

Supplementary material

To accompany:

Rioux, C., Murray, J., Castellanos-Ryan, N., Séguin, J. R., Tremblay, R. E. & Parent, S. Moderation of parenting by inhibitory control in the prediction of the common and unique variance of hyperactivity-impulsivity and inattention. *Development and Psychopathology*.

1. RATINGS FOR OBSERVATIONS SCALES

All six scales were measured in the reading, dot-to-dot drawing and Mystero tasks. Quality of guidance and acceptance of the child were measured in the joint story-telling task. All 20 scales were averaged to create the positive parenting score. Because scales did not all have the same range of scores, they were standardized before averaging them.

Quality of guidance

This scale evaluates the quality of the mother's guidance, i.e., her capacity to leave room for the child's autonomy, while guiding him adequately. The mother must adapt her contribution, her way of guiding, her help and her willingness to compromise, to the level of development and abilities of her child, and to the goal of the task.

Low score (1): The mother does not give the child enough opportunities to contribute to the task. The mother constantly controls the child, verbally or physically. The mother may also be inflexible or may interrupt each intervention from the child. The situation is therefore not a good learning opportunity for the child.

High score (5): There is an excellent and constant balance (given the level of development and skills of the child) between the mother's and the child's contribution to the task. The mother is highly sensitive to her child's cues and the degree of guidance he needs. She adjusts during the task to her child's initiatives and attention. The mother is flexible and elaborates from the contributions of her child. The mother invites the child to participate and accepts his contributions.

Supportive presence

This scale consists in identifying the emotional support offered by the mother to her child. Unlike the quality of guidance, which involves support from the mother for the purpose of performing the activity (guide), this scale emphasizes the emotional support offered to the child.

Low score (1): The mother does not offer emotional support to the child during the task. For example, she may be distant, unavailable or hostile to the child when he needs support.

High score (7): The mother provides optimal support for the child during the reading task. She demonstrates from the beginning her confidence in her child's efforts. If the child is having difficulty, she offers support, strengthens and encourages him. This support is ongoing, timely, frequent and constant.

Effective structure and limit setting

This scale reflects the mother's ability to structure and appropriately limit the child's behavior during the task.

Low score (1): The mother is not able to communicate a structure or limits to the child except in a minimal way. She shows no leadership, she does not seem in charge. Thus, the mother makes few requests concerning the behavior of the child and seems powerless to structure the task.

High score (7): The mother structures the task so that her goals are accomplished. She responds coherently and democratically to the child's disobediences. She maintains optimal leadership and discipline that keeps her in charge of events. Even if the child does not obey, the mother maintains her leadership in dealing with the problem. She may be more strict or kind, intrusive or respectful of the child's autonomy, but in any case she reaches this level of structure and imposition of limits during the task.

Acceptation of the child

This scale refers to the mother's emotional expression, the way the mother responds to her child's reactions or initiatives, the degree to which she accepts these reactions, and the degree to which she accepts her child in general.

Low score (1): The mother is strongly rejecting her child. She is very angry with him and she treats him with contempt. Her reactions to her child's contributions are very critical so that she seems to disturb the child in carrying out the task. The mother tends to use expressions of anger or contempt and humiliation towards her child. Most of the time she will tend to abruptly deny the child's speech and make him feel that he is not good enough. She can even hit him by giving him a quick pat on the hand for example. There are many negative or discouraging remarks, there are rarely any positive comments or praise, her tone of voice is negative, there is little visual and/or physical contact, she resists the affectionate openings of the child and there are few or no smiles.

High score (9): The mother speaks to the child in a positive tone and seems to accept his actions and reactions. Most of the time she seems attentive to her child, she admires him and is happy to accept his contributions. It happens a few times that she tries to widen and enrich the reactions of the child. She responds to her child's requests and reactions in a non-rejecting way. The mother is very sensitive to the emotional state of the child. For example, if the child has difficulty cooperating, she encourages him with sensitivity and understanding. She makes several positive comments, several smiles, several visual and/or physical contacts and a positive evaluation of the child. There is also praise to the child, the tone of voice very affectionate, friendly and warm. The mother clearly and frequently shows signs of positive interaction with the child.

Respect for the child's autonomy

This scale reflects the extent to which the mother acts in a manner that aims to recognize and respect the child's individuality, motivations and perceptions during the task.

Low score (1): The mother completely denies the individuality of the child by the techniques she uses. The mother is very intrusive in her control over the child. Instead of developing a mutual

negotiating relationship, she exerts her expectations on the child so that he is like a satellite or servant of the mother, or she implicitly defines her interactions in terms of a struggle, where the obedience of the child makes the mother the winner and the child submissive.

High score (7): The mother clearly interacts with the child to demonstrate that she recognizes the validity of the child's perception, she encourages the child to recognize his own intentions and to negotiate the course of interactions during the task. In these negotiated interactions, the mother also models her own individuality for the child. She may insist on the importance of following her instructions, but she does so while recognizing the reality and validity of the child's perception and never does so intrusively.

Hostility

This scale reflects expressions of anger, denigration or rejection of the child by the mother.

Low score (1): The mother shows no sign of rejection. She may or may not be supportive but she does not try to belittle the child or to avoid him in a rejecting way. This includes passive or emotionally uninvolved mothers if they did not reject the child or did not communicate hostility to the child.

High score (6-7): This mother frequently has expressions of rejection and hostility towards the child. There is little or no warmth shown during substantial parts of the task, especially after the mother has been irritated by the child (that is, the mother may initially be warm and then reject the child strongly). The mother is openly and directly rejecting and hostile. Any warmth seems superficial due to the distance the mother creates between her and the child and rejection is used as a control technique against the child. Highest scores (7) are given when expressions of anger towards the child are also accompanied by strong emotions and barely controlled suggesting the possibility of physical abuse or neglect of the child in certain situations.

Note 1: Given the relatively low frequency of maternal rejecting behaviors during a filmed session, coding instructions were that any clearly hostile event must have a strong impact on the score at this scale.

Note 2: The scale was reverse coded, with a high score reflecting low hostility, before averaging with the other scales.

2. RESULTS OF CONFIRMATORY FACTOR ANALYSES

Previous studies have shown support for a bifactor model of hyperactivity-impulsivity and inattention (Gibbins, Toplak, Flora, Weiss, & Tannock, 2012; Martel, von Eye, & Nigg, 2010; Normand, Flora, Toplak, & Tannock, 2012; Toplak et al., 2012; Willoughby, Blanton, & Family Life Project Investigators, 2015). While the present study aimed to examine the predictors of the common and unique variance of hyperactivity-impulsivity and inattention captured in a bifactor model, this model was compared to alternative models to confirm that it best fit the data in this sample, as it was the case in previous research.

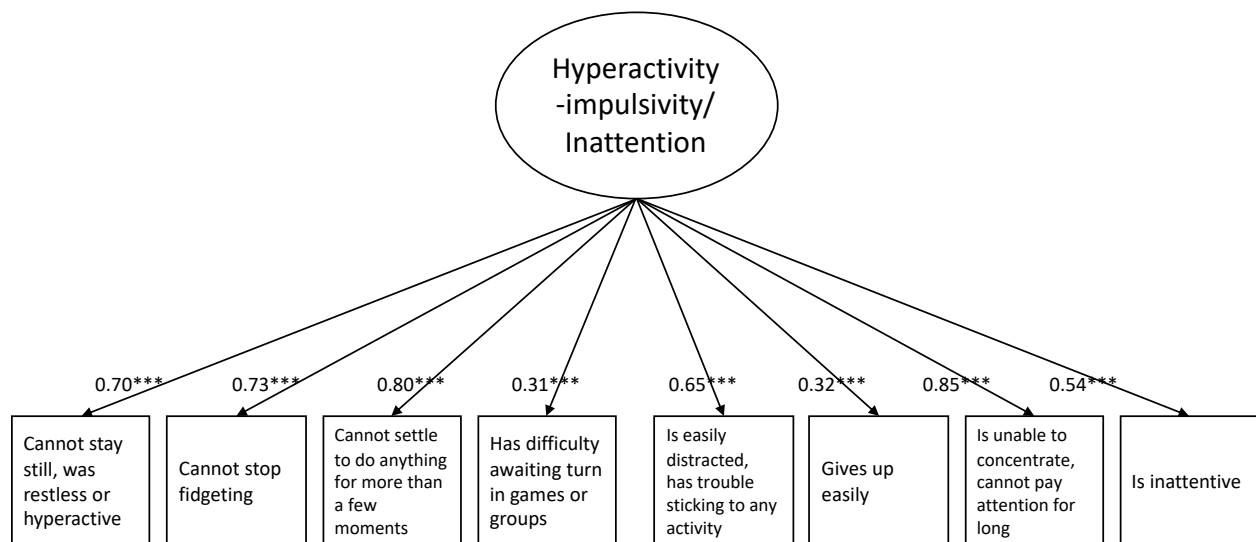
First, a one factor model was assessed, in which all variables loaded on a single hyperactivity-impulsivity/inattention factor. Then, a correlated factors model was assessed, in which variables assessing hyperactivity-impulsivity and inattention loaded on two specific factors that were allowed to covary. Then, a second-order factor model was assessed, in which variables assessing hyperactivity-impulsivity and inattention loaded on two subfactors, which then loaded on a higher-order hyperactivity-impulsivity/inattention factor. Finally, the bifactor model was assessed, in which a general hyperactivity-impulsivity/inattention factor was added at the same level as the specific hyperactivity-impulsivity factor and inattention factor.

Results confirmed the hypothesis that the bifactor model would fit the data best. Model fit and results for all three models are provided below.

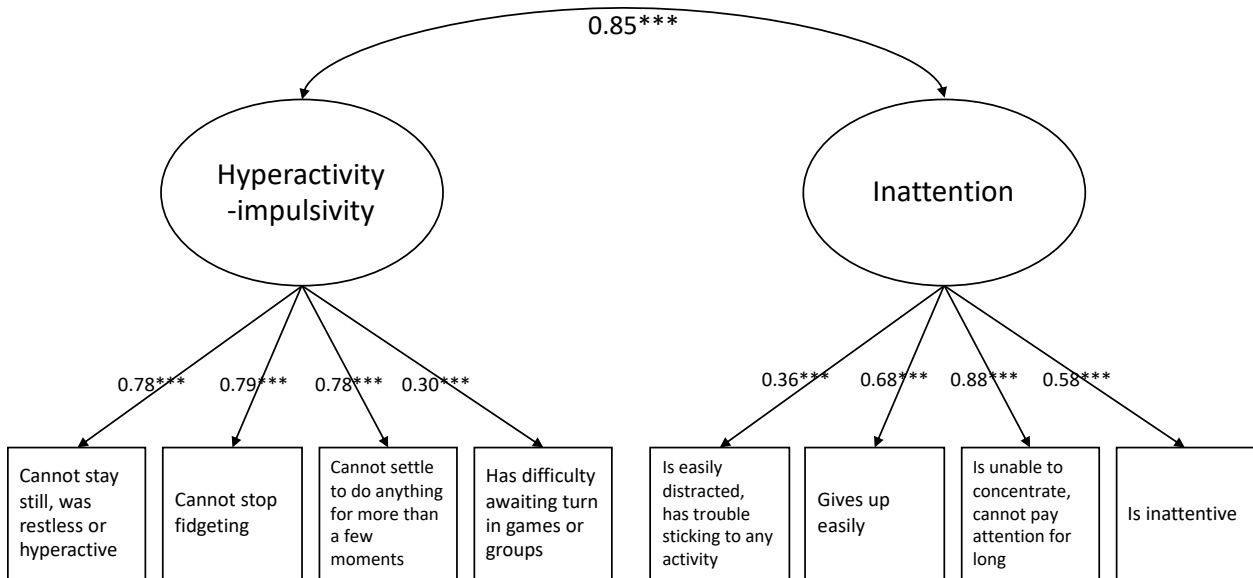
Model	χ^2	df	RMSEA	SRMR	TLI	CFI	BIC	AIC
One factor	54.08***	20	.12	.06	.85	.90	1623	1555
Correlated factors	44.81***	19	.10	.05	.88	.92	1614	1543
Second-order	44.81***	19	.10	.05	.88	.92	1614	1543
Bifactor	8.58	13	.00	.03	1.03	1.00	1609	1520

Note. ***p<.001

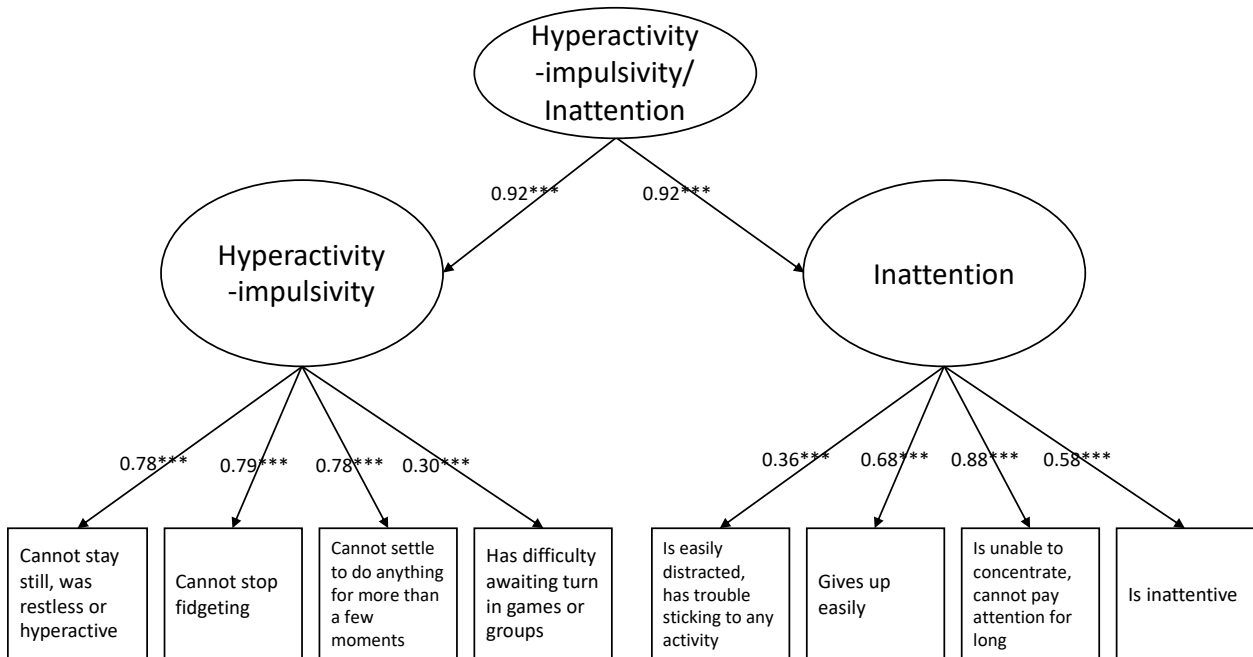
1. One factor model



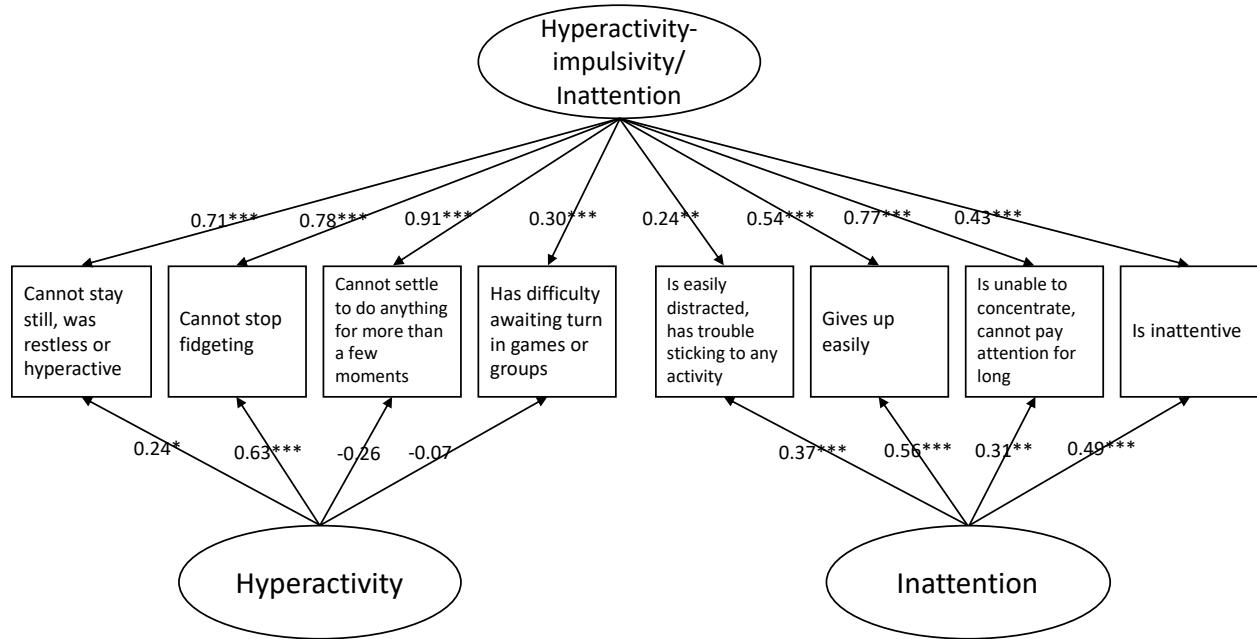
2. Correlated factors model



3. Second-order factor model



4. Bifactor model



The general hyperactivity/inattention factor captures variance from all the items. The specific inattention factor captures variance from the four inattention items. The specific hyperactivity factor only captures variance from the items specific to hyperactive motor activity, and not impulsivity.

3. CORRELATIONS BETWEEN ALL STUDY VARIABLES

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. H-I item 1	–												
2. H-I item 2	.71**	–											
3. H-I item 3	.59**	.56**	–										
4. H-I item 4	.19*	.19*	.29**	–									
5. Inattention item 1	.37**	.42**	.51**	.13	–								
6. Inattention item 2	.12	.17	.23*	.13	.33**	–							
7. Inattention item 3	.55**	.60**	.70**	.24**	.58**	.31**	–						
8. Inattention item 4	.31**	.33**	.40**	.30**	.52**	.28**	.49**	–					
9. Positive parenting	-.33**	-.27**	-.37**	-.26**	-.22*	-.14	-.33**	-.18*	–				
10. Coercive parenting	.24**	.17	.21*	.01	.16	.25**	.19*	.20*	-.08	–			
11. Inhibitory control 1	-.54**	-.53**	-.35**	-.27**	-.26**	-.08	-.43**	-.29**	.14	-.18*	–		
12. Inhibitory control 2	-.30**	-.27**	-.18	-.12	-.23*	-.12	-.29**	-.27**	-.01	-.25**	.73**	–	
13. SES	-.19*	-.17	-.15	-.11	-.24**	.04	-.08	.02	.34**	-.03	.12	-.11	–
14. Conduct problems	.39**	.43**	.41**	.34**	.37**	.33**	.43**	.29**	-.35**	.28**	-.37**	-.18	-.32**

Note. H-I = Hyperactivity-Impulsivity. H-I item 1 “Cannot stay still, was restless or hyperactive”; item 2 “Cannot stop fidgeting”; item 3 “Cannot settle to do anything for more than a few moments”; item 4 “Has difficulty awaiting turn in games or groups”. Inattention item 1 “Is easily distracted, has trouble sticking to any activity”; item 2 “Gives up easily”; item 3 “Is unable to concentrate, cannot pay attention for long”; item 4 “Is inattentive”.

Inhibitory control 1 = full scale; Inhibitory control 2 = 3 item scale.

* $p < .05$ ** $p < .01$.

4. RESULTS OF MODERATION ANALYSES WITH THE ORIGINAL INHIBITORY CONTROL SCALE

*Main and interaction effects of parenting and **inhibitory control (original scale)** on the unique and common variance of hyperactivity and inattention at 7 years*

	Common factor		Hyperactivity factor		Inattention factor	
	B (SE)	β	B (SE)	β	B (SE)	β
Main effects						
SES (5 months)	0.06 (0.12)	0.05	-0.04 (0.11)	-0.04	0.13 (0.32)	0.11
Conduct problems (7 years)	0.40 (0.15)	0.29**	0.10 (0.20)	0.09	0.36 (0.42)	0.32
Positive parenting (4 years)	-0.38 (0.13)	-0.27**	0.16 (0.15)	0.15	0.07 (0.19)	0.06
Coercive parenting (5 years)	0.12 (0.12)	0.09	0.04 (0.11)	0.03	0.31 (0.32)	0.28
Inhibitory control (6 years)	-0.50 (0.13)	-0.37***	-0.31 (0.14)	-0.29*	0.07 (0.28)	0.06
Interaction effects						
SES	0.06 (0.12)	0.04	-0.03 (0.00)	-0.03	0.21 (0.30)	0.18
Conduct problems	0.39 (0.14)	0.29**	0.11 (0.19)	0.11	0.46 (0.32)	0.39
Positive parenting	-0.36 (0.14)	-0.26**	0.13 (0.21)	0.12	0.05 (0.24)	0.04
Coercive parenting	0.12 (0.15)	0.09	0.03 (0.12)	0.03	0.33 (0.19)	0.28
Inhibitory control	-0.49 (0.14)	-0.36***	-0.32 (0.16)	-0.30*	0.10 (0.19)	0.09
Inhibitory control*Positive	-0.21 (0.08)	-0.15*	0.05 (0.15)	0.05	-0.06 (0.29)	-0.05
Inhibitory control*Coercive	-0.06 (0.12)	-0.04	-0.02 (0.11)	-0.02	0.15 (0.45)	0.12

Note. * $p < .05$ ** $p < .01$ *** $p < .001$

Model fit main effects model: $\chi^2(38) = 65.13$; CFI = 0.94, TLI = 0.89, RMSEA = 0.06 (95% C.I. = 0.03-0.09), SRMR = 0.04. Model fit interaction model: $\chi^2(48) = 82.91$; CFI = 0.92, TLI = 0.86, RMSEA = 0.06 (95% C.I. = 0.04-0.08), SRMR = 0.04.

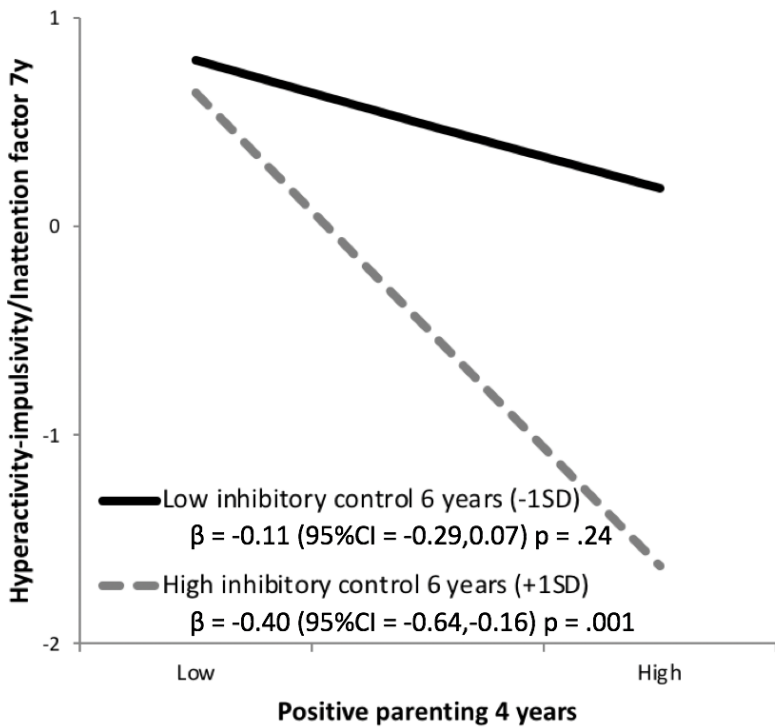


Figure. Age 4 positive parenting by age 6 **inhibitory control (original scale)** interaction predicting the common hyperactivity/inattention factor at age 7. Positive parenting range showed: -2SD to +2SD. Sample distribution: low inhibitory control (below -1 SD) 15.7%, mean inhibitory control (between -1 SD and +1 SD) 64.9%, high inhibitory control (above +1 SD) 19.4%. The regions of significance analysis showed that children higher or lower on inhibitory control differed on hyperactivity/inattention only at higher levels of positive parenting, with a higher bound of significance at -1.0 SD. PoI = 0.99.

References

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