Inhibitory Control and Cognitive Flexibility in Children with Specific Language Impairment: A Meta-analysis

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Introduction

Executive Functions (EF)

- Higher order cognitive processes
- Required for planning and executing goal-driven behaviour (Barkley, 1997; Diamond, 2013; Miyake et al., 2000)

Inhibitory Control (IC)

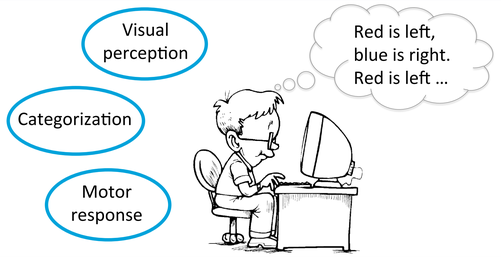
- Control of attention
- Suppressing reflexes or ignoring distracting information (Diamond, 2013; Nigg, 2000; Friedman & Miyake, 2004)

Cognitive Flexibility (CF)

- Switching between task demands or problem solving strategies (Miyake et al., 2000; Wylie & Allport, 2000)
- Generating multiple exemplars or alternative solutions (Diamond, 2013)

Task Impurity Problem

- Multiple cognitive processes are recruited for EF tasks
- Difficult to assess isolated EFs (Friedman & Miyake, 2004; Huizinga et al., 2006; Miyake et al., 2000)



Verbal mediation

Language may support EF by:

- regulating behaviour or
- supporting maintenance of information in memory (Fatzer & Roebers, 2012; Miyake et al., 2004)

Study Questions

- How do children with SLI compare to typical peers on measures of executive function?
- Does group difference change when looking at inhibitory control or cognitive flexibility tasks?
- Is group difference affected by task factors such as verbal loading or task complexity?

Search Strategy

Systematic Review

Databases searched:
PsycINFO, Web of Knowledge, LLBA, Proquest Dissertations and Theses

Search terms:

[(specific language impairment) or (primary language impairment) or (language disorder) or (language disability)]
AND
[(cognitive flexibility) or (task switching) or (set shifting) or (attention switching) or (inhibitory control) or (inhibition) or (interference control) or (response inhibition) or (attentional control) or (executive function) or (cognitive process)]

Search Results

Initial search 1424 studies
↳ After abstract review 33 studies

Exclusions:	
Insufficient data	5 studies
Not behavioural measures	3 studies
Tasks did not meet criteria	4 studies
Participants overlap	2 studies
Ceiling performance	1 study

↳ Total included in analysis 18 studies

Inclusion Criteria

- Participants aged 4-13 years
- SLI: Language impairment despite typical nonverbal IQ
- Age-matched control group or available norms
- Behavioural measures of IC or CF
- **IC tasks:** inhibit entrained response or respond to select stimuli while ignoring distractors
- **CF tasks:** switch between tasks, or produce series of unique items
- Report adequate data for computing effect size

Analysis

Included Studies

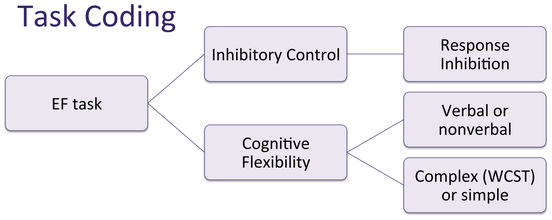
Total Studies	17
Studies with IC measures	12
Studies with CF measures	11
Samples with IC data only	7
Samples with CF data only	6
Samples with both IC & CF data	5
Participants: SLI/TD	382/386
Participant mean ages	4;8 – 12;3

Data Coding

1) n SLI, n controls*
2) Mean age of participant groups
3) Type of EF task
4) M & SD of EF task

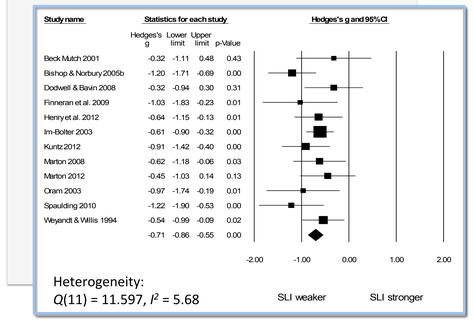
* Where age-matched control groups were unavailable (2 studies), the SLI group was comparing to age-appropriate norms for the WCST (Paniak, Miller, Murphy, Patterson, & Keizer, 1996)

Task Coding

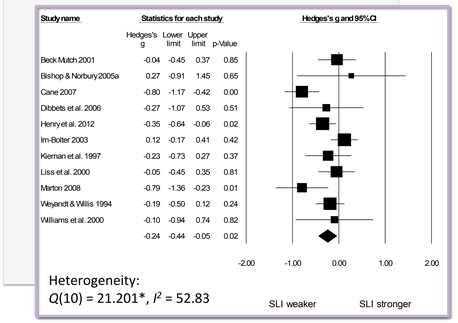


Results

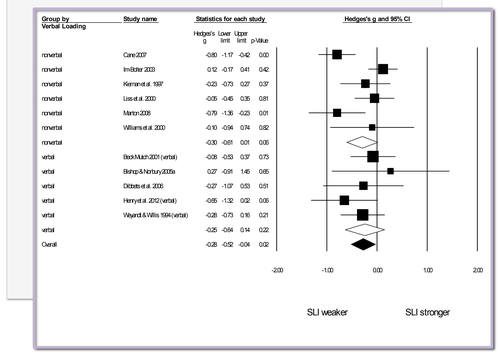
Inhibitory Control Tasks



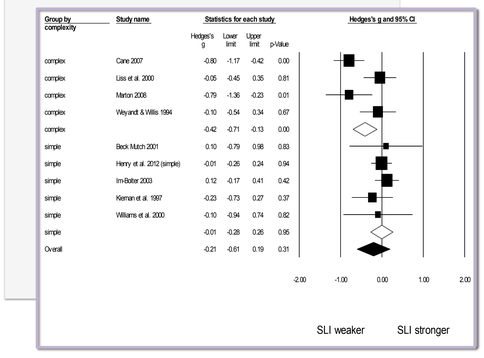
Cognitive Flexibility Tasks



Cognitive Flexibility Tasks
Grouped by verbal demands



Cognitive Flexibility Tasks
Grouped by task type



* significant at $p<.05$

Conclusions

Inhibitory Control

- Children with SLI show poor inhibitory control relative to peers
- Perhaps poor verbal retention in children with SLI limits ability to keep goal of task in current focus of attention, increasing vulnerability to distractors

Cognitive Flexibility

- No difference between groups on classic measures of task switching
- Verbal demands of task do not appear to affect magnitude of difference between groups
- Variation in results for WCST suggests that it may not be a reliable measure of CF

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