Kognitiv-motorische Interferenz im Sturzgeschehen: Hintergründe – Assessment – Training

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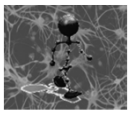
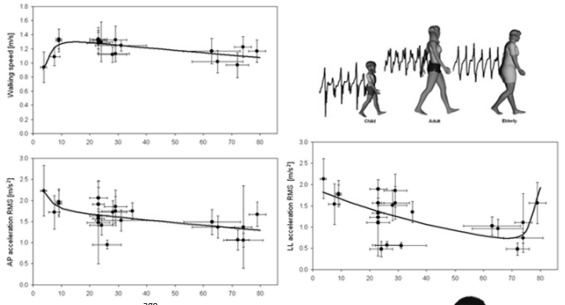


Veränderungen im Gang



Iosa et al., 2014

Zusammenhang von Gang & Kognition

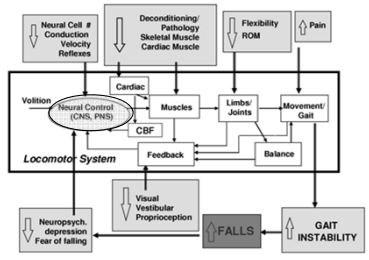
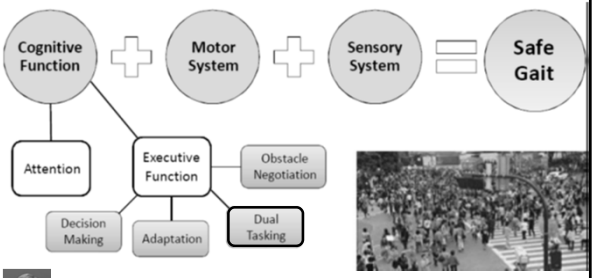


Table 1 Risk factors for falls		
Risk factor	Relative risk	Range
Muscle weakness	4.4	1.5–10.3
History of falls	3.0	1.7–7.0
Gait deficits	2.9	1.3–5.2
Balance deficits	2.9	1.6–5.4
Use of assist device	2.6	1.2–4.6
Visual deficits	2.5	1.6–3.5
Arthritis	2.4	1.9–2.9
Impaired activities of daily living (ADL)	2.3	1.5–3.1
Depression	2.2	1.7–2.5
Cognitive impairment	1.8	1.0–2.3
Age > 80 years	1.7	1.1–2.5

Hausdorff et al, *J Appl Physiol* 2001

Montero-Odasso et al, *J Am Geriatr Soc* 2012

Formel für die Sicherheit im Alltag



Hausdorff , 2015

Definition

Cognitive-motor interference (CMI) occurs when simultaneous (dual-task) performance of a cognitive and a motor task results in deterioration of performance in one or both tasks, relative to performance of each task separately (single-task performance).

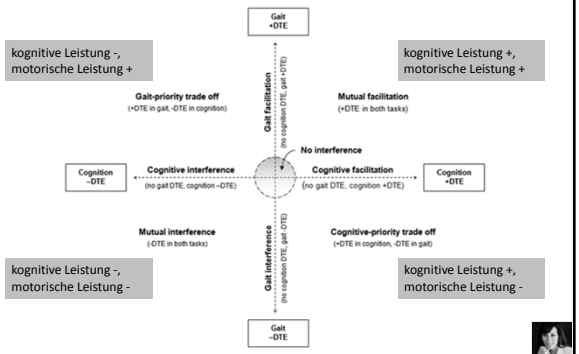
Abernathy, 1988

$$DTE(\%) = \frac{(\text{dual task gait speed} - \text{single task gait speed})}{\text{single task gait speed}} \times 100\%$$

Beispiele für die Kombination von motorischen & kognitiven Aufgaben

Primäre motorische Aufgabe	Sekundäre motorische Aufgabe	Sekundäre kognitive Aufgabe
Rückwärts eine Acht durchlaufen		
Gehen über unterschiedliche Untergründe	2 Einkaufstüten tragen	Wortlisten erinnern
Gehen über Hindernisse	Tablett mit und ohne Tassen tragen	Addieren/Subtrahieren
Gehen gegen Wiederstände	Wäschekorb tragen	Wörter einer Kategorie benennen
Treppen steigen	Ballon hochhalten	Wiederholen einer Zahlensequenz
Gehen mit gleichzeitiger Kopfdrehung	Fingersequenz	Uhrenaufgabe
Buchstaben mit dem Fuß in die Luft malen	Eine Hand kreist über dem Bauch, die andere über dem Kopf	Benennen von Gegensätzen
Tandemstand, Störung durch eine 2. Person		Buchstabensalat lösen
Gehen neben oder hinter einer Person		
Balancieren		

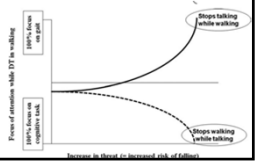
Muster verschiedener CMI-Effekte



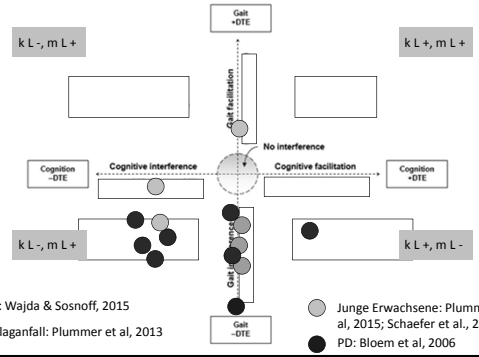
Plummer & Eskes (2015), Frontiers Hum Neurosci

Strategien der Priorisierung

- ⇨ Gehen: **CMI-Effekte** (1) Veränderung des Gangmuster (u.a. Gehgeschwindigkeit oder –variabilität) oder (2) Abnahmen der kognitiven Leistungsfähigkeit
- ⇨ 2 aufmerksamkeitsrelevante Aufgaben, **Priorisierung einer Aufgabe** basierend auf motorischen und/ oder kognitiven Reserven (Yogev-Seligmann et al., 2012)



Muster verschiedener CMI-Effekte



- MS: Wajda & Sosnoff, 2015
- Schlaganfall: Plummer et al, 2013
- Junge Erwachsene: Plummer et al, 2015; Schaefer et al., 2010
- PD: Bloem et al, 2006

ELSEVIER

Physiotherapy

Physiotherapy xxx (2015) xxx–xxx

Systematic review

Dual-task testing to predict falls in community-dwelling older adults: a systematic review

S.W. Muir-Hunter[a,*], J.E. Wittwer[b]

(1) Specific recommendations cannot be made on the type of secondary task to use with gait testing (e.g. cognitive or motor).
(2) There is no information available about how to grade dual-task test difficulty or whether tests that increase the attentional load incrementally can identify the threshold of difficulty that affects performance on the primary task.
(3) If the secondary task is cognitive, specific recommendations cannot be made about the category of cognitive task to perform, as per Al-Yahya *et al.* [16], or the difficulty of the numeracy mental tracking task. There is no indication that all cognitive tasks provide the same association with future fall risk.
(4) The form of the dual-task test result to use to quantify future risk (e.g. absolute values, relative values, thresholds) cannot be determined.
(5) The threshold or magnitude of change in the dual-task gait test that would identify fall risk cannot be recommended.
(6) Measures of maximal postural sway in quiet standing with eyes open or closed under dual-task conditions are not associated with future fall risk. !

Conclusion and implications of key findings Changes in gait under dual-task testing are associated with future fall risk, and this association is stronger than that for single-task conditions. Limitations in the available literature preclude development of detailed recommendations for dual-task gait testing procedures in clinical practice to identify and stratify fall risk in older adults.

Doppelaufgabentaxonomie

Type of tasks	Tasks	Task novelty	Task complexity: Low	Task complexity: High
Single motor		Low		
		High		
Single cognitive		Low		
		High		
double Motor-motor	Motor task A	Low		
		High		
	Motor task B	Low		
		High		
double Cognitive-motor	Motor task A	Low		
		High		
	Cognitive task	Low		
		High		

McIsaac, *BioMed Research International,* 2015

Doppelaufgaben taxonomie

Type of task(s)	Task novelty	Task complexity: Low	Task complexity: High
Single motor	Low	Drinking a cup of water	Walking with a cup of water* (i.e., transporting)
	High	Propelling a wheelchair	Walking with forearm crutches
Single cognitive	Low	Reciting the alphabet*	Calculating subtractions*
	High	Reciting alternating letters of the alphabet*	Paced auditory serial addition task (PASAT)
Dual motor-motor	Low	Drinking a cup of water while writing a note with the other hand	Walking while texting on a cell phone*
	High	Tapping the foot as fast as possible while drawing a 6-pointed star	Unicycling on a college campus while juggling*
Dual cognitive-motor (1)	Low	Standing on one foot while saying the alphabet	Walking over obstacles while naming the people in your family
	High	Standing on one foot while performing word generation task	Walking over obstacles while subtracting by 7's
Dual cognitive-motor (2)	Low	Pointing to a target as fast as possible* while counting to100	Transferring coins between pockets* while subtracting by 3's
	High	Using a sock aid while naming all the clothing you might find in a closet	Juggling while subtracting by 7's

(1) Novelty of cognitive task changes while complexity of motor task changes.
(2) Novelty of motor task changes while complexity of cognitive task changes.

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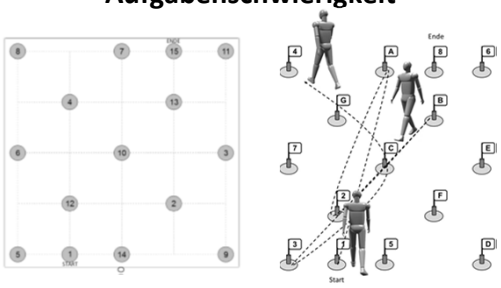
Trail-Walking-Test: Überprüfung der Interferenzen bei unterschiedlicher Aufgabenschwierigkeit



Trail Walking Test (TWT-D), Schott, *Z Gerontol Geriat,* 2015

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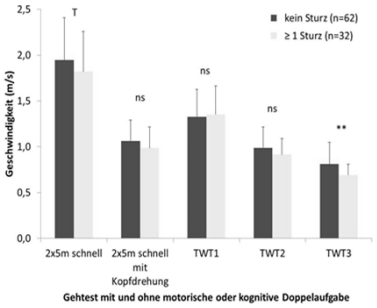
Gehgeschwindigkeit & Stürze



Schott, *Z Gerontol Geriat,* 2015

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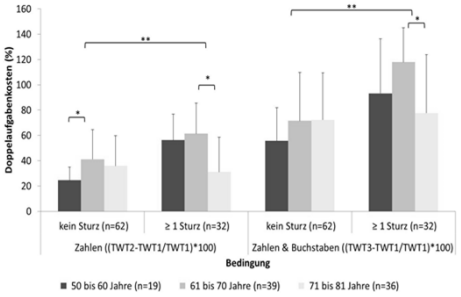
mDTC & Stürze



Schott, *Z Gerontol Geriat,* 2015

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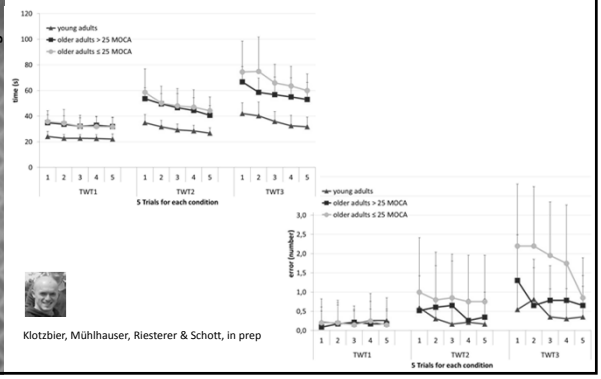
Kognitive Einschränkungen (MCI)



Klotzbier, Mühlhauser, Riesterer & Schott, in prep

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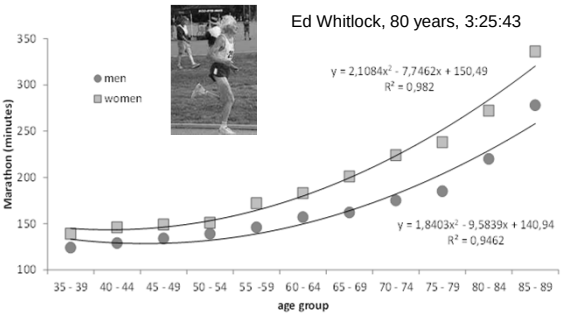
Beeindruckende Leistungsstabilität



Schott & Schlicht (2013)

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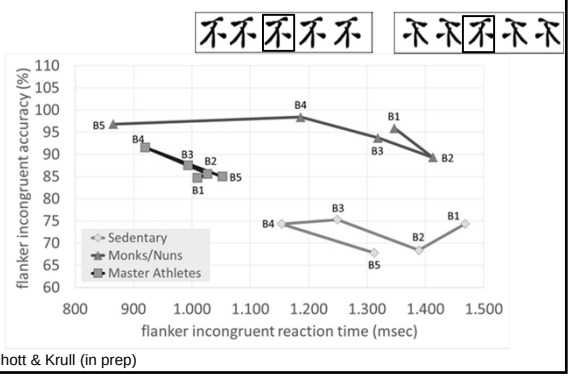
Exekutive Funktionen – Was ist möglich?



Schott & Krull (in prep)

A systematic review of interventions conducted in clinical or community settings to improve dual-task postural control in older adults

2014

This article was published in the following Dove Press journal:
Clinical Interventions in Aging
25 March 2014
Number of times this article has been viewed

Maayan Agmon[1]
Basia Belza[2]
Huong Q Nguyen[2,3]
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Valerie E Kelly[4]
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Background: Injury due to falls is a major problem among older adults. Decrements in dual-task postural control performance (simultaneously performing two tasks, at least one of which requires postural control) have been associated with an increased risk of falling. Evidence-based interventions that can be used in clinical or community settings to improve dual-task postural control may help to reduce this risk.
Purpose: The aims of this systematic review are: 1) to identify clinical or community-based interventions that improved dual-task postural control among older adults; and 2) to identify the key elements of those interventions.

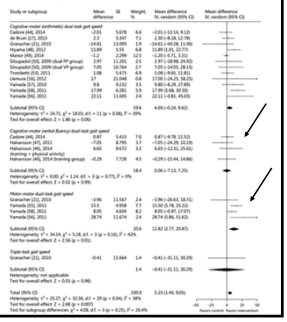
Dual-task training appears to be necessary **to improve dual-task performance**. While variability amongst studies makes it difficult to identify optimal parameters of interventions, it appears that effective interventions can be conducted in either **group or one-on-one settings**, with a variety of task combinations incorporated into the intervention. The shortest training schedule of **20 minutes twice a week for 24 weeks** as well as only five sessions of 1 hour each demonstrated improvement in some aspects of dual-task performance.

Effects of Physical Exercise Interventions on Gait-Related Dual-Task Interference in Older Adults: A Systematic Review and Meta-Analysis

Gerontology, 2015

Prudence Plummer[a, b] Lisa A. Zukowski[a] Carol Giuliani[a, b] Amber M. Hall[c, d]
David Zurakowski[c, d]

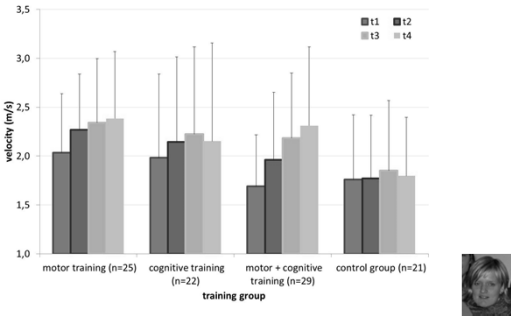
meta-analysis of DTC on gait speed (%)



pared to active or inactive controls. In summary, physical exercise interventions can improve dual-task walking in older adults primarily by increasing the speed at which individuals walk in dual-task conditions. Currently, evidence concerning whether physical exercise interventions reduce DTC or alter the self-selected dual-task strategy during unobstructed walking is greatly lacking, mainly due to the failure of studies to measure and report reciprocal dual-task effects on the non-gait task.

Inkonsistente Befunde =>
Heterogenität der Interventionsprogramme

Effektivität verschiedener Trainingsformen auf die Gehgeschwindigkeit



Kurz & Schott, in prep

Danke für Ihre Aufmerksamkeit!

Kognitiv-motorische Interferenz im Sturzgeschehen: Hintergründe – Assessment – Training

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