

# Executive Functioning of Children with ASD: An Analysis of the BRIEF-Questionnaire

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### Background

Executive Functioning (EF) is an umbrella term for cognitive processes which are necessary for starting, stopping and changing behavior. They are needed to show adequate and goal-directed behavior. Children with Autism Spectrum Disorders (ASD) often have EF-problems (Hill, 2004). The possible differences in EF between ASD subgroups have amply been studied (Verté et al., 2006).

To evaluate EF, both neuropsychological tests and rating measures can be applied. The latter assess how a child performs in complex unstructured everyday problem-solving situations. They are considered to have greater ecological validity than performance-based neuropsychological tests. Next to that, they are often administered in considerable less time.

The BRIEF questionnaire (Behavior Rating Inventory of Executive Functions; Gioia et al., 2000) is such a rating measure. It screens for EF problems in 5- to 18-year-olds and focuses on potential problems in the areas of inhibition, shifting, emotional control, initiation, working memory, planning and organizing, organization of materials, and monitoring.

### Objectives

The main question is whether there is a specific BRIEF score profile found in children with ASD. The consequential question is whether different ASD subtypes (Autistic disorder, Asperger's disorder and PDD-NOS) show different profiles. The final question regards on how IQ and BRIEF scores relate to one another in ASD.

### Methods

The sample consisted of 127 Dutch children between 5 and 18 years old (98 boys, 29 girls) (see Table 1). All were diagnosed with a specific ASD ( $n = 35$  AD,  $n = 27$  AS &  $n = 65$  PDD-NOS). Parents filled in a BRIEF questionnaire (Dutch version). The BRIEF consists of 75 behavior descriptions. The eight clinical scales (T-scores) and the validity scales (negativity and inconsistency) were analyzed. All children received an IQ test, the WISC-III (see Table 2); PIQ and VIQ scores were analyzed.

There was no control group for this study; the norm group from the original Dutch BRIEF manual was used as a reference group. It concerns Dutch children in the age of five to eighteen, from primary and secondary school, without a psychiatric or learning disorder/problem ( $n = 847$ ).

Table 1 Descriptives of the participants

Age (in years)	n (m/f) <sup>a</sup>	Mean age (SD)	Diagnosis		
			AD	AS	PDD-NOS
5 - 8	37 (29/8)	7.34 (0.97)	12	7	18
9 - 11	42 (34/8)	10.43 (0.90)	10	9	23
12 -14	26 (19/7)	13.77 (0.85)	7	5	14
15 - 18	22 (16/6)	16.27 (0.83)	6	6	10
Total	127 (98/29)	11.23 (3.35)	35	27	65

<sup>a</sup>m male, f female.

Table 2 VIQ and PIQ descriptives of the three ASD subgroups

Diagnosis	M (SD)	
	VIQ	PIQ
AD	83.14 (15.92)	83.60 (16.77)
AS	113.19 (17.38)	105.56 (12.63)
PDD-NOS	89.28 (16.35)	91.98 (19.26)
Total	92.67 (19.69)	92.56 (18.87)

Note. Results of one-way ANOVA show that the three ASD subgroups differ on VIQ ( $F(2, 124) = 28.23; p < .001$ ) as well as on PIQ ( $F(2, 124) = 12.24; p < .001$ ). Bonferroni post-hoc analyses show that children with AS have, as can be expected, a higher VIQ and PIQ than the other two groups.

Table 3 Overview of the Negativity scale items of the BRIEF (Gioia et al., 2000)

Item	Behavior description	Rigidity
8	Tries same approach to a problem over and over even when it does not work	✓
13	Is disturbed by change of teacher or class	✓
23	Resists change of routine, food, places, etc.	✓
30	Has trouble getting used to new situations (classes, groups, friends)	✓
62	Angry or tearful outbursts are intense, but end suddenly	✓
71	Lies around the house a lot	✓
73	Has trouble moving from one activity to another	✓
74	Cannot stay on the same topic when talking	✓
75	Says the same thing over and over	✓

Table 4 Mean T-scores of BRIEF scales for ASD group compared to the mean of the BRIEF norm group (T = 50)

Scale	n	M (SD)				
		Total / AD / AS / PDD-NOS	ASD	AD	AS	PDD-NOS
Inhibit	127 / 35 / 27 / 65	63.60 (12.81)***	65.43 (13.27)***	62.22 (11.77)***	63.18 (13.05)***	
Shift	126 / 35 / 27 / 64	67.94 (12.04)***	67.63 (11.68)***	68.19 (10.99)***	68.02 (12.81)***	
Emotional Control	127 / 35 / 27 / 65	63.26 (13.30)***	62.11 (13.11)***	64.04 (12.87)***	63.55 (13.73)***	
Initiate	126 / 34 / 27 / 65	62.31 (10.61)***	63.00 (9.47)***	63.07 (12.21)***	61.63 (10.59)***	
Working Memory	126 / 35 / 27 / 64	59.76 (11.39)***	60.86 (9.94)***	57.59 (11.66)**	60.08 (12.06)***	
Plan/Organize	116 / 31 / 26 / 59	57.44 (11.66)***	58.84 (10.54)***	56.08 (11.80)*	57.31 (12.27)***	
Organization of Materials	127 / 35 / 27 / 65	50.16 (12.09)	50.26 (11.30)	52.41 (11.61)	49.17 (12.73)	
Monitor	124 / 33 / 27 / 64	59.49 (9.18)***	60.30 (8.51)***	59.15 (9.24)***	59.22 (9.59)***	

\*\*\* $p < .001$ ; \*\* $p < .01$ ; \* $p < .05$ .

### Results

The Negativity scale deviated in 65% of the participants. As stated by the manual, this does not necessarily implicate that these data are invalid, since a high score on this scale can also indicate serious EF problems or rigidity problems. After checking the content of the items, it turned out that six out of nine items of this scale focus on rigid behavior (see Table 3). This scale correlates highly with the Shift scale ( $r = .75, p < .001$ ).

The total ASD group ( $N = 127$ ) has significantly higher scores - indicative of more EF problems - than the BRIEF norm group on all clinical scales (mean T-score  $\geq 50, p < .001$ ), except for Organization of Materials (See Table 4: column ASD). The shift scale even shows a significant clinical elevation (mean T-score  $\geq 65, p = .007$ ).

Each ASD subgroup has the same score profile as mentioned above (mean T-score  $\geq 50, p = .05-.001$ ; see Table 4: columns AD/AS/PDD-NOS). ANCOVA demonstrates that they do not differ significantly. Next to that, decision tree analysis and hierarchical cluster analysis show that none of the BRIEF variables serve as a predictor for any of the ASD subgroups.

In the total group, PIQ has significant negative correlations with the BRIEF scales Inhibit, Shift, Working Memory, Plan/Organize and Monitor. However, in the case of clinically elevated EF-problems (T-score  $\geq 65$ ), PIQ only correlates with the scale Inhibit. Also, the greater the distance between PIQ and VIQ (fav. PIQ), the less EF problems occur on the scales Initiate, Working Memory, Plan/Organize, Organization of Materials, and Monitor.

### Conclusions

In children with ASD, the Negativity scale should not be considered a validity index - indicative of a negative answer tendency of parents - but much more as a significant characteristic of their BRIEF profile, namely as an indicator for rigidity problems.

Consistent with other studies, children with ASD have elevated scores on all BRIEF clinical scales, except for Organization of Materials. The scores are however not clinically elevated; they should be considered as more general trends considering potential EF problems. One BRIEF scale is clinically elevated, namely Shift (a.k.a. cognitive flexibility). This indicates a clinically significant EF weakness in ASD.

No differentiation could be made between the three ASD subgroups, which is in agreement with the DSM-5 proposed revisions: dictating a single diagnostic category (ASD) with the inclusion of individual clinical specifiers (e.g., severity and verbal abilities) and associated features (e.g., intellectual disability). EF problems could be seen as such an associated feature, for which the severity should be specified individually.

The relation between IQ and EF is complicated in children with ASD. There are some significant correlations, but this depends on the type of intelligence considered, the possible discrepancy between verbal and performance intelligence, the EF ability measured and whether the EF score is clinically elevated or not. More research is needed.

### References

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INTER-PSY 

