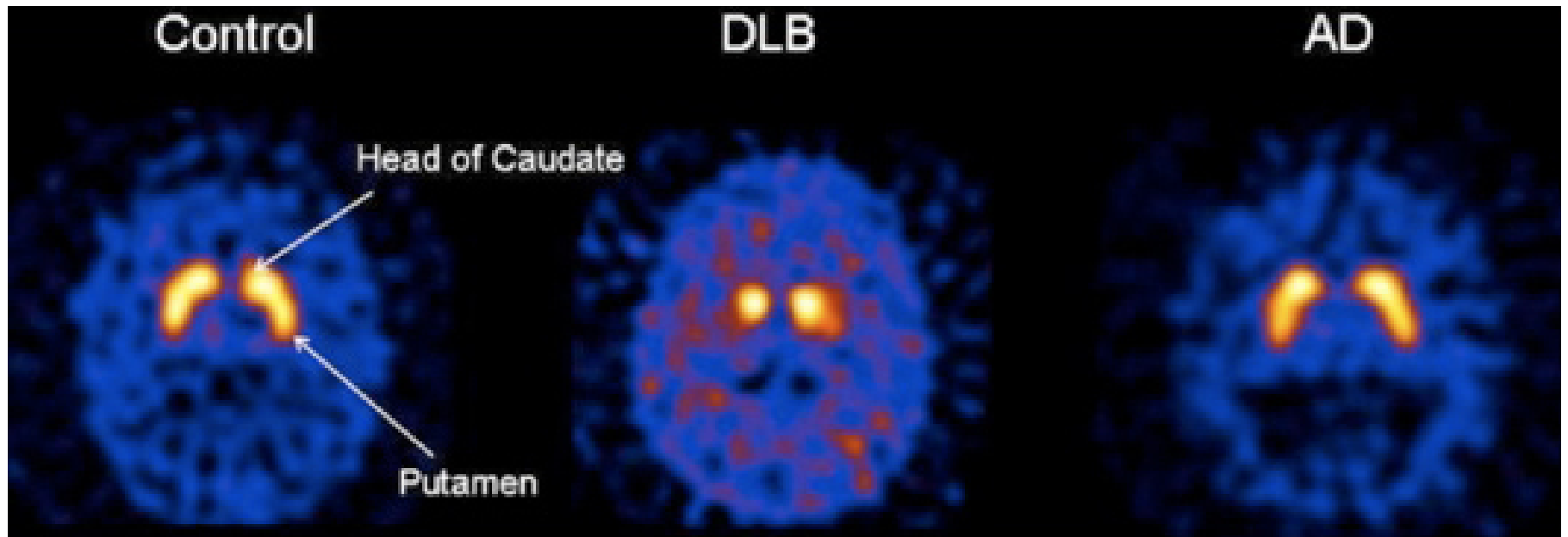
Tau imaging

[18F]THK-5351 PET images — Healthy control, MCI, AD

Aβ & tau imaging

DAT Scan for LBD

Conclusions

- **Assessing cognition is more than an MMSE**
- **History, history, history**
- **Physical and mental state**
- **Consider medications, context**
- **Brief cognitive testing is just a first step**
- **Neuropsychological testing is long procedure, stressful and expensive**
- **Testing cognition can have work, insurance and personal consequences**

Thank you

CHeBA www.cheba.unsw.edu.au

Dementia Outcomes Measurement Suite

http://dementiakt.com.au/doms/

DCRC www.dementiaresearch.org.au

UNSW
SYDNEY