



Enhancing the evidence-base on cognitive rehabilitation: what do we know and what do we need?

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Cognitive functioning after cardiac arrest

(Steinbusch et al, 2017)

Cohort study, n=141

Cardiac arrest

3-10d
eligibility

T1: 2w
baseline

T2: 3m

T3: 1y

T4: 2y

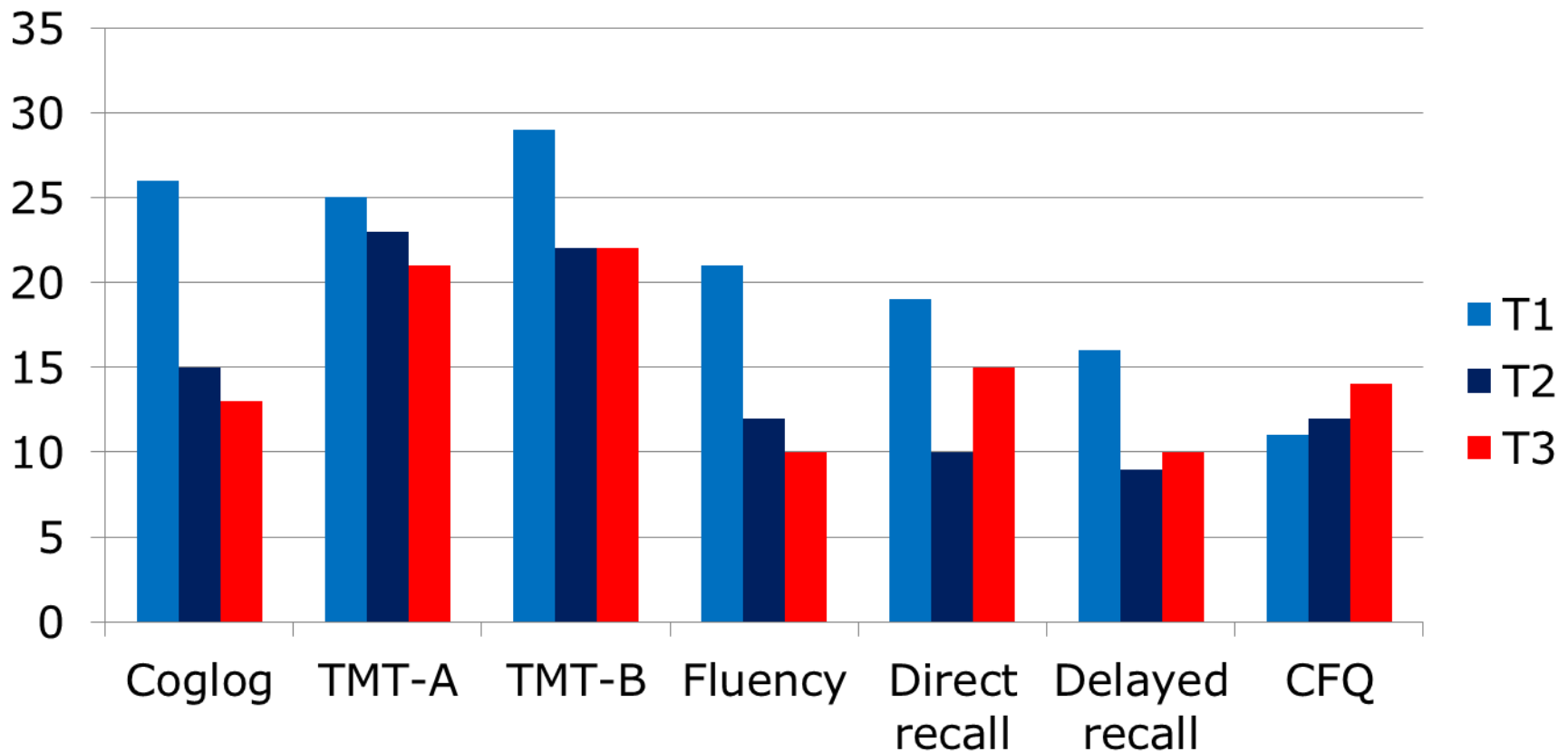
Coglog screening
NP tests: attention, task switching, executive control, memory, speed
CFQ cognitive complaints



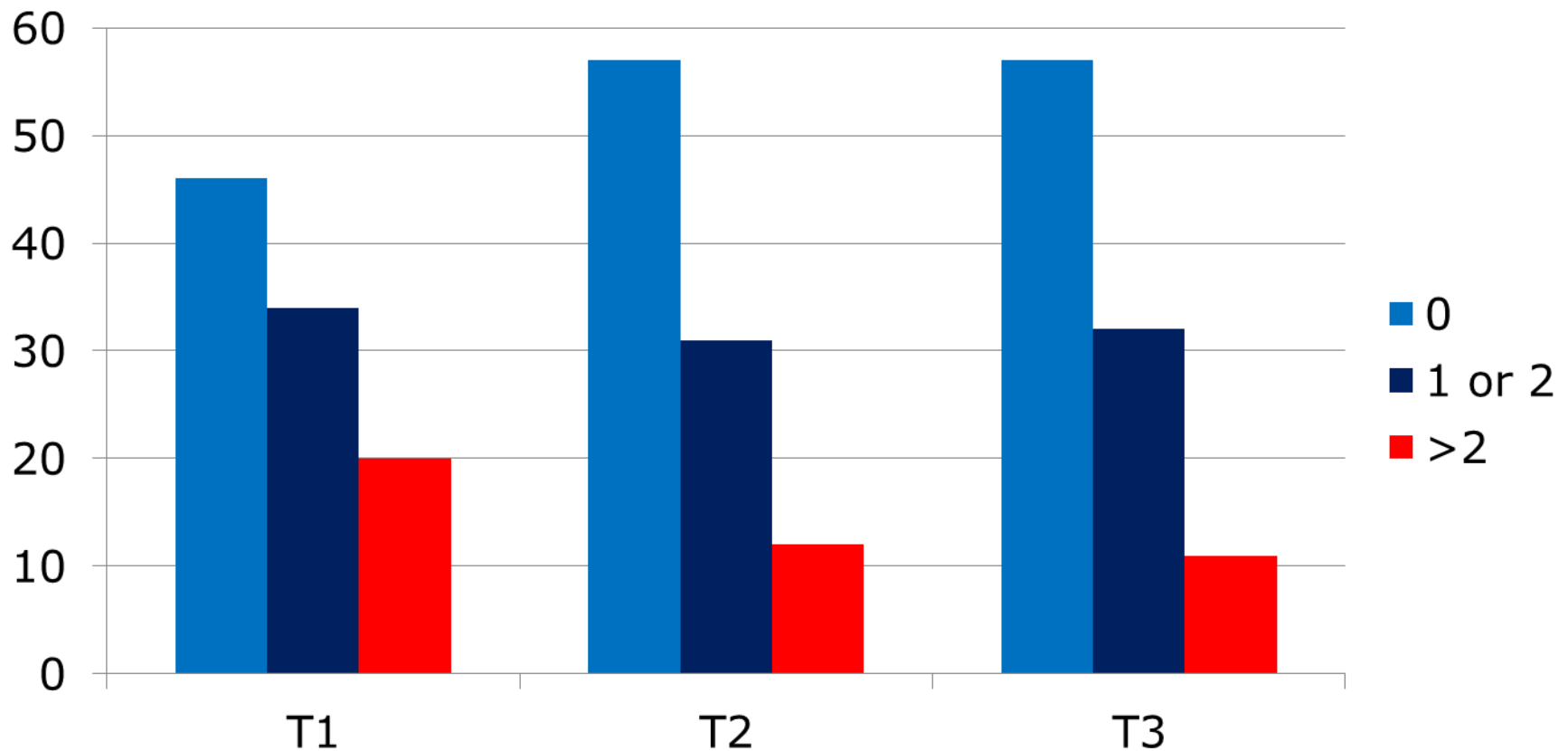
Patient characteristics (n=141)

Characteristics	N	M (sd) or n (%)
Gender, male	141	118 (84%)
Age	141	60 (11)
Education, high	130	26 (20)
Premorbid employment	130	63 (48%)
Cardiovascular history	135	84 (62%)
Cardiac cause of CA	132	117 (89%)
Out of hospital CA	141	112 (79%)
Time collapse-circulation (min)	62	10 (0-60)
Discharge home	129	114 (89%)

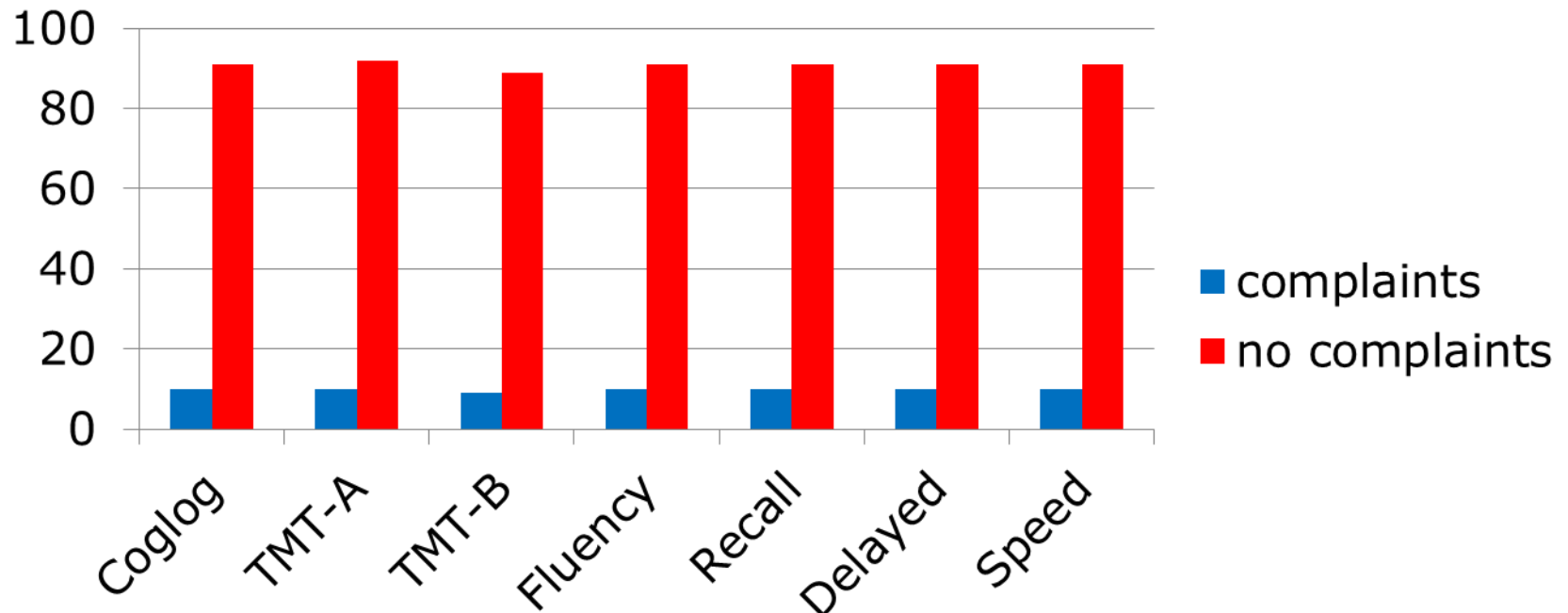
Percentage cognitively impaired per domain



Number of cognitive impairments



Patients with and without complaints at T1



- * Same pattern at T2 and T3
- * No significant correlations between NP tests and CFQ

Conclusions

- Only about 10% has cognitive complaints
- Cognitive impairments are more often present:
 - 16 - 29% at 2 weeks
 - 9 - 26 % at 3 months
 - 10 - 22 % at 1 year
- 43% scores abnormal on one of the tests at 3 months
- No significant relation between objective tests and subjective complaints
- Improvement is present in all domains
- Recovery occurs mostly in the first 3 months

Comparable results

- Orbo et al (2014): 44% cognitively impaired at 3 months post CA
Tiaien et al (2015): 51% cognitively inmpaired at 6 months post CA
- Boyce-van der Wal et al (2015):
cognitive problems in cardiac rehab cohort study n=77
23% cognitive problems
associations with aspects of participation, autonomy, QoL
no overlap complaints-impairments
- Lilja & Nordstrom (2017):
early cognitive screening + individualized support needed
- Boyce & Goossens (2017):
cardiac and cognitive rehab should be integrated

Cognitive rehabilitation: the past.....



WO I:
Kurt Goldstein

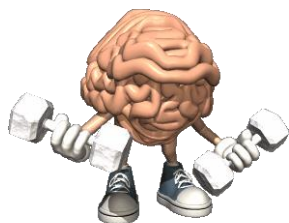


WO II:
Alexander Luria
Oliver Zangwill

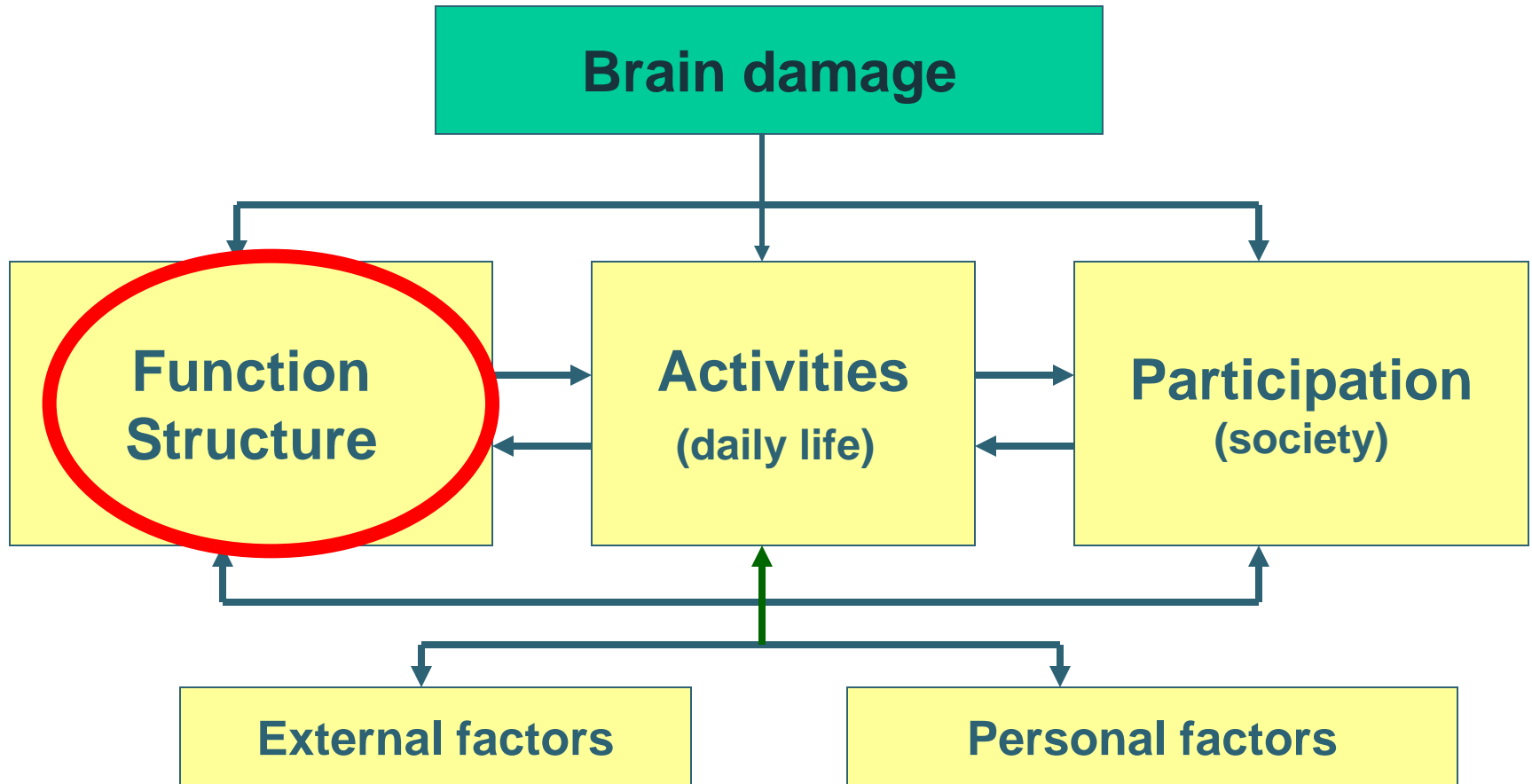


1990> :
Barbara Wilson

Mental muscle approach:
Restoration of functions
Drill and practice
Cognitive retraining



Cognitive retraining

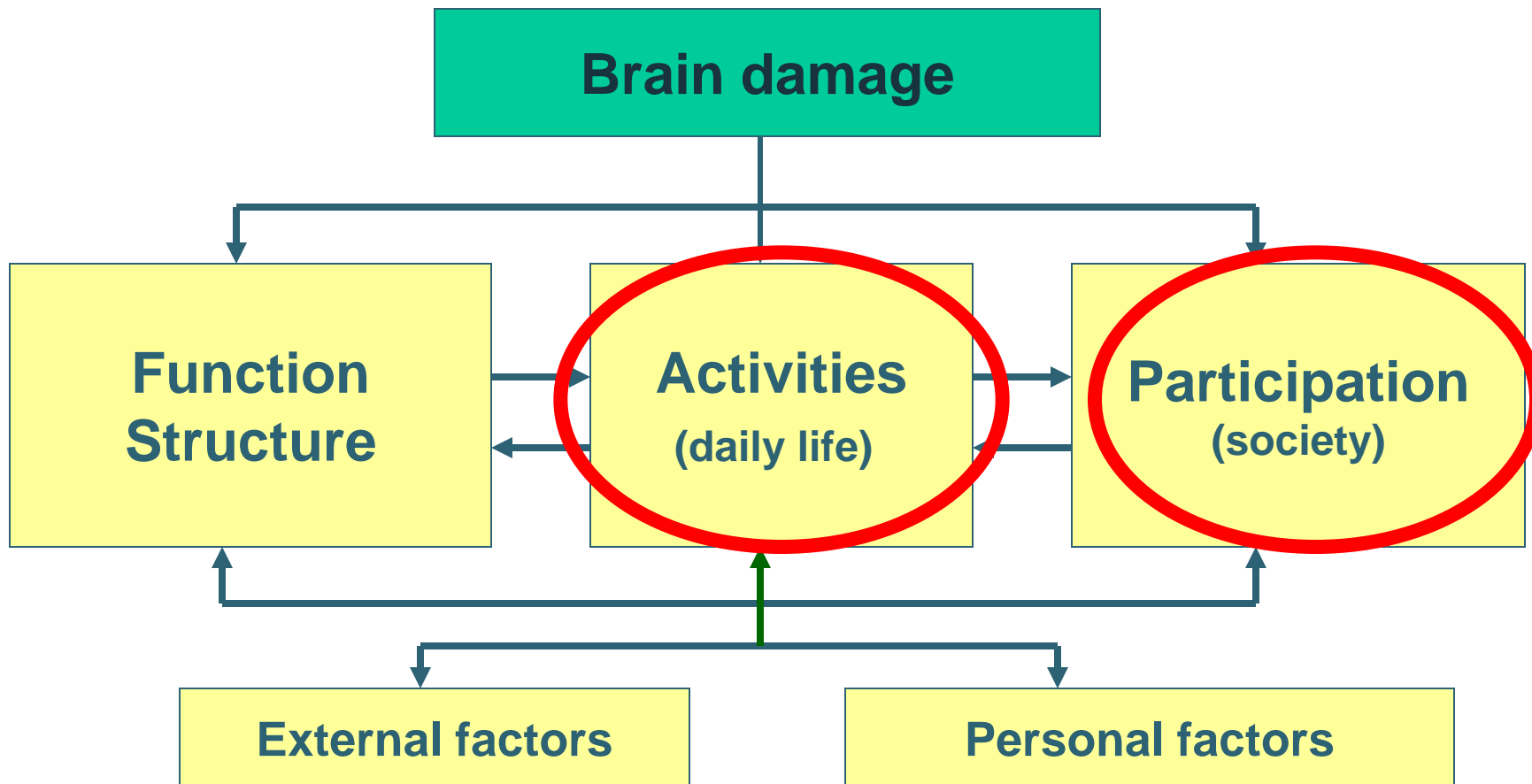


What is cognitive rehabilitation? (Wilson, 1997)

The term “cognitive rehabilitation” can apply to any intervention strategy or technique which intends to enable clients or patients, and their families, **to live with, manage, by-pass, reduce or come to terms with** cognitive deficits precipitated by injury to the brain.



Goals of (cognitive) rehabilitation



Current clinical practice

- Psycho-education and information provision
- Skills training (therapy-calendar, clock watching)
- Strategy training (memory, EF, mental sped, etc.)
- Mostly compensatory approach
- **No restorative approach: no generalisation to daily life functioning**
- Environmental adaptation (signs, routes, routines)
- Neuropsychological rehabilitation:
 - * Also incorporating emotional, behavioural and social consequences
 - * in a therapeutic environment
 - * Holistic therapeutic approach

Current evidence (Van Heugten et al, 2012)

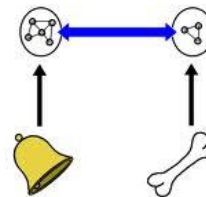
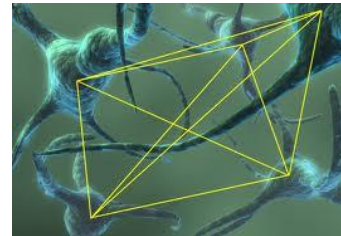
- RCTs: N=95
n=4068 patients, mainly stroke and TBI, **no studies on CA**
age=52 y, 24 m post injury, in 22 studies <3 m, 30 hrs training
- Effectiveness:
55% of studies exp > control
25% of studies no difference
20% of studies partial effects
Mostly comensatory approaches
- Main problem: content of treatment is often not described and therefore **not comparable, reproducible or implementable**

Cognitive rehabilitation 1.0

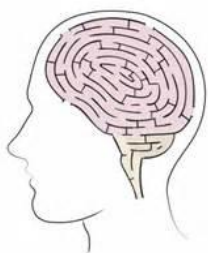
Rehabilitation = learning

- * *Relearning* old skills
- * *Learning* new skills
- * *Learning* to deal with lasting consequences
- * *Learning* to adapt to a changed life
- * *Learning* to accept a changed life

What is learning?



The era of neurosciences....



From the brain as a maze
or a puzzle and post mortem
brains.....



To living, active brains



**New forms of
cognitive rehabilitation?**

How plastic is our brain?

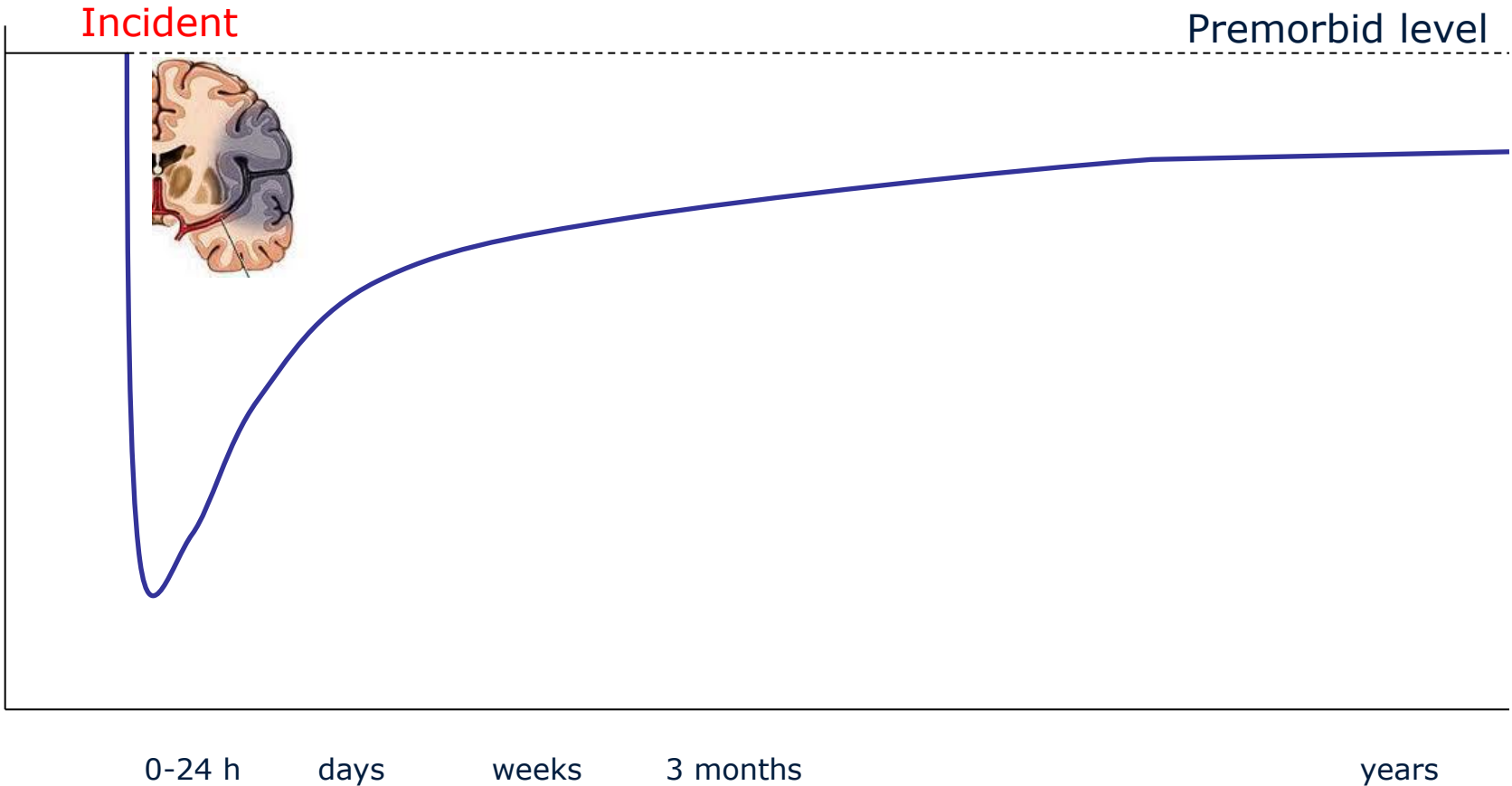
Neuroplasticity = the capacity of the brain to reorganize in terms of function and structure as a result of experience or environmental stimulation during the complete life span

Repetitive execution of routine tasks because of profession leads to permanent brain changes

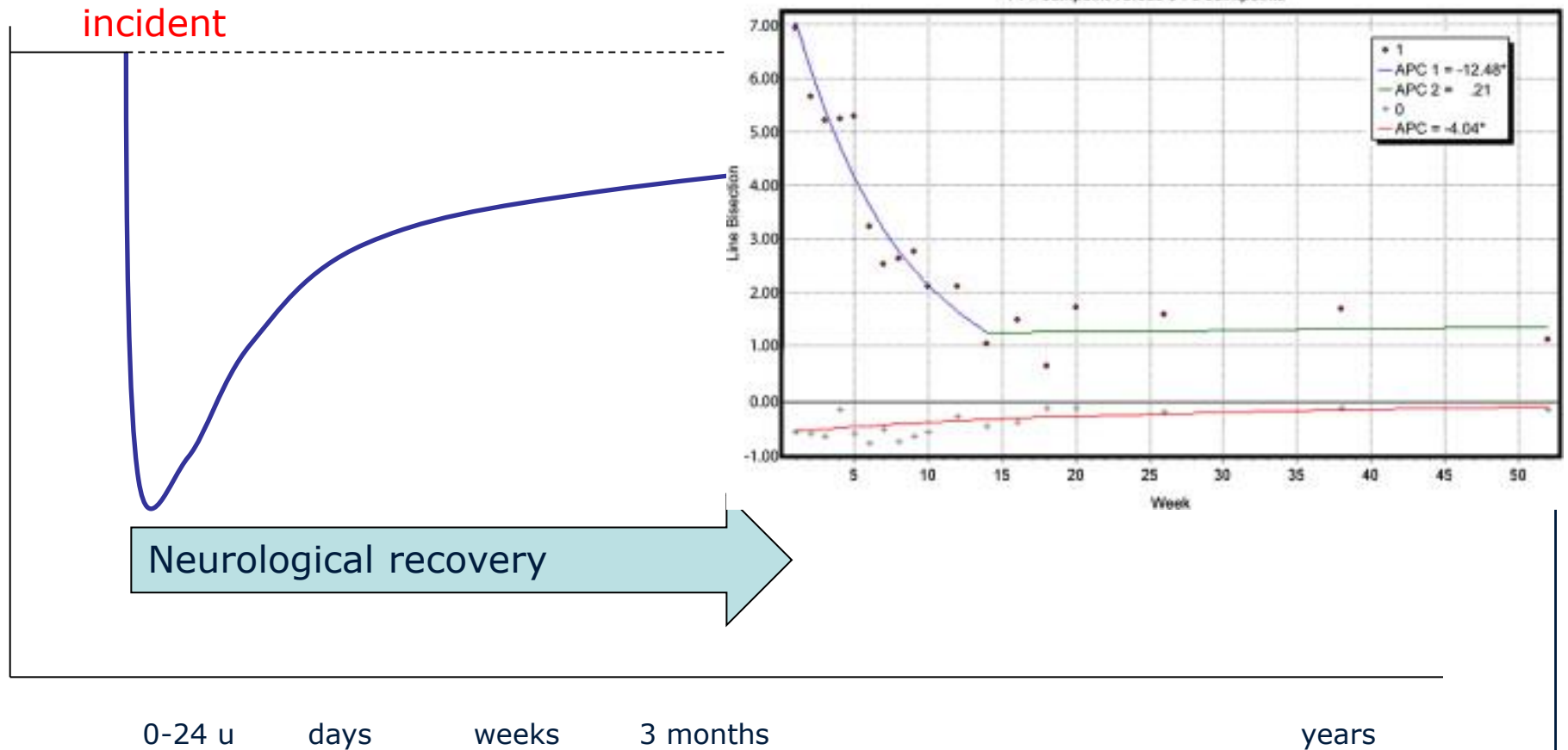


Short intensive training of a new task also leads to structural and functional changes in the brain

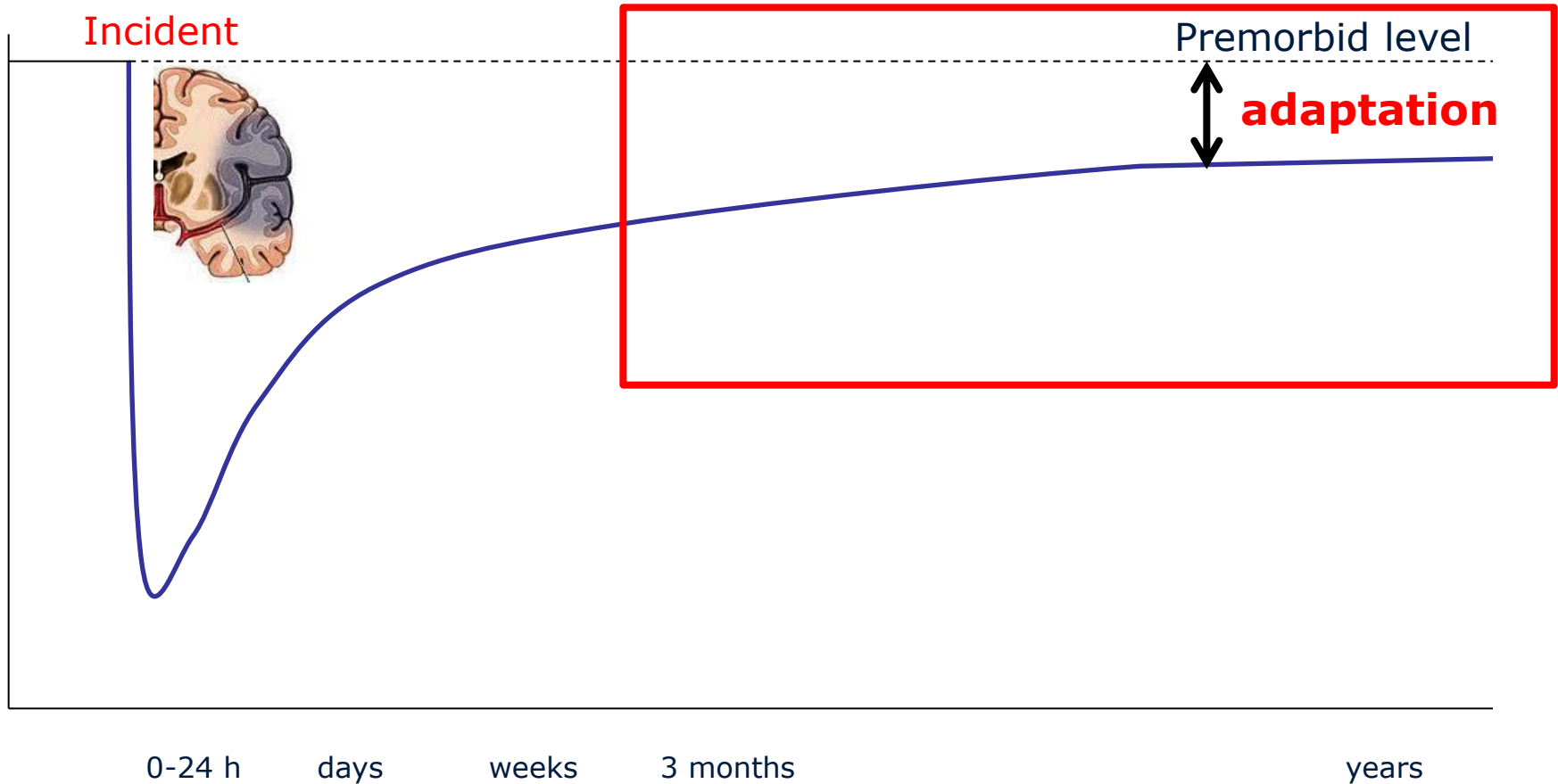
Recovery after brain damage



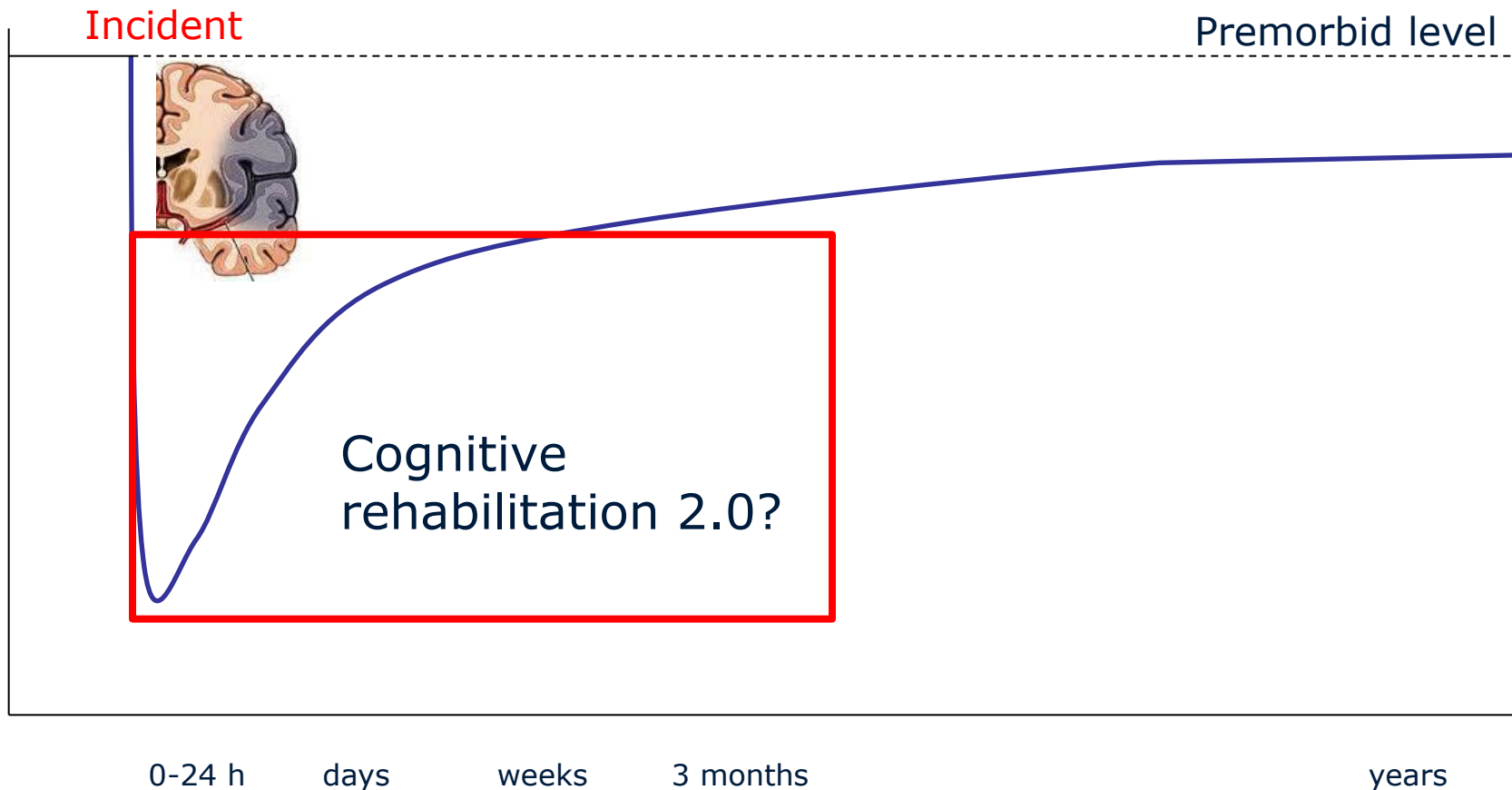
Plasticity after brain damage (Nijboer, 2013; Winrters, 2017)



Cognitive rehabilitation 1.0



Recovery of (cognitive) function



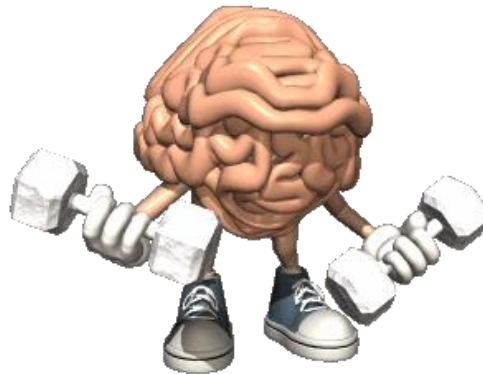
Improving cognitive functioning?



Computerized brain training



Virtual reality



Brain stimulation



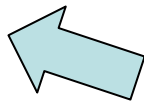
Medication

Effectiveness of brain training? (Van Heugten et al, 2016)

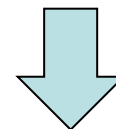
- Popular in the areas of working memory, attention, EF, speed, children with learning disabilities and cognitive aging
- **Claims are not met:**
Lumosity to Pay \$2 Million to Settle FTC Deceptive Advertising Charges for Its "Brain Training" Program
Company Claimed Program Would Sharpen Performance in Everyday Life and Protect Against Cognitive Decline
- **Effects are task-specific: what you train is what you gain**
- Not a new approach: Abikoff, 1979 -> no generalisation
- New elements:
 - * adaptive training
 - * better training materials



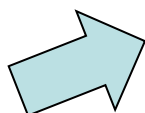
What is learning?



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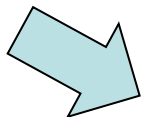


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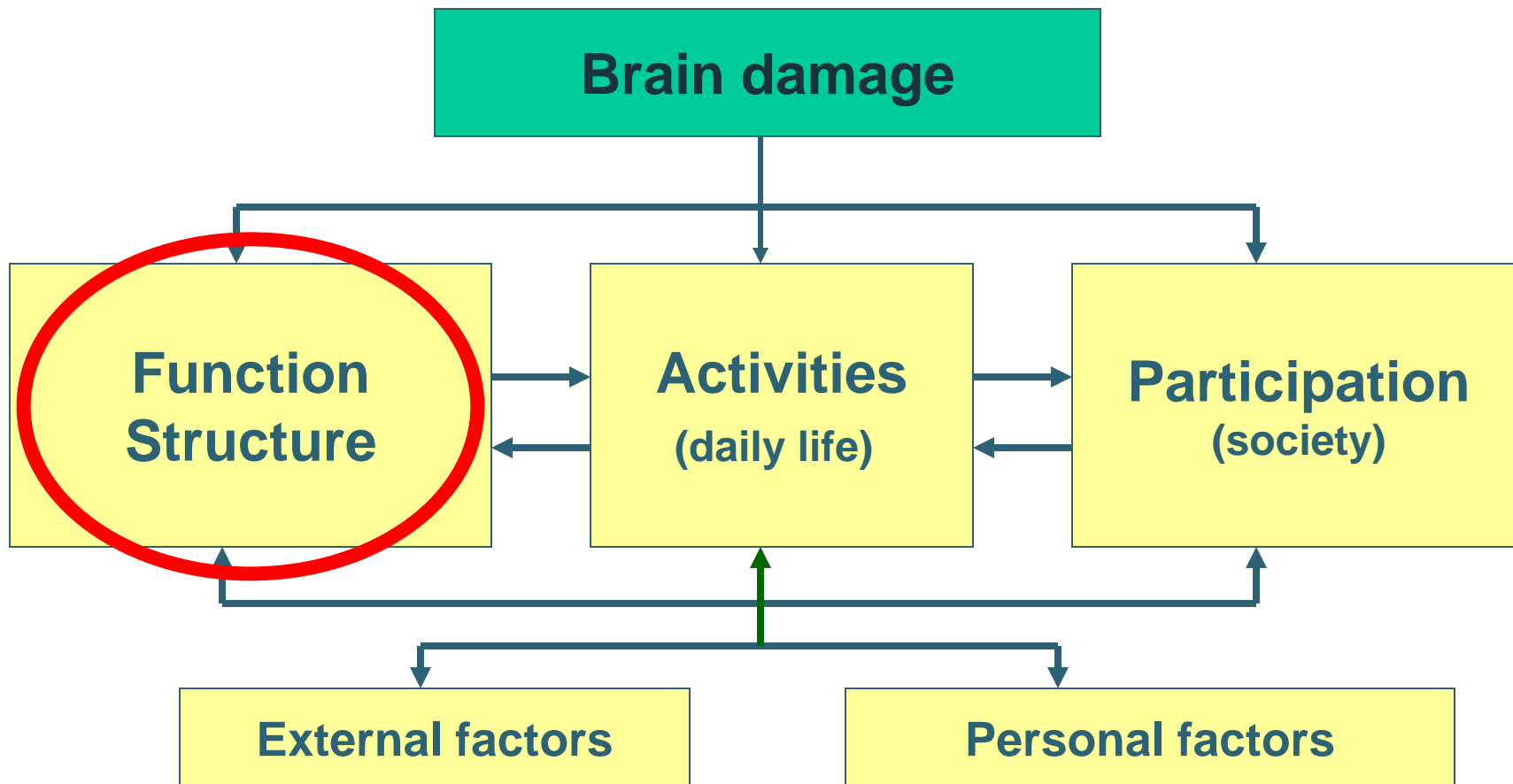
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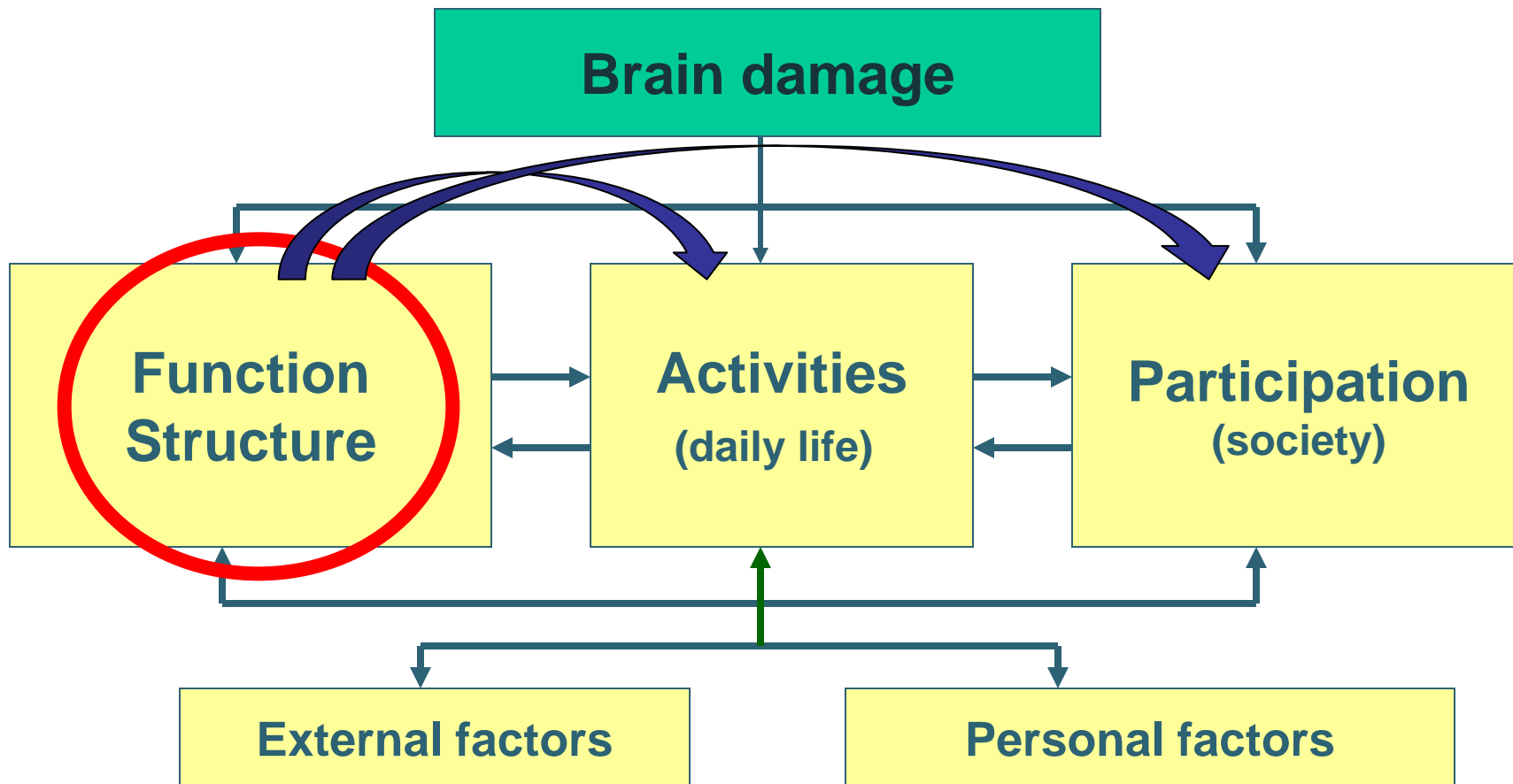


AMP	HAAN	DRACK	SLANG
猴	鸡	龙	蛇
HOND	ZWIJN	PAARD	SCHAAP
狗	猪	马	羊
RAT	OS	TIGER	HAAS
鼠	牛	虎	兔

Cognitive rehabilitation: does it work?



Cognitive rehabilitation: does it help?



Effectiveness of pharmacotherapy?

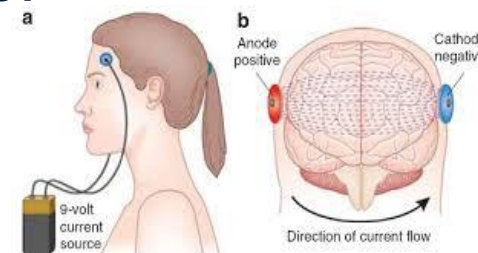
- Not much evidence available
- Dougall et al, 2015 (Cochrane review) chronic phase TBI:
 - * modafinil
 - * (–)-OSU6162, a monoamine stabiliser
 - * atomoxetine
 - * **rivastigmine**
- **Methylphenidate:**
 - * positive effect on sustained attention after TBI (Huang et al, 2016)
 - * poor evidence for effect on speed after TBI (Sivan, 2010, Willmott & Ponsford, 2009)

Effectiveness of non-invasive brain stimulation?

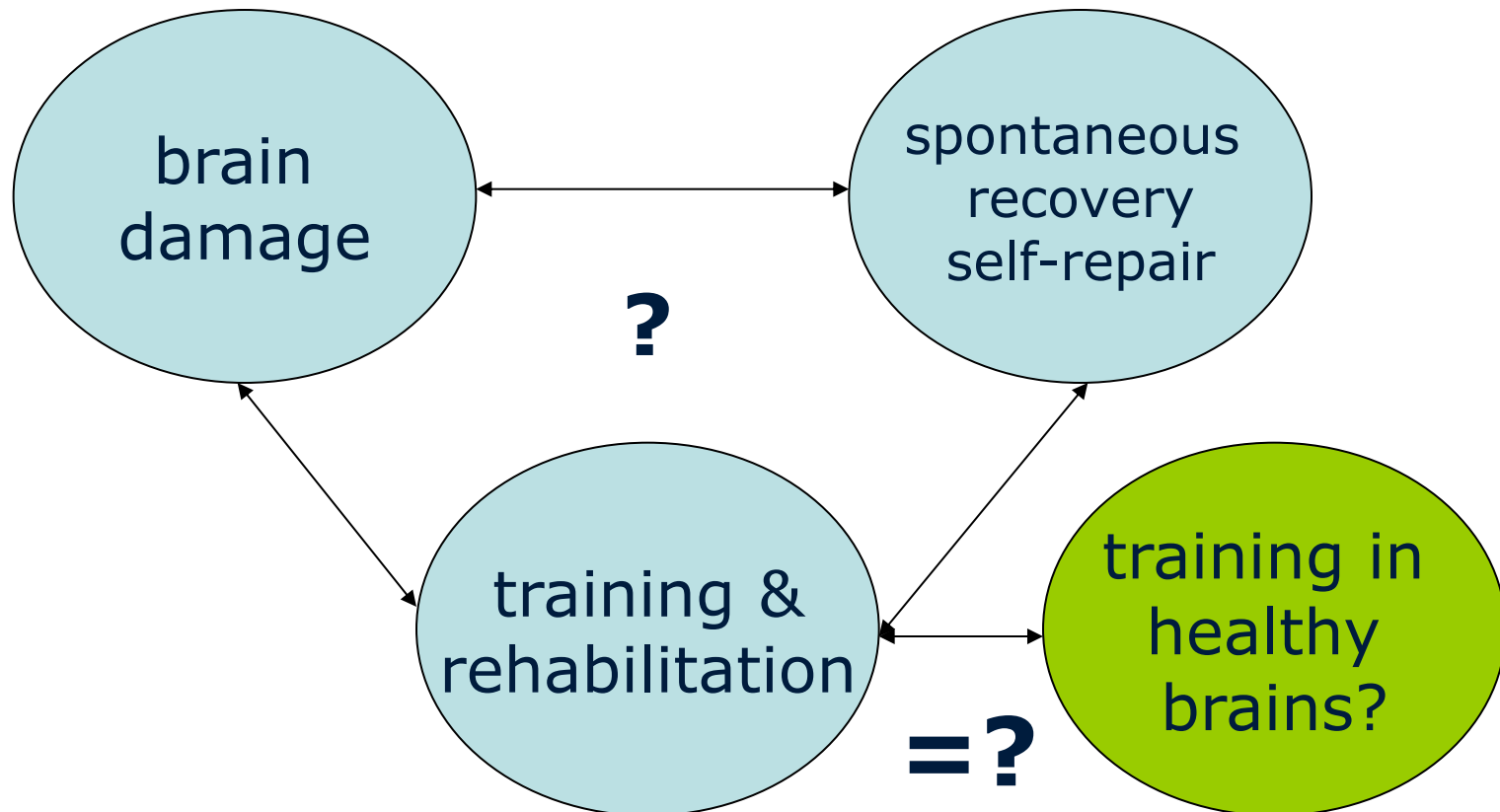
- **Application for specific deficits**
- TMS, rTMS, TBS, tDCS for neglect (Fasotii & van Kessel, 2014):
 - * Reactivation of the hypoactive cortical region (right hemisphere)
 - * Reduction of the hyperactive contralateral cortical region (left hemisphere)
- TBS also long term effects and functional improvements
- rTMS effective for neglect (TBI; Dhaliwal et al, 2015)
- Anodal tDCS increases attention after TBI (Kang et al, 2012)
- DBS increases arousal after severe injury (Shin et al, 2014)

Effectiveness of non-invasive brain stimulation?

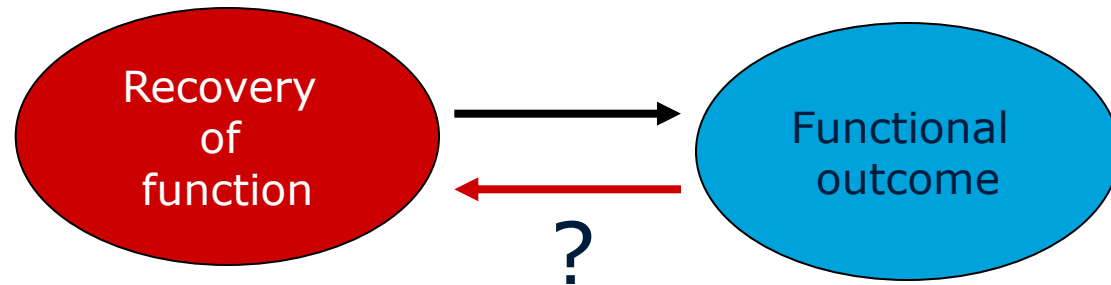
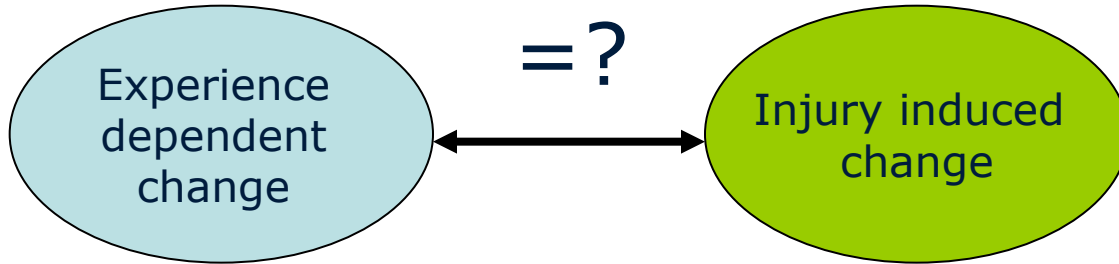
- **Application to increase the functionality of the whole brain** in order to create better circumstances for a learning environment: increase excitability and connectivity
- NIBS as adjuvant therapy to stimulate behavioural change through training (Wessel et al, 2015)
- Non-invasive modulation of brain oscillations:
 - * Combination of EEG and ACS



Neuroplasticity and training

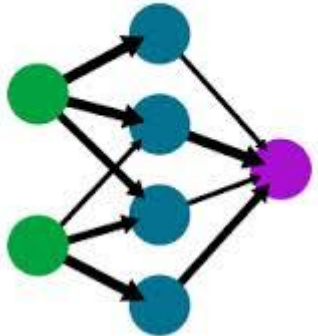


MHENS School for Mental Health and Neuroscience



A simple neural network

input layer hidden layer output layer



From a neural network perspective:
Learning to speak = relearning to speak?
Learning to walk = relearning to walk?

Wiring = rewiring?

Cells that fire together wire together

Factors influencing recovery

- Mechanisms underlying plasticity and recovery (e.g. timing)
- Demographic factors (e.g. age)
- Injury-related factors (e.g. severity of injury)
- Factors related to treatment (e.g. intensity)
- **Psychological factors (e.g. motivation, mood, coping styles)**



Cognitive rehabilitation after cardiac arrest: what do we know?

- Cognitive problems are not uncommon after cardiac arrest
- Patients do not necessarily complain about cognitive problems
- Screen for cognitive problems, both subjective and objective

- Integrate cardiac and cognitive rehabilitation if necessary
- For now, current clinical practice should be maintained:
 - * information and education
 - * compensatory cognitive training
 - * emotional support
 - * family support

Cognitive rehabilitation after cardiac arrest: what do we need?

- Rehabilitation = learning:
 - * train what needs to be learned (task-specific but functional)
 - * train what the person wants to learn (motivation, awareness)
 - * optimize the brain learning environment (NIBS)
 - * optimize the behavioural learning environment (psychological factors)
 - * personalize (family) care
- Help to stimulate evidence-based (cognitive) rehabilitation:
 - * describe treatments as complete as possible
 - * conduct high quality research studies into the effectiveness



**Thanks for
your attention!**