Executive Function and ASD: Measurement, Context, and Implications for Daily Life

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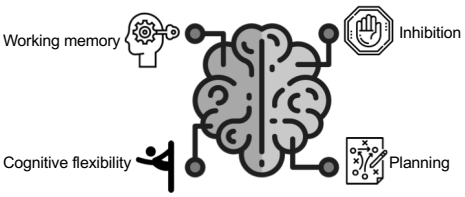
What is Executive Function (EF)?

› Higher-level cognitive control processes involved in the conscious control of thought and action



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What do we know about EF in those with ASD?

› Damasio and Maurer (1978) first linked executive dysfunction and autism

› Originally, strongest evidence for planning and cognitive flexibility impairment with relative sparing of inhibition and working memory

› More evidence → less consensus

› No clear 'EF/EDF' profile characterizing those with ASD

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Why is reaching consensus so challenging?

› Who are you testing?
  › Individual variability and chosen comparison group

› When (in development)?
  › Role of unfolding development and particular age assessed

› What task (and what is purported EF domain)?
  › EF conceptualization and task complexity

› How is EF assessed?
  › Experimenter- vs computer-administered

› 'Where' is EF assessed (in the context of the lab or real world)?
  › Traditional tasks vs ecologically valid approach (tasks and questionnaires)

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EF in young children with ASD

› Aimed to capture multidimensional nature of EF in young children with ASD
  › Computerized tasks and parent report


Assessment of executive function in young children with and without ASD using parent ratings and computerized tasks of executive function

› Hypotheses:
  1. No significant differences on measures of specific EF components (WM, inhibition, flexibility)
  2. Significant differences on multidimensional task (planning) and on parent report

› First to compare young children with computerized tasks

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EF in young children with ASD: Methods

	ASD (*n* = 24)	TD (*n* = 19)	*p*
Age (months)	66.9	58.5	.07
IQ	98.9	106.2	.12
% Male	83	58	.07

› Measures

› Executive Function Content Scale (*BASC-2*)

(Gardiner et al., 2017, *Clinical Neuropsychologist*)

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EF in young children with ASD: Results

	ASD (*n* = 24)	TD (*n* = 19)	*p*	Cohen's *d*
Spatial WM	2.96 (1.6)	2.88 (1.5)	.87	.05
WM Composite	.26 (1.8)	-.32 (1.7)	.28	.33
Inhibition Composite	.31 (3.0)	-.38 (2.0)	.39	.27
Flexibility	21.59 (7.1)	23.26 (6.1)	.42	.25
Planning (avg moves/trial)	4.25 (2.8)	5.13 (1.3)	.20	.40
Planning (level achieved)	5.58 (4.1)	8.48 (4.7)	.04	.67
EFCS (*parent-report*)	61.04 (8.5)	51.32 (12.0)	<.001	.96

(Gardiner et al., 2017, *Clinical Neuropsychologist*)

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EF in young children with ASD: Implications

- Underscores importance of context of EF assessment
  - Single EF components intact
  - Measures assessing more 'complex' EF impaired
- Performance-based tasks and informant report tools assess distinct underlying mental constructs
- What can relative success on performance-based tasks tell us about opportunities for intervention?

(Gardiner et al., 2017, *Clinical Neuropsychologist*)

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Everyday EF, Adaptive and Internalizing Behaviour

- Examined relations between everyday EF and adaptive behaviour, mental health
- Adaptive Functioning
  - Independent execution of developmentally-appropriate skills (communication, socialization, daily living)
  - Closely associated with long-term outcomes
- Mental Health
  - Prevalent concern for population

RESEARCH ARTICLE

Everyday Executive Function Predicts Adaptive and Internalizing Behavior among Children with and without Autism Spectrum Disorder

Emily Gardiner © and Grace Iarocci

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Everyday EF: Methods

	TD (*n* = 67)	ASD (*n* = 59)	*p*
Age (years)	9.5	10.1	.07
IQ	111.4	107.5	.10
Mental Age	10.6	10.8	.69
% Male	49	86	<.001

- Measures
  - BRIEF
    - Behavioural Regulation Index: Inhibit, Shift, Emotional Control
    - Metacognition Index: Initiate, WM, Plan/Organize, Organization of Materials, Monitor
  - BASC-2
    - Adaptive Functioning: Social Skills, ADL, Functional Communication
    - Mental Health: Anxiety, Depression

(Gardiner & Iarocci, 2018, *Autism Research*)

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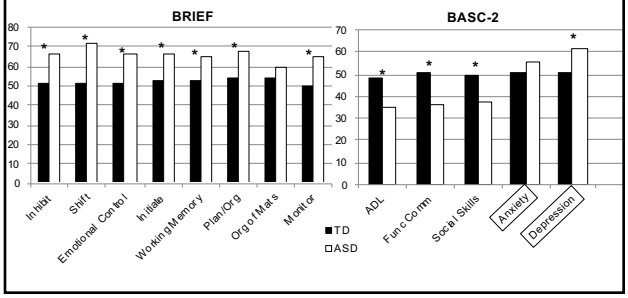
Everyday EF: Results



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Everyday EF: Results for Children with ASD

ADL

Predictor	β	*t*	*p*
Age	.33	3.31	.01
FSIQ	-.11	-1.23	.22
BRI*	-.32	-2.81	.01
MCI*	-.54	-5.09	<.001

Communication

Predictor	β	*t*	*p*
Age	.02	.18	.86
FSIQ	.27	2.60	.01
BRI	-.15	-1.14	.26
MCI	-.49	-4.04	<.001

Social Skills

Predictor	β	*t*	*p*
Age	.18	1.35	.18
FSIQ	-.12	-.96	.34
BRI	.04	.26	.80
MCI	-.44	-3.08	<.001

*Shift scale emerged as significant.
*Organization of Materials scale emerged as significant.

Anxiety

Predictor	β	*t*	*p*
Age	.36	2.73	.01
FSIQ	.01	.09	.93
BRI	.22	1.48	.14
MCI	.08	.59	.56

Depression

Predictor	β	*t*	*p*
Age	.07	.60	.55
FSIQ	.15	1.37	.18
BRI*	.53	3.90	<.001
MCI	.09	.70	.48

*Shift and Emotional control scales emerged as significant.

(Gardiner & Iarocci, 2018, *Autism Research*)

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Everyday EF: Implications

- Interventions that target EF may exert cascading effects across development and functioning
- For children with ASD, generalized 'self-management' approaches may be appropriate
  - Focus on goal setting, organization, and problem solving
- EF intervention research for those with ASD is limited, but some show promise for relevant domains
  - Unstuck and On Target (Kenworthy et al., 2014)
  - Social Competence Intervention for Adolescents (Stichter et al., 2016)
  - Makota arena training intervention (Hilton et al., 2014)

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Final Thoughts

- Conceptualization of 'functioning'
  - Domain-specific vs developmental approach
- EF research provides insight into critical opportunities for building on strengths
  - Early years
  - Computer-based tasks
- Further consideration of what 'traditional EF' (as assessed with performance-based tasks) tells us about functioning in everyday life for those with ASD

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