Université de Montréal

Interactions parent-enfant en début de vie et développement des fonctions exécutives à l'âge scolaire

Par

Sophie Regueiro

Département de psychologie

Faculté des arts et des sciences

Thèse présentée en vue de l'obtention du grade de Philosophiae Doctor (Ph.D.)

en psychologie recherche et intervention, option neuropsychologie clinique

Août 2021

Université de Montréal

Département de psychologie, Faculté des arts et des sciences

Cette thèse intitulée

Interactions parent-enfant en début de vie et développement des fonctions exécutives à l'âge scolaire

Présentée par

Sophie Regueiro

A été évaluée par un jury composé des personnes suivantes

Miriam Beauchamp

Présidente du jury

Annie Bernier

Directrice de recherche

Célia Matte-Gagné

Codirectrice

Mireille Cyr

Membre du jury

Sophie Jacques

Examinatrice externe

Résumé

La recherche en psychologie du développement a démontré l'importance des fonctions exécutives (FE) pour les apprentissages et l'adaptation à la vie quotidienne. Des études distinctes suggèrent que des aspects différents de la qualité des interactions parent-enfant contribuent aux FE de l'enfant; cependant, la spécificité de ces liens s'avère peu documentée. De plus, les études portent principalement sur les mères et peu ont exploré les interactions père-enfant. La majorité de la recherche sur les FE est également transversale, limitant les connaissances quant aux patrons de changement des FE et aux prédicteurs de ces patrons. Adoptant une perspective longitudinale, multidimensionnelle et inclusive des deux parents, la présente thèse vise à explorer les liens entre des aspects affectifs et cognitifs de la qualité des interactions mère-enfant et père-enfant à l'âge préscolaire et le développement des FE durant la période scolaire.

La thèse est composée de deux articles empiriques. Le premier (*N* = 108) examine les liens prospectifs entre l'orientation mentale paternelle observée à 18 mois et les FE de l'enfant telles que manifestées quotidiennement en milieu scolaire, en tenant compte de la sécurité d'attachement mère-enfant. Les résultats révèlent que l'orientation mentale paternelle est associée à moins de difficultés exécutives selon l'enseignant de maternelle, et ce, peu importe la qualité de l'attachement mère-enfant.

Le deuxième article (*N* = 102) explore les rôles respectifs de la sécurité d'attachement mère-enfant et du soutien maternel à l'autonomie à l'âge préscolaire quant aux changements qui surviennent au plan des FE durant la période scolaire. Les FE ont été mesurées annuellement de la 2^{e} à la 4^{e} année du primaire via trois tâches ciblant la mémoire de travail, la flexibilité cognitive et la planification. La courbe de croissance moyenne de chaque FE a été modélisée. Les résultats révèlent que la sécurité d'attachement est liée de façon unique et positive à toutes les habiletés exécutives entre la 2^{e} et la 4^{e} année, alors que le soutien à l'autonomie est principalement lié de façon unique à une meilleure performance initiale de planification.

Cette thèse suggère que les aspects affectifs des interactions parent-enfant (sécurité d'attachement et orientation mentale) pourraient contribuer à la compétence exécutive globale de l'enfant, alors que les aspects cognitifs, tels que le soutien à l'autonomie, pourraient être particulièrement importants pour l'émergence d'habiletés exécutives complexes telles que la planification. D'autre part, la thèse souligne la contribution unique des pères aux FE de l'enfant et met en évidence que divers aspects des interactions parent-enfant sont susceptibles de placer les enfants sur une trajectoire développementale exécutive prometteuse.

Mots-clés: fonctions exécutives, orientation mentale paternelle, sécurité d'attachement mère-enfant, soutien maternel à l'autonomie, âge scolaire, courbes de croissance

Abstract

Research in developmental psychology has shown the importance of executive functioning (EF) for learning and adaptation to everyday life. Distinct studies suggest that different aspects of the quality of parent-child interactions contribute to child EF; yet, the specificity of these links remains poorly documented. Furthermore, studies mainly focus on mothers and few investigated father-child interactions. Most research on EF is also cross-sectional, limiting the understanding of EF patterns of growth and the predictors of these patterns. Taking a perspective that is longitudinal, multidimensional, and inclusive of both parents, the current thesis seeks to explore the links between affective and cognitive aspects of mother-child and father-child interactions at preschool age and EF development during the school years.

The thesis includes two empirical articles. The first (N = 108) examines prospective links between paternal mind-mindedness observed at 18 months and child EF as manifested in everyday school settings, considering mother-child attachment security. Results indicate that paternal mind-mindedness is associated with fewer executive problems as perceived by kindergarten teachers, above the contribution of the quality of mother-child attachment security.

The second article (N = 102) investigates the respective roles of mother-child attachment security and maternal autonomy support at preschool age in the changes that occur in EF during the school years. EF were measured yearly between Grade 2 and 4 of elementary school with three tasks tackling working memory, cognitive flexibility, and planning. The average growth curve of each EF was modeled. Findings show that attachment security is uniquely and positively related to all EF skills between Grade 2 and 4, whereas autonomy support is mainly independently related to better initial planning performance.

This thesis suggests that the affective aspects of the parent-child interactions (attachment security and mind-mindedness) are particularly important for developing global executive competence whereas cognitive aspects such as autonomy support are mostly involved in the emergence of complex EF abilities, such as planning. Moreover, the thesis underlines the unique contribution of fathers to child EF, and highlights that several aspects of parent-child interactions are likely to set children on promising EF developmental trajectories.

Keywords: executive functioning, paternal mind-mindedness, mother-child attachment security, maternal autonomy support, school age, growth curves

Table des matières

Liste des tableaux

Liste des abréviations

ABC	Attachment and Biobehavioral Catch-up
AIC	Akaike Information Criterion
AQS	Attachment Behavior Q-Sort
BRIEF-P	Behavior Rating Inventory of Executive Function-Preschool Version
DCCS	Dimensional Change Card Sort
EF	Executive Functioning
FE	Fonctions exécutives
FIML	Full Information Maximum Likelihood
GEC	Global Executive Composite
ICC	Intraclass Correlation Coefficient
LL	Log Likelihood
MLM	Multilevel Modeling
MLR	Robust Maximum Likelihood estimation
MTB	Minding the Baby
NEPSY	Developmental Neuropsychological Assessment
RT	Reaction Time
SES	Socioeconomic Status
WPPSI	Wechsler Preschool and Primary Scale of Intelligence

À la mémoire de Suzanne Parent, mon éternelle complice

Remerciements

La présente thèse n'aurait pas pu voir le jour sans l'aide et le soutien de nombreuses personnes. Mes premiers remerciements vont à mes directrices de recherche, Annie Bernier et Célia Matte-Gagné, pour leur disponibilité, leur rigueur et leur soutien affectif. Annie, merci de m'avoir si bien encadrée et guidée par tes judicieux conseils, ta patience et ton enthousiasme contagieux qui me motivait à aller de l'avant. Je te remercie pour toutes les belles opportunités d'apprentissage que tu m'as données. Je garderai toujours de bons souvenirs de nos discussions et réflexions où les idées foisonnaient, entremêlées d'éclats de rire, et du moment où j'ai été baptisée Jacqueline. Célia, grâce à toi j'ai découvert un nouveau domaine de recherche et fait les premiers pas déterminants pour cette grande aventure doctorale. Merci de m'avoir introduite au laboratoire Grandir Ensemble! Tes travaux de recherche ont été pour moi une importante source d'inspiration et ta précieuse aide m'a permis de surmonter plusieurs défis. Je me considère extrêmement choyée d'avoir pu être supervisée par un duo si efficace et chaleureux.

Je tiens à remercier mes collègues du laboratoire Grandir Ensemble pour leur écoute et leur soutien qui m'ont aidée à cheminer dans ce doctorat. De plus, avec vous, les congrès étaient très agréables! Merci à Catherine Cimon-Paquet pour m'avoir épaulée dans mes travaux de recherche et pour les bons moments passés ensemble, notamment en voyage. Merci à Nadine Marzougui pour sa coordination hors pair du projet, sa patience et son accueil chaleureux lors de mes nombreuses allées et venues dans son bureau.

J'aimerais remercier tous les membres de ma cohorte. Nos sorties, discussions et rencontres du Groupe d'Intérêt en Neuropsychologie ont égayé mon doctorat, tout en faisant évoluer mes connaissances en neuropsychologie. Je suis très reconnaissante d'avoir pu faire partie d'une cohorte si soudée et présente, autant dans les bons moments que les difficiles.

Un merci tout particulier à ma mère, Suzanne Parent, décédée lors de ma troisième année de doctorat. Tu étais un vrai modèle de résilience et de force. C'est en étant guidée par ton amour et ton soutien que j'ai pu m'épanouir et devenir la femme que je suis aujourd'hui. Tu as toujours cru en moi et en ma capacité à relever de grands défis, c'est pourquoi je dédie cette thèse à ta mémoire. Je sais que tu veilles sur moi et continues à m'accompagner. Un grand merci à mon père, Manuel Regueiro, toujours disponible pour fêter mes succès et m'épauler devant la difficulté. Tes encouragements et tes conseils m'ont soutenue durant mon parcours et m'ont poussée à me dépasser. Je souhaite remercier mes beaux-parents, Diane St-André et Serge Paiement, pour leur soutien et pour tous ces moments joyeux passés ensemble qui me permettaient de revenir en force dans mes études. Merci beaucoup Diane pour la relecture!

Mille mercis à mon partenaire de vie, Samuel Paiement, sans qui je n'y serais pas arrivée! Je te serai à jamais reconnaissante pour tout ton soutien, ton amour et ta patience lors de cette grande étape de ma vie. Tu m'as permis de repousser mes limites et de vivre des réussites que je n'aurais jamais cru possibles. Grâce à toi, j'apprends à profiter de la vie, je gagne en confiance et deviens une meilleure version de moi-même chaque jour.

Je tiens à remercier chaleureusement mes amies de longue date, Sarah et Sophia Zehrouni, pour leur présence authentique et leur soutien constant, autant dans mes hauts que mes bas. Merci pour vos bons conseils, vos encouragements et votre dynamisme légendaire qui m'ont beaucoup aidée à mener à terme ce doctorat. Merci à mes amies Mirjana Vucetic, Émilie Langlois et Anne-Thalissa Springuel qui m'accompagnent depuis le début de mon parcours universitaire. Je suis très reconnaissante pour tout le réconfort, le soutien et la joie que vous m'avez procurés tout au long de ces années. Merci à mon amie Rachel Perrier pour son écoute attentive et sa présence chaleureuse. Tu m'as permis de découvrir de précieux outils pour ma croissance personnelle et je t'en remercie grandement. Merci à Julie Laniel pour son soutien, son énergie et ses encouragements qui m'ont aidée à grandir en confiance.

J'aimerais aussi remercier mes parents, ma directrice Annie Bernier, la Faculté des études supérieures et postdoctorales de l'Université de Montréal, les Instituts de Recherche en Santé du Canada et les Fonds de Recherche du Québec – Santé et Société et Culture pour leur soutien financier.

Mes derniers remerciements vont aux familles du projet Grandir Ensemble qui nous ont généreusement ouvert les portes de leur demeure et sans qui cette thèse n'existerait pas.

Introduction

Dès leur premier regard sur le monde, les enfants sont appelés à interagir avec une multitude de facteurs environnementaux. C'est dans le cadre de ces interactions que sera notamment forgé leur développement cognitif futur. Selon Vygotsky (1978), les processus mentaux de haut niveau émergeraient d'abord au sein des relations interpersonnelles. C'est en étant guidés par des partenaires sociaux compétents que les enfants arriveraient graduellement à faire un usage autonome et volontaire de leur capacité mentale. À cet égard, les parents sont susceptibles de jouer un rôle central puisqu'en bas âge, les enfants dépendent largement de leurs figures parentales (Sameroff, 2010). Dans cette optique, la thèse, composée de deux articles empiriques à devis longitudinaux, vise globalement à mieux comprendre la contribution de différents aspects de la qualité des interactions parent-enfant pendant la période préscolaire au développement des fonctions cognitives supérieures appelées les fonctions exécutives (FE).

Les fonctions exécutives: définition et composantes centrales

Les FE sont des habiletés cognitives qui gouvernent le contrôle conscient de l'action, de la pensée et des émotions afin de permettre l'atteinte d'objectifs dans des situations complexes et nouvelles (Zelazo & Carlson, 2012). Né du domaine de la neuropsychologie, le terme FE a d'abord été adopté pour rendre compte de sémiologies du lobe frontal du cerveau auprès de populations cliniques adultes (Luria, 1966; Milner, 1963). À ce jour, les études en neuroimagerie indiquent que les FE sont en grande partie sous-tendues par le cortex préfrontal et recrutent également un réseau neuronal impliquant les circuits frontopariétal et frontostriatal (Fiske & Holmboe, 2019). Il existe une diversité de conceptualisations des FE. Toutefois, l'inhibition, la mémoire de travail et la flexibilité cognitive ressortent comme étant trois composantes centrales, à partir desquelles se bâtiraient des habiletés exécutives plus complexes, telles que la planification (Diamond, 2013; Miyake et al., 2000). L'inhibition réfère à la capacité d'inhiber volontairement une réponse automatique dominante, des impulsions ou de l'information non pertinente au but visé (Howard et al., 2014). Cette habileté cognitive entre en jeu notamment pour rester centré sur un travail malgré les distractions autour de soi, ainsi que pour s'arrêter et penser avant d'agir. La mémoire de travail correspond quant à elle à la capacité de maintenir et de manipuler mentalement de l'information sur une courte période de temps (Baddeley & Hitch, 1974). Elle permet entre autres d'effectuer des calculs mentaux et de suivre le déroulement d'histoires. Enfin, la flexibilité cognitive se définit comme étant la capacité à ajuster ses comportements ou pensées pour s'adapter aux demandes et règles changeantes de l'environnement (Dajani & Uddin, 2015). Elle permet notamment de modifier ses stratégies initiales devant une impasse, de considérer différentes perspectives à un problème et de naviguer entre diverses tâches. La recherche montre que des différences individuelles au plan des FE apparaissent dès les premières années de vie (Cuevas et al., 2018) et qu'elles peuvent être mesurées de façon fiable durant l'enfance (Devine et al., 2019).

Mesurer les différences individuelles dans les FE

Deux types de mesures s'utilisent pour évaluer les FE, soit les évaluations d'adultes (mesure indirecte, p. ex., questionnaires) complétées par des personnes qui connaissent bien l'enfant ou observent quotidiennement son comportement et les tâches expérimentales (mesure directe). De faibles corrélations, parfois non-significatives, sont néanmoins fréquemment rapportées entre ces deux types de mesure de FE (Soto et al., 2020). À ce sujet, les auteurs d'une revue de littérature (Toplak et al., 2013) suggèrent que les évaluations d'adultes et les tâches mesureraient des aspects *différents* des FE. Plus précisément, les évaluations d'adultes captureraient la coordination de plusieurs FE pour permettre l'atteinte de buts en contextes typiques de la vie de tous les jours, sans guidance explicite. Par exemple, la capacité des enfants à compléter leurs jeux et travaux malgré les bruits et mouvements environnants. En revanche, les tâches évalueraient l'efficacité d'une fonction exécutive précise en contexte un-à-un où les instructions sont clairement spécifiées et les distractions minimisées. En ce sens, les évaluations d'adultes permettraient de révéler un portrait écologique des FE, caractéristique de l'usage habituel de ces habiletés au quotidien (Cuevas et al., 2012). L'évaluation directe via des tâches expérimentales offre quant à elle un meilleur contrôle des impacts potentiels de variables confondantes (p. ex., niveau d'exigence de l'environnement, état émotionnel et biais subjectifs du répondant, qualité de la relation entre le répondant et l'enfant; Isquith et al., 2013).

En accord avec Toplak et ses collègues (2013), des données de neuroimagerie obtenues auprès d'enfants et d'adolescents suggèrent que les corrélats neuronaux liés aux tâches expérimentales de FE diffèreraient de ceux liés aux évaluations d'adultes (Faridi et al., 2015). En particulier, les évaluations d'adultes seraient associées à l'épaisseur corticale d'une région cérébrale impliquée dans l'encodage du contexte des évènements (gyrus parahippocampique postérieur), ce qui appuie le caractère écologique suggéré de ce type de mesure. Néanmoins, d'un point de vue empirique, il a fréquemment été observé que les évaluations d'adultes et les tâches peuvent toutes deux prédire des aspects clés du fonctionnement de l'enfant, notamment la réussite scolaire et la régulation comportementale (Clark et al., 2010; Lonigan et al., 2017; Soto et al., 2020). En somme, les deux types de mesure de FE apparaissent apporter des informations importantes et complémentaires. Dans cette perspective, pour mesurer les FE de l'enfant, le premier article de la thèse utilise un questionnaire standardisé complété par l'enseignant et le second, des tâches expérimentales.

Importance des fonctions exécutives

Il est bien établi que les FE suivent un développement prolongé jusqu'à l'âge adulte (Ferguson et al., 2021). Toutefois, ce développement ne se fait pas au même rythme pour tous les enfants, faisant en sorte qu'à tout âge donné, certains enfants ont de meilleures capacités exécutives que d'autres. Des preuves empiriques grandissantes attestent d'associations positives entre des variations exécutives normatives, mesurées autant par des évaluations d'adultes que par des tâches expérimentales, et plusieurs indices du développement de l'enfant. Sur le plan socioaffectif, la recherche montre que de plus fortes FE sont liées à une théorie de l'esprit supérieure (Devine & Hughes, 2014; Marcovitch et al., 2015), plus de comportements prosociaux (Hao, 2017) et moins de problèmes intériorisés et extériorisés (Morgan et al., 2019). Dans la sphère cognitive, des FE supérieures ont été associées à un meilleur développement langagier, tant chez les enfants (Fuhs & Day, 2011; Gooch et al., 2016; Matte-Gagné & Bernier, 2011) que les adolescents (Berninger et al., 2017). De plus, des études indiquent que de plus fortes FE sont positivement liées à la mémoire (Mahy & Moses, 2011) et à la capacité d'apprendre d'expériences passées (Benson et al., 2013).

Les FE joueraient aussi un rôle crucial en milieu scolaire. En effet, ces fonctions supporteraient les apprentissages et la performance scolaire en facilitant les processus de résolution de problèmes, l'adaptation aux changements et la concentration en dépit des distractions (Blair & Raver, 2015; Zelazo & Carlson, 2020). Il a notamment été largement démontré que les FE prédisent la réussite en mathématiques et en lecture dès l'entrée à l'école et jusqu'à l'adolescence (Burchinal et al., 2020; Ribner, 2020; pour une méta-analyse, voir Jacob & Parkinson, 2015), et ce, au-delà des habiletés intellectuelles générales (Blair & Razza, 2007; Clark et al., 2010). En outre, les FE permettraient de garder le fil des échanges qui se déroulent en classe, en plus de favoriser l'adoption de comportements appropriés et le respect des consignes (Blair & Raver, 2015; Shonkoff et al., 2011). Les enfants ayant de plus fortes FE seraient ainsi plus susceptibles de vivre des interactions gratifiantes en contexte scolaire avec leurs pairs et enseignants. En retour, cette meilleure expérience sociale à l'école pourrait contribuer à la persévérance et la réussite scolaire à long terme et ultimement à moins de décrochage (Blair & Diamond, 2008). Les FE apparaissent donc déterminantes pour l'épanouissement tant académique que social en milieu scolaire. Compte tenu de l'importance des FE pour les différentes sphères de vie de l'enfant et particulièrement en contexte scolaire, il apparait crucial d'identifier les facteurs qui sont associés à de meilleures FE dès l'entrée à l'école. De ce fait, la thèse explore les antécédents des FE de l'enfant à l'âge scolaire (premier article: maternelle; deuxième article : 2^{e} à 4^{e} année du primaire).

Prédicteurs des fonctions exécutives: comportements parentaux

Il est maintenant reconnu qu'une combinaison de facteurs biologiques et environnementaux sous-tendent les FE (Zelazo, 2013). Selon une recension d'études de jumeaux, les FE seraient de modestement à modérément héritables (l'héritabilité se situerait entre 0,09 et 0,56 chez l'enfant et l'adolescent selon les tâches expérimentales utilisées pour les mesurer; Li & Roberts, 2018). Une part importante de la variance dans les FE serait donc attribuable à des facteurs environnementaux. Parmi ceux-ci, étant au cœur de l'environnement social du jeune enfant, la qualité des interactions parent-enfant a beaucoup retenu l'attention des chercheurs dans la dernière décennie.

Plusieurs études se sont intéressées aux comportements parentaux et leur rôle dans le développement des FE (Bernier, St-Laurent et al., 2017; Fay-Stammbach et al., 2014). Les résultats d'une méta-analyse de Valcan et collègues (2018) révèlent que les dimensions affective et cognitive de ces comportements sont toutes deux associées à la compétence exécutive globale (k = 41; r = ,20 à ,25) et aux habiletés exécutives spécifiques de l'enfant (p. ex., inhibition, mémoire de travail et flexibilité cognitive, k = 19; r = ,10 à ,21). La dimension affective réfère aux comportements axés sur l'établissement et le maintien de la relation entre le parent et son enfant, tandis que la dimension cognitive correspond aux comportements orientés vers les buts, c'est-à-dire l'exécution de tâches et la résolution de problèmes (Hughes & Devine, 2018). Or, les comportements parentaux qui sont affectivement et cognitivement de qualité apparaissent liés à un meilleur développement des FE. Ce domaine de recherche comporte toutefois trois lacunes importantes que la thèse propose d'adresser.

Les questions qui demeurent

Comportements parentaux et FE de l'enfant: spécificité des liens

Tout d'abord, beaucoup reste à savoir quant à la spécificité des liens entre les comportements parentaux et les FE de l'enfant. En effet, peu d'études adoptent une perspective multidimensionnelle permettant d'examiner au sein d'un même devis les contributions respectives de conduites parentales distinctes en relation avec les habiletés exécutives (Hughes & Devine, 2019). De telles informations pourraient pourtant s'avérer utiles pour mieux orienter les interventions visant à promouvoir le développement des FE. La présente thèse contribue à faire avancer les connaissances dans ce domaine en examinant le rôle de différents aspects des interactions parent-enfant documentés comme étant associés aux FE de l'enfant, soit l'orientation mentale, la sécurité d'attachement et le soutien à l'autonomie.

L'orientation mentale réfère à la capacité du parent à s'accorder avec la vie mentale de son enfant et à l'inférer correctement à partir du comportement de ce dernier (Meins, 2013). Elle se manifeste lors d'interactions parent-enfant par des commentaires verbaux qui reflètent de façon appropriée les états mentaux (p. ex., pensées, désirs et souvenirs) de l'enfant (Meins et al., 2001). Quant à la sécurité d'attachement, elle représente la qualité du lien affectif entre le parent et son enfant et s'observe dans les comportements de l'enfant (Bowlby, 1982). Enfin, le soutien à l'autonomie correspond aux comportements parentaux qui encouragent l'enfant à résoudre par lui-même les problèmes, à effectuer ses propres choix et à participer aux décisions (Grolnick & Ryan, 1989). Il implique un soutien concret (p. ex., suggestions) adapté au niveau de compétence, besoins et rythme de l'enfant (Whipple et al., 2011). Le soutien à l'autonomie est un indicateur de la dimension cognitive des comportements parentaux, alors que l'orientation mentale et la sécurité d'attachement sont des indicateurs de la dimension affective.

Depuis les deux dernières décennies, l'orientation mentale parentale suscite un intérêt grandissant en psychologie du développement, mais a peu été étudiée en lien avec la sphère cognitive (McMahon & Bernier, 2017), et ce, malgré plusieurs appuis suggérant son importance pour la cognition (Bernier, McMahon, & Perrier, 2017). De nombreuses questions demeurent ainsi quant au rôle de l'orientation mentale en relation avec les FE. En revanche, la sécurité d'attachement ressort comme un prédicteur robuste des FE de l'enfant (Bernier et al., 2012, 2015; Lind et al., 2017; Matte-Gagné et al., 2018). Ainsi, afin de mieux comprendre la contribution unique de l'orientation mentale au développement des FE, le premier article de thèse examine pour la première fois cette contribution en tenant compte de la sécurité d'attachement.

Le soutien à l'autonomie figure parmi les comportements parentaux les plus étudiés en lien avec les FE de l'enfant (Bernier et al., 2010; Distefano et al., 2018; Matte-Gagné et al., 2015). Cet aspect cognitif des interactions parent-enfant serait associé à de meilleures FE durant la période préscolaire, mais sa contribution à l'âge scolaire est méconnue, de même que sa contribution au-delà d'aspects affectifs tels que l'attachement. Pour répondre à ces limites, le deuxième article de la thèse explore le rôle respectif et unique de la sécurité d'attachement et du soutien à l'autonomie en lien avec les FE de l'enfant durant la période scolaire.

La contribution des deux parents

Malgré un essor dans les dernières années de la recherche portant sur les pères (Volling & Cabrera, 2019), une importante limite de la recherche sur les FE est le peu d'études documentant les contributions paternelles (Fay-Stammbach et al., 2014). Les chercheurs dans le domaine des relations père-enfant suggèrent pourtant que les pères se situent au sein d'un réseau d'interactions continuelles et réciproques entre les figures parentales responsables de l'enfant (Volling & Cabrera, 2019). Compte tenu de l'interdépendance des relations mère-enfant et père-enfant, il apparait crucial de tenir compte des deux parents pour bien comprendre les antécédents parentaux des FE.

Bien que peu nombreux, il existe quelques appuis à l'effet que le père et ses comportements joueraient un rôle important pour les FE de l'enfant. À cet égard, les données d'une récente méta-analyse de Rodrigues et collègues (2021) révèlent une association modeste mais significative entre la sensibilité paternelle et les FE de l'enfant (k = 8; r = ,19). De plus, issue d'un domaine de recherche connexe aux FE, l'étude expérimentale de Meuwissen et Carlson (2019) indique que des enfants d'âge préscolaire exposés à un plus haut niveau de soutien à l'autonomie après une courte intervention auprès de leur mère et de leur père présentaient de meilleures capacités d'auto-régulation. Cependant, les études qui examinent si la contribution paternelle est *propre* à la relation père-enfant, c'est-à-dire unique et spécifique si l'on tient compte de la qualité de la relation mère-enfant, sont encore plus limitées (Hertz et al., 2019; Lucassen et al., 2015; Meuwissen & Englund, 2016; Roskam et al., 2014). L'orientation mentale paternelle plus spécifiquement a très peu été explorée et on ne sait pas si elle fait partie des conduites paternelles importantes pour le développement des FE. Le premier article de thèse propose de pallier ces lacunes de la littérature en examinant le rôle unique de l'orientation mentale paternelle quant aux FE de l'enfant tout en prenant en compte la qualité de la relation mère-enfant (c.-à-d., la sécurité d'attachement).

Trajectoires développementales de FE

Peu d'études ont formellement exploré les *patrons de changement développementaux* des FE au fil du temps, c'est-à-dire leur rythme et leur forme (p. ex., linéaire ou quadratique) de développement. L'accent a principalement été mis sur la comparaison de groupes d'enfants d'âges différents (pour des revues de littérature, voir Best & Miller, 2010; De Luca & Leventer, 2008), ce qui limite grandement la compréhension du développement des FE. Il est effectivement impossible, dans un devis transversal, d'isoler l'effet d'âge de tout autre facteur non contrôlé qui pourrait différencier les cohortes distinctes d'enfants. Pour remédier à cette lacune, l'usage de techniques contemporaines d'analyses de données longitudinales a été suggéré, notamment la modélisation de courbes de croissance (Clark et al., 2013). Cette technique permet l'exploration du changement intra-individuel (trajectoire individuelle de développement) et des différences inter-individuelles dans ce changement (variation inter-individuelle dans la trajectoire intra-individuelle), en plus d'en documenter la forme (Hoffman, 2015). Il est possible d'évaluer le niveau initial de performance des enfants à des tâches mesurant les FE et le taux de changement au fil du temps dans cette performance (augmentations ou diminutions qui suivent une constance linéaire ou plutôt une accélération/décélération), dressant ainsi une trajectoire développementale des FE. De plus, contrairement aux analyses de corrélations et de régressions basées sur deux temps de mesure, les courbes de croissance en incluent minimalement trois. Cela a l'avantage de différencier les effets transitoires et permanents des variables prédictives (Fraley et al., 2013). Par exemple, il est possible d'évaluer si l'effet d'un facteur environnemental résulte en des disparités dans les FE qui s'amoindrissent ou s'accroissent avec le temps ou si plutôt ces disparités demeurent stables. Les courbes de croissance offrent ainsi une caractérisation plus fine et complète du développement des FE et des variables impliquées dans leur développement au fil du temps.

Un nombre limité d'études témoignent de liens entre certains aspects des interactions parent-enfant (p. ex., sensibilité, sécurité d'attachement et supervision) et les patrons de changement développementaux des FE (Bindman et al., 2013; Camerota et al., 2015; Friedman et al., 2014; Hackman et al., 2015; Matte-Gagné et al., 2018; Roskam et al., 2014). L'objectif du deuxième article est de contribuer à cette littérature en modélisant des courbes de croissance de FE pour en explorer les associations longitudinales avec la sécurité d'attachement mère-enfant et le soutien maternel à l'autonomie.

Les objectifs de la thèse

La présente thèse vise à contribuer à l'avancement des connaissances sur les antécédents parentaux des FE de l'enfant d'âge scolaire de trois façons: (1) en employant une perspective multidimensionnelle considérant différents aspects des interactions parent-enfant; (2) en incluant au sein d'un même devis les contributions maternelles et paternelles; et (3) en modélisant des courbes de croissance de FE pour en examiner les patrons de changement développementaux.

La thèse se compose de deux articles scientifiques. Le premier a pour objectif de mieux comprendre les relations entre l'orientation mentale paternelle à l'âge préscolaire et les FE de l'enfant en contexte scolaire telles que perçues par l'enseignant de maternelle, et ce, au-delà de la sécurité d'attachement mère-enfant. Cet article est accepté pour publication dans la revue *Early Childhood Research Quarterly*. Le deuxième article est basé sur un devis longitudinal s'échelonnant sur neuf années. Il examine les patrons de changement dans la performance à des tâches mesurant les FE entre la 2^e^ et la 4^e^ année du primaire et la contribution respective de la sécurité d'attachement mère-enfant et du soutien maternel à l'autonomie observés à l'âge préscolaire quant à l'explication des différences individuelles dans ces patrons. Cet article est publié dans le *Journal of Experimental Child Psychology* (décembre 2020).

En Annexe F figure également un article découlant d'un travail de recherche distinct auquel j'ai contribué et qui est connexe à la thèse. Cet article explore le rôle de la qualité d'interactions triadiques (mère-père-enfant) dans la prédiction des FE de l'enfant à l'âge scolaire. Il est accepté pour publication dans le *Journal of Cognition and Development*. J'ai cosupervisé la première auteure et j'ai contribué à la conceptualisation de l'étude, à la méthodologie et aux révisions du manuscrit.

Article 1

Paternal Mind-Mindedness and Child Executive Functioning in the Kindergarten Classroom

Regueiro, S., Matte-Gagné, C., & Bernier, A. (sous presse). Paternal mind-mindedness and child executive functioning in the kindergarten classroom. *Early Childhood Research Quarterly*.

Pour cet article, j'ai participé à la collecte des données. J'ai également occupé un rôle central dans la conceptualisation, la recension des écrits, la méthodologie, l'analyse des données, l'interprétation des résultats et la rédaction des manuscrits originaux. Mes coauteurs m'ont supervisée dans tout le processus et ont contribué aux révisions du manuscrit, ainsi qu'aux ressources matérielles, administratives et financières.

Abstract

Growing research shows that parent–child relationships are reliable predictors of child executive functioning (EF), a set of cognitive skills of key importance for learning and school adjustment. However, few EF studies have considered fathers and even fewer have examined paternal mind-mindedness, an aspect of parental behavior that is gaining attention in developmental research. Accordingly, the aim of this longitudinal study (*N* = 108) was to investigate the role of paternal mind-mindedness in the prediction of individual differences in child EF as manifested at school. Paternal mind-mindedness was assessed during a 10-min father–toddler free play sequence when children were aged 18 months, and child EF problems were reported by teachers in kindergarten. The findings indicated that toddlers who were exposed to more paternal mind-mindedness were later considered by their teachers to present fewer EF problems in everyday school settings. The results held after controlling for other documented predictors of EF, namely mother–toddler attachment security, paternal socioeconomic status, and prenatal risk. This study underscores the relevance of parental mind-mindedness for child cognitive development and adds to growing research on fathers and their importance for child EF. Futures studies should adopt a systemic approach, including both parents and their children, to enhance the understanding of the parental and family antecedents of child EF.

Keywords: fathers, mind-mindedness, executive functioning, kindergarten

Paternal Mind-Mindedness and Child Executive Functioning in the Kindergarten Classroom

One of the fundamental goals of developmental psychology is to better understand how and why children differ from each other, notably in terms of their cognitive abilities. As a primary source of stimulation and social interaction in early childhood, parents play a crucial role in their children's cognitive development. Growing research shows that parent–child relationships are particularly important for the development of child executive functioning (EF; Fay-Stammbach et al., 2014; Valcan et al., 2018), a set of cognitive skills that are key for learning and school adjustment (for reviews, see Shonkoff et al., 2011; Zelazo et al., 2016). The term EF refers to higher-order cognitive processes such as inhibition, working memory, cognitive flexibility, and planning that serve the goal-directed control of thought, emotion, and behavior (Diamond, 2013; Zelazo & Carlson, 2012).

In addition to the use of experimental tasks, child EF is commonly assessed using adult ratings (e.g., parent or teacher reports). EF ratings are thought to provide an ecological perspective of child EF, capturing how well children can use their executive skills to achieve their goals in everyday situations without explicit instructions (Toplak et al., 2013). For instance, in school settings, teacher reports can evaluate children's ability to stop their behavior so as not to act impulsively, to complete tasks once started, to modulate their emotional responses, or to plan and organize their work. Research suggests that such reports tap into meaningful real-life executive manifestations, in that teacher ratings of child EF have been found to predict preschool literacy skills as well as reading and mathematics achievement during school years (e.g., Clark et al., 2010; Gerst et al., 2017; Hooper et al., 2020). Accordingly, an important agenda for the field of parenting and child EF is to document the parental factors that bolster children's capacity to use their EF in real-life settings, notably when they enter school, a significant transition that may heavily solicit young children's executive skills (Bernier et al., 2015).

Moving from a traditional view of parent–child relationships mainly focused on mothers as primary caregivers, the last two decades have witnessed the emergence of a growing number of studies centered on fathers (Schoppe-Sullivan & Fagan, 2020; Volling & Cabrera, 2019). Despite evidence showing that fathers, as well as mothers, play an important role in children's sociocognitive development (Cabrera & Tamis-LeMonda, 2013), one lingering issue in the EF literature is the dearth of studies including fathers (Fay-Stammbach et al., 2014). One way to advance the study of paternal influences on child EF may be to consider mind-mindedness (Meins, 1997), an important aspect of parental verbal behavior that is gaining increasing attention in the developmental literature. Most often studied in relation to child socio-emotional functioning, mind-mindedness may also contribute to child cognition, including EF; however, little research has addressed such questions (McMahon & Bernier, 2017). Tackling these gaps while focusing on the ecological aspect of child EF, the current study sought to investigate the relation between paternal mind-mindedness in early toddlerhood and child EF as manifested at school, in kindergarten.

Paternal Mind-Mindedness

Increasingly recognized as a salient aspect of parental behavior in developmental research, mind-mindedness is defined as parents' proclivity to consider their child as an individual with an autonomous mental life and captures parental attunement, namely parents' capacity to "tune in" to their child's mental states (e.g., thoughts, feelings, preferences) and infer them correctly based on child cues (Meins, 2013). During parent–child interactions, mind-mindedness is manifested through appropriate (i.e., attuned) comments on the child's presumed mental activity (Meins et al., 2001), such as: "You're thinking this toy looks fun and you want to play with it". Still few studies have examined paternal mind-mindedness (McMahon & Bernier, 2017). There is, however, emerging evidence supporting its importance in child development. For instance, Colonnesi et al. (2019) reported that fathers' frequent misreading of their toddler's ongoing mental activity (i.e., non-attuned mental-state comments) was predictive of lower social competence and more externalizing behaviors in preschool years. Goffin et al. (2020) also observed that paternal mind-mindedness at 7 months was positively related to preschoolers' later ability to understand their own and others' mental states (i.e., theory of mind). The current study aims to contribute to this nascent literature, bringing paternal mind-mindedness into the realm of child cognition by examining its relations to child EF.

Parental Mind-Mindedness and Child Executive Functioning

It appears likely that stimulating family environments characterized by frequent exposure to parental mind-related comments could promote child cognitive skills. Parental verbal input, broadly speaking, is important for children's cognitive development (e.g., Hurtado et al., 2008; Taumoepeau, 2016). More specifically, Meins (1997) proposed that mind-minded caregivers, because of their inclination to pay attention to their children's mental states, are well equipped to recognize their children's cognitive potential, to correctly identify their zone of proximal development, and consequently to provide appropriate developmental challenges to maximize their learning opportunities. Consistent with this, there is some evidence showing that maternal mind-mindedness is predictive of certain aspects of child cognitive functioning, such as language (Costantini et al., 2017; Laranjo & Bernier, 2013; Meins et al., 2013) and cognitive school readiness (Bernier et al., 2017). Accordingly, mind-minded parenting may promote child EF as well. Indeed, attuned interactions with caregivers who pay attention to and comment appropriately on their child's ongoing cognitive activity likely provide a verbal scaffold that structures the child's thought processes (Fernyhough, 2008). In turn, this may facilitate children's awareness of their cognitive and behavioral processes and support top-down control, thus fostering executive competence (Matte-Gagné & Bernier, 2011).

Providing support for this idea, three studies have found that parental mind-mindedness assessed in infancy is associated with child EF and related constructs (i.e., effortful control) in early childhood (Bernier et al., 2012, 2017; Cheng et al., 2018). However, these studies were focused on mothers and the role of paternal mind-mindedness in child EF is poorly understood. To the best of our knowledge, only one study from our team has investigated this association. Studying a subsample of the father–child dyads included in the present report, we observed that higher paternal mind-mindedness at 18 months was predictive of better child performance on a lab-based task of inhibitory control (one aspect of EF) at age 3 years (Gagné et al., 2018). No other aspect of child EF was considered in that preliminary report.

The current study builds on these initial findings in three ways. First, here we examine child everyday EF manifestations at school. Specifically, we focus on EF problems as reported by kindergarten teachers (e.g., doing tasks too quickly, being disorganized, having difficulty integrating feedback). Within the naturalistic contexts of school settings, teachers can observe and compare multiple same-age children across a variety of situations. Consequently, teacher ratings may capture ecological aspects of EF that are not assessed with lab-based tasks but that are manifested and important on a daily basis at school (Cuevas et al., 2012). Second, given that socioeconomic status (SES) is often associated with child EF (Lawson et al., 2018), as is prenatal risk (prenatal exposure to alcohol and/or tobacco, low birth weight, prematurity; e.g., Khoury et al., 2015; van Houdt et al., 2019), here we controlled for these factors. Third and importantly, to ensure a conservative test of the specific links between paternal mind-mindedness and child EF, mother–child attachment security was also included as a covariate. Indeed, mother–child attachment stands as a robust predictor of child EF as measured by both experimental tasks and adult ratings (e.g., Bernier et al., 2015; Lind et al., 2017; Matte-Gagné et al., 2018), hence constituting a particularly stringent control.

The Present Study

The present longitudinal study set out to investigate the role of paternal mind-mindedness in early toddlerhood in the prediction of individual differences in child EF problems as manifested almost five years later in the kindergarten classroom, controlling for paternal SES, child prenatal risk, and mother–child attachment security. Given our previous results (Gagné et al., 2018) and empirical evidence showing that certain aspects of paternal behavior (e.g., support and monitoring) are related to child EF in childhood (Hertz et al., 2019; Meuwissen & Englund, 2016; Roskam et al., 2014), greater use of mind-related comments by fathers during father–toddler free-play interactions was expected to be associated with less child EF problems at school.

Method

Participants

The sample consisted of 108 families (49 boys and 59 girls) living in a large Canadian metropolitan area. These families are part of an on-going longitudinal study of child development (Bernier et al., 2020). They were recruited from birth lists randomly generated and provided by the Ministry of Health and Social Services. Families received a letter describing the project and were then contacted by phone; 39% of contacted families agreed to participate. The absence of any known developmental delay in the child was required for participation. The study protocol was approved by the local human research ethics committee and informed consent was obtained prior to participation. Obstetric and socioeconomic information was collected upon recruitment (*M* = 7.40 months, *SD* = 0.94) with a maternal questionnaire. Full-term (≥ 37 gestational weeks) and late preterm (36 or 36.5 gestational weeks) children were included. When they entered the study, mothers were between 20 and 45 years (*M* = 31.86, *SD* = 4.23), and fathers between 25 and 58 years (*M* = 34.44, *SD* = 5.93). Most mothers (95.4%) and fathers (89.8%) were White. Both mothers and fathers had 16 years of education on average, varying from 11 to 18 years for mothers and from 11 to 21 for fathers. Family income varied from the $20,000 – $39,000 CDN bracket to more than $100,000 CDN, with an average in the $60,000 – $79,000 bracket.

Procedure

Families took part in three 90-min toddlerhood visits aimed at assessing paternal mind-mindedness and mother–child attachment security, and children's EF problems were reported by their respective kindergarten teachers four years later. The toddlerhood visits took place when children were aged 15 months (T1; *M* = 15.50 months, *SD* = 0.71), 18 months (T2; *M* = 18.33 months, *SD* = 0.95), and 2 years (T3; *M* = 25.19 months, *SD* = 1.05). Attachment security was assessed at T1 and T3 with the Attachment Behavior Q-Sort (AQS; see below) based on observations made throughout home visits that were modeled after the work of Pederson and Moran (1995). These visits were designed to challenge the mother's capacity to divide her attention between research tasks and child demands, thus reproducing daily natural conditions when caring for a young child. They included child-centered tasks, a brief interview with the mother, a videotaped mother–child interaction, and questionnaires that mothers had to complete while the child was not supervised by the research assistants. Paternal mind-mindedness was assessed in the lab at T2 during a 10-min father–toddler free play sequence, in which fathers were asked to play as they normally would with their child, but with toys that were provided by the research team. Within such contexts (i.e., free play in laboratory settings), child physical and emotional needs are likely to be satisfied, which is thought to be particularly suitable for measuring parents' attunement to their child's mental states (Meins, 2013). Upon parents' agreement, in the Spring of children's kindergarten year (February through April – T4; *M* = 6.07 years, *SD* = 0.25), their teachers were asked to fill in the Behavior Rating Inventory of Executive Function-Preschool Version (BRIEF-P; see below) and to return it by mail to our team in a prepaid envelope. There was no instance of two children of the study being in the same class the same year; accordingly, every teacher assessed the EF manifestations of one child only.

Among the 108 families constituting the sample, all had paternal mind-mindedness and mother-child attachment security data. Seventy-eight (72.22%) kindergarten teachers reported on child EF problems. The 30 families with missing data on the BRIEF-P did not differ from the other 78 families on sociodemographics, paternal mind-mindedness, or attachment security (all *p*s > .15). As per currently recommended best practices (Enders, 2010), multiple imputation was used to handle missing data prior to data analyses (as described below).

Measures

Prenatal Risk Factors

Based on obstetric information reported by mothers upon recruitment, five prenatal risk factors were derived: low birth weight (< 2,500g), preterm pregnancy (< 37 weeks), alcohol consumption, tobacco consumption, and pregnancy complications (e.g., cardiac problems, diabetes, anemia or rubella). Each factor was coded 0 (*no)* or 1 (*yes)*, except for pregnancy complications, which were coded as 0 (*none)*, 1 (*one complication)*, and 2 (*more than one complication)*. The five prenatal risk factors were then summed to create a cumulative prenatal risk score varying from 0 to 6 (*M* = 0.91, *SD* = 0.83, range = 0–3 in the current sample), with higher scores indicating higher risk.

Paternal Mind-Mindedness

Paternal mind-mindedness was rated at 18 months (T2) based on videotaped father–toddler interactions using Meins et al.'s (2001) coding system. Five categories of mind-related comments were assessed: (a) mental states, such as thoughts, desires, and knowledge; (b) mental processes, such as remembering and decision making; (c) emotional engagement; (d) attempts to manipulate other people's thoughts, such as joking and teasing; and (e) father talking for the child (e.g., father saying "I don't want to play with this toy, dad"). Following Meins et al.'s guidelines (2001), each mind-related comment was then coded as appropriate or non-attuned. A comment is considered appropriate when it meets at least one of the following three criteria: (a) based on observed child cues, the coder agrees with the father's comment on the child's ongoing state of mind; (b) the comment is linked with a past, current or future activity; and (c) the comment clarifies how to proceed after a lull in the interaction. Non-attuned mind-related comments were not considered here as they were very rare in the sample (more than 90% of fathers made no such comments at all).

Meins et al.'s (2001) coding system shows good interrater reliability (κ = .70; Meins et al., 2013) and its construct validity is documented with measures of child theory of mind and maternal sensitivity (Meins et al., 2003). In the current sample, a randomly selected subset of 19 videotapes (18% of the interactions) was coded by an independent rater. Interrater reliability was satisfactory, Intraclass Correlation (*ICC)* = .83. In order to control for variation in fathers' verbosity, proportional scores were computed. Hence, mind-mindedness scores consisted of the total number of appropriate mind-related comments divided by the total number of verbal comments made by the father during the sequence.

Mother–Child Attachment Security

Child attachment to mother was assessed at 15 months (T1) and 2 years (T3) using the Attachment Behavior Q-Sort (AQS; Waters, 1995). The AQS is comprised of 90 items describing potential child behaviors. Items are sorted by an observer into nine piles, reflecting the degree to which each item describes the target child's observed behavior. The observer's sort is then correlated with a criterion sort provided by the authors of the instrument representing the prototypically securely attached child. As a result, the obtained attachment score can vary from -1 (*highly insecure)* to 1 (*highly secure)*. A substantial body of research shows that the AQS is a valid measure of child attachment (for a meta-analysis, see Cadman et al., 2018). The AQS also demonstrates good interrater reliability (.87, Tarabulsy et al., 2008). In the present study, interrater reliability was conducted for 22% of the dyads at T1 and for 19% at T3 and was found to be satisfactory: *ICC* = .71 and .70, respectively. The correlation between AQS scores at 15 months (*M* = .43, *SD* = .25) and at 2 years (*M* = .47, *SD* = .24) was $r = .25$, $p < .05$, which is consistent with meta-analytic data on the temporal stability of the AQS ($r = .28$, van IJzendoorn et al., 2004). In line with previous studies using the AQS (e.g., Bernier et al., 2015; Tarabulsy et al., 2005), the two AQS scores (T1 and T3) were averaged into a global score of child attachment security to reduce measurement and situational error.

Teacher Report: The Behavior Rating Inventory of Executive Function-Preschool Version

The BRIEF-P (Gioia et al., 2003) was used at 6 years (T4) to assess child EF problems as observed by teachers through everyday behavior at school. This commonly used standardized questionnaire includes 63 items, rated on a 1–3 Likert scale (*never, sometimes, often*). Higher scores indicate greater levels of perceived EF impairments (e.g., "Gets easily sidetracked during activities"; "Forgets what he/she is doing in the middle of an activity"; "Has trouble changing activities"). The BRIEF-P targets five specific executive subdomains, from which three indices as well as an overall Global Executive Composite (GEC) can be computed. The first two subdomains, Inhibit and Emotional Control, are combined to form the Inhibitory Self-Control Index (hereafter Self-Control; 26 items). Self-Control reflects the child's ability to manage actions, emotions, and behavior using adequate inhibitory control. The Shift and Emotional Control subdomains compose the Flexibility Index (Flexibility; 20 items). Flexibility represents the child's ability to move among actions, responses, emotions and behavior. The other two subdomains, Working Memory and Plan/Organize, form the Emergent Metacognition Index (Metacognition; 27 items). Metacognition refers to the child's capacity to maintain ideas in mind and to initiate, plan, pursue and organize activities or problem-solving. The three index scores (Self-Control, Flexibility, and Metacognition) and the GEC were used as outcome measures in the present study to provide more thorough information about the nature (specific or global) of the associations between paternal mind-mindedness and child EF. Global scores such as the GEC also reduce measurement error and thus may be more robust indicators. Mean scores were derived in all cases, with the GEC representing the average of the 63 items. Scores could thus vary from 1 to 3, corresponding to the questionnaire's Likert scale.

The teacher version of the BRIEF-P has well-demonstrated psychometric properties, including good internal consistency (Cronbach's α between .80 and .97) and adequate test–retest reliability (r = .65 to .94), and documented convergent and divergent validity (Gioia et al., 2003). It has also been found to be sensitive to individual differences in EF among typically developing preschoolers (Garon et al., 2016). In the current sample, internal consistency was .95, .87, .92, and .96, respectively, for Self-Control, Flexibility, Metacognition, and the GEC.

Analytic Strategy

First, zero-order correlations were computed to examine associations among main study variables. Then, the multiple imputation procedure in SPSS 25.0 was used to estimate missing data on the BRIEF-P. To reduce bias and maximize the precision of imputed data (Enders, 2010), 20 imputations were conducted, with missing data imputed from a large set of auxiliary variables, including all variables used in the current study (covariates and main variables) as well as sociodemographic data.

Next, data were submitted to hierarchical regression analyses. A distinct regression was carried out for each BRIEF-P outcome (i.e., three index scores and the GEC) and accordingly, four models were fit. In each model, fathers' SES (here, a standardized average of paternal education and family income) and the cumulative prenatal risk score (described above) were entered in the first block, followed by mother–child attachment security in the second block, and by paternal mind-mindedness in the third and last block. All presented regression results constitute the pooled averages of the estimates obtained from each of the 20 imputed data sets.

Results

Descriptive Overview

Descriptive statistics and correlations among the main study variables are presented in Table 1. All variables showed normal or near-normal distributions, although few executive problems were perceived. Paternal mind-mindedness and mother–child attachment security were positively but not significantly inter-correlated. Paternal mind-mindedness was moderately related to all three BRIEF-P index scores, as well as to the GEC. All correlations were in the expected directions: greater exposure to paternal mind-mindedness was related to less EF problems as perceived by teachers.

Predicting Children's EF Problems as Perceived by Kindergarten Teachers

Table 2 presents the results of the hierarchical regression analyses. The final models predicted between 6.70% and 15.86% of variance in BRIEF-P outcomes. Over and above mother–child attachment security and other covariates, paternal mind-mindedness predicted unique additional variance in Flexibility ($\beta = -.26$, $p = .018$), Metacognition ($\beta = -.27$, $p = .012$), and the GEC ($\beta = -.28$, $p = .014$), and made a marginal contribution to the prediction of Self-Control ($\beta = -.22$, $p = .062$). In all cases, relations were in the expected direction: children who were exposed to more paternal mind-mindedness at 18 months were considered as presenting less EF impairments at school by their kindergarten teachers. Overall, mind-mindedness predicted between 4.84% and 7.84% of unique variance in BRIEF-P outcomes

Discussion

A common observation among early childhood educators is that children vary greatly in their capacity to use their EF, with some having more difficulty adapting to new situations, getting started on tasks after receiving instructions, or not acting on impulse. Inevitably, these difficulties have important impacts on children's learning capacities (Blair et al., 2015) and eventually, school achievement (Gerst et al., 2017). Hence, investigating malleable antecedents of individual differences in child EF, such as parental influences, represents an important matter for applied developmental research. Consequently, building on recent progress in fathering research, this longitudinal study examined the capacity of paternal mind-mindedness, assessed as early as almost five years before school entry, to predict child EF as manifested in the kindergarten classroom. The findings suggested a positive association between paternal mind-mindedness and child EF: kindergarteners who were exposed to more appropriate mind-related comments while playing with their father in early toddlerhood were considered by their teachers to present less EF problems in everyday school situations.

This study extends prior research that showed that fathers can play a meaningful role in the development of child EF (Hertz et al., 2019; Meuwissen & Englund, 2016; Roskam et al., 2014) by indicating that mind-mindedness, an aspect of parenting behavior than can be learned (Zeegers et al., 2020), is another way in which fathers may promote their children's capacity to use their executive competence when faced with school demands. The current results also extend mind-mindedness research, in that they add to studies reporting positive links between maternal mind-mindedness and other aspects of child cognitive development (e.g., Bernier et al., 2017; Meins et al., 2013). To our knowledge, findings from Gagné et al. (2018) and this study are the first to suggest that paternal mind-mindedness may likewise be beneficial for child cognition, and in particular child EF.

Interestingly, results were quite similar across BRIEF-P indicators, with paternal mind-mindedness uniquely predicting 7–8% of the variance in Flexibility, Metacognition, and the GEC, as well as a marginal 5% of the variance in Self-Control. It thus appears that paternal mind-mindedness may strengthen general executive competence, namely what is common to BRIEF-P indices and is reflected in the GEC. In other words, the results appear to suggest that, rather than having specific effects on particular executive functions or manifestations, paternal mind-mindedness may broadly promote children's capacity to use their EF at school, resulting in less EF problems overall as perceived by teachers. All in all though, considering the dearth of studies on either parent's mind-mindedness and child EF, more research is needed to draw reliable conclusions regarding the specific versus global nature of the association between parental mind-mindedness and child EF.

Importantly, the relations observed here between paternal mind-mindedness and child EF manifestations in naturalistic school environments were robust, in that they held over and above paternal SES, child prenatal risk (although these two factors did not predict EF here), and mother–child attachment security, a salient predictor of child EF (e.g., Regueiro et al., 2020). Moreover, even though the measure of mother–child attachment security was psychometrically stronger (assessed over 90-min interactions at two time points) than the measure of paternal mind-mindedness (10-min free play sequence at one time point), mind-mindedness explained additional unique variance in child EF. Furthermore, as mentioned above, the levels of teacher-reported EF impairments were, as expected, relatively low in this normative sample. Yet, paternal mind-mindedness predicted unique portions of this modest variation in children's capacity to use their EF. One may speculate that these predictive associations might be even more pronounced in clinical or otherwise at-risk samples, in which more significant EF impairments are expected (Ezpeleta & Granero, 2015). Overall, the current results highlight the potentially meaningful contribution of early paternal mind-mindedness in protecting children against EF problems when facing real-life kindergarten situations.

Nevertheless, it is important to acknowledge what the BRIEF-P does and does not assess. It is recognized that environmental influences (e.g., contexts with high demands) and rater perspective (e.g., quality of the relationship between the respondent and the child, emotional states) may affect teachers' responses on the BRIEF-P (Isquith et al., 2013). Furthermore, EF performance-based tasks have been found to correlate modestly with EF ratings (Soto et al., 2020). In light of these results, it has been suggested that tasks and ratings assess different aspects of EF, namely processing efficiency and goal pursuits in real-life settings, respectively (Toplak et al., 2013). Soto and colleagues (2020) also argued that these two EF measures may respectively tap into cognitive versus behavioral manifestations of EF. Furthermore, there is evidence showing that the BRIEF-P provides a useful global index of EF capacity but may be less adequate in assessing *specific* facets of EF (Spiegel et al., 2017). Therefore, the current findings with the GEC may be the most meaningful or reliable.

Several mechanisms may explain the association observed here between paternal mind-mindedness and child EF as subsequently manifested in the classroom, and represent intriguing directions for future studies. First, by its verbal nature, paternal mind-mindedness could provide children with language-based strategies, such as private speech (Winsler, 2009), which may help them develop self-regulation skills (Vallotton & Ayoub, 2011). This, in turn, may promote children's capacity to organize their behavior autonomously during everyday situations and problem-solving, and thus show executive competence, especially in school settings where they are exposed to changing learning and social contexts.

Second, the putative influence of paternal mind-mindedness on child EF manifestations in kindergarten could also transit through child theory of mind, which shows robust positive connections with both mind-mindedness and EF skills (see Devine & Hughes, 2014, 2018, and

McMahon & Bernier, 2017). It has been argued that children's meta-representational understanding that mental states govern actions, inherent to theory of mind, may foster their capacity to control their own thoughts and behaviors (Wade et al., 2018). Thus, greater exposure to paternal mind-mindedness may support toddlers' understanding of mental states, which in turn could help them exert greater executive control, particularly to behave appropriately in daily situations at school (e.g., interactions with peers and teachers, task completion in the classroom).

Third, neurophysiological systems are likely vehicles to account for the link between paternal mind-mindedness and child EF in kindergarten. Indeed, there is evidence suggesting that parental mind-mindedness is associated with better infant physiological emotion regulation, as indexed by higher baseline heart rate variability (Zeegers et al., 2018), and with more mature neural connectivity in fronto-temporal brain regions (Dégeilh et al., 2018), cerebral areas related to EF (Fiske & Holmboe, 2019).Therefore, by fostering optimal functioning of neural circuitry and other neurophysiological systems, paternal mind-mindedness could support children's capacity to handle arousal and promote their capacity to use their EF in naturalistic school environments.

Strengths and Limitations

The current study has several strengths, including the focus on fathers, the longitudinal design, the use of proportional scores for assessing mind-mindedness (i.e., controlling for paternal verbosity), and the multi-informant and multi-method assessment approach. Another strength is the consideration of paternal SES, prenatal risk, and particularly mother–child attachment security in the analyses. This study is also one of the first to investigate any child cognitive outcome of either parent's mind-mindedness, although these putative associations rest on solid theoretical grounds (Bernier et al., 2017). However, a number of limitations may have influenced the results obtained. The greatest limitation is perhaps that we did not measure maternal mind-mindedness. Further research should include both mothers and fathers to clarify similarities and differences in mind-mindedness and how these relate to child EF development. Second, the sample was mainly composed of White middle-class families, and very preterm or very low birth weight children were not included in the study. The low-risk nature of the sample limited variability in some variables, notably the cumulative prenatal risk score, which may explain why this score was not associated with child EF. The nature of the sample also constrains the generalization of the findings to other populations (e.g., low SES families; Blair et al., 2011; Sarsour et al., 2011). Third, the current design was correlational and thus we can only speculate about causal processes. Fourth, other factors not considered here, such as child language, theory of mind, and neurophysiological mechanisms, should be addressed in the future as they could contribute significantly to EF development and perhaps explain some of the links observed in this study. Finally, research shows that genetic influences contribute to individual differences in EF (Engelhardt et al., 2015; Friedman & Miyake, 2017) and thus, we cannot rule out a genetic explanation for the current results.

Conclusion

This study contributes to both mind-mindedness research and to the emerging literature on fathers and child EF. Study results indicate that fathers' tendency to talk about their toddlers' mental states and processes while playing with them may bolster children's future capacity to use their EF, including in the classroom when they are in kindergarten. This potential contribution of paternal mind-mindedness is independent from mother–child attachment security, providing support for the specific importance of fathers in child executive development. An interesting avenue for future studies is to adopt a systemic approach, including both parents and their children (Schoppe-Sullivan & Fagan, 2020). This approach has the potential to move the EF research field forward by providing a more thorough and nuanced understanding of the parental and family antecedents of child EF.

References

Bernier, A., Beauchamp, M. H., Carlson, S. M., & Lalonde, G. (2015). A secure base from which to regulate: Attachment security in toddlerhood as a predictor of executive functioning at school entry. *Developmental Psychology, 51*(9), 1177–1189. http://dx.doi.org/10.1037/dev0000032

Bernier, A., Beauchamp, M. H., & Cimon-Paquet, C. (2020). From early relationships to preacademic knowledge: A sociocognitive developmental cascade to school readiness. *Child Development*, *91*(1), e134–e145. https://doi.org/10.1111/cdev.13160

Bernier, A., Carlson, S. M., Deschênes, M., & Matte-Gagné, C. (2012). Social factors in the development of early executive functioning: A closer look at the caregiving environment. *Developmental Science, 15*(1), 12–24. https://doi.org/10.1111/j.1467-7687.2011.01093.x

Bernier, A., McMahon, C. A., & Perrier, R. (2017). Maternal mind-mindedness and children's school readiness: A longitudinal study of developmental processes. *Developmental Psychology, 53*(2), 210–221. https://doi.org/10.1037/dev0000225

Blair, C., Granger, D. A., Willoughby, M., Mills-Koonce, R., Cox, M., Greenberg, M. T., Kivlighan, K. T., Fortunato, C. K., & Family Life Project Investigators. (2011). Salivary cortisol mediates effects of poverty and parenting on executive functions in early childhood. *Child Development, 82*(6), 1970–1984. https://doi.org/10.1111/j.1467-8624.2011.01643.x

Blair, C., & Raver, C. C. (2015). School readiness and self-regulation: A developmental psychobiological approach. *Annual Review of Psychology, 66*(1), 711–731. https://doi.org/10.1146/annurev-psych-010814-015221

Cabrera, N. J., & Tamis-LeMonda, C. (2013). *Handbook of father involvement: Multidisciplinary perspectives* (2nd ed.). Taylor & Francis Group.

Cadman, T., Diamond, P. R., & Fearon, P. (2018). Reassessing the validity of the attachment Q-sort: An updated meta-analysis. *Infant and Child Development*, *27*(1), e2034. https://doi.org/10.1002/icd.2034

Cheng, N., Lu, S., Archer, M., & Wang, Z. (2018). Quality of maternal parenting of 9-month-old infants predicts executive function performance at 2 and 3 years of age. *Frontiers in Psychology, 8*, Article 2293. https://doi.org/10.3389/fpsyg.2017.02293

Clark, C. A., Pritchard, V. E., & Woodward, L. J. (2010). Preschool executive functioning abilities predict early mathematics achievement. *Developmental Psychology*, *46*(5), 1176–1191. https://doi.org/10.1037/a0019672

Colonnesi, C., Zeegers, M. A. J., Majdandzic, M., van Steensel, F. J. A., & Bogels, S. M. (2019). Fathers' and mothers' early mind-mindedness predicts social competence and behavior problems in childhood. *Journal of Abnormal Child Psychology, 47*(9), 1421–1435. https://doi.org/10.1007/s10802-019-00537-2

Costantini, A., Coppola, G., Fasolo, M., & Cassibba, R. (2017). Preterm birth enhances the contribution of mothers' mind-mindedness to infants' expressive language development: A longitudinal investigation. *Infant Behavior and Development, 49*, 322–329. https://doi.org/10.1016/j.infbeh.2017.10.006

Cuevas, K., Hubble, M., & Bell, M. A. (2012). Early childhood predictors of post-kindergarten executive function: Behavior, parent-report, and psychophysiology. *Early Education and Development, 23*(1), 59–73. https://doi.org/10.1080/10409289.2011.611441

Dégeilh, F., Bernier, A., Leblanc, E., Daneault, V., & Beauchamp, M. H. (2018). Quality of maternal behaviour during infancy predicts functional connectivity between default mode network and salience network 9 years later. *Developmental Cognitive Neuroscience, 34*, 53–62. https://doi.org/10.1016/j.dcn.2018.06.003

Devine, R. T., & Hughes, C. (2014). Relations between false belief understanding and executive function in early childhood: A meta-analysis. *Child Development, 85*(5), 1777–1794. https://doi.org/10.1111/cdev.12237

Devine, R. T., & Hughes, C. (2018). Family correlates of false belief understanding in early childhood: A meta-analysis. *Child Development*, *89*(3), 971–987. https://doi.org/10.1111/cdev.12682

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135–168. https://doi.org/10.1146/annurev-psych-113011-143750

Enders, C. K. (2010). *Applied missing data analysis*. Guilford.

Engelhardt, L. E., Briley, D. A., Mann, F. D., Harden, K. P., & Tucker-Drob, E. M. (2015). Genes unite executive functions in childhood. *Psychological Science*, *26*(8), 1151–1163.

https://doi.org/10.1177/0956797615577209

Ezpeleta, L., & Granero, R. (2015). Executive functions in preschoolers with ADHD, ODD, and comorbid ADHD-ODD: Evidence from ecological and performance-based measures. *Journal of Neuropsychology*, *9*(2), 258–270. https://doi.org/10.1111/jnp.12049

Fay-Stammbach, T., Hawes, D. J., & Meredith, P. (2014). Parenting influences on executive function in early childhood: A review. *Child Development Perspectives, 8*(4), 258–264. https://doi.org/10.1111/cdep.12095

Fernyhough, C. (2008). Getting Vygotskian about theory of mind: Mediation, dialogue and the development of social understanding. *Developmental Review*, *28*(2), 225–262. https://doi.org/10.1016/j.dr.2007.03.001

Fiske, A., & Holmboe, K. (2019). Neural substrates of early executive function development. *Developmental Review, 52*, 42–62. https://doi.org/10.1016/j.dr.2019.100866

Friedman, N. P., & Miyake, A. (2017). Unity and diversity of executive functions: Individual differences as a window on cognitive structure. *Cortex*, *86*, 186–204. http://dx.doi.org/10.1016/j.cortex.2016.04.023

Gagné, C., Bernier, A., & McMahon, C. A. (2018). The role of paternal mind-mindedness in preschoolers' self-regulated conduct. *Infant and Child Development*, *27*(3), Article e2081. https://doi.org/10.1002/icd.2081

Garon, N. M., Piccinin, C., & Smith, I. M. (2016). Does the BRIEF-P predict specific executive function components in preschoolers? *Applied Neuropsychology: Child, 5*(2), 110–118. https://doi.org/10.1080/21622965.2014.1002923

Gerst, E. H., Cirino, P. T., Fletcher, J. M., & Yoshida, H. (2017). Cognitive and behavioral rating measures of executive function as predictors of academic outcomes in children. *Child Neuropsychology, 23*(4), 381–407. https://doi.org/10.1080/09297049.2015.1120860

Gioia, G. A., Espy, K. A., & Isquith, P. K. (2003). *Behavior rating inventory of executive function-preschool version (BRIEF-P)*. Psychological Assessment Resources.

Goffin, K. C., Kochanska, G., & Yoon, J. E. (2020). Children's theory of mind as a mechanism linking parents' mind-mindedness in infancy with children's conscience. *Journal of Experimental Child Psychology, 193*, Article 104784. https://doi.org/10.1016/j.jecp.2019.104784

Hertz, S., Bernier, A., Cimon-Paquet, C., & Regueiro, S. (2019). Parent–child relationships and child executive functioning at school entry: The importance of fathers. *Early Child Development and Care*, *189*(5), 718–732. https://doi.org/10.1080/03004430.2017.1342078

Hooper, S. R., Costa, L.-J. C., Green, M. B., Catlett, S. R., Barker, A., Fernandez, E., & Faldowski, R. A. (2020). The relationship of teacher ratings of executive functions to emergent literacy in Head Start. *Reading and Writing, 33*, 963–989. https://doi.org/10.1007/s11145-019-09992-1

Hurtado, N., Marchman, V. A., & Fernald, A. (2008). Does input influence uptake? Links between maternal talk, processing speed and vocabulary size in Spanish-learning children. *Developmental Science, 11*(6), F31–F39. https://doi.org/10.1111/j.1467-7687.2008.00768.x

Isquith, P. K., Roth, R. M., & Gioia, G. (2013). Contribution of rating scales to the assessment of executive functions. *Applied Neuropsychology*: Child, *2*(2), 125–132. https://doi.org/10.1080/21622965.2013.748389

Khoury, J. E., Milligan, K., & Girard, T. A. (2015). Executive functioning in children and adolescents prenatally exposed to alcohol: A meta-analytic review. *Neuropsychology Review, 25*(2), 149–170. https://doi.org/10.1007/s11065-015-9289-6

Laranjo, J., & Bernier, A. (2013). Children's expressive language in early toddlerhood: Links to prior maternal mind-mindedness. *Early Child Development and Care, 183*(7), 951–962. https://doi.org/10.1080/03004430.2012.699964

Lawson, G. M., Hook, C. J., & Farah, M. J. (2018). A meta-analysis of the relationship between socioeconomic status and executive function performance among children. *Developmental Science*, *21*(2), Article e12529. https://doi.org/10.1111/desc.12529

Lind, T., Lee Raby, K., Caron, E. B., Roben, C. K., & Dozier, M. (2017). Enhancing executive functioning among toddlers in foster care with an attachment-based intervention. *Development and Psychopathology, 29*(2), 575–586. https://doi.org/10.1017/S0954579417000190

Matte-Gagné, C., & Bernier, A. (2011). Prospective relations between maternal autonomy support and child executive functioning: Investigating the mediating role of child language ability. *Journal of Experimental Child Psychology, 110*(4), 611–625. https://doi.org/10.1016/j.jecp.2011.06.006

Matte-Gagné, C., Bernier, A., Sirois, M. S., Lalonde, G., & Hertz, S. (2018). Attachment security and developmental patterns of growth in executive functioning during early elementary school. *Child Development*, *89*(3), e167–e182. https://doi.org/10.1111/cdev.12807

McMahon, C. A., & Bernier, A. (2017). Twenty years of research on parental mind-mindedness: Empirical findings, theoretical and methodological challenges, and new directions. *Developmental Review, 46*, 54–80. https://doi.org/10.1016/j.dr.2017.07.001

Meins, E. (1997). *Security of attachment and the social development of cognition*. Psychology Press.

Meins, E. (2013). Sensitive attunement to infants' internal states: Operationalizing the construct of mind-mindedness. *Attachment and Human Development, 15*(5-6), 524–544. https://doi.org/10.1080/14616734.2013.830388

Meins, E., Fernyhough, C., Arnott, B., Leekam, S. R., & de Rosnay, M. (2013). Mind-mindedness and theory of mind: Mediating roles of language and perspectival symbolic play. *Child Development, 84*(5), 1777–1790. https://doi.org/10.1111/cdev.12061

Meins, E., Fernyhough, C., Fradley, E., & Tuckey, M. (2001). Rethinking maternal sensitivity: Mothers' comments on infants' mental processes predict security of attachment at 12 months. *The Journal of Child Psychology and Psychiatry, 42*(5), 637–648. https://doi.org/10.1017/S0021963001007302

Meins, E., Fernyhough, C., Wainwright, R., Clark-Carter, D., Das Gupta, M., Fradley, E., & Tuckey, M. (2003). Pathways to understanding mind: Construct validity and predictive validity of maternal mind-mindedness. *Child Development*, *74*(4), 1194–1211. https://doi.org/10.1111/1467-8624.00601

Meuwissen, A. S., & Englund, M. M. (2016). Executive function in at-risk children: Importance of father-figure support and mother parenting. *Journal of Applied Developmental Psychology, 44*, 72–80. https://doi.org/10.1016/j.appdev.2016.04.002

Pederson, D. R., & Moran, G. (1995). A categorical description of infant–mother relationships in the home and its relation to Q-sort measures of infant–mother interaction*. Monographs of the Society for Research in Child Development*, *60*(2-3), 111–132. https://doi.org/10.1111/j.1540-5834.1995.tb00207.x

Regueiro, S., Matte-Gagné, C., & Bernier, A. (2020). Patterns of growth in executive functioning during school years: Contributions of early mother–child attachment security and maternal autonomy support. *Journal of Experimental Child Psychology*, *200*, Article 104934. https://doi.org/10.1016/j.jecp.2020.104934

Roskam, I., Stievenart, M., Meunier, J. C., & Noel, M. P. (2014). The development of children's inhibition: Does parenting matter? *Journal of Experimental Child Psychology, 122*, 166–182. https://doi.org/10.1016/j.jecp.2014.01.003

Sarsour, K., Sheridan, M., Jutte, D., Nuru-Jeter, A., Hinshaw, S., & Boyce, W. T. (2011). Family socioeconomic status and child executive functions: The roles of language, home environment, and single parenthood. *Journal of the International Neuropsychological Society, 17*(1), 120–132. https://doi.org/10.1017/S1355617710001335

Schoppe-Sullivan, S. J., & Fagan, J. (2020). The Evolution of fathering research in the 21st century: Persistent challenges, new directions. *Journal of Marriage and Family*, *82*(1), 175–197. https://doi.org/10.1111/jomf.12645

Shonkoff, J. P., Duncan, G. G., Fisher, P. A., Magnuson, K., Raver, C. C., & Yoshikawa, H. (2011). *Building the brain's 'air traffic control' system: How early experiences shape the development of executive function* (Working Paper No. 11). Center on the Developing Child, Harvard University. http://developingchild.harvard.edu/wp-content/uploads/2011/05/How-Early-Experiences-Shape-the-Development-of-Executive-Function.pdf

Soto, E. F., Kofler, M. J., Singh, L. J., Wells, E. L., Irwin, L. N., Groves, N. B., & Miller, C. E. (2020). Executive functioning rating scales: Ecologically valid or construct invalid? *Neuropsychology*, *34*(6), 605–619. http://dx.doi.org/10.1037/neu0000681

Spiegel, J. A., Lonigan, C. J., & Phillips, B. M. (2017). Factor structure and utility of the Behavior Rating Inventory of Executive Function-Preschool Version. *Psychological Assessment*, *29*(2), 172–185. http://dx.doi.org/10.1037/pas0000324

Tarabulsy, G. M., Bernier, A., Provost, M. A., Maranda, J., Larose, S., Moss, E., Larose, M., &

Tessier, R. (2005). Another look inside the gap: Ecological contributions to the transmission of attachment in a sample of adolescent mother–infant dyads. *Developmental Psychology*, *41*(1), 212–224. http://dx.doi.org/10.1037/0012-1649.41.1.212

Tarabulsy, G. M., Provost, M. A., Larose, S., Moss, E., Lemelin, J. P., Moran, G., Forbes, L., & Pederson, D. R. (2008). Similarities and differences in mothers' and observers' ratings of infant security on the Attachment Q-Sort. *Infant Behavior and Development*, *31*(1), 10–22. https://doi.org/10.1016/j.infbeh.2007.05.002

Taumoepeau, M. (2016). Maternal expansions of child language relate to growth in children's vocabulary. *Language Learning and Development, 12*(4), 429–446. https://doi.org/10.1080/15475441.2016.1158112

Toplak, M. E., West, R. F., & Stanovich, K. E. (2013). Practitioner review: Do performance-based measures and ratings of executive function assess the same construct? *Journal of Child Psychology and Psychiatry, 54*(2), 131–143. https://doi.org/10.1111/jcpp.12001

Valcan, D. S., Davis, H., & Pino-Pasternak, D. (2018). Parental behaviours predicting early childhood executive functions: A meta-analysis. *Educational Psychology Review*, *30***,** 607–649. https://doi.org/10.1007/s10648-017-9411-9

Vallotton, C., & Ayoub, C. (2011). Use your words: The role of language in the development of toddlers' self-regulation. *Early Childhood Research Quarterly, 26*(2), 169–181. https://doi.org/10.1016/j.ecresq.2010.09.002

van Houdt, C. A., Oosterlaan, J., van Wassenaer-Leemhuis, A. G., van Kaam, A. H., & Aarnoudse-Moens, C. S. H. (2019). Executive function deficits in children born preterm or at low birthweight: A meta-analysis. *Developmental Medicine and Child Neurology, 61*(9), 1015–1024. https://doi.org/10.1111/dmcn.14213

van IJzendoorn, M. H., Vereijken, C. M., Bakermans-Kranenburg, M. J., & Riksen-Walraven, J. M. (2004). Assessing attachment security with the Attachment Q-Sort: Meta-analytic evidence for the validity of the observer AQS. *Child Developmen*t, *75*(4), 1188–1213. https://doi.org/10.1111/j.1467-8624.2004.00733.x

Volling, B. L., & Cabrera, N. J. (2019). Advancing research and measurement on fathering and child development. *Monographs of the Society for Research in Child Development*, *84*(1), 7–160. https://doi.org/10.1111/mono.12404

Wade, M., Prime, H., Jenkins, J. M., Yeates, K. O., Williams, T., & Lee, K. (2018). On the relation between theory of mind and executive functioning: A developmental cognitive neuroscience perspective. *Psychonomic Bulletin and Review, 25*(6), 2119–2140. https://doi.org/10.3758/s13423-018-1459-0

Waters, E. (1995). Appendix A: The attachment Q-set (version 3.0). *Monographs of the Society for Research in Child Development*, *60*(2-3), 234–246. https://doi.org/10.1111/j.1540-5834.1995.tb00214.x

Winsler, A. (2009). Still talking to ourselves after all these years: A review of current research on private speech. In A. Winsler, C. Fernyhough, & I. Montero (Eds.), *Private speech, executive functioning, and the development of verbal self-regulation* (pp. 3–41). Cambridge University Press. https://doi.org/10.1017/CBO9780511581533.003

Zeegers, M. A. J., Colonnesi, C., Noom, M. J., Polderman, N., & Stams, G.-J. J. M. (2020). Remediating child attachment insecurity: Evaluating the Basic Trust Intervention in adoptive families. *Research on Social Work Practice, 30*(7), 736–749. https://doi.org/10.1177/1049731519863106

Zeegers, M. A. J., de Vente, W., Nikolic, M., Majdandzic, M., Bogels, S. M., & Colonnesi, C. (2018). Mothers' and fathers' mind-mindedness influences physiological emotion regulation of infants across the first year of life. *Developmental Science, 21*(6), Article e12689. https://doi.org/10.1111/desc.12689

Zelazo, P. D., Blair, C. B., & Willoughby, M. T. (2016). *Executive Function: Implications for Education* (NCER 2017-2000). Institute of Education Sciences. https://ies.ed.gov/ncer/pubs/20172000/pdf/20172000.pdf

Zelazo, P. D., & Carlson, S. M. (2012). Hot and cool executive function in childhood and adolescence: Development and plasticity. *Child Development Perspectives, 6*(4), 354–360. https://doi.org/10.1111/j.1750-8606.2012.00246.x

Table 1

Descriptive Statistics and Correlations among Main Study Variables

	n [b]	Minimum	Maximum	Mean	*SD*	Correlations	
						Paternal mind-mindedness	Mother–child attachment security
Paternal mind-mindedness	108	0	0.38	0.10	0.07	—	.14
Mother–child attachment security	108	−.29	.78	.45	0.21	—	—
BRIEF-P Self-Control [a]	78	1	2.42	1.27	0.33	−.30**	−.19
BRIEF-P Flexibility [a]	78	1	2.00	1.20	0.23	−.26*	−.18
BRIEF-P Metacognition [a]	78	1	2.04	1.19	0.24	−.36**	−.33**
BRIEF-P GEC [a]	78	1	2.08	1.23	0.24	−.36**	−.30**

Note. BRIEF-P = Preschool version of the Behavior Rating Inventory of Executive Function; GEC = Global Executive Composite. Higher scores on the BRIEF-P indicate more executive problems.

[a] Mean scores are reported. [b] Sample size before multiple imputation.

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

Table 2

Summary of Regression Analyses Predicting Children's EF Problems as Perceived by Kindergarten Teachers

	BRIEF-P			
Blocks and predictors	Self-Control β	Flexibility β	Metacognition β	GEC β
1.Paternal SES	−.08	.02	−.03	−.03
Prenatal risk	.01	−.02	.08	.04
2.Mother–child attachment security	−.11	−.08	−.28*	−.23*
3.Paternal mind-mindedness	−.22^{t}	−.26*	−.27*	−.28*
Mind-mindedness unique R^2 (%)	4.84%	6.76%	7.29%	7.84%
Total R^2 (%)	6.70%	7.48%	15.86%	13.38%

Note. Coefficients from the final models are presented. BRIEF-P = Preschool version of the Behavior Rating Inventory of Executive Function; SES = socioeconomic status; GEC = Global Executive Composite. Higher scores on the BRIEF-P indicate more executive problems.

$^{t}p < .10$. $^{*}p < .05$.

Article 2

Patterns of Growth in Executive Functioning during School Years: Contributions of Early Mother–Child Attachment Security and Maternal Autonomy Support

Regueiro, S., Matte-Gagné, C., & Bernier, A. (2020). Patterns of growth in executive functioning during school years: Contributions of early mother–child attachment security and maternal autonomy support. *Journal of Experimental Child Psychology*, *200*, Article 104934. https://doi.org/10.1016/j.jecp.2020.104934

Note. Le deuxième article de thèse est conforme aux normes de la sixième édition du manuel de l'American Psychological Association (APA), car il a été publié ainsi.

Pour cet article, j'ai participé à la collecte des données. J'ai également occupé un rôle central dans la conceptualisation, la recension des écrits, la méthodologie, l'analyse des données, l'interprétation des résultats et la rédaction des manuscrits originaux. Mes coauteurs m'ont supervisée dans tout le processus et ont contribué aux révisions du manuscrit, ainsi qu'aux ressources matérielles, administratives et financières.

Abstract

Executive functioning (EF) undergoes marked developmental improvements during the early school years. Given the crucial role of EF in learning and school adjustment, it is important to document the factors that bolster the development of executive competence, especially during a period of growth. Although substantial evidence suggests that parent–child relationships relate to EF, few longitudinal studies have examined the parental antecedents of EF developmental trajectories during school years. Accordingly, this multiyear longitudinal study (*N* = 102) explored the respective roles of early mother–child attachment security and maternal autonomy support in the prediction of patterns of growth in working memory, cognitive flexibility, and planning skills across Grades 2 to 4. Multilevel growth curve analyses revealed a unique positive relation between attachment security and all EF skills, whereas autonomy support was mainly independently associated with initial planning performance. These findings provide further suggestion for a global contribution of secure attachment relationships to children's executive competence and highlight the importance of supporting children's autonomy to foster the emergence of more complex EF abilities, such as planning. This study also supports the relevance of considering multiple aspects of parent–child relationships to delineate how early caregiving experiences contribute to children's EF development.

Keywords: executive functioning, attachment security, autonomy support, growth curves

Patterns of Growth in Executive Functioning during School Years: Contributions of Early Mother–Child Attachment Security and Maternal Autonomy Support

The early school years are associated with many challenges as children have to adapt simultaneously to increasing learning demands and changing social contexts. Executive functioning (EF) is a set of cognitive skills that has received much interest in developmental and educational sciences as it allows such adaptation. The term EF refers to higher-order cognitive processes such as inhibition, working memory, cognitive flexibility, and planning that serve the goal-directed control of thought, emotion, and behavior (Diamond, 2013; Zelazo & Carlson, 2012). Extensive research indicates that EF is centrally involved in learning processes and in the self-regulated behavior necessary both for gaining knowledge and maintaining adequate interactions with peers and teachers in school settings (for reviews, see Shonkoff et al., 2011; Zelazo, Blair, & Willoughby, 2016).

Given the crucial role of EF in learning and school adjustment, it is important to document the factors that bolster the development of executive competence, especially during a period of growth (i.e., developmental improvement in EF). Yet, despite clear evidence from cross-sectional studies that substantial age-related differences in EF skills can be observed during the elementary school years (reviews: Best & Miller, 2010; De Luca & Leventer, 2008), limited longitudinal work has focused on the antecedents of individual differences in EF developmental trajectories during school years. Tackling this gap, this longitudinal study examined the predictive roles of mother–child attachment security and maternal autonomy support, assessed in toddlerhood and preschool years, in EF patterns of growth between the second and fourth year of elementary school (hereafter called Grade 2 and Grade 4 as per the North American system).

Patterns of Growth in Child EF and Parent–Child Relationships

In the first years of life, parents represent a primary source of socioenvironmental influence that may shape brain development and neurocognitive skills, including EF (Blair et al., 2011; Lupien et al., 2011). Not surprisingly, the quality of parent–child interactions stands as a reliable predictor of age-specific EF performance (Valcan, Davis, & Pino-Pasternak, 2018). However, relatively few studies have investigated these links longitudinally, using growth modeling approaches to formally model trajectories of EF development (Clark et al., 2013). Growth modeling allows for superior and unique characterization of EF development and its antecedents by describing interindividual differences in intraindividual change and nonlinear patterns of change (for more details, see Bornstein, Putnick, & Esposito, 2017 and Hoffman, 2015). Such an approach is of great interest for developmental research as it can contribute to enhanced understanding of the developmental associations that unfold over time between a putative predictor and developing EF skills (see Fraley, Roisman, & Haltigan, 2013).

In the EF literature, longitudinal studies have mostly been conducted with preschoolers, although many factors suggest the relevance of addressing EF development in school-aged children. First, it has been suggested that the novel experiences and challenges that characterize the school years raise a wide range of news questions about the outcomes of EF and its antecedents (Best, Miller, & Jones, 2009). Second, cortical gray matter volume and thickness continue to develop throughout school age including in the frontal lobes (Tamnes et al., 2017), a cerebral region most often associated with EF (Fiske & Holmboe, 2019). Third, there is evidence showing EF skills begin to differentiate into separate components during school years (Bardikoff & Sabbagh, 2017). Finally, results from twin studies indicate a modest contribution of genetic factors to EF skills during middle childhood, thus leaving substantial variance to be explained by environmental factors (Li & Roberts, 2017). Overall, the school years are associated with EF-relevant changes at multiple levels (environmental context, frontal brain development, EF structure) while representing a period of likely substantial environmentally driven influence on individual differences in EF. Therefore, the school years may constitute an important time to examine the parental predictors of individual differences in EF's developmental patterns of growth. In line with this, a limited body of work using growth modeling suggests that different indicators of parent–child interactions relate to patterns of change in child EF during school years (Friedman et al., 2014; Hackman, Gallop, Evans, & Farah, 2015; Roskam, Stievenart, Meunier, & Noël, 2014). These studies showed that self-reports of parenting behaviors (e.g., monitoring and discipline) and observed maternal sensitivity are associated with the developmental trajectories of inhibition capacities (Roskam et al., 2014) and planning skills (Friedman et al., 2014; Hackman et al., 2015), respectively.

Parent–Child Relationships as a Multidimensional Construct

It is believed that the parent–child relationship is a complex multidimensional construct that involves distinct interactive domains, each associated with different socialization processes and child outcomes (Grusec & Davidov, 2010). This domain-specific view of parental influences is supported by recent meta-analytic data showing that several different aspects of the quality of parent–child interactions are found by different studies to correlate with child EF (Valcan et al., 2018). Nonetheless, studies contrasting the respective roles of distinct parental influences in the prediction of child EF within the same sample are scarce (see Hughes & Devine, 2019 for a recent exception, however focusing on age-specific EF). This may be an important gap as there is little evidence about the specific versus global nature of the parenting–EF links (Valcan et al., 2018). The present study seeks to contribute to this emerging literature using observational measures of two different aspects of parent–child relationships as predictors of patterns of change in child performance on several EF tasks during school age.

EF and parent–child attachment. Developmental research highlights that the relational context in which parental behaviors are embedded may meaningfully contribute to child EF (Valcan et al., 2018). A widely recognized indicator of the quality of the parent–child relational context is attachment. Attachment security is defined as the quality of the enduring emotional bond forming during the first year of life between a child and his or her primary caregivers (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1982; for a comprehensive review, see Cassidy & Shaver, 2016). It has been suggested that secure parent–child attachment relationships provide a safe and harmonious environment in which children can experience successful dyadic regulation with their caregiver, especially when exposed to emotional or cognitive challenges (Calkins, 2011; Sroufe, 1996). With time, such successful dyadic regulation is thought to facilitate the internalization of regulatory strategies that children can later use independently in other tasks or contexts (Calkins, 2004). These views are supported by meta-analytic data (Pallini et al., 2018) indicating a modest yet positive and significant relation (r = .20) between child or adolescent attachment security and effortful control, a construct sharing strong similarities to some aspects of EF and defined as the ability to use top-down control to self-regulate (Nigg, 2017). Hence, by providing children with a context in which they can learn to master top-down self-regulation skills, secure attachment relationships may facilitate their capacity to control thoughts and behaviors autonomously and thus, promote their executive development.

Consistent with this, we previously reported, using a growth modeling approach, that more secure early mother–child attachment was associated with superior executive competence overall between kindergarten and Grades 2 or 3 (according to which EF was considered; Matte-Gagné, Bernier, Sirois, Lalonde, & Hertz, 2018). Based on the same sample, the present study expands on these previous findings in three ways. First, the EF growth curves are modeled from Grades 2 to 4. Second, the current report includes the assessment of planning, a higher-order EF skill that is believed to be built upon other EF components and to develop later (Best et al., 2009; Diamond, 2013). Few longitudinal studies (Friedman et al., 2014; Hackman et al., 2015) have examined parental predictors of the developmental trajectories of planning skills during school years, and to our knowledge, the role of parent–child attachment in this regard remains unknown. Finally, in line with a multidimensional view of parenting, here we consider both the overall affective quality of parent–child relationships (i.e., attachment security) and a specific task-based cognitive dimension of parenting (autonomy support) as predictors of child EF patterns of growth.

EF and parental autonomy support. Among different cognitive dimensions of parental behaviors, substantial attention has been afforded in the EF literature to in-task instructional behaviors, such as scaffolding and autonomy support, the second aspect of parent–child interactions that we examined here. Autonomy support refers to parental behaviors that encourage children's independent problem solving, choice, and participation (Grolnick & Ryan, 1989). Autonomy-supportive parents provide guidance that is contingent on children's current level of competence and needs, facilitate children's initiative-taking during challenging activities, and also acknowledge children's perspective and respect their pace (Grolnick & Pomerantz, 2009). Such parental behaviors are thought to foster children's motivation to participate in future activities and learning experiences (Grolnick, 2009; Pomerantz & Grolnick, 2017). Consequently, autonomy support may promote the gradual strengthening of EF by increasing children's exposure to successful goal-directed activities and self-initiated opportunities to practice their EF skills.

In line with these views, parental autonomy support and closely related constructs (e.g., scaffolding) have often been positively associated with child age-specific EF, both concurrently and longitudinally (Bernier, Carlson, & Whipple, 2010; Bibok, Carpendale, & Müller, 2009; Conway & Stifter, 2012; Distefano, Galinsky, McClelland, Zelazo, & Carlson, 2018; Hammond, Müller, Carpendale, Bibok, & Liebermann-Finestone, 2012; Hughes & Ensor, 2009; Matte-Gagné & Bernier, 2011). Recent findings further highlight the robustness of these links, reporting that parental scaffolding plays a unique and specific role in child EF, above other parental influences (Hughes & Devine, 2019). Despite this convincing body of research, no prior study to our knowledge has investigated parental autonomy support as a predictor of EF patterns of growth, especially not above and beyond other aspects of parent–child relationships.

The Present Study

Following up the same sample as Matte-Gagné et al. (2018), the aim of this multiyear longitudinal study was to investigate the respective roles of mother–child attachment security and maternal autonomy support, assessed in toddlerhood and preschool years, in the prediction of individual differences in patterns of growth in child performance on tasks involving working memory, cognitive flexibility, and planning skills between Grade 2 and Grade 4. In line with findings showing a modest correlation between child attachment security and maternal autonomy support ($r = .32$, $p < .01$; Whipple, Bernier, & Mageau, 2011), both were expected to predict a unique portion of the interindividual variance in EF patterns of change, specifically to predict superior EF performance across time over and above each other. Given the dearth of prior longitudinal research on the links between parent–child relationships and EF patterns of growth from a multidimensional perspective, specific hypotheses regarding attachment security and autonomy support could not be formulated.

Method

Participants

One hundred and two mother–child dyads (59 girls) living in a large Canadian metropolitan area participated in this study. Families were recruited from birth lists randomly generated and provided by the Ministry of Health and Social Services. The study protocol was approved by the local human research ethics committee and informed consent was obtained prior to participation. Upon recruitment (*M* = 7.34 months, *SD* = 0.86) obstetric and socioeconomic information was obtained with a maternal questionnaire. Inclusion criteria were full-term pregnancy (i.e., at least 37 weeks of gestation) and the absence of any known developmental delay in the child. Mothers were between 20 and 45 years old (*M* = 32.07, *SD* = 4.43) and were predominantly Caucasian (80.40%) and French speaking (77.50%). They had on average 16 years of education (*SD* = 2.24, range = 10–18) with most holding a college degree (59.80%). Family income varied from less than $20,000 CDN to more than $100,000 CDN, with an average in the $80,000 to $99,000 bracket.

Procedure

Families took part in seven 90-minute home visits over nine years: two in toddlerhood, two in preschool years, and three during the early school years. Children were assessed at 15 months (T1; *M* = 15.55 months, *SD* = 0.84), 2 (T2; *M* = 2.16 years, *SD* = 0.09), 3 (T3; *M* = 3.07 years, *SD* = 0.07), and 4 years of age (T4; *M* = 4.08, *SD* = 0.72), as well as in Grade 2 (T5; *M* = 7.81 years, *SD* = 0.31), Grade 3 (T6; *M* = 8.73 years, *SD* = 0.30) and Grade 4 (T7; *M* = 9.89 years, *SD* = 0.31).

The aim of the T1 to T3 visits was to assess maternal autonomy support and mother–child attachment security. Modeled after the work of Pederson and Moran (1995), these visits were designed to challenge the mother's capacity to divide her attention between the research tasks and the child's demands, thus reproducing daily natural conditions when caring for a young child. These visits included child-centered tasks, a brief interview with the mother, a videotaped mother–child interaction, and questionnaires that mothers had to complete while the child was *not* supervised by the research assistants. Attachment security was assessed with the Attachment Behavior Q-Sort (AQS; see below) based on observations made throughout the T1 and T2 visits. Autonomy support was assessed at T1 and T3 during 10-min mother–child interactive sequences in which dyads were invited to complete challenging tasks together. These tasks were designed to be slightly too difficult for the children, such that they would prompt mothers' assistance (three puzzles at T1, and a block sorting task at T3). Mother–child interactions were videotaped and later coded for maternal autonomy-supportive behaviors (see below). To strengthen inference about directionality of any links found between early parenting and subsequent child EF, child general cognitive ability was assessed at T4 with a standardized test of intellectual functioning (described below). The school-years visits (T5–T7) consisted in the yearly administration of three different behavioral EF tasks tapping into working memory, cognitive flexibility, and planning.

Only families with at least one assessment of attachment security and one assessment of autonomy support who also participated in at least one school-year home visit (T5–T7) were included in the analyses (N = 102). Of these families, between 91 and 97 had T5 data, between 91 and 93 had T6 data, and between 89 and 94 had T7 data (the exact *n*s vary slightly across EF tasks). Given the method used to handle missing data (described in the following), all 102 families were retained and thus constitute the analytic sample.

Measures

Mother–child attachment security. Child attachment was assessed at 15 months (T1) and 2 years (T2) using the Attachment Behavior Q-Sort (AQS; Waters, 1995). The AQS is comprised of 90 items describing potential child behaviors. Items are sorted by an observer into nine piles, reflecting the degree to which each item describes the target child's observed behavior. The observer's sort is then correlated with a criterion sort provided by the authors of the instrument representing the prototypically securely attached child. As a result, the obtained attachment score can vary from -1 = *highly insecure* to 1 = *highly secure*. Interrater reliability was conducted for 22% of the dyads at T1 and for 19% at T2 and was found to be satisfactory: Intraclass Correlation (*ICC*) = .71 and .70, respectively. The correlation between AQS scores at 15 months (M = .48, SD = 0.26) and at 2 years (M = .51, SD = 0.24) was r = .23, p < .05, which is consistent with meta-analytic data on the temporal stability of the AQS (r = .28, van IJzendoorn, Vereijken, Bakermans-Kranenburg, & Riksen-Walraven, 2004). In line with studies based on the current sample (Matte-Gagné et al., 2018) and independent samples (Tarabulsy et al., 2005), the two AQS scores (T1 and T2) were averaged into a global score of child attachment security to reduce measurement and situational error and create an optimally reliable index. Such a composite score approximates the child's average level of attachment security in toddlerhood above and beyond expected daily fluctuations, longer-term developmental change, and measurement or contextual error, and thus provides a presumably more accurate estimate than single time point scores.

Maternal autonomy support. Maternal autonomy support was assessed at 15 months (T1) and 3 years (T3). Following Whipple and colleagues' (2011) rating system (developed based on Grolnick, Frodi, & Bridges, 1984), maternal behavior was rated on four Likert scales ranging from 1 = *not autonomy-supportive* to 5 = *extremely autonomy-supportive*. These scales assess the extent to which the mother (a) encourages her child in the pursuit of the task, gives useful hints and suggestions, and uses verbal support; (b) takes her child's perspective and demonstrates flexibility in her attempts to keep the child on task; (c) follows her child's pace, provides the child with the opportunity to make choices and ensures that he or she plays an active role in completing the task; and (d) intervenes according to the child's needs and adapts the task to create an optimal challenge for the child, minimizing the use of controlling strategies (giving orders, using punishments, or physical restrictions). A high autonomy support score indicates that mothers adjust their behavior to child needs, abilities, rhythm, and emotional state. Given the intercorrelations among the four scales (ranging from .40 to .76), they were averaged into a total autonomy support score at each age (α = .89 at T1 and α = .84 at T3). Randomly selected subsets (n = 40 at T1 and n = 42 at T2) of videotapes were coded by independent raters. Interrater reliability on the total score was satisfactory, ICC = .86 at T1 and ICC = .93 at T3. Maternal autonomy support scores at T1 (M = 3.52, SD = 1.01) and T3 (M = 2.77, SD = 1.02) were moderately correlated (r = .39, p < .01). As for attachment security, T1 and T3 scores were averaged to produce a psychometrically stronger index of maternal autonomy support.

Child executive functioning.

***Backward digit span* (Carlson, Moses, & Breton, 2002).** Backward digit span was used to assess working memory. Following a 2-digit practice trial, children were given a series of digits and asked to repeat them backward. List size increased (2, 3, 4, 5, 6, 7, and 8 digits) with each level succeeded. Each level had two trials and the task ended when the child erred two consecutive times at a given level. The number of succeeded trials, ranging from 0 to 16, was used in data analyses.

***Dimensional change card sort* (DCCS; Zelazo, 2006).** A computerized version of the DCCS was used to assess cognitive flexibility. Eight practice trials with feedback were first administered, in which cards varying on two dimensions (i.e., shape [rabbit and boat] and color [white and green]) were shown on a screen monitor. Children were instructed to match one of two lateralized cards to a centrally presented card, first by shape and then by color, using arrows on the keyboard. Subsequently, children proceeded to a 30-trial mixed block (the test phase) in which they had to sort cards either by shape or by color, switching between dimensions in a pseudo-random order. As per the standard procedure, 10 test trials that consisted of sorting cards first by shape and then by color were administered to children under 8 years before the 30 test trials. Children under 8 years thus did a total of 40 test trials and older children did a total of 30. Accordingly, all scores were computed as percentages. In all test trials, blue and yellow were used as colors, and balls and trucks as shapes.

We previously observed that children in the current sample reached a high level of accuracy (*M* = 86%) on this version of the DCCS in Grade 2 (Matte-Gagné et al., 2018), which corresponds to the first assessment here. Therefore, in line with previous child studies (e.g., Park, Ellis Weismer, & Kaushanskaya, 2018) and in order to capture sufficient variation up until Grade 4, mean reaction time (RT) in milliseconds (msec) on correct test trials was used in the analyses (with shorter RT indicating more efficient information processing). Following Zelazo et al. (2013), outliers (i.e., RTs lower than 100 msec or greater than 3 SDs from each participant's mean RT) were excluded prior to calculation of mean RT.

***NEPSY tower*.** Planning skills were assessed using the Tower subtest from the Developmental Neuropsychological Assessment (NEPSY; Korkman, Kirk, & Kemp, 1998). Children were presented with a model in which three colored balls (red, blue, and yellow) were positioned on separate vertical pegs of different heights, which could hold either one, two, or three balls. After the balls were arranged according to a predetermined starting position, children were shown a target arrangement and asked to reproduce this model by moving the balls as fast as they could, within a prescribed number of moves and a time limit, and while also following specific movement rules. There were 20 trials of increasing difficulty. A trial was succeeded if the target position was reached within the time limit and the predetermined number of moves. Total number of trials passed, varying from 0 to 20, was used in the analyses.

Child general cognitive ability. The Matrix Reasoning subscale from the Wechsler Preschool and Primary Scale of Intelligence (WPPSI–III; Wechsler, 2002) was used at 4 years (T4) to evaluate child general cognitive ability. There were 29 items in which children were asked to select one picture from a set of four to five possible answers that best continued a sequence of complex visual patterns. The number of correct responses was used in the analyses. Matrix Reasoning taps into abstract reasoning skills. It was chosen here as it was found to be one of the WPPSI subtests most highly related with general intelligence (r = .63; Wechsler, 2002).

Analytic Strategy

To predict patterns of change in child EF across time, growth curves were fitted in Mplus (Muthén & Muthén, 2012) using a multilevel modeling (MLM) framework (i.e., Hierarchical Linear Modeling). MLM treats repeated observations as nested within individuals and provides information about within-person (Level-1) and between-person (Level-2) change over time (Hoffman, 2015). This framework was chosen here (instead of structural equation modeling approaches) because it is particularly well suited for modest sample sizes (yielding more power), partially missing data, and data collected across a range of ages within any one occasion (Burchinal, Nelson, & Poe, 2006; Singer & Willett, 2003). This last characteristic allowed us to model EF trajectories covering the full range of ages between 7.31 (minimal age in Grade 2) and 11.20 years (maximal age in Grade 4), thus describing fine developmental change instead of variation between fixed ages (8, 9 and 10 years). As per currently recommended best practices to handle missing data (Enders, 2010), full information maximum likelihood estimation (FIML) was used in the analyses. All models were estimated using robust maximum likelihood estimation (MLR), which yields standard errors that are robust to non-normality. Goodness of fit was assessed using the log-likelihood (LL), the Akaike information criterion (AIC), and an adjusted chi-square difference test ($\Delta\chi^2$) based on LL values.

First, an unconditional random linear model, which includes the random effect of time (i.e., between-person variability in individual intercepts and slopes), was specified for each EF task. The intercept was coded to represent EF performance at the first assessment (i.e., Grade 2) and the slope refers to the yearly rate of change from Grade 2 to Grade 4. The correlation between intercept and slope was retained in the final growth models only if significant. Furthermore, a quadratic term was also tested for each EF task to evaluate the presence of a significant acceleration or deceleration in the slope across time (i.e., indicating an accelerating or decelerating curvilinear trajectory). Quadratic terms were retained if the pertinent *p*-value for the estimate was < .05 and if the model's LL differed significantly with the addition of the quadratic slope term. The assessment of three time points is necessary and sufficient to estimate a fixed quadratic term (Hoffman, 2015).

Secondly, conditional models were tested. Both predictors (i.e., mother–child attachment security and maternal autonomy support) were entered simultaneously in each model and were grand-mean centered for ease of interpretation. Accordingly, the intercept (Grade 2) represents the estimated initial status given a predictor's average value. Given that family socioeconomic status (here, a standardized average of maternal education and family income), child sex, child general cognitive ability, and child birthweight are often associated with child EF (Clark et al., 2013; Friedman & Miyake, 2017; Lawson, Hook, & Farah, 2018; Wade, Browne, Madigan, Plamondon, & Jenkins, 2014), these covariates were also entered in the growth models. To ensure parsimony, only the variables that were significant or that improved the model fit (Singer & Willett, 2003) were retained in the final models.

Results

Descriptive Overview

Table 1 reports descriptive statistics for the main study variables, correlations across time points, and intercorrelations among EF tasks. The coefficients of stability for EF tasks, ranging from low to moderate (*r*s between .18 and .48), indicate change in interindividual differences across school years. There were no significant correlations between EF tasks. This pattern of results is expected, especially among children (Blair, 2016), and supports the specificity of each task in measuring a unique executive indicator. It is also in line with evidence showing the fractioned nature of EF in the school years (Bardikoff & Sabbagh, 2017), and supports the importance of running separate growth models for each task.

Predicting Child EF Growth Curves

Table 2 displays the parameters and goodness of fit statistics for the final unconditional and conditional models for child performance on each EF task. As can be seen, model fit was improved (higher LL value, lower AIC value, and significant difference indicated by $\Delta\chi^2$) in all cases after entering the predictors (i.e., mother–child attachment security and maternal autonomy support). Given that the current study focused on testing these two potential predictors of individual differences in patterns of growth in EF performance, only the results of the conditional models are presented here.

Backward digit span. On the Backward digit span, children's performance significantly increased by 0.37 point each year, starting at 5.51 points in Grade 2. There was a significant positive relation between mother–child attachment security and the initial status. Every one-standard-deviation increase in attachment security was associated with a 1.42-point (p = .038) increase in Backward digit span performance in Grade 2. Maternal autonomy support was not associated with Backward digit span initial status (p = .443). With respect to developmental change, neither attachment security nor autonomy support were significant predictors of the rate of change (both ps ≥ .154). Thus, higher attachment security in toddlerhood was uniquely (i.e., over and above maternal autonomy support) associated with higher performance on the Backward digit span, with no effect on the slope. This indicates that child performance remained higher across time for children with higher levels of attachment security, regardless of whether they had been exposed to more or less autonomy support.

DCCS. RT on correct trials of the DCCS followed a decelerating curvilinear trajectory. Children's RT significantly decreased by 0.17 second each year, starting at 1.14 second in Grade 2. However, there was a significant deceleration in the slope across time, indicated by the significant positive quadratic term (0.04). This suggests that with increasing age, children showed lower RT, but eventually, this tendency to respond faster tended to stabilize. There was a significant negative relation between mother–child attachment security and initial RT on the DCCS. Every one-standard-deviation increase in attachment security was associated with a 0.43-sec (p = .019) decrease in initial RT. Thus, children who were involved in more secure attachment relationships during toddlerhood took a shorter time to answer accurately on the DCCS in Grade 2, which suggests that they were processing information more efficiently. Maternal autonomy support was not associated with initial RT of the DCCS (p = .378). Neither child attachment security nor maternal autonomy support were significant predictors of the rate of change (both ps ≥ .076). Thus, higher attachment security in toddlerhood was uniquely associated with faster accurate responses on the DCCS.

NEPSY tower. Children's performance on the NEPSY tower significantly increased by 0.50 point each year, starting at 12.36 points in Grade 2. There was a significant positive relation between mother–child attachment security and the initial status. Every one-standard-deviation increase in attachment security was associated with a 2.20-point (p = .047) increase in NEPSY tower performance in Grade 2. Above and beyond this, maternal autonomy support was positively associated with the initial status of NEPSY tower, where every one-standard-deviation increase in maternal autonomy support was associated with a 0.60-point (p = .012) increase in performance in Grade 2. Child attachment security was not a significant predictor of the rate of change (p = .061). Thus, higher attachment security in toddlerhood was uniquely associated with higher performance on the NEPSY tower. Maternal autonomy support, however, was negatively associated with the rate of change. Every one-standard-deviation increase in maternal autonomy support was associated with slower yearly growth in NEPSY tower performance (decreases of 0.42 point, p = .002) from Grade 2 to 4. Thus, children exposed to higher levels of autonomy support during toddlerhood and preschool years displayed higher performance on the NEPSY tower at younger ages, over and above attachment security, yet, this positive effect tended to decrease with time.

Discussion

In the past decades, research in developmental psychology has been marked by a growing interest in the development of child EF. The current study suggests that certain aspects of early parent–child interactions may play an important role in explaining individual differences in executive development during school years. Expanding on previous findings (Matte-Gagné et al., 2018), we examined the respective capacities of mother–child attachment security and maternal autonomy support, assessed in the first three years of life, to predict individual differences in developmental patterns of change in EF performance across early school years. The findings suggested that (a) the positive association between early attachment security and working memory performance, initially observed between kindergarten and Grade 3 by Matte-Gagné et al. (2018), holds between Grades 2 and 4 above and beyond one of the most robust parenting predictors of child EF, namely autonomy support; (b) the positive association of attachment is also found with aspects of EF not previously studied on this cohort, namely efficiency of information processing during a cognitive flexibility task as well as planning performance; and (c) exposure to higher maternal autonomy support is associated with superior initial performance in planning. Importantly, in all cases the results for attachment security and autonomy support were additive, holding over and above each other, which supports a multidimensional view of EF-relevant dimensions of parent–child relationships (Valcan et al., 2018), specifically suggesting that both the affective quality of parent–child relationships and task-based cognitive dimensions of parenting may play a role in EF trajectories during school years.

Attachment Security

The current findings revealed that, at similar levels of received autonomy support, more securely attached children across 15 months and 2 years obtained higher scores on Backward digit span and NEPSY tower and provided faster accurate responses on the DCCS 6 years later. These results indicate that children enjoying a safe and harmonious relationship with their mother subsequently were better able to maintain and manipulate information in memory, plan actions in advance, and switch perspectives efficiently. Connecting the current results with our previous findings on the same cohort (Matte-Gagné et al., 2018), this study provides further suggestion for a global (i.e., not task-specific) contribution of secure attachment relationships to children's executive competence. Effect sizes for attachment were quite substantial on all three EF tasks: with every one-standard-deviation increase in attachment security, children's Grade 2 performance increased by about two succeeded trials on the Backward digit span and the NEPSY tower, and nearly 0.5 sec on the DCCS. Taken together, results from Matte-Gagné et al. (2018) and this study highlight the importance of attachment security for working memory, both the competence (performance) and the process (efficiency) of cognitive flexibility, and planning skills, thus suggesting that more securely attached children have a richer executive skill set in the early school years, which is likely to set them on promising school trajectories (Schmitt, Geldhof, Purpura, Duncan, & McClelland, 2017).

The unique associations between attachment security in toddlerhood and child EF performance did not increase nor decrease from Grades 2 to 4 (i.e., attachment had no effect on the slope), which suggests that these links persist across time. The results observed here are in line with studies reporting enduring associations (i.e., diminishing but persisting effects with time) between early caregiving experiences and developmental outcomes, such as academic and social competence (Fraley et al., 2013; Raby, Roisman, Fraley, & Simpson, 2015), and with meta-analytic data supporting the enduring significance of early attachment security for child socioemotional development (Groh, Fearon, van IJzendoorn, Bakermans-Kranenburg, & Roisman, 2017). However, for both the DCCS and the NEPSY tower, there was a marginally significant link between attachment security and the rate of change (see Table 2), which raises a degree of uncertainty about the persistent contribution of attachment security to child EF. Longer-term follow-ups are needed to determine whether the EF performance disparities observed here in relation to early attachment security eventually disappear with time, namely if less securely attached children eventually catch up with their more securely attached counterparts.

There are different pathways through which a putative influence of early attachment security on child EF skills could transit. Experiences promoted by attachment security (e.g., successful dyadic regulation) may directly strengthen children's EF in toddlerhood which in turn, may foster children's adaptation to challenges requiring EF skills, hence promoting further EF development into the school years. In other words, the executive advantage afforded by attachment security in early years may snowball in a self-perpetuating fashion. EF development may also be carried forward via indirect effects of attachment security, for instance on neurophysiological systems. Preliminary evidence supports this idea by suggesting that secure attachment and higher-quality parenting (e.g., more sensitivity and support) are respectively associated with larger cortical volumes and more optimal neural functioning in fronto-temporal brain regions during infancy and childhood (Bernier, Calkins, & Bell, 2016; Dégeilh, Bernier, Leblanc, Daneault, & Beauchamp, 2018; Leblanc, Dégeilh, Daneault, Beauchamp, & Bernier, 2017). Furthermore, recent meta-analytic findings (Groh & Narayan, 2019) indicate that insecure attachment is related to heightened physiological stress responses (e.g., increases in cortisol) that have been linked with reduced EF skills in preschool years (Blair et al., 2011). On a behavioral level, securely attached children have been found to show higher levels of participation in joint mother–child problem-solving tasks and to value learning more (Moss & St-Laurent, 2001). Consequently, secure attachment relationships may support children’s task engagement and intrinsic motivation for learning, which in turn could provide them with more opportunities to practice and strengthen their EF skills.

Autonomy Support

The current study indicates that children exposed to higher levels of autonomy support across 15 months and 3 years later showed higher scores on the NEPSY tower. Children who experienced more maternal behaviors that supported their initiatives, considered their perspective, and followed their pace, later displayed a better capacity to establish a plan of action to solve a problem. Importantly, these results held over and above secure attachment, which was associated with higher EF competence globally, suggesting that autonomy support may be especially needed to promote the development of more complex EF abilities, such as planning.

Interestingly, maternal autonomy-supportive behavior was mainly associated with planning performance in Grade 2, namely around 7-8 years, which corresponds to a crucial developmental period for planning skills (Anderson, 2002; Anderson, Anderson, & Lajoie, 1996). However, as illustrated by the negative association with the rate of change in NEPSY tower performance (see Table 2), the link between autonomy support and planning tended to wane gradually with time. This finding suggests that children who had experienced lower levels of autonomy support during toddlerhood and preschool years eventually caught up with their counterparts by Grade 3 or 4.

One possible explanation for this waning link is that the kind of problem-solving strategies learned from early maternal autonomy-supportive behaviors may be especially useful for performing during a challenging task involving skills that are emerging (here, planning). In line with this, autonomy support was assessed during mother–child interactive sequences in which mothers had to help their children complete tasks that were too difficult because slightly above their current skill levels. The strategies learned in this context may be especially useful to help children perform on a complex task recruiting skills that are still emerging, such as the NEPSY tower in Grade 2. With time as the required skills develop, the task becomes less challenging and hence the advanced problem-solving skills learned from early autonomy support may become less advantageous, resulting in the narrowing disparities observed here between children exposed to lower and higher levels of maternal autonomy support early in life. At this point, other factors such as individual characteristics (e.g., genes, temperament, motivation, neural development) or contemporaneous social influences may contribute to explain individual differences in child performance on the NEPSY tower.

This developmental hypothesis may also explain why autonomy support was not associated with working memory or cognitive flexibility in the present study, whereas it has been found to relate to these EF dimensions among toddlers and preschoolers (Bernier et al., 2010; Distefano et al., 2018). The development of working memory and cognitive flexibility starts early on during the preschool years (Best et al., 2009); thus, if autonomy support is particularly useful to solve problems recruiting emerging skills as we have hypothesized, it should indeed be more influential on working memory and cognitive flexibility in preschool than school years. A different issue is that the above previous studies, unlike the current one, did not investigate the effects of autonomy support over and above those of attachment security. Overall, more research is needed to tease apart the respective contributions of parent–child attachment and parental autonomy support (among other parental factors) to specific EF skills at different developmental periods. In fact, in the current study, EF skills were not predicted equally: mother–child attachment security was uniquely associated with all EF skills, whereas maternal autonomy support was independently related to planning skills only. Importantly, both predictors were predictive of initial performance in Grade 2, yet neither predicted more pronounced growth in EF. Thus, further research is needed to identify the factors that may promote not only superior EF performance throughout the school years but also more rapid developmental improvements in EF across those years.

Strengths and Limitations

This study presents a number of strengths including the multiyear longitudinal design, the behavioral tasks tapping into different EF skills, and the modelling of growth trajectories. Other strengths were the inclusion of observational measures with two time points each for both parental predictors, and the simultaneous consideration of attachment security and autonomy support in all models. However, there were also some limitations. First, the modest size and low-risk nature of the sample limited variability in attachment security and autonomy support scores, as well as the generalizability of the results, which may not apply to high-risk populations known to have EF difficulties (e.g., low SES families; Hackman et al., 2015). Second, this study included mothers only, hence direct comparisons with father–child attachment security and paternal autonomy support could not be drawn. Research suggests that fathers can play a significant role in the development of both child age-specific EF skills (Meuwissen & Carlson, 2015) and patterns of change (Roskam et al., 2014). Further studies including both mothers and fathers are necessary to investigate their respective and combined contributions, providing a clearer and more complete picture of parental influences on children's EF development. Mutual transactions between parenting and child EF also deserve more empirical attention given the wide consensus that socialization is a bidirectional process (Sameroff, 2009) and that child influences on parenting are likely (Davidov, Knafo-Noam, Serbin, & Moss, 2015). Third, the current design was correlational and thus, does not allow for causal inference. A randomized control design involving an empirically validated intervention to foster autonomy support or secure attachment and subsequent assessment of changes in EF would provide a strong experimental test of the presumed influences investigated here. In fact, an attachment-based program, the ABC-T intervention, has been found to enhance children's EF skills (Lind, Raby, Caron, Roben, & Dozier, 2017), and emergent findings suggest that a brief intervention on parental autonomy support could foster child self-regulation, a construct overlapping with EF (Meuwissen & Carlson, 2019). The implementation of such intervention paradigms in conjunction with the type of longitudinal EF assessments and analyses used in the current study would allow for a particularly stringent test of the causal and enduring role of parenting quality in child EF development.

Conclusion

Expanding on a limited body of longitudinal work (Friedman et al., 2014; Hackman et al., 2015; Matte-Gagné et al., 2018; Roskam et al., 2014), this study sought to enhance the understanding of the parental antecedents of EF patterns of growth during school years. Overall, the results suggest that early secure mother–child attachment is likely to set children on a promising EF developmental trajectory. The findings also suggest the importance of supporting children's autonomy to foster their emerging planning skills. This study emphasizes the need to examine multiple aspects of parent–child relationships to better capture how the complex and multidimensional interplay between children and their caregivers may shape the development of their EF skills.

References

Ainsworth, M. D. S., Blehar, M. C., Waters, E., & Wall, S. (1978). *Patterns of attachment: A psychological study of the strange situation*. Hillsdale, NJ: Erlbaum.

Anderson, P. (2002). Assessment and development of executive function (EF) during childhood. *Child Neuropsychology*, *8*, 71–82. doi: 10.1076/chin.8.2.71.8724

Anderson, P., Anderson, V., & Lajoie, G. (1996). The tower of London test: Validation and standardization for pediatric populations. *The Clinical Neuropsychologist*, *10*, 54–65. doi: 10.1080/13854049608406663

Bardikoff, N., & Sabbagh, M. (2017). The differentiation of executive functioning across development: Insights from developmental cognitive neuroscience. In N. Budwig, E. Turiel, & P. D. Zelazo (Eds.), *New perspectives on human development* (pp. 47–66). New York, NY: Cambridge University Press.

Bernier, A., Calkins, S. D., & Bell, M. A. (2016). Longitudinal associations between the quality of mother–infant interactions and brain development across infancy. *Child Development*, *87*, 1159–1174. doi: 10.1111/cdev.12518

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children's executive functioning. *Child Development*, *81*, 326–339. doi: 10.1111/j.1467-8624.2009.01397.x

Best, J. R., & Miller, P. H. (2010). A developmental perspective on executive function. *Child Development*, *81*, 1641–1660. doi: 10.1111/j.1467-8624.2010.01499.x

Best, J. R., Miller, P. H., & Jones, L. L. (2009). Executive functions after age 5: Changes and correlates. *Developmental Review*, *29*, 180–200. doi: 10.1016/j.dr.2009.05.002

Bibok, M. B., Carpendale, J. I. M., & Müller, U. (2009). Parental scaffolding and the development of executive function. *New Directions for Child and Adolescent Development*, *123*, 17–34. doi: 10.1002/cd.233

Blair, C. (2016). Developmental science and executive function. *Current Directions in Psychological Science*, *25*, 3–7. doi: 10.1177/0963721415622634

Blair, C., Granger, D. A., Willoughby, M., Mills-Koonce, R., Cox, M., Greenberg, M. T., . . . & the FLP Investigators. (2011). Salivary cortisol mediates effects of poverty and parenting on executive functions in early childhood. *Child Development*, *82*, 1970–1984. doi: 10.1111/j.1467-8624.2011.01643.x

Bornstein, M. H., Putnick, D. L., & Esposito, G. (2017). Continuity and stability in development. *Child Development Perspectives*, *11*, 113–119. doi: 10.1111/cdep.12221

Bowlby, J. (1982). *Attachment and loss. Vol. 1: Attachment* (2nd Ed.). New York, NY: Basic Books.

Burchinal, M. R., Nelson, L., & Poe, M. (2006). IV. Growth curve analysis: An introduction to various methods for analyzing longitudinal data. *Monographs of the Society for Research in Child Development*, *71*(Serial No. 3), 65–87. doi: 10.1111/j.1540-5834.2006.00405.x

Calkins, S. D. (2004). Early attachment process and the development of emotional self-regulation. In R. F. Baumeister & K. D. Vohs (Eds.), *Handook of self-regulation: Research, theory, and applications* (pp. 324–339). New York, NY: Guilford Press.

Calkins, S. D. (2011). Caregiving as coregulation: Psychobiological processes and child functioning. In A. Booth, S. M. McHale, & N. S. Landale (Eds.), *Biosocial foundations of family processes* (pp. 49–59). New York, NY: Springer. doi: 10.1007/978-1-4419-7361-0_3

Carlson, S. M., Moses, L. J., & Breton, C. (2002). How specific is the relation between executive function and theory of mind? Contributions of inhibitory control and working memory. *Infant and Child Development*, *11*, 73–92. doi: 10.1002/icd.298

Cassidy, J., & Shaver, P. R. (2016). *Handbook of attachment: Theory, research, and clinical applications* (3rd ed.). New York, NY: Guilford Press.

Clark, C. A. C., Sheffield, T. D., Chevalier, N., Nelson, J. M., Wiebe, S. A., & Espy, K. A. (2013). Charting early trajectories of executive control with the shape school. *Developmental Psychology*, *49*, 1481–1493. doi: 10.1037/a0030578

Conway, A., & Stifter, C. A. (2012). Longitudinal antecedents of executive function in preschoolers. *Child Development*, *83*, 1022–1036. doi:10.1111/j.1467-8624.2012.01756.x

Davidov, M., Knafo-Noam, A., Serbin, L. A., & Moss, E. (2015). The influential child: How children affect their environment and influence their own risk and resilience. *Development and Psychopathology*, *27*, 947–951. doi: 10.1017/S0954579415000619

De Luca, C. R., & Leventer, R. J. (2008). Developmental trajectories of executive functions across the lifespan. In V. Anderson, R. Jacobs, & P. J. Anderson (Eds.), *Executive functions and the frontal lobes: A lifespan perspective* (pp. 23–53). New York, NY: Taylor & Francis.

Dégeilh, F., Bernier, A., Leblanc, É., Daneault, V., & Beauchamp, M. H. (2018). Quality of maternal behaviour during infancy predicts functional connectivity between default mode network and salience network 9 years later. *Developmental Cognitive Neuroscience*, *34*, 53–62. doi: 10.1016/j.dcn.2018.06.003

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135–168. doi: 10.1146/annurev-psych-113011-143750

Distefano, R., Galinsky, E., McClelland, M. M., Zelazo, P. D., & Carlson, S. M. (2018). Autonomy-supportive parenting and associations with child and parent executive function. *Journal of Applied Developmental Psychology*, *58*, 77–85. doi: 10.1016/j.appdev.2018.04.007

Enders, C. K. (2010). *Applied missing data analysis*. New York, NY: Guilford press.

Fiske, A., & Holmboe, K. (2019). Neural substrates of early executive function development. *Developmental Review*, *52*, 42–62. doi:10.1016/j.dr.2019.100866

Fraley, R. C., Roisman, G. I., & Haltigan, J. D. (2013). The legacy of early experiences in development: Formalizing alternative models of how early experiences are carried forward over time. *Developmental Psychology*, *49*, 109–126. doi: 10.1037/a0027852

Friedman, N. P., & Miyake, A. (2017). Unity and diversity of executive functions: Individual differences as a window on cognitive structure. *Cortex*, *86*, 186–204. doi: 10.1016/j. cortex.2016.04.023

Friedman, S. L., Scholnick, E. K., Bender, R. H., Vandergrift, N., Spieker, S., Hirsh Pasek, K., . . . & NICHD Early Child Care Research Network. (2014). Planning in middle childhood: Early predictors and later outcomes. *Child Development*, *85*, 1446–1460. doi: 10.1111/cdev.12221

Groh, A. M., Fearon, R. P., van IJzendoorn, M. H., Bakermans-Kranenburg, M. J., & Roisman, G. I. (2017). Attachment in the early life course: Meta-analytic evidence for its role in socioemotional development. *Child Development Perspectives*, *11*, 70–76. doi: 10.1111/cdep.12213

Groh, A. M., & Narayan, A. J. (2019). Infant attachment insecurity and baseline physiological activity and physiological reactivity to interpersonal stress: A meta-analytic review. *Child Development*, *90*, 679–693. doi: 10.1111/cdev.13205

Grolnick, W. S. (2009). The role of parents in facilitating autonomous self-regulation for education. *Theory and Research in Education*, *7*, 164 –173. doi: 10.1177/1477878 509104321

Grolnick, W. S., Frodi, A., & Bridges, L. (1984). Maternal control style and the mastery motivation of one-year-olds. *Infant Mental Health Journal*, *5*, 72–82. doi: 10.1002/1097-0355(198422)5:2<72::AID-IMHJ2280050203>3.0.CO;2-O

Grolnick, W. S., & Pomerantz, E. M. (2009). Issues and challenges in studying parental control: Toward a new conceptualization. *Child Development Perspectives*, *3*, 165–170. doi: 10.1111/j.1750-8606.2009.00099.x

Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self-regulation and competence in school. *Journal of Educational Psychology*, *81*, 143–154. doi: 10.1037/0022-0663.81.2.143

Grusec, J. E., & Davidov, M. (2010). Integrating different perspectives on socialization theory and research: A domain-specific approach. *Child Development*, *81*, 687–709. doi: 10.1111/j.1467-8624.2010.01426.x

Hackman, D. A., Gallop, R., Evans, G. W., & Farah, M. J. (2015). Socioeconomic status and executive function: Developmental trajectories and mediation. *Developmental Science*, *18*, 686–702. doi: 10.1111/desc.12246

Hammond, S. I., Müller, U., Carpendale, J. I. M, Bibok, M. B., & Liebermann-Finestone, D. P. (2012). The effects of parental scaffolding on preschoolers' executive function. *Developmental Psychology*, *48*, 271–281. doi: 10.1037/a0025519

Hoffman, L. (2015). *Longitudinal analysis: Modeling within-person fluctuation and change*. New York, NY: Routledge.

Hughes, C., & Devine, R. T. (2019). For Better or for Worse? Positive and negative parental influences on young children's executive function. *Child Development*, *90*, 593–609. doi: 10.1111/cdev.12915

Hughes, C. H., & Ensor, R. A. (2009). How do families help or hinder the emergence of early executive function? *New Directions in Child and Adolescent Development*, *2009*, 35–50. doi: 10.1002/cd.234

Korkman, M., Kirk, U., & Kemp, S. (1998). *NEPSY: A developmental neuropsychological assessment manual*. San Antonio, TX: The Psychological Corporation.

Lawson, G. M., Hook, C. J., & Farah, M. J. (2018). A meta-analysis of the relationship between socioeconomic status and executive function performance among children. *Developmental Science*, *21*, e12529. doi: 10.1111/desc.12529

Leblanc, É., Dégeilh, F., Daneault, V., Beauchamp, M. H., & Bernier, A. (2017). Attachment security in infancy: A preliminary study of prospective links to brain morphometry in late childhood. *Frontiers in Psychology*, *8*, article 2141. doi: 10.3389/fpsyg.2017.02141

Li, J. J., & Roberts, D. K. (2017). Genetic influences on executive functions across the life span. In S. A. Wiebe & J. Karbach (Eds.), *Executive function: Development across the life span* (pp. 106–123). New York, NY: Routledge.

Lind, T., Raby, K. L., Caron, E. B., Roben, C. K. P., & Dozier, M. (2017). Enhancing executive functioning among toddlers in foster care with an attachment-based intervention. *Development and Psychopathology*, *29*, 575–586. doi: 10.1017/S0954579417000190

Lupien, S. J., Parent, S., Evans, A. C., Tremblay, R. E., Zelazo, P. D., Corbo, V., . . . & Séguin, J. R. (2011). Larger amygdala but no change in hippocampal volume in 10-year-old children exposed to maternal depressive symptomatology since birth. *Proceedings of the National Academy of Sciences*, *108*, 14324–14329. doi: 10.1073/pnas.1105371108

Matte-Gagné, C., & Bernier, A. (2011). Prospective relations between maternal autonomy support and child executive functioning: Investigating the mediating role of child language ability. *Journal of Experimental Child Psychology*, *110*, 611–625. doi: 10.1016/j.jecp.2011.06.006

Matte-Gagné, C., Bernier, A., Sirois, M. S., Lalonde, G., & Hertz, S. (2018). Attachment security and developmental patterns of growth in executive functioning during early elementary school. *Child Development*, *89*, e167–e182. doi: 10.1111/cdev.12807

Meuwissen, A. S., & Carlson, S. M. (2015). Fathers matter: The role of father parenting in preschoolers' executive function development. *Journal of Experimental Child Psychology*, *140*, 1–15. doi: 10.1016/j.jecp.2015.06.010

Meuwissen, A. S., & Carlson, S. M. (2019). An experimental study of the effects of autonomy support on preschoolers' self-regulation. *Journal of Applied Developmental Psychology*, *60*, 11–23. doi: 10.1016/j.appdev.2018.10.001

Moss, E., & St-Laurent, D. (2001). Attachment at school age and academic performance. *Developmental Psychology*, *37*, 863–874. doi: 10.1037/0012-1649.37.6.863

Muthén, L. K., & Muthén, B. O. (2012). *Mplus user's guide* (7th ed.). Los Angeles, CA: Author.

Nigg, J. T. (2017). Annual Research Review: On the relations among self-regulation, self-control, executive functioning, effortful control, cognitive control, impulsivity, risk-taking, and inhibition for developmental psychopathology. *Journal of Child Psychology and Psychiatry*, *58*, 361–383. doi: 10.1111/jcpp.12675

Pallini, S., Chirumbolo, A., Morelli, M., Baiocco, R., Laghi, F., & Eisenberg, N. (2018). The relation of attachment security status to effortful self-regulation: A meta-analysis. *Psychological Bulletin*, *144*, 501–531. doi: 10.1037/bul0000134

Park, J., Ellis Weismer, S., & Kaushanskaya, M. (2018). Changes in executive function over time in bilingual and monolingual school-aged children. *Developmental Psychology*, *54*, 1842–1853. doi: 10.1037/dev0000562

Pederson, D. R., & Moran, G. (1995). A categorical description of infant–mother relationships in the home and its relation to Q-sort measures of infant–mother interaction*. Monographs of the Society for Research in Child Development*, *60*(Serial No. 2-3), 111–132. doi: 10.2307/1166174

Pomerantz, E. M., & Grolnick, W. S. (2017). The role of parenting in children's motivation and competence: What underlies facilitative parenting? In A. J. Elliot, C. S. Dweck, & D. S. Yeager (Eds.), *Handbook of competence and motivation: Theory and application* (pp. 566–585). New York, NY: Guilford Press.

Raby, K. L., Roisman, G. I., Fraley, R. C., & Simpson, J. A. (2015). The enduring predictive significance of early maternal sensitivity: Social and academic competence through age 32 years. *Child Development*, *86*, 695–708. doi: 10.1111/cdev.12325

Roskam, I., Stievenart, M., Meunier, J. C., & Noël, M. P. (2014). The development of children's inhibition: Does parenting matter? *Journal of Experimental Child Psychology*, *122*, 166–182. doi: 10.1016/j.jecp.2014.01.003

Sameroff, A. (2009). The transactional model. In A. Sameroff (Ed.), *The transactional model of development: How children and contexts shape each other* (p. 3–21). American Psychological Association. doi: 10.1037/11877-001

Schmitt, S. A., Geldhof, G. J., Purpura, D. J., Duncan, R., & McClelland, M. M. (2017). Examining the relations between executive function, math, and literacy during the transition to kindergarten: A multi-analytic approach. *Journal of Educational Psychology*, *109*, 1120–1140. doi: 10.1037/edu0000193

Shonkoff, J. P., Duncan, G. G., Fisher, P. A., Magnuson, K., Raver, C. C., & Yoshikawa, H. (2011). *Building the brain's 'Air Traffic Control' system: How early experiences shape the development of executive function* (Working Paper No. 11). Retrieved from Center of the Developing Child website: http://developingchild.harvard.edu/wp-content/uploads/2011/05/How-Early-Experiences-Shape-the-Development-of-Executive-Function.pdf

Singer, J. D., & Willett, J. B. (2003). *Applied longitudinal data analysis: Modeling change and event occurrence*. New York, NY: Oxford University Press.

Sroufe, A. (1996). Attachment: The dyadic regulation of emotion. In A. Sroufe (Ed.), *The organization of emotional life in the early years* (pp. 172–191). New York, NY: Cambridge University Press.

Tamnes, C. K., Herting, M. M., Goddings, A. L., Meuwese, R., Blakemore, S. J., Dahl, R. E., . . . & Mills, K. L. (2017). Development of the cerebral cortex across adolescence: A multisample study of inter-related longitudinal changes in cortical volume, surface area, and thickness. *Journal of Neuroscience*, *37*, 3402–3412. doi: 10.1523/JNEUROSCI.3302 -16.2017

Tarabulsy, G. M., Bernier, A., Provost, M. A., Maranda, J., Larose, S., Moss, E., . . . & Tessier, R. (2005). Another look inside the gap: Ecological contributions to the transmission of attachment in a sample of adolescent mother–infant dyads. *Developmental Psychology*, *41*, 212–224. doi: 10.1037/0012-1649.41.1.212

Valcan, D. S., Davis, H., & Pino-Pasternak, D. (2018). Parental behaviours predicting early childhood executive functions: A meta-analysis. *Educational Psychology Review*, *30*, 607–649. doi: 10.1007/s10648-017-9411-9

van IJzendoorn, M. H., Vereijken, C. M., Bakermans-Kranenburg, M. J., & Riksen-Walraven, J. M. (2004). Assessing attachment security with the Attachment Q-Sort: Meta-analytic evidence for the validity of the observer AQS. *Child Developmen*t, *75*, 1188–1213. doi:10.1111/j.1467-8624.2004.00733.x

Wade, M., Browne, D. T., Madigan, S., Plamondon, A., & Jenkins, J. M. (2014). Normal birth weight variation and children's neuropsychological functioning: Links between language, executive functioning, and theory of mind. *Journal of the International Neuropsychological Society*, *20*, 909–919. doi: 10.1017/S1355617714000745

Waters, E. (1995). Appendix A: The attachment Q-set (version 3.0). *Monographs of the Society for Research in Child Development*, *60*(Serial No. 2-3), 234–246. doi: 10.1111/j.1540-5834.1995.tb00214.x

Wechsler, D. (2002). *Wechsler Intelligence Scale for Children* (3rd ed.). San Antonio, TX: The Psychological Corporation.

Whipple, N., Bernier, A., & Mageau, G. (2011). Broadening the study of infant security of attachment: Maternal autonomy support in the context of infant exploration. *Social Development*, *20*, 17–32. doi: 10.1111/j.1467-9507.2010.00574.x

Zelazo, P. D. (2006). The dimensional change card sort (DCCS): A method of assessing executive function in children. *Nature Protocols*, *1*, 297–301. doi:10.1038/nprot.2006.46

Zelazo, P. D., Anderson, J. E., Richler, J., Wallner-Allen, K., Beaumont, J. L., & Weintraub, S. (2013). II. NIH Toolbox Cognition Battery (CB): Measuring executive function and attention. *Monographs of the Society for Research in Child Development*, *78*(Serial No. issue 4), 16–33. doi: 10.1111/mono.12032

Zelazo, P. D., Blair, C. B., & Willoughby, M. T. (2016). *Executive Function: Implications for Education*: (NCER 2017-2000). Retrieved from Institute of Education Sciences website https://ies.ed.gov/ncer/pubs/20172000/pdf/20172000.pdf

Zelazo, P. D., & Carlson, S. M. (2012). Hot and cool executive function in childhood and adolescence: Development and plasticity. *Child Development Perspectives*, *6*, 354–360. doi: 10.1111/j.1750-8606.2012.0024

Table 1

Descriptive Statistics, Correlations Across Time Points, and Intercorrelations Among EF Tasks

			Correlations across ages		Intercorrelations among tasks	
Age	*M*(*SD*)	Range	G2	G3	DCCS-RT	Tower
Backward						
G2	5.74 (1.20)	3–9	—	—	−.14	.13
G3	5.98 (1.36)	2–9	.24*	—	−.04	.01
G4	6.54 (1.73)	3–11	.24*	.46**	−.11	.16
DCCS-RT						
G2	1.06 (0.27)	0.51–1.76	—	—	—	−.02
G3	0.98 (0.23)	0.52–1.64	.48**	—	—	−.05
G4	0.96 (0.21)	0.54–1.58	.21	.26*	—	.03
Tower						
G2	12.74 (2.00)	7–17	—	—	—	—
G3	12.89 (2.19)	6–18	.30**	—	—	—
G4	13.80 (2.12)	8–19	.18	.31**	—	—

Note. G2 = Grade 2; G3 = Grade 3; G4 = Grade 4; DCCS = Dimensional Change Card Sort; RT = reaction time. Reaction times for DCCS are presented in seconds.
**p* < .05. ***p* < .01.

Table 2

Final Unconditional and Conditional Models of Child EF Performance during School Years

	Par	Backward		DCCS-RT		Tower	
		Model 1	Model 2	Model 1	Model 2	Model 1	Model 2
Initial status π_{0i}							
Intercept (G2)	γ_{00}	5.54 (0.13)***	5.51 (0.14)***	1.14 (0.04)***	1.14 (0.04)***	12.42 (0.23)***	12.36 (0.23)***
Attachment security	γ_{01}	—	1.42 (0.69)*	—	−0.43 (0.19)*	—	2.20 (1.11)*
Autonomy support	γ_{02}	—	0.13 (0.17)	—	0.03 (0.03)	—	0.60 (0.24)*
Rate of change π_{1i}							
Child age in years	γ_{10}	0.35 (0.09)***	0.37 (0.09)***	−0.17 (0.05)**	−0.17 (0.05)**	0.46 (0.13)***	0.50 (0.12)***
Attachment security	γ_{11}	—	−0.54 (0.38)	—	0.13 (0.07)^{t}	—	−0.92 (0.49)^{t}
Autonomy support	γ_{12}	—	−0.03 (0.11)	—	−0.03 (0.02)	—	−0.42 (0.14)**
Change in slope: quadratic term	γ_{20}	—	—	0.04 (0.02)*	0.04 (0.02)*	—	—
Within-person variance (residual)	σ^2_E	1.20 (0.16)***	1.17 (0.16)***	0.03 (0.01)***	0.03 (0.004)***	3.08 (0.41)***	2.96 (0.39)***
Variance in initial status	σ^2_0	0.23 (0.18)	0.23 (0.17)	0.06 (0.02)***	0.05 (0.02)***	1.05 (0.38)**	1.20 (0.36)**
Variance in rate of change	σ^2_1	0.21 (0.06)**	0.21 (0.06)**	0.00 (0.00)	0.00 (0.00)	0.09 (0.11)	0.02 (0.10)
Slope-intercept covariance	σ_{01}	—	—	−0.02 (0.01)*	−0.02 (0.01)*	—	—
Goodness of fit	LL	−497.39	−484.52	22.88	28.51	−603.73	−584.69
	AIC	1004.78	987.05	−31.75	−35.01	1217.46	1187.39
	$\Delta\chi^2$		27.43***		9.92*		45.22***
	Δdf		4		4		4

Note. Standard errors are within parentheses. Model 1 represents the final unconditional models, and Model 2, the conditional models. In Model 2, family socioeconomic status, child sex, child general cognitive ability, and child birthweight were controlled for, but were not associated with EF growth curve parameters, and thus were not retained. G2 = Grade 2; Par = parameters; LL = log likelihood; AIC = Akaike information criterion; $\Delta\chi^2$ = adjusted chi-square difference test; *df* = degrees of freedom; DCCS = Dimensional Change Card Sort; RT = reaction time. Reaction times for the DCCS are presented in seconds.
$^{t}p < .10$. $^{*}p < .05$. $^{**}p < .01$. $^{***}p < .001$.

Conclusion

Synthèse des objectifs et des résultats

L'objectif général de la thèse et des deux articles empiriques qui la composent était de contribuer à l'avancement des connaissances sur les antécédents parentaux des FE de l'enfant à l'âge scolaire, et ce, de trois façons. D'abord, en explorant différents aspects des interactions parent-enfant, soit l'orientation mentale, la sécurité d'attachement et le soutien à l'autonomie, en relation avec les FE. Par la suite, en considérant les conduites paternelles en plus des conduites maternelles. Finalement, en modélisant des courbes de croissance de FE à l'âge scolaire.

Le premier article de thèse visait à explorer les liens prospectifs entre l'orientation mentale paternelle et les FE de l'enfant telles que manifestées en milieu scolaire. Les résultats révèlent que plus les pères font des commentaires qui reflètent adéquatement les états mentaux de l'enfant lors d'un jeu libre à 18 mois, moins les enfants présentent de difficultés exécutives selon leur enseignant de maternelle. Ces relations entre l'orientation mentale des pères et les FE de l'enfant demeurent significatives même après avoir tenu compte de la sécurité d'attachement mère-enfant, un prédicteur robuste des FE (Bernier et al., 2012, 2015; Lind et al., 2017; Matte-Gagné et al., 2018), et d'autres variables généralement liées aux FE, soit le statut socio-économique de la famille (Lawson et al., 2018) et le risque prénatal (Khoury et al., 2015; van Houdt et al., 2019). Ainsi, les résultats suggèrent que l'orientation mentale paternelle est associée de façon robuste à de meilleures FE en contexte scolaire dès la maternelle, et ce, peu importe la qualité de l'attachement mère-enfant.

Le deuxième article de thèse avait pour but d'examiner les liens longitudinaux entre deux indicateurs relationnels (la sécurité d'attachement mère-enfant et le soutien maternel à l'autonomie) à l'âge préscolaire et les changements qui surviennent dans plusieurs FE (mémoire de travail, flexibilité mentale et planification) évaluées par des tâches expérimentales entre la 2^{e} et la 4^{e} année du primaire. Afin d'estimer ces changements, la courbe de croissance de chaque FE a été modélisée. Les résultats indiquent que plus le lien d'attachement mère-enfant est sécurisé, meilleure est la performance de l'enfant aux trois FE mesurées entre la 2^{e} et la 4^{e}année, et ce, peu importe le degré de soutien à l'autonomie de la mère. Ce dernier s'est avéré être associé à une meilleure capacité de planification chez l'enfant, et ce, en tenant compte de la sécurité d'attachement mère-enfant. L'association observée dans ce cas s'avère plus forte en 2e année, suggérant que le soutien maternel à l'autonomie serait surtout impliqué dans l'émergence de la planification. L'ensemble de ces relations persistent en considérant des variables clés liées aux FE, soit le statut socio-économique de la famille et le sexe, le poids à la naissance et les habiletés cognitives générales de l'enfant (Clark et al., 2013; Friedman & Miyake, 2017; Lawson et al., 2018; Wade et al., 2014). Ainsi, il apparait que la sécurité d'attachement mère-enfant pourrait globalement contribuer au développement des FE durant les premières années du primaire, tandis que le soutien maternel à l'autonomie pourrait faciliter plus spécifiquement l'émergence des FE de plus haut niveau telles que la planification.

Contributions principales et intégration des résultats

Il a été démontré que les dimensions affective et cognitive des comportements parentaux sont associées aux FE de l'enfant (Valcan et al., 2018), mais la recherche demeure limitée quant à la spécificité de ces liens. En ce sens, la thèse a permis d'examiner différents aspects de la qualité des interactions parent-enfant en relation avec des FE distinctes. Les résultats révèlent que les aspects affectifs, tels que l'orientation mentale et la sécurité d'attachement, pourraient favoriser la compétence exécutive globale de l'enfant, alors que les aspects cognitifs, tels que le soutien à l'autonomie, seraient plus spécifiquement liés aux habiletés exécutives complexes comme la planification. À titre explicatif, il a été suggéré qu'un lien d'attachement sécurisé et que l'exposition à une orientation mentale plus élevée permettent à l'enfant de vivre des expériences positives de régulation avec son parent qui agit alors à titre de régulateur externe (Fernyhough, 2008; Sroufe, 1996). Il est possible que cette qualité affective de la relation parent-enfant puisse en retour aider l'enfant à exercer un contrôle autonome sur ses pensées et comportements, contribuant de ce fait à supporter le développement global de ses FE. Au regard de la dimension cognitive, les conduites parentales permettant de soutenir l'autonomie de l'enfant pourraient quant à elles encourager la prise d'initiatives, l'engagement et la participation active de l'enfant dans les tâches (Pomerantz & Grolnick, 2017). Cette meilleure disposition à la tâche, combinée aux stratégies de résolution de problèmes apprises via le soutien à l'autonomie, pourraient s'avérer particulièrement pertinentes pour optimiser les capacités de l'enfant à résoudre des problèmes plus complexes sollicitant des FE de haut niveau telles que la planification.

D'autre part, les résultats de la thèse ont répondu au besoin criant de considérer davantage le rôle des pères en plus de celui des mères dans la recherche sur les FE de l'enfant (Fay-Stammbach et al., 2014). Le premier article s'ajoute au peu d'études documentant les liens uniques qui existent entre la qualité des interactions père-enfant et les FE de l'enfant (Hertz et al., 2019; Lucassen et al., 2015; Meuwissen & Englund, 2016) et permet d'étendre ce domaine en examinant l'orientation mentale paternelle. Au-delà de l'étude de Gagné et al. (2018), basée sur un sous-échantillon de celui étudié dans cette thèse, les résultats suggèrent pour la première fois que l'orientation mentale pourrait faire partie des conduites propres à la relation père-enfant qui sont importantes pour le développement des FE. Ce faisant, cet article contribue également à enrichir les connaissances dans le domaine de l'orientation mentale et ses liens avec le développement de l'enfant. En accord avec un nombre limité d'études (p. ex., Bernier, McMahon, & Perrier, 2017; Cheng et al., 2018; Costantini et al., 2017; Meins et al., 2013), la thèse appuie la pertinence de s'intéresser à l'orientation mentale parentale lorsque l'on tente d'identifier les facteurs impliqués dans le développement cognitif de l'enfant.

Une autre contribution importante de la thèse est la modélisation de courbes de croissance permettant d'étudier formellement les patrons de changement développementaux des FE au fil du temps et leurs associations avec différents aspects des relations parent-enfant (Clark et al., 2013; Fraley et al., 2013). Ces patrons de changement sont méconnus étant donné le peu d'études longitudinales avec mesures répétées de *différentes* FE, surtout à l'âge scolaire (Friedman et al., 2014; Hackman et al., 2015; Matte-Gagné et al., 2018; Roskam et al., 2014). S'ajoutant à cette littérature naissante, le deuxième article révèle que la sécurité d'attachement mère-enfant et le soutien maternel à l'autonomie seraient tous deux associés, mais de façon différente, à une trajectoire développementale exécutive plus élevée durant les premières années du primaire. En effet, les liens avec les FE tendraient à persister pour la sécurité d'attachement, alors qu'ils diminueraient avec le temps pour le soutien à l'autonomie. Une interprétation plausible de cette différence est que les aspects affectifs des interactions parent-enfant seraient impliqués de façon persistante et globale dans le développement des FE, tandis que les aspects cognitifs seraient surtout saillants lorsque le niveau de défi est plus élevé pour l'enfant, tel que durant des activités requérant des FE complexes en émergence (ici, la planification en 2e année).

Dans l'ensemble, les deux articles permettent de dégager un portrait plus précis et détaillé des conduites parentales associées au développement des FE à l'âge scolaire. Ces nouvelles connaissances s'avèrent significatives considérant l'importance des FE pour plusieurs sphères du développement de l'enfant. L'originalité de la thèse réside dans son approche multidimensionnelle de la qualité des interactions parent-enfant et des FE, ses mesures environnementales observationnelles et multi-agents (incluant les deux parents), son approche de mesure multiméthodes pour les FE (utilisant une évaluation d'adultes et des tâches expérimentales), son devis longitudinal et ses analyses statistiques contemporaines.

Limites de la thèse

Les articles qui constituent la thèse présentent néanmoins des limites méthodologiques qui doivent être considérées dans l'interprétation des résultats et soulignent le besoin de répliquer ceux-ci et de poursuivre la recherche dans le domaine. D'abord, les deux études ont été menées auprès d'un échantillon composé majoritairement de personnes blanches, de nationalité canadienne et à faible risque socio-économique. En conséquence, les résultats s'avèrent difficilement généralisables à des populations à risque ou à d'autres cultures. En effet, un faible statut socio-économique, qui coïncide souvent avec plusieurs facteurs de risque tels que l'instabilité résidentielle, des conflits familiaux et un stress élevé, est lié à de plus faibles FE (Finch & Obradović, 2018; Lawson et al., 2018). La recherche révèle par ailleurs des différences exécutives entre les enfants et adolescents issus de cultures distinctes, possiblement rattachées à des divergences au plan des attentes parentales, approches pédagogiques et normes sociales (Schirmbeck et al., 2020). L'expression de conduites parentales telles que l'orientation mentale et le soutien à l'autonomie pourrait aussi varier au sein de cultures privilégiant davantage l'indépendance ou l'interdépendance (Benito-Gomez et al., 2020; Hughes et al., 2018). Compte tenu de la multiculturalité grandissante au Québec et au Canada, une investigation multiculturelle et multidimensionnelle des conduites parentales liées aux FE de l'enfant serait très intéressante et pertinente.

D'autre part, il importe de mentionner que le devis corrélationnel utilisé dans la thèse ne permet pas de faire des inférences causales. Des études à devis expérimentaux examinant si le fait d'intervenir sur les conduites parentales ciblées dans la thèse entraîne des changements au plan des FE de l'enfant sont nécessaires pour statuer plus formellement sur la direction et la nature causale des relations observées. Des programmes d'intervention permettant d'améliorer l'orientation mentale, la sécurité d'attachement et le soutien à l'autonomie existent d'ailleurs (Dozier et al., 2014; Faber & Mazlish, 1980; Slade et al., 2005) et pourraient être utilisés en recherche.

En outre, un aspect important de la compétence exécutive, soit les FE dites *hot*, n'a pas été explicitement examiné. Tel que le soulignent Zelazo et Carlson (2020), il est possible de distinguer les *hot* EF et les *cool* EF. Les premières réfèrent aux habiletés cognitives de haut niveau qui entrent en jeu lors de situations ayant une signification émotionnelle ou motivationnelle (p. ex., délai de gratification). Les secondes ont fait l'objet de la thèse (p. ex., mémoire de travail, flexibilité cognitive) et sont impliquées dans des situations affectivement neutres. Le fait de considérer simultanément les *cool* et *hot* EF aurait permis de documenter davantage la spécificité des liens entre les conduites parentales et les FE de l'enfant, d'autant plus que des preuves empiriques suggèrent que la nature de ces relations diffère selon le type de FE mesuré (Bernier et al., 2012; Kamza et al., 2016; Matte-Gagné & Bernier, 2011; Rochette & Bernier, 2014, 2016).

Finalement, mentionnons que bien que la thèse adopte une approche multidimensionnelle et multi-agents, chaque aspect des interactions parent-enfant n'a été examiné que chez un seul parent (sécurité d'attachement et soutien à l'autonomie: mère; orientation mentale: père). Considérant que la relation parent-enfant est caractérisée par des processus de socialisation distincts (Grusec & Davidov, 2010) et qu'une même conduite adoptée par les mères et les pères peut être associée à des issues différentes chez l'enfant (Karberg et al., 2019), l'évaluation des mêmes comportements chez les deux parents dans la thèse aurait permis de discerner plus nettement leurs contributions respectives aux FE de l'enfant.

Pistes de recherche futures

Une avenue de recherche prometteuse serait de considérer les FE du parent. En effet, des FE supérieures chez le parent ont été associées à de plus fortes FE chez l'enfant (Cuevas, Deater-Deckard, Kim-Spoon, Wang, et al., 2014; Hughes & Devine, 2019; Hughes & Ensor, 2009). Quelques études suggèrent également un lien indirect entre les FE du parent et celles de l'enfant via les comportements parentaux (Cuevas, Deater-Deckard, Kim-Spoon, Watson, et al., 2014; Distefano et al., 2018). Il apparait ainsi que de meilleures FE pourraient aider les parents à réguler leurs comportements envers leur enfant, ce qui en retour pourrait faciliter le bon développement des FE de l'enfant. Cependant, beaucoup reste à savoir dans le domaine, notamment sur la contribution unique des FE *paternelles* aux FE de l'enfant. Par ailleurs, la recherche dans ce domaine s'est principalement centrée sur la période préscolaire et le rôle des FE parentales après l'entrée à l'école est méconnu. De telles informations pourraient pourtant s'avérer importantes étant donné que les FE représentent des outils clés pour la réussite scolaire et le fonctionnement à l'école.

D'autre part, il est bien établi qu'autant les caractéristiques du parent que de l'enfant façonnent leurs interactions (Bell, 1968; Davidov et al., 2015). Cependant, la contribution d'indices propres à l'enfant, tels que son tempérament et son bagage génétique, est peu documentée dans la recherche sur les FE. Considérant que les parents transmettent non seulement un environnement, mais aussi des gènes à leur enfant, les caractéristiques génétiques partagées entre le parent et son enfant représentent une variable cruciale à considérer dans de futures études pour étendre les résultats de la thèse. Dans cette optique, la recherche démontre que les FE sont en partie héritables (Friedman & Miyake, 2017). De même, les résultats d'une méta-analyse de données de génétique comportementale suggèrent que les gènes de l'enfant peuvent contribuer à influencer les conduites de ses parents à son égard (Klahr & Burt, 2014). Ainsi, les différences génétiques entre les enfants seraient associées à une exposition environnementale différente, ce qui réfère à la notion de *corrélation* gènes-environnement. De plus, le bagage génétique de l'enfant peut moduler la façon dont son environnement l'affecte, via ce qu'il est convenu d'appeler des *interactions* gènes-environnement (Dick, 2011). Dans ce cas, l'enfant pourrait être plus ou moins susceptible aux comportements de son parent (c.-à-d., bénéficier plus des aspects positifs et être davantage affecté par les aspects négatifs) selon ses caractéristiques génétiques (Belsky & van IJzendoorn, 2017). En bref, les apports de l'environnement familial n'excluent aucunement des contributions génétiques. Par conséquent, l'étude des liens entre les interactions parent-enfant et les FE devrait idéalement tenir compte des diverses formes d'interface possibles entre ces deux familles de facteurs d'influence.

D'autre part, selon les théories familiales systémiques, la famille est constituée de sous-systèmes, incluant les dyades parent-enfant et la triade mère-père-enfant, qui s'inter-influencent et modulent également chaque membre de la famille (Minuchin, 1985). Malgré ces propos théoriques, la recherche sur les FE porte presque exclusivement sur les dyades parent-enfant (mère-enfant et père-enfant) et les contributions des interactions triadiques s'avèrent très peu documentées. Selon Repetti et al. (2002), la qualité de l'environnement familial serait déterminante pour la santé physique et mentale des enfants. Les données d'une méta-analyse et d'une revue de littérature systématique récentes suggèrent entre autres qu'un milieu familial caractérisé par de l'instabilité et de la désorganisation est négativement associé aux FE de l'enfant et de l'adolescent (Andrews et al., 2021; Marsh et al., 2020). Le contexte des triades mère-père-enfant est en lui-même potentiellement propice à la pratique des FE, alors que chaque membre doit attendre son tour de parole, garder le fil de la conversation et alterner son focus attentionnel selon l'interlocuteur. Dans cette optique, la recherche gagnerait à adopter une perspective systémique explorant la qualité des interactions mère-père-enfant en relation avec les FE de l'enfant. L'article en Annexe F s'inscrit dans cette lignée.

Implications cliniques

La thèse suggère qu'il serait judicieux d'agir sur l'orientation mentale, la sécurité d'attachement et le soutien à l'autonomie pour soutenir le développement optimal des FE de l'enfant. Quelques programmes d'intervention impliquant des visites au domicile des familles apparaissent prometteurs, tels que *Minding the Baby* (MTB; Slade et al., 2005) et le *Attachment and Biobehavioral Catch-up* (ABC; Dozier et al., 2014). Au regard de l'orientation mentale, MTB utilise une approche interdisciplinaire impliquant des professionnels de la santé et des travailleurs sociaux dans le but de développer une saine relation parent-enfant. Des appuis empiriques indiquent que MTB est efficace pour augmenter les capacités réflexives des parents, les aidant à mieux comprendre les états mentaux de leurs enfants (Slade et al., 2020). Pour sa part, ABC vise à favoriser la création d'un lien d'attachement parent-enfant sécurisé en aidant le parent à adopter des réponses sensibles aux signaux de son enfant et à offrir une présence prévisible, chaleureuse et apaisante supportant la régulation comportementale et biologique de l'enfant. Des études expérimentales confirment que ABC permet d'améliorer la qualité de la relation d'attachement (Grube & Liming, 2018; Zajac et al., 2020). À notre connaissance, aucun programme d'intervention ne s'est spécifiquement axé sur le soutien à l'autonomie. Néanmoins, le programme *How to talk so kids will listen & listen so kids will talk* (Faber & Mazlish, 1980) comporte plusieurs aspects rejoignant les fondements du soutien à l'autonomie (p. ex., faire preuve d'empathie et encourager la prise d'initiatives de l'enfant). Le mandat est d'aider les parents à mieux communiquer avec leurs enfants par l'usage de diverses techniques parentales. Les résultats préliminaires de l'étude de Joussemet et al. (2014) s'avèrent encourageants et révèlent que ce programme pourrait permettre d'augmenter le niveau de soutien à l'autonomie. Mentionnons néanmoins que ces programmes d'intervention sont majoritairement axés sur les mères et leur efficacité pour améliorer les FE de l'enfant est méconnue. Étant donné les impacts documentés de ces interventions sur les interactions parent-enfant et à la lumière des résultats de la thèse, des études futures devraient inclure les deux parents et gagneraient à investiguer les répercussions que pourraient avoir ces programmes sur le développement des FE de l'enfant.

Conclusion

La thèse met de l'avant l'importance de la qualité des interactions mère-enfant et père-enfant pour les FE de l'enfant d'âge scolaire. Elle révèle que les indicateurs parentaux affectifs, tels que l'orientation mentale et la sécurité d'attachement, et cognitifs, tels que le soutien à l'autonomie, peuvent contribuer de façon différente au sain développement des FE. En ce sens, elle souligne la pertinence d'adopter une approche longitudinale, multidimensionnelle et multi-agents pour mieux comprendre l'interface complexe entre les interactions parent-enfant et les FE. Considérant les résultats de la thèse, les pistes d'études futures et les implications cliniques qui en découlent, la combinaison d'études observationnelles soignées de la qualité des interactions parent-enfant, de devis génétiques et d'études expérimentales apparait prometteuse pour poursuivre l'enrichissement des connaissances dans le domaine des facteurs parentaux et familiaux favorables au développement des FE de l'enfant.

Références citées dans l’introduction et la conclusion

Andrews, K., Atkinson, L., Harris, M., & Gonzalez, A. (2021). Examining the effects of household chaos on child executive functions: A meta-analysis. *Psychological Bulletin*, *147*(1), 16–32. http://dx.doi.org/10.1037/bul0000311

Baddeley, A. D., & Hitch, G. (1974). Working memory. In G. A. Bower (Ed.), *The psychology of learning and motivation* (Vol. 8, pp. 47–89). Academic Press.

Bell, R. Q. (1968). A reinterpretation of the direction of effects in studies of socialization. *Psychological Review*, *75*(2), 81–95. https://doi.org/10.1037/h0025583

Belsky, J., & van IJzendoorn, M. H. (2017). Genetic differential susceptibility to the effects of parenting. *Current Opinion in Psychology*, *15*, 125–130. https://doi.org/10.1016/j.copsyc.2017.02.021

Benito-Gomez, M., Williams, K. N., McCurdy, A., & Fletcher, A. C. (2020). Autonomy-supportive parenting in adolescence: Cultural variability in the contemporary United States. *Journal of Family Theory & Review*, *12*(1), 7–26. https://doi.org/10.1111/jftr.12362

Benson, J. E., Sabbagh, M. A., Carlson, S. M., & Zelazo, P. D. (2013). Individual differences in executive functioning predict preschoolers' improvement from theory-of-mind training. *Developmental Psychology*, *49*(9), 1615–1627. http://dx.doi.org/10.1037/a0031056

Bernier, A., Beauchamp, M. H., Carlson, S. M., & Lalonde, G. (2015). A secure base from which to regulate: Attachment security in toddlerhood as a predictor of executive functioning at school entry. *Developmental Psychology*, *51*(9), 1177–1189. http://dx.doi.org/10.1037/dev0000032

Bernier, A., Carlson, S. M., Deschênes, M., & Matte-Gagné, C. (2012). Social factors in the development of early executive functioning: A closer look at the caregiving environment. *Developmental Science*, *15*(1), 12–24. https://doi.org/10.1111/j.1467-7687.2011.01093.x

Bernier, A., Carlson, S. M., & Whipple, N. (2010). From external regulation to self-regulation: Early parenting precursors of young children’s executive functioning. *Child Development*, *81*(1), 326–339. https://doi.org/10.1111/j.1467-8624.2009.01397.x

Bernier, A., McMahon, C. A., & Perrier, R. (2017). Maternal mind-mindedness and children's school readiness: A longitudinal study of developmental processes. *Developmental Psychology*, *53*(2), 210–221. https://doi.org/10.1037/dev0000225

Bernier, A., St-Laurent, D., Matte-Gagné, C., Milot, T., Hammond, I. S., & Carpendale, M. I. J. (2017). Parenting and young children's executive function development. In M. J. Hoskyn, G. Iarocci, & A. R. Young (Eds.), *Executive functions in children's everyday lives* (pp. 70–87). Oxford University Press.

Berninger, V., Abbott, R., Cook, C. R., & Nagy, W. (2017). Relationships of attention and executive functions to oral language, reading, and writing skills and systems in middle childhood and early adolescence. *Journal of Learning Disabilities*, *50*(4), 434–449. https://doi.org/10.1177/0022219415617167

Best, J. R., & Miller, P. H. (2010). A developmental perspective on executive function. *Child Development*, *81*(6), 1641–1660. https://doi.org/10.1111/j.1467-8624.2010.01499.x

Bindman, S. W., Hindman, A. H., Bowles, R. P., & Morrison, F. J. (2013). The contributions of parental management language to executive function in preschool children. *Early Childhood Research Quarterly*, *28*(3), 529–539. https://doi.org/10.1016/j.ecresq.2013.03.003

Blair, C., & Diamond, A. (2008). Biological processes in prevention and intervention: The promotion of self-regulation as a means of preventing school failure. *Development and Psychopathology*, *20*(3), 899–911. https://doi.org/10.1017/S0954579408000436

Blair, C., & Raver, C. C. (2015). School readiness and self-regulation: A developmental psychobiological approach. *Annual Review of Psychology*, *66*(1), 711–731. https://doi.org/10.1146/annurev-psych-010814-015221

Blair, C., & Razza, R. P. (2007). Relating effortful control, executive function, and false belief understanding to emerging math and literacy ability in kindergarten. *Child Development*, *78*(2), 647–663. https://doi.org/10.1111/j.1467-8624.2007.01019.x

Bowlby, J. (1982). Attachment and loss. *Attachment*. Basic Books.

Burchinal, M., Foster, T. J., Bezdek, K. G., Bratsch-Hines, M., Blair, C., Vernon-Feagans, L., & Family

Life Project Investigators. (2020). School-entry skills predicting school-age academic and social–emotional trajectories. *Early Childhood Research Quarterly*, *51*, 67–80. https://doi.org/10.1016/j.ecresq.2019.08.004

Camerota, M., Willoughby, M. T., Cox, M., Greenberg, M. T., & Investigators, F. L. P. (2015). Executive function in low birth weight preschoolers: The moderating effect of parenting. *Journal of Abnormal Child Psychology*, *43*(8), 1551–1562. https://doi.org/10.1007/s10802-015-0032-9

Cheng, N., Lu, S., Archer, M., & Wang, Z. (2018). Quality of maternal parenting of 9-month-old infants predicts executive function performance at 2 and 3 years of age. *Frontiers in Psychology*, *8*, Article 2293. https://doi.org/10.3389/fpsyg.2017.02293

Clark, C. A. C., Pritchard, V. E., & Woodward, L. J. (2010). Preschool executive functioning abilities predict early mathematics achievement. *Developmental Psychology*, *46*(5), 1176–1191. https://doi.org/10.1037/a0019672

Clark, C. A. C., Sheffield, T. D., Chevalier, N., Nelson, J. M., Wiebe, S. A., & Espy, K. A. (2013). Charting early trajectories of executive control with the shape school. *Developmental Psychology*, *49*(8), 1481–1493. https://doi.org/10.1037/a0030578

Costantini, A., Coppola, G., Fasolo, M., & Cassibba, R. (2017). Preterm birth enhances the contribution of mothers' mind-mindedness to infants' expressive language development: A longitudinal investigation. *Infant Behavior and Development*, *49*, 322–329. https://doi.org/10.1016/j.infbeh.2017.10.006

Cuevas, K., Deater-Deckard, K., Kim-Spoon, J., Wang, Z., Morasch, K. C., & Bell, M. A. (2014). A longitudinal intergenerational analysis of executive functions during early childhood. *British Journal of Developmental Psychology*, *32*(1), 50–64. https://doi.org/10.1111/bjdp.12021

Cuevas, K., Deater-Deckard, K., Kim-Spoon, J., Watson, A. J., Morasch, K. C., & Bell, M. A. (2014). What's mom got to do with it? Contributions of maternal executive function and caregiving to the development of executive function across early childhood. *Developmental Science*, *17*(2), 224–238. https://doi.org/10.1111/desc.12073

Cuevas, K., Hubble, M., & Bell, M. A. (2012). Early childhood predictors of post-kindergarten executive function: Behavior, parent-report, and psychophysiology. *Early Education and Development*, *23*(1), 59–73. https://doi.org/10.1080/10409289.2011.611441

Cuevas, K., Rajan, V., & Bryant, J. L. (2018). Emergence of executive function in infancy. In S. A. Wiebe & J. Karbach (Eds.), *Executive function: Development across the life span* (pp. 11–28). Routledge.

Dajani, D. R., & Uddin, L. Q. (2015). Demystifying cognitive flexibility: Implications for clinical and developmental neuroscience. *Trends in Neurosciences*, *38*(9), 571–578. https://doi.org/10.1016/j.tins.2015.07.003

Davidov, M., Knafo-Noam, A., Serbin, L. A., & Moss, E. (2015). The influential child: How children affect their environment and influence their own risk and resilience. *Development and Psychopathology*, *27*(4), 947–951. https://doi.org/10.1017/S0954579415000619

De Luca, C. R., & Leventer, R. J. (2008). Developmental trajectories of executive functions across the lifespan. In V. Anderson, R. Jacobs, & P. J. Anderson (Eds.), *Executive functions and the frontal lobes: A lifespan perspective* (pp. 23–53). Taylor & Francis.

Devine, R. T., & Hughes, C. (2014). Relations between false belief understanding and executive function in early childhood: A meta-analysis. *Child Development*, *85*(5), 1777–1794. https://doi.org/10.1111/cdev.12237

Devine, R. T., Ribner, A., & Hughes, C. (2019). Measuring and predicting individual differences in executive functions at 14 months: A longitudinal study. *Child Development*, *90*(5), e618–e636. https://doi.org/10.1111/cdev.13217

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135–168. https://doi.org/10.1146/annurev-psych-113011-143750

Dick, D. M. (2011). Gene-environment interaction in psychological traits and disorders. *Annual Review of Clinical Psychology*, *7*, 383–409. https://doi.org/10.1146/annurev-clinpsy-032210-104518

Distefano, R., Galinsky, E., McClelland, M. M., Zelazo, P. D., & Carlson, S. M. (2018). Autonomy-supportive parenting and associations with child and parent executive function. *Journal of Applied Developmental Psychology*, *58*, 77–85. https://doi.org/10.1016/j.appdev.2018.04.007

Dozier, M., Meade, E., & Bernard, K. (2014). Attachment and Biobehavioral Catch-up: An intervention for parents at risk of maltreating their infants and toddlers. In S. Timmer & A. Urquiza (Eds.), *Advances in Child Abuse Prevention Knowledge* (Vol. 3, pp. 43–59). Springer.

Faber, A., & Mazlish, E. (1980). *How to talk so kids will listen & Listen so kids will talk*. Rawson.

Faridi, N., Karama, S., Burgaleta, M., White, M. T., Evans, A. C., Fonov, V., Collins, L. D., & Waber, D. P. (2015). Neuroanatomical correlates of behavioral rating versus performance measures of working memory in typically developing children and adolescents. *Neuropsychology*, *29*(1), 82–91. https://doi.org/10.1037/neu0000079

Fay-Stammbach, T., Hawes, D. J., & Meredith, P. (2014). Parenting influences on executive function in early childhood: A review. *Child Development Perspectives*, *8*(4), 258–264. https://doi.org/10.1111/cdep.12095

Ferguson, H. J., Brunsdon, V. E., & Bradford, E. E. (2021). The developmental trajectories of executive function from adolescence to old age. Scientific Reports, *11*(1), 1–17. https://doi.org/10.1038/s41598-020-80866-1

Fernyhough, C. (2008). Getting Vygotskian about theory of mind: Mediation, dialogue and the development of social understanding. *Developmental Review*, *28*(2), 225–262. https://doi.org/10.1016/j.dr.2007.03.001

Finch, E. J., & Obradović, J. (2018). Adversity and Stress: Implications for the Development of Executive Functions. In S. A. Wiebe & J. Karbach (Eds.), *Executive function: Development across the life span* (pp. 147–159). Routledge.

Fiske, A., & Holmboe, K. (2019). Neural substrates of early executive function development. *Developmental Review*, *52*, 42–62. https://doi.org/10.1016/j.dr.2019.100866

Fraley, R. C., Roisman, G. I., & Haltigan, J. D. (2013). The legacy of early experiences in development: Formalizing alternative models of how early experiences are carried forward over time. *Developmental Psychology*, *49*(1), 109–126. https://doi.org/10.1037/a0027852

Friedman, N. P., & Miyake, A. (2017). Unity and diversity of executive functions: Individual differences as a window on cognitive structure. *Cortex*, *86*, 186–204.

http://dx.doi.org/10.1016/j.cortex.2016.04.023

Friedman, S. L., Scholnick, E. K., Bender, R. H., Vandergrift, N., Spieker, S., Hirsh Pasek, K., Keating, P. D., Park, Y., & NICHD Early Child Care Research Network. (2014). Planning in middle childhood: Early predictors and later outcomes. *Child Development*, *85*(4), 1446–1460. https://doi.org/10.1111/cdev.12221

Fuhs, M. W., & Day, J. D. (2011). Verbal ability and executive functioning development in preschoolers at head start. *Developmental Psychology*, *47*(2), 404–416. https://doi.org/10.1037/a0021065

Gagné, C., Bernier, A., & McMahon, C. A. (2018). The role of paternal mind-mindedness in preschoolers' self-regulated conduct. *Infant and Child Development*, *27*(3), Article e2081. https://doi.org/10.1002/icd.2081

Gooch, D., Thompson, P., Nash, H. M., Snowling, M. J., & Hulme, C. (2016). The development of executive function and language skills in the early school years. *Journal of Child Psychology and Psychiatry*, *57*(2), 180–187. https://doi.org/10.1111/jcpp.12458

Grolnick, W. S., & Ryan, R. M. (1989). Parent styles associated with children's self-regulation and competence in school. *Journal of Educational Psychology*, *81*(2), 143–154. https://doi.org/10.1037/0022-0663.81.2.143

Grube, W. A., & Liming, K. W. (2018). Attachment and Biobehavioral Catch-up: A systematic review. *Infant Mental Health Journal*, *39*(6), 656–673. https://doi.org/10.1002/imhj.21745

Grusec, J. E., & Davidov, M. (2010). Integrating different perspectives on socialization theory and research: A domain-specific approach. *Child Development*, *81*(3), 687–709. https://doi.org/10.1111/j.1467-8624.2010.01426.x

Hackman, D. A., Gallop, R., Evans, G. W., & Farah, M. J. (2015). Socioeconomic status and executive function: Developmental trajectories and mediation. *Developmental Science*, *18*(5), 686–702. https://doi.org/10.1111/desc.12246

Hao, J. (2017). Do children with better inhibitory control donate more? Differentiating between early and middle childhood and cool and hot inhibitory control. *Frontiers in Psychology*, *8*, Article 2182. https://doi.org/10.3389/fpsyg.2017.02182

Hertz, S., Bernier, A., Cimon-Paquet, C., & Regueiro, S. (2019). Parent–child relationships and child executive functioning at school entry: The importance of fathers. *Early Child Development and Care*, *189*(5), 718–732. https://doi.org/10.1080/03004430.2017.1342078

Hoffman, L. (2015). *Longitudinal analysis: Modeling within-person fluctuation and change*. Routledge.

Howard, S. J., Johnson, J., & Pascual-Leone, J. (2014). Clarifying inhibitory control: Diversity and development of attentional inhibition. *Cognitive Development, 31*, 1–21. https://doi.org/10.1016/j.cogdev.2014.03.001

Hughes, C., & Devine, T. R. (2018). Parental influences on children's executive function: a differentiated approach. In S. A. Wiebe & J. Karbach (Eds.), *Executive function: Development across the life span* (pp. 160–171). Routledge.

Hughes, C., & Devine, R. T. (2019). For better or for worse? Positive and negative parental influences on young children's executive function. *Child Development*, *90*(2), 593–609. https://doi.org/10.1111/cdev.12915

Hughes, C., Devine, R. T., & Wang, Z. (2018). Does parental mind-mindedness account for cross-cultural differences in preschoolers' theory of mind?. *Child Development*, *89*(4), 1296–1310. https://doi.org/10.1111/cdev.12746

Hughes, C., & Ensor, R. (2009). How do families help or hinder the development of executive function? *New Directions in Child and Adolescent Psychiatry*, *123*, 35–50. https://doi.org/10.1002/cd.234

Isquith, P. K., Roth, R. M., & Gioia, G. (2013). Contribution of rating scales to the assessment of executive functions. Applied *Neuropsychology: Child*, *2*(2), 125–132. https://doi.org/10.1080/21622965.2013.748389

Jacob, R., & Parkinson, J. (2015). The potential for school-based interventions that target executive function to improve academic achievement: A review. *Review of Educational Research*, *85*(4), 512–552. https://doi.org/10.3102/0034654314561338

Joussemet, M., Mageau, G. A., & Koestner, R. (2014). Promoting optimal parenting and children's mental health: A preliminary evaluation of the how-to parenting program. *Journal of Child and Family Studies*, *23*(6), 949–964. https://doi.org/10.1007/s10826-013-9751-0

Kamza, A., Putko, A., & Zlotogorska, A. (2016). Maternal parenting attitudes and preschoolers' hot and cool executive functions. *Polish Psychological Bulletin*, *47*(2), 236–246. https://doi.org/10.1515/ppb-2016-0028

Karberg, E., Cabrera, N. J., Malin, J., & Kuhns, C. (2019). Longitudinal contributions of maternal and paternal intrusive behaviors to children's sociability and sustained attention at prekindergarten. *Monographs of the Society for Research in Child Development*, *84*(1), 79–93. https://doi.org/10.1111/mono.12404

Khoury, J. E., Milligan, K., & Girard, T. A. (2015). Executive functioning in children and adolescents prenatally exposed to alcohol: A meta-analytic review. *Neuropsychology Review*, *25*(2), 149–170. https://doi.org/10.1007/s11065-015-9289-6

Klahr, A. M., & Burt, S. A. (2014). Elucidating the etiology of individual differences in parenting: A meta-analysis of behavioral genetic research. *Psychological Bulletin*, *140*(2), 544–586. https://doi.org/10.1037/a0034205

Lawson, G. M., Hook, C. J., & Farah, M. J. (2018). A meta-analysis of the relationship between socioeconomic status and executive function performance among children. *Developmental Science*, *21*(2), e12529. https://doi.org/10.1111/desc.12529

Li, J. J., & Roberts, D. K. (2018). Genetic influences on executive functions across the life span. In S. A. Wiebe & J. Karbach (Eds.), *Executive function: Development across the life span* (pp. 106–123). Routledge.

Lind, T., Lee Raby, K., Caron, E. B., Roben, C. K., & Dozier, M. (2017). Enhancing executive functioning among toddlers in foster care with an attachment-based intervention. *Development and Psychopathology*, *29*(2), 575–586. https://doi.org/10.1017/S0954579417000190

Lonigan, C. J., Spiegel, J. A., Goodrich, J. M., Morris, B. M., Osborne, C. M., Lerner, M. D., & Phillips, B. M. (2017). Does preschool self-regulation predict later behavior problems in general or specific problem behaviors? *Journal of Abnormal Child Psychology*, *45*(8), 1491–1502. https://doi.org/10.1007/s10802-016-0260-7

Lucassen, N., Kok, R., Bakermans-Kranenburg, M. J., van Ijzendoorn, M. H., Jaddoe, V. W., Hofman, A., Verhulst, C. F., Lambregtse-Van den Berg, P. M., & Tiemeier, H. (2015). Executive functions in early childhood: the role of maternal and paternal parenting practices. *British Journal of Developmental Psychology*, *33*(4), 489–505. https://doi.org/10.1111/bjdp.12112

Luria, A. R. (1966). *Higher cortical functions in man*. Basic Books.

Mahy, C. E., & Moses, L. J. (2011). Executive functioning and prospective memory in young children. *Cognitive Development*, *26*(3), 269–281. https://doi.org/10.1016/j.cogdev.2011.06.002

Marcovitch, S., O'Brien, M., Calkins, S. D., Leerkes, E. M., Weaver, J. M., & Levine, D. W. (2015). A longitudinal assessment of the relation between executive function and theory of mind at 3, 4, and 5 Years. *Cognitive Development*, *33*, 40–55. https://doi.org/10.1016/j.cogdev.2014.07.001

Marsh, S., Dobson, R., & Maddison, R. (2020). The relationship between household chaos and child, parent, and family outcomes: A systematic scoping review. *BMC Public Health*, *20*(1), 1–27. https://doi.org/10.1186/s12889-020-08587-8

Matte-Gagné, C., & Bernier, A. (2011). Prospective relations between maternal autonomy support and child executive functioning: Investigating the mediating role of child language ability. *Journal of Experimental Child Psychology*, *110*(4), 611–625. https://doi.org/10.1016/j.jecp.2011.06.006

Matte-Gagné, C., Bernier, A., & Lalonde, G. (2015). Stability in maternal autonomy support and child executive functioning. *Journal of Child and Family Studies*, *24*(9), 2610–2619. https://doi.org/10.1007/s10826-014-0063-9

Matte-Gagné, C., Bernier, A., Sirois, M. S., Lalonde, G., & Hertz, S. (2018). Attachment security and developmental patterns of growth in executive functioning during early elementary school. *Child Development*, *89*(3), e167–e182. https://doi.org/10.1111/cdev.12807

McMahon, C. A., & Bernier, A. (2017). Twenty years of research on parental mind-mindedness: Empirical findings, theoretical and methodological challenges, and new directions. *Developmental Review*, *46*, 54–80. https://doi.org/10.1016/j.dr.2017.07.001

Meins, E. (2013). Sensitive attunement to infants' internal states: Operationalizing the construct of mind-mindedness. *Attachment and Human Development*, *15*(5-6), 524–544. https://doi.org/10.1080/14616734.2013.830388

Meins, E., Fernyhough, C., Arnott, B., Leekam, S. R., & de Rosnay, M. (2013). Mind-mindedness and theory of mind: Mediating roles of language and perspectival symbolic play. *Child Development*, *84*(5), 1777–1790. https://doi.org/10.1111/cdev.12061

Meins, E., Fernyhough, C., Fradley, E., & Tuckey, M. (2001). Rethinking maternal sensitivity: Mothers' comments on infants' mental processes predict security of attachment at 12 months. *The Journal of Child Psychology and Psychiatry*, *42*(5), 637–648. https://doi.org/10.1017/S0021963001007302

Meuwissen, A. S., & Carlson, S. M. (2019). An experimental study of the effects of autonomy support on preschoolers' self-regulation. *Journal of Applied Developmental Psychology*, *60*, 11–23. https://doi.org/10.1016/j.appdev.2018.10.001

Meuwissen, A. S., & Englund, M. M. (2016). Executive function in at-risk children: Importance of father-figure support and mother parenting. *Journal of Applied Developmental Psychology, 44*, 72–80. https://doi.org/10.1016/j.appdev.2016.04.002

Milner, B. (1963). Effects of different brain lesions on card sorting: The role of the frontal lobes. *Archives of Neurology*, *9*(1), 90–100. https://doi.org/10.1001/archneur.1963.00460070100010

Minuchin, P. (1985). Families and individual development: Provocations from the field of family therapy. *Child Development*, *56*(2), 289–302. https://doi.org/10.2307/1129720

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology*, *41*(1), 49–100. https://doi.org/10.1006/cogp.1999.0734

Morgan, P. L., Farkas, G., Hillemeier, M. M., Pun, W. H., & Maczuga, S. (2019). Kindergarten children's executive functions predict their second-grade academic achievement and behavior. *Child Development*, *90*(5), 1802–1816. https://doi.org/10.1111/cdev.13095

Pomerantz, E. M., & Grolnick, W. S. (2017). The role of parenting in children's motivation and competence: What underlies facilitative parenting? In A. J. Elliot, C. S. Dweck, & D. S. Yeager (Eds.), *Handbook of competence and motivation: Theory and application* (pp. 566–585). Guilford Press.

Repetti, R. L., Taylor, S. E., & Seeman, T. E. (2002). Risky families: family social environments and the mental and physical health of offspring. *Psychological Bulletin*, *128*(2), 330–366. https://doi.org/10.1037//0033-2909.128.2.330

Ribner, A. D. (2020). Executive function facilitates learning from math instruction in kindergarten: Evidence from the ECLS-K. *Learning and Instruction*, *65*, 101251. https://doi.org/10.1016/j.learninstruc.2019.101251

Rochette, É., & Bernier, A. (2014). Parenting, family socioeconomic status, and child executive functioning: A longitudinal study. *Merrill-Palmer Quarterly*, *60*(4), 431–460. https://doi.org/10.13110/merrpalmquar1982.60.4.0431

Rochette, É., & Bernier, A. (2016). Parenting and preschoolers' executive functioning: A case of differential susceptibility?. *International Journal of Behavioral Development*, *40*(2), 151–161. https://doi.org/10.1177/0165025414557370

Rodrigues, M., Sokolovic, N., Madigan, S., Luo, Y., Silva, V., Misra, S., & Jenkins, J. (2021). Paternal sensitivity and children's cognitive and socioemotional outcomes: A meta-analytic review. *Child Development*, *92*(2), 554–577. https://doi.org/10.1111/cdev.13545

Roskam, I., Stievenart, M., Meunier, J. C., & Noël, M. P. (2014). The development of children's inhibition: Does parenting matter? *Journal of Experimental Child Psychology*, *122*, 166–182. https://doi.org/10.1016/j.jecp.2014.01.003

Sameroff, A. (2010). A unified theory of development: A dialectic integration of nature and nurture. *Child Development*, *81*(1), 6–22. https://doi.org/10.1111/j.1467-8624.2009.01378.x

Schirmbeck, K., Rao, N., & Maehler, C. (2020). Similarities and differences across countries in the development of executive functions in children: A systematic review. *Infant and Child Development*, *29*(1), Article e2164. https://doi.org/10.1002/icd.2164

Shonkoff, J. P., Duncan, G. G., Fisher, P. A., Magnuson, K., Raver, C. C., & Yoshikawa, H. (2011).

Building the brain's ''Air Traffic Control" system: How early experiences shape the development of executive function (Working Paper No. 11). Center on the Developing Child at Harvard University. https://developingchild.harvard.edu/wp-content/uploads/2011/05/How-Early-Experiences-Shape-the-Development-of-Executive-Function.pdf

Slade, A., Holland, M. L., Ordway, M. R., Carlson, E. A., Jeon, S., Close, N., Mayes, L. C., & Sadler, L. S. (2020). Minding the Baby®: Enhancing parental reflective functioning and infant attachment in an attachment-based, interdisciplinary home visiting program. *Development and Psychopathology*, *32*(1), 123–137. https://doi.org/10.1017/S0954579418001463

Slade, A., Sadler, L. S., & Mayes, L. C. (2005). Minding the Baby: Enhancing parental reflective functioning in a nursing/mental health home visiting program. In L. J. Berlin, Y. Ziv, L. Amaya-Jackson, & M. T. Greenberg (Eds.), *Enhancing early attachments: Theory, research, interventions and policy* (pp. 152–177). Guildford Press.

Soto, E. F., Kofler, M. J., Singh, L. J., Wells, E. L., Irwin, L. N., Groves, N. B., & Miller, C. E. (2020). Executive functioning rating scales: Ecologically valid or construct invalid? *Neuropsychology*, *34*(6), 605–619. http://dx.doi.org/10.1037/neu0000681

Sroufe, A. (1996). Attachment: The dyadic regulation of emotion. In A. Sroufe (Ed.), *The organization of emotional life in the early years* (pp. 172–191). Cambridge University Press.

Toplak, M. E., West, R. F., & Stanovich, K. E. (2013). Practitioner review: Do performance-based measures and ratings of executive function assess the same construct? *Journal of Child Psychology and Psychiatry*, *54*(2), 131–143. https://doi.org/10.1111/jcpp.12001

Valcan, D. S., Davis, H., & Pino-Pasternak, D. (2018). Parental behaviours predicting early childhood executive functions: A meta-analysis. *Educational Psychology Review*, *30*, 607–649. https://doi.org/10.1007/s10648-017-9411-9

van Houdt, C. A., Oosterlaan, J., van Wassenaer-Leemhuis, A. G., van Kaam, A. H., & Aarnoudse-Moens, C. S. H. (2019). Executive function deficits in children born preterm or at low birthweight: A meta-analysis. *Developmental Medicine and Child Neurology*, *61*(9), 1015–1024. https://doi.org/10.1111/dmcn.14213

Volling, B. L., & Cabrera, N. J. (2019). Advancing research and measurement on fathering and child development. *Monographs of the Society for Research in Child Development*, *84*(1), 7–160. https://doi.org/10.1111/mono.12404

Vygotsky, L. S. (1978). *Mind in society: The development of higher psychological processes*. Harvard University Press.

Wade, M., Browne, D. T., Madigan, S., Plamondon, A., & Jenkins, J. M. (2014). Normal birth weight variation and children's neuropsychological functioning: Links between language, executive functioning, and theory of mind. *Journal of the International Neuropsychological Society*, *20*(9), 909–919. https://doi.org/10.1017/S1355617714000745

Whipple, N., Bernier, A., & Mageau, G. (2011). Broadening the study of infant security of attachment: Maternal autonomy support in the context of infant exploration. *Social Development*, *20*(1), 17–32. https://doi.org/10.1111/j.1467-9507.2010.00574.x

Zajac, L., Raby, K. L., & Dozier, M. (2020). Sustained effects on attachment security in middle childhood: results from a randomized clinical trial of the Attachment and Biobehavioral Catch-up (ABC) intervention. *Journal of Child Psychology and Psychiatry*, *61*(4), 417–424. https://doi.org/10.1111/jcpp.13146

Zelazo, P. D. (2013). Developmental psychology: A new synthesis. In P. D. Zelazo (Ed.), *The Oxford handbook of developmental psychology* (pp. 3–12). Oxford University Press.

Zelazo, P. D., & Carlson, S. M. (2012). Hot and cool executive function in childhood and adolescence: Development and plasticity. *Child Development Perspectives*, *6*(4), 354–360. https://doi.org/10.1111/j.1750-8606.2012.00246.x

Zelazo, P. D., & Carlson, S. M. (2020). The neurodevelopment of executive function skills: Implications for academic achievement gaps. *Psychology & Neuroscience*, *13*(3), 273–298. http://dx.doi.org/10.1037/pne0000208

Annexe A

Évaluation des fonctions exécutives – questionnaire professeur

Gioia, G. A., Espy, K. A., & Isquith, P. K. (2003). *Behavior rating inventory of executive function-preschool version (BRIEF-P)*. Psychological Assessment Resources.

Évaluation du professeur – BRIEF-P

Instructions

Les pages suivantes comprennent une liste d'énoncés décrivant des enfants. Nous désirons savoir si l'enfant a eu des problèmes avec ces comportements au cours des **six derniers mois.** Veuillez répondre à tous les items du mieux que vous pouvez. S'il vous plaît, ne sautez aucun item. Pensez à l'enfant en lisant chacun des énoncés et encerclez votre réponse :

J si le comportement n'est **JAMAIS** un problème

P si le comportement constitue **PARFOIS** un problème

S si le comportement est **SOUVENT** un problème

Connaissez-vous bien l'enfant?

- Pas très bien   Assez bien   Très bien

Je connais l'enfant depuis: ___________________mois/année

Au cours des 6 derniers mois, à quelle fréquence chacun de ces comportements a-t-il été un problème?

J = JAMAIS   P = PARFOIS   S = SOUVENT

1. Réagit de manière excessive à de petits problèmes.	**J**	**P**	**S**
2. Si on lui donne deux choses à faire, se souvient uniquement de la première ou de la dernière.	**J**	**P**	**S**
3. Ne se rend pas compte comment son comportement affecte ou dérange les autres.	**J**	**P**	**S**
4. Lorsqu'on lui demande de ranger, le fait n'importe comment, de façon désorganisée.	**J**	**P**	**S**
5. Est dérangé(e) par les nouvelles situations.	**J**	**P**	**S**
6. Fait des crises de colère explosives.	**J**	**P**	**S**
7. A de la difficulté à réaliser les actions nécessaires pour compléter des tâches (essayer de placer des morceaux de casse-tête un à la fois, ranger ses choses pour mériter une récompense).	**J**	**P**	**S**
8. Ne cesse de rire de choses ou d'événements amusants même quand les autres ne rient plus.	**J**	**P**	**S**

J = JAMAIS	P = PARFOIS	S = SOUVENT		

9. A besoin qu'on lui dise de commencer une tâche, et ce, même si disposé(e) à la faire.	**J**	**P**	**S**
10. A de la difficulté à s'habituer à de nouvelles personnes (comme un professeur, un ami, une éducatrice).	**J**	**P**	**S**
11. Se fâche trop facilement.	**J**	**P**	**S**
12. A de la difficulté à se concentrer sur les jeux, les casse-têtes ou autres activités.	**J**	**P**	**S**
13. A besoin de plus de supervision que ses compagnons de jeux.	**J**	**P**	**S**
14. Lorsqu'on lui demande d'aller chercher quelque chose, oublie ce qu'il(elle) devait aller chercher.	**J**	**P**	**S**
15. Est dérangé(e) par les changements de plans ou de routine (par exemple, changement dans l'ordre habituel des activités quotidiennes).	**J**	**P**	**S**
16. S'emporte facilement à la moindre occasion.	**J**	**P**	**S**
17. Répète sans cesse les mêmes erreurs même après qu'on l'ait aidé(e).	**J**	**P**	**S**
18. Agit de façon plus excitée ou immature que les autres lorsqu'il(elle) est en groupe (comme durant les récréations, les jeux en groupe).	**J**	**P**	**S**
19. Ne retrouve pas ses vêtements, souliers, jouets ou livres même quand il(elle) a reçu des indications précises.	**J**	**P**	**S**
20. Met beaucoup de temps à s'habituer aux nouveaux endroits ou aux nouvelles situations (comme de nouveaux amis).	**J**	**P**	**S**
21. A de fréquents changements d'humeur.	**J**	**P**	**S**
22. Fait des erreurs bêtes sur des choses qu'il(elle) est capable de faire.	**J**	**P**	**S**
23. Est agité(e), ne tient pas en place, se tortille sans arrêt.	**J**	**P**	**S**
24. A de la difficulté à suivre les routines établies comme pour le coucher, les repas ou les activités de jeux.	**J**	**P**	**S**
25. Est dérangé(e) par les bruits forts, les lumières intenses ou par certaines odeurs.	**J**	**P**	**S**
26. Des événements mineurs provoquent d'intenses réactions.	**J**	**P**	**S**
27. A de la difficulté avec les activités ou les tâches qui ont plus d'une étape.	**J**	**P**	**S**
28. Est impulsif(impulsive).	**J**	**P**	**S**
29. A de la difficulté à penser à une manière différente de résoudre un problème ou de compléter une activité lorsqu'il(elle) est dans une impasse.	**J**	**P**	**S**
30. Est perturbé(e) par des changements dans l'environnement (comme du nouveau mobilier, le réaménagement d'une pièce, ou de nouveaux vêtements).	**J**	**P**	**S**
31. Ses crises de colère ou de larmes sont intenses, mais elles s'arrêtent d'un coup sec.	**J**	**P**	**S**
32. A besoin de l'aide d'un adulte pour demeurer sur une tâche.	**J**	**P**	**S**

J = JAMAIS P = PARFOIS S = SOUVENT

33. Ne remarque pas quand ses comportements provoquent des réactions négatives.	**J**	**P**	**S**
34. Laisse du désordre ou des dégâts que les autres doivent nettoyer même après qu'on lui ait demandé de ranger.	**J**	**P**	**S**
35. A de la difficulté à changer d'activité.	**J**	**P**	**S**
36. Réagit plus fortement aux situations que les autres enfants.	**J**	**P**	**S**
37. Oublie ce qu'il(elle) est en train de faire en plein milieu d'une activité.	**J**	**P**	**S**
38. Ne réalise pas que certains comportements dérangent les autres.	**J**	**P**	**S**
39. S'attarde aux détails d'une tâche ou d'une situation et ne parvient pas à voir l'idée générale.	**J**	**P**	**S**
40. A de la difficulté à participer lors d'activités sociales non familières (comme des fêtes d'anniversaires, des pique-niques).	**J**	**P**	**S**
41. Se sent facilement envahi(e) ou surstimulé(e) par des activités quotidiennes typiques.	**J**	**P**	**S**
42. A de la difficulté à terminer les tâches (comme les jeux, casse-têtes, jeux de faire semblant).	**J**	**P**	**S**
43. Perd le contrôle plus fréquemment que ses compagnons de jeux.	**J**	**P**	**S**
44. Ne peut trouver des choses dans la pièce ou dans l'aire de jeux même quand il(elle) reçoit des indications précises.	**J**	**P**	**S**
45. Résiste aux changements de routine, d'aliments, de lieux, etc.	**J**	**P**	**S**
46. Après avoir connu un problème ou une difficulté, reste déçu(e) pendant longtemps.	**J**	**P**	**S**
47. Est incapable de rester sur un même sujet lorsqu'il(elle) parle.	**J**	**P**	**S**
48. Parle ou joue trop fort.	**J**	**P**	**S**
49. Ne complète pas les tâches même après avoir reçu des consignes précises.	**J**	**P**	**S**
50. Est envahi(e) ou surstimulé(e) dans les situations où il y a plusieurs personnes ou plusieurs activités (par exemple, quand il y a beaucoup de bruit, d'activités ou de gens).	**J**	**P**	**S**
51. A de la difficulté à débuter une activité ou une tâche même après qu'on lui ait demandé.	**J**	**P**	**S**
52. Agit de manière trop excitée ou difficilement contrôlable.	**J**	**P**	**S**
53. Ne fait pas autant d'efforts sur les activités qu'il(elle) en est capable.	**J**	**P**	**S**
54. A de la difficulté à freiner ses actions mêmes après qu'on lui ait demandé.	**J**	**P**	**S**

J = JAMAIS	P = PARFOIS	S = SOUVENT		
55. Est incapable de compléter la description d'un événement, d'une personne ou d'une histoire.	**J**	**P**	**S**
56. Termine les tâches ou les activités trop rapidement.	**J**	**P**	**S**
57. Ne se rend pas compte quand il(elle) agit bien et quand il(elle) n'agit pas bien.	**J**	**P**	**S**
58. Est facilement distrait(e) pendant les activités.	**J**	**P**	**S**
59. A de la difficulté à se rappeler les choses même après une courte période de temps.	**J**	**P**	**S**
60. Devient trop immature.	**J**	**P**	**S**
61. A une capacité d'attention limitée.	**J**	**P**	**S**
62. S'amuse de façon imprudente ou dangereuse dans des situations où il(elle) pourrait se blesser (comme au terrain de jeux, à la piscine).	**J**	**P**	**S**
63. Ne se rend pas compte s'il(elle) a effectué correctement une tâche ou non.	**J**	**P**	**S**

Annexe B

Tâches expérimentales de fonctions exécutives

Carlson, S. M., Moses, L. J., & Breton, C. (2002). How specific is the relation between executive function and theory of mind? Contributions of inhibitory control and working memory. *Infant and Child Development*, *11*(2), 73–92. https://doi.org/10.1002/icd.298

Korkman, M., Kirk, U., & Kemp, S. (1998). *NEPSY: A developmental neuropsychological assessment manual*. Psychological Corporation.

Zelazo, P. D. (2006). The Dimensional Change Card Sort (DCCS): A method of assessing executive function in children. *Nature Protocols*, *1*(1), 297–301. https://doi.org/10.1038/nprot.2006.46

Procédure pour les tâches de fonctions exécutives

BACKWARD DIGIT SPAN

« Maintenant je vais te dire d'autres chiffres mais, cette fois-ci, quand je vais m'arrêter, je veux que tu les répètes à l'envers. Si je dis "8-2", que dois-tu dire? ».

Si l'enfant dit "2-8" : « C'est ça, bravo! Essayons d'autres chiffres ».
Et on commence à administrer les items.

Si l'enfant donne une réponse incorrecte : « Ce n'est pas tout à fait comme ça. J'ai dit "8-2". Donc, pour les dire à l'envers, tu dois dire "2-8". Essayons d'autres chiffres, souviens-toi, tu dois les répéter à l'envers: "5-6" ». On refait un exemple de pratique et on commence à administrer les items.

Encercler les bonnes réponses, barrer les échecs.
Score d'arrêt : lorsque l'enfant se trompe aux deux essais d'un niveau.

TOUR (NEPSY)

Placer le support en bois en face de l'enfant et dire : « Nous allons jouer avec ces trois boules. Montre-moi la boule rouge… la boule bleue… et la boule jaune (*attendre à chaque fois que l'enfant ait pointé la boule*). Tu peux déplacer ces boules d'une tige à l'autre comme ceci (*montrer en plaçant la boule rouge au-dessus de la boule bleue*) ».

« Voici les règles du jeu (*donner des exemples pour chacune*) :

- Tu ne peux déplacer qu'une seule boule à la fois ;
- Tu dois laisser les boules sur les tiges quand tu ne les changes pas de place ;
- Lorsque tu as pris une boule, que tu l'as placée et que tu l'as lâchée sur une tige, cela compte pour un déplacement ».

Disposer les boules dans la position de départ, montrer l'item de démonstration et dire : « Regarde la boule rouge (*la montrer sur le support*). Regarde le modèle et mets la boule rouge au même endroit (*aider l'enfant si nécessaire*). Regarde le modèle, ce que tu as fait est exactement pareil (*montrer sur l'image puis passer à l'item de départ*) ».

« Maintenant nous allons faire d'autres parties. Pour chaque partie, je te dirai combien de déplacements tu dois utiliser pour reproduire le modèle ».

Avant de présenter chaque item, replacer les boules dans la position de départ. Rappeler les consignes si nécessaire. Dire à l'enfant combien de déplacements il/elle doit utiliser. Dites-lui ensuite : « Vas-y le plus rapidement possible! ». Déclencher le chronomètre dès que les instructions pour un item sont données et que le modèle est révélé. En cas de bris de règle, continuer à chronométrer, corriger l'enfant (remettre à la position avant le bris de règle) et lui rappeler la règle. Pour chaque item, arrêter le chronomètre lorsque l'enfant a fini ou lorsque le temps maximal est écoulé (items 1 à 4 : 30 secondes et items 5 à 20 : 45 secondes).

Un item est réussi si l'enfant :
(1) place les boules dans la bonne position (position cible), (2) en utilisant le nombre de coups permis et (3) à l'intérieur du temps alloué.

Noter le temps de réponse de l'enfant et si l'item est réussi ou échoué (indiquer le type d'erreur : trop de coups, trop de temps ou pas dans la position cible).
Score d'arrêt : quatre échecs <u>consécutifs</u>.

DIMENSIONAL CHANGE CARD SORT (DCCS) – version informatisée

Démonstration et pratique

<u>Jeu des formes (4 essais)</u>

« On va jouer à un jeu d'association ».

« Si je dis le mot FORME, tu dois associer l'image du centre à la case (*pointer les deux images du bas*) qui contient la même forme. Si c'est un bateau, ça veut dire que tu dois choisir cette case (*droite*) et appuyer sur ce bouton (*droit*). Si c'est un lapin, c'est cette case-ci qu'il faut choisir (*gauche*). Donc tu appuieras sur ce bouton (*gauche*). Laisse-moi te montrer! »

« Regarde, je vais essayer. Ici, c'est un lapin. Dans le jeu des FORMES, le lapin va dans cette case (*gauche*). Tu dois donc appuyer sur ce bouton (*gauche*). Ici, c'est un bateau. Dans le jeu des FORMES, le bateau va dans cette case (*droite*). Tu dois donc appuyer sur ce bouton (*droit*) ».

« Maintenant, tu peux te pratiquer. Souviens-toi de regarder l'étoile que tu verras apparaître au centre de l'écran. Essaie de répondre le plus rapidement possible sans faire d'erreur. Si tu fais une erreur, continue. Met tes doigts vis-à-vis les flèches lorsque tu es prêt(e) à commencer ».

<u>Jeu des couleurs (4 essais)</u>

« On peut aussi jouer au jeu des COULEURS. Quand je dis COULEUR, les images vertes vont dans cette case (*droite*). Tu devras donc appuyer sur ce bouton (*droit*). Et toutes les images blanches vont dans cette case (*gauche*). Tu dois donc appuyer sur ce bouton (*gauche*) ».

« Ok! Met tes doigts vis-à-vis les flèches quand tu es prêt(e) à commencer ».

Aux exercices de pratique, l'enfant doit obtenir au moins trois bonnes réponses sur quatre pour poursuivre la tâche, sinon, l'exercice est répété jusqu'à trois fois. L'expérimentateur(trice) donne de la rétroaction à chaque essai (félicite une bonne réponse et corrige une mauvaise réponse).

Phase test

<u>Jeu des couleurs (5 essais) – enfants de moins de 8 ans uniquement</u>

« Maintenant, tu es prêt(e) à jouer pour de vrai. Commençons par le jeu des COULEURS. Tu te souviens du jeu des couleurs? Quand tu entends le mot COULEUR, tous les bleus vont dans cette case (*gauche*). Tu dois donc appuyer sur ce bouton (*gauche*). Et tous les jaunes vont dans celle-là (*droite*). Tu dois donc appuyer sur ce bouton (*droit*) ».

« Souviens-toi de regarder l'étoile que tu verras apparaître au centre de l'écran. Essaie de répondre le plus rapidement possible sans faire d'erreur. Si tu fais une erreur, continue. Met tes doigts vis-à-vis les flèches quand tu es prêt(e) à commencer ».

<u>Jeu des formes (5 essais) – enfants de moins de 8 ans uniquement</u>

« Bravo! Maintenant, nous allons arrêter de jouer au jeu des couleurs. On va plutôt jouer au jeu des FORMES. Tu te souviens du jeu des formes? Quand tu entends le mot FORME, tous les camions vont dans cette case (*droite*). Tu dois donc appuyer sur ce bouton (*droit*). Et toutes les balles vont dans celle-ci (*gauche*). Tu dois donc appuyer sur ce bouton (*gauche*) ».

« Maintenant, c'est à ton tour. Met tes doigts vis-à-vis les flèches quand tu es prêt(e) à commencer ».

L'enfant doit obtenir au moins quatre bonnes réponses sur cinq pour poursuivre la tâche.

<u>Jeu de flexibilité formes ET couleurs (30 essais)</u>

« Maintenant, tu es prêt(e) à jouer aux deux jeux, soit attentif(attentive)! »

« Souviens-toi, si je dis le mot FORME, tu dois associer l'image du centre avec la bonne case qui contient la même forme. Si je dis le mot COULEUR, tu dois associer l'image du centre avec la bonne case qui contient la même couleur ».

« Met tes doigts vis-à-vis les flèches lorsque tu es prêt(e) à commencer! »

Le mot « FORME » ou « COULEUR » est généralement répété à l'enfant avant chaque essai, selon le jugement de l'expérimentateur(trice).

Annexe C

Système de codification de l’orientation mentale paternelle

Meins, E., Fernyhough, C., Fradley, E., & Tuckey, M. (2001). Rethinking maternal sensitivity: Mothers' comments on infants' mental processes predict security of attachment at 12 months. *The Journal of Child Psychology and Psychiatry, 42*(5), 637–648. https://doi.org/10.1017/S0021963001007302

Système de codification de l’orientation mentale paternelle

Total de commentaires mentaux appropriés :
Total de commentaires :

Commentaires sur l’état mental	Commentaires sur les processus mentaux	Commentaires sur le degré d’engagement émotionnel de l’enfant	Commentaires sur les tentatives de l’enfant de « manipuler » les pensées des autres	Tentative du père d’interpréter les pensées de l’enfant
Identifier les commentaires faisant référence <u>aux connaissances, préférences et désirs de l’enfant.</u> **Exemples** C’est quoi la forme? Qu’est-ce qu’elle fait la vache? Veux-tu essayer? Par quel jeu veux-tu commencer?	Identifier les commentaires faisant référence <u>aux processus mentaux de l’enfant.</u> **Exemples** Tu penses à comment tu devrais t’y prendre? Tu reconnais ça ce jeu-là. Tu décides qu’il va là.	Identifier les commentaires faisant référence <u>au degré d’engagement émotionnel de l’enfant.</u> **Exemples** Tu es excité(e). Tu es content(e). Tu n’as plus envie de jouer.	Identifier les commentaires faisant référence <u>aux tentatives de l’enfant de « manipuler » les pensées des autres.</u> **Exemples** Tu me fais des blagues. Tu ris de moi. Tu me joues des tours. Tu veux faire le contraire de ce que je te dis.	Identifier les commentaires faisant référence <u>aux tentatives du père d’interpréter les pensées de son l’enfant.</u> Le père dit ce qu’il pense que l’enfant se dit dans sa tête. **Exemples** « Ça me tente pas » « Je trouve ça plate moi ce jeu-là » « C’est plus intéressant la caméra que ces jouets-là »

Annexe D

Système de codification de l'attachement mère-enfant

Waters, E. (1995). Appendix A: The attachment Q-set (version 3.0). *Monographs of the Society for Research in Child Development*, *60*(2-3), 234–246. https://doi.org/10.1111/j.1540-5834.1995.tb00214.x

Tri de cartes du comportement de l'enfant[1]

1. Partage facilement avec M ou la laisse tenir des objets si elle lui demande. *Atypique: refus.*

2. Lorsqu'il revient près de M après avoir joué, il est parfois maussade (grognon) sans raison apparente. *Atypique: il est joyeux et affectueux lorsqu'il revient près de M, entre ou après ses périodes de jeu.*

3. Lorsqu'il est bouleversé ou blessé, il acceptera d'être réconforté par des adultes autres que M. *Atypique: M est la seule personne par qui il accepte de se faire réconforter.*

4. Est soigneux et doux avec les jouets et les animaux domestiques.

5. Est plus intéressé par les gens que par les objets. *Atypique: plus intéressé par les objets que les gens.*

6. S'il est près de M et qu'il voit quelque chose avec lequel il veut jouer, il devient accaparant ou essaie d'amener M vers l'objet. *Atypique: va de lui-même vers l'objet qu'il désire avec entrain ou sans essayer d'amener M vers cet objet.*

7. Rit et sourit facilement à plusieurs personnes différentes. *Atypique: M peut l'amener à rire ou à sourire plus facilement que toute autre personne.*

8. Lorsqu'il pleure, il pleure fort. *Atypique: pleure, sanglote, mais ne pleure pas fort ou si cela lui arrive, ça ne dure jamais très longtemps.*

9. Est de bonne humeur et enjoué la plupart du temps. *Atypique: a tendance à être sérieux, triste ou ennuyé la majorité du temps.*

10. Pleure ou résiste souvent quand M l'amène au lit pour sa sieste ou au moment du coucher.

11. Souvent se serre ou se blottit contre M sans qu'elle lui ait demandé ou invité à le faire.

Atypique: ne se serre pas ou ne s'étreint pas souvent sauf si M l'étreint la première ou qu'elle lui demande de lui faire une caresse.

12. Va rapidement aller vers les personnes ou va utiliser les objets qui initialement le gênaient ou l'apeuraient. *Neutre: s'il n'est jamais gêné ou effrayé.*

13. Lorsqu'il est bouleversé par le départ de M, il va continuer à pleurer ou va se fâcher après qu'elle soit partie. *Atypique: arrête de pleurer juste après son départ. Neutre: s'il n'est pas bouleversé par son départ.*

14. S'il découvre quelque chose de nouveau pour jouer, il va l'apporter à M ou le lui montrer à travers la pièce. *Atypique: joue calmement avec le nouvel objet ou va dans un endroit où il pourra jouer avec, sans être interrompu.*

[1] M fait référence à la mère de l'enfant dont le comportement est observé.

15. Accepte de parler à de nouvelles personnes, de leur montrer des jouets ou de leur montrer ce qu'il est capable de faire si M lui demande.

16. Préfère les jouets qui peuvent représenter des êtres vivants (poupées, animaux en peluche, etc.). *Atypique: préfère les ballons, les blocs, les casseroles, etc*.

17. Perd rapidement son intérêt pour les adultes nouveaux s'ils font quelque chose qui l'ennuie.

18. Agit facilement selon les suggestions de M, même lorsqu'elles sont clairement des suggestions et non des ordres. *Atypique: ignore ou refuse ses suggestions sauf si elle lui ordonne.*

19. Quand M lui demande de lui apporter ou de lui donner quelque chose, il obéit. (Ne pas tenir compte des refus qui font partie d'un jeu à moins que cela ne devienne clairement de la désobéissance). *Atypique: M doit prendre elle-même l'objet ou élever la voix pour l'obtenir*.

20. Réagit peu à la plupart des coups, des chutes et des sursauts. *Atypique: pleure suite aux coups ou sursauts mineurs.*

21. Surveille les déplacements de M quand il joue dans la maison:
•appelle M de temps en temps;
•remarque ses déplacements d'une pièce à une autre;
•remarque si elle change d'activités.
Neutre: s'il n'est pas autorisé ou s'il n'y a pas d'endroit où il peut jouer loin de M.

22. Agit comme un parent affectueux envers ses poupées, les animaux domestiques ou les jeunes enfants. *Atypique: joue avec eux d'une autre manière. Neutre: s'il ne joue pas ou s'il ne possède pas de poupées, d'animaux domestiques ou s'il n'y a pas de jeunes enfants dans son entourage*.

23. Quand M est assise avec les autres membres de la famille ou qu'elle est affectueuse avec eux, il essaie d'obtenir son affection pour lui seul. *Atypique: laisse M être affectueuse avec les autres. Peut participer, mais pas d'une manière jalouse.*

24. Lorsque M lui parle fermement ou qu'elle élève la voix, il devient bouleversé, désolé ou honteux de lui avoir déplu. (Ne pas coter typique s'il est simplement bouleversé par le ton de la voix ou s'il a peur d'être puni).

25. Il est difficile pour M de savoir où il est lorsqu'il joue hors de sa vue. *Atypique: parle et appelle M lorsqu'il est hors de sa vue:*
• facile à trouver;
• facile de savoir avec quoi il joue.
Neutre: s'il ne joue jamais hors de la vue de M.

26. Pleure lorsque M le laisse à la maison avec une gardienne, l'autre parent ou l'un des grands-parents. *Atypique: ne pleure pas s'il est avec une de ces personnes.*

27. Rit lorsque M le taquine. *Atypique: contrarié quand M le taquine. Neutre: si M ne le taquine jamais durant les jeux ou les conversations*.

28. Aime relaxer assis sur les genoux de M. *Atypique: préfère relaxer sur le plancher ou sur une chaise, un lit, sofa, etc. Neutre: s'il ne s'assoit jamais pour relaxer.*

29. Par moment, il est tellement concentré à quelque chose qu'il ne semble pas entendre lorsque quelqu'un lui parle. *Atypique: même s'il est très impliqué dans un jeu, il prête attention lorsque quelqu'un lui parle.*

30. Se fâche facilement contre les jouets.

31. Veut être le centre d'attention de M. Si M est occupée ou qu'elle parle à quelqu'un, il l'interrompt. *Atypique: ne remarque pas ou n'est pas préoccupé d'être le centre d'attention de M.*

32. Quand M lui dit « non » ou qu'elle le punit, il cesse de se comporter mal (au moins à ce moment-là). Elle n'a pas à lui dire deux fois.

33. Quelque fois il signale à M (ou lui donne l'impression) qu'il veut être posé par terre. Lorsqu'elle le pose, il devient aussitôt maussade et veut être repris de nouveau. *Atypique: toujours prêt à aller jouer au moment où il lui signale de le poser par terre.*

34. Quand il est bouleversé lorsque M le quitte, il s'assoit à l'endroit où il est et pleure. Ne la suit pas. *Atypique: suit activement M quand il est bouleversé. Neutre: s'il n'est jamais bouleversé quand M le quitte.*

35. Est indépendant avec M. Préfère jouer seul: quitte facilement M quand il veut jouer. *Atypique: préfère jouer avec ou près de M. Neutre: s'il n'est pas autorisé ou s'il n'y a pas de pièces où il peut jouer loin de M.*

36. Montre clairement qu'il utilise M comme point de départ de ses explorations:
•s'éloigne pour jouer;
•revient ou joue près de M;
•s'éloigne pour jouer encore, etc.
Atypique: toujours loin jusqu'à ce que M le retrouve ou demeure toujours près de M.

37. Est très actif. Bouge toujours. Préfère les jeux actifs aux jeux calmes.

38. Est exigeant et impatient envers M. S'obstine et persiste sauf si M fait immédiatement ce qu'il veut.

39. Est souvent sérieux et méthodique lorsqu'il joue loin de moi ou quand il est seul avec ses jouets. *Atypique: exprime souvent du plaisir ou rit quand il joue loin de M, seul avec ses jouets.*

40. Examine les nouveaux objets ou jouets dans les moindres détails. Essaie de les utiliser de différentes manières ou de les démonter. *Atypique: jette un coup d'œil rapide aux nouveaux objets ou jouets (cependant il peut s'y intéresser plus tard).*

41. Lorsque M lui demande de le suivre, il le fait. (Ne pas tenir compte des refus ou délais qui font partie d'un jeu, sauf s'ils deviennent clairement de la désobéissance).

42. Reconnaît la détresse de M (lorsqu'elle est bouleversée):
•devient calme ou bouleversé;
•essaie de la réconforter;
•demande ce qui ne va pas, etc.

43. Demeure ou revient près de M, plus souvent que le requiert le simple fait de rester en contact avec elle. *Atypique: ne se tient pas au courant de façon précise de la localisation de M ou de ses activités.*

44. Demande et prend plaisir quand M le prend, l'embrasse et le caresse. *Atypique: n'est pas spécialement enthousiaste pour ces démonstrations d'affection. Les tolère mais ne les recherche pas ou se tortille pour être posé par terre.*

45. Aime danser ou chanter au son de la musique. *Atypique: est indifférent à la musique ou n'aime pas mais ne déteste pas la musique.*

46. Marche et court sans se cogner, tomber ou trébucher. *Atypique: coups, chutes ou faux pas se produisent tout au long de la journée (même si aucune blessure n'en résulte).*

47. Acceptera et prendra plaisir aux bruits forts ou sautillera près de la source du bruit en jouant si M lui sourit et qu'elle lui montre que c'est supposé être plaisant. *Atypique: devient bouleversé même si M lui signale que le bruit ou l'activité est sécuritaire ou plaisant.*

48. Permet facilement aux nouveaux adultes de tenir les objets qu'il a et les partage avec eux s'ils lui demandent.

49. Court vers M avec un sourire gêné quand de nouvelles personnes les visitent à la maison. *Atypique: même s'il sera éventuellement chaleureux envers les visiteurs, sa réaction initiale est de courir vers M en pleurnichant ou en pleurant. Neutre: s'il ne court pas vers M quand des visiteurs arrivent*.

50. Sa réaction initiale quand des gens les visitent à la maison est de les ignorer ou de les éviter, même s'il deviendra éventuellement chaleureux avec eux.

51. Aime grimper sur les visiteurs quand il joue avec eux. *Atypique: ne recherche pas un contact intime avec les visiteurs quand il joue avec eux. Neutre: s'il ne joue pas avec les visiteurs.*

52. A de la difficulté à manipuler de petits objets ou à assembler de petites choses. *Atypique: très habile avec de petits objets, crayons, etc.*

53. Met ses bras autour de M ou met la main sur l'épaule quand M le prend. *Atypique: accepte d'être pris dans les bras de M, mais ne l'aide pas particulièrement ou ne se tient pas après M.*

54. Agit comme s'il s'attendait à ce que M empiète sur ses activités quand elle essaie simplement de l'aider avec quelque chose. *Atypique: accepte facilement l'aide de M sauf si elle intervient dans une situation où son aide n'est pas nécessaire.*

55. Imite un certain nombre de comportements ou de manières de faire les choses en observant le comportement de M. *Atypique: n'imite pas visiblement le comportement de M.*

56. Devient mal à l'aise ou perd de l'intérêt quand il semble qu'une activité pourrait être difficile. *Atypique: pense qu'il peut faire des tâches difficiles.*

57. Est aventureux (sans peur). *Atypique: est prudent ou craintif.*

58. En général, ignore les adultes qui les visitent à la maison. Trouve ses activités plus intéressantes. *Atypique: trouve les visiteurs très intéressants même s'il est un peu gêné au début.*

59. Quand il termine une activité ou un jeu, il trouve généralement autre chose à faire, sans revenir vers M entre ses activités. *Atypique: quand il termine une activité ou un jeu, il revient vers M pour jouer, pour chercher de l'affection ou pour chercher de l'aide afin de trouver une autre chose à faire.*

60. Si M le rassure en lui disant « c'est correct » ou « cela ne te fera pas mal », il approchera ou jouera avec des choses qui initialement l'avaient rendu craintif ou l'avaient effrayé. *Neutre: s'il n'est jamais craintif ou effrayé.*

61. Joue brutalement avec M. Frappe, égratigne ou mord durant les jeux physiques. (Ne signifie pas qu'il blesse M). *Atypique: joue à des jeux physiques sans faire mal à M. Neutre: si ses jeux ne sont jamais très physiques.*

62. S'il est de bonne humeur, il le demeure toute la journée. *Atypique: sa bonne humeur est très changeante.*

63. Même avant d'essayer des choses par lui-même, il essaie d'avoir quelqu'un pour l'aider.

64. Aime grimper sur M quand ils jouent. *Atypique: ne veut pas spécialement plusieurs contacts intimes avec M quand ils jouent.*

65. Est facilement bouleversé quand M le fait passer d'une activité à une autre, même si la nouvelle activité est quelque chose qu'il aime souvent faire.

66. Développe facilement de l'affection pour les adultes qui le visitent à la maison et qui sont amicaux envers lui.

67. Lorsque notre famille a des visiteurs, il désire que ceux-ci lui portent beaucoup d'attention.

68. Généralement, il est une personne plus active que M. *Atypique: généralement, il est une personne moins active que M.*

69. Demande rarement de l'aide à M. *Atypique: demande souvent de l'aide à M. Neutre: s'il est trop jeune pour demander de l'aide à M.*

70. Salue rapidement M avec un grand sourire lorsqu'il entre dans la pièce où elle est. (Montre un jouet, fait signe ou dit: « Bonjour maman »). *Atypique: ne salue pas M, sauf si M le salue en premier.*

71. Après avoir été effrayé ou bouleversé, il cesse de pleurer et se remet rapidement si M le prend dans ses bras. *Atypique: n'est pas facilement réconforté ou consolé.*

72. Si des visiteurs rient et approuvent ce qu'il fait, il recommence maintes et maintes fois. *Atypique: les réactions des visiteurs ne l'influencent pas de cette manière.*

73. A un jouet qu'il caresse ou une couverture qui le rassure (doudou), qu'il apporte partout, qu'il amène au lit ou qu'il tient quand il est bouleversé. (Cela n'inclut pas sa bouteille de lait ou sa suce s'il a moins de 2 ans).

74. Quand M ne fait pas ce qu'il veut immédiatement, il se comporte comme si elle n'allait pas le faire (pleurniche, se fâche, fait d'autres activités, etc.). *Atypique: attend un délai raisonnable comme s'il s'attendait à ce qu'elle fasse bientôt ce qu'il lui avait demandé.*

75. À la maison, il devient bouleversé ou pleure quand M sort de la pièce où ils étaient (peut ou non la suivre). *Atypique: remarque le départ de M, peut la suivre mais ne devient pas bouleversé.*

76. S'il a le choix, il jouera avec des jouets plutôt qu'avec les adultes. *Atypique: jouera avec les adultes plutôt qu'avec des jouets.*

77. Lorsque M lui demande de faire quelque chose, il comprend rapidement ce qu'elle veut (peut ou non obéir). *Atypique: quelques fois incertain, perplexe ou lent à comprendre ce que M veut. Neutre: s'il est trop jeune pour comprendre.*

78. Aime être étreint et tenu par des personnes autres que ses parents et/ou ses grands-parents.

79. Se fâche facilement contre M. *Atypique: ne se fâche pas contre M sauf si elle est vraiment intrusive ou qu'il est très fatigué*.

80. Considère les expressions faciales de M comme étant une bonne source d'information quand quelque chose semble risqué ou menaçant. *Atypique: évalue par lui-même la situation sans surveiller d'abord les expressions faciales de M.*

81. Pleurer est une façon pour lui d'obtenir que M fasse ce qu'il veut. *Atypique: pleure surtout à cause d'un véritable inconfort (fatigue, tristesse ou peur).*

82. Passe la plupart de ses temps de jeu avec seulement quelques jouets préférés ou pratique ses activités favorites durant ces moments.

83. Lorsqu'il s'ennuie, il vient vers M, cherchant quelque chose à faire. *Atypique: flâne ou ne fait rien pendant un certain temps jusqu'à ce que quelque chose arrive.*

84. Fait au moins un certain effort pour être propre et soigné à la maison. *Atypique: souvent se tache et renverse des choses sur lui ou sur les planchers.*

85. Est fortement attiré par les nouvelles activités et les nouveaux jouets. *Atypique: ne délaissera pas ses jouets et activités familiers pour de nouvelles choses.*

86. Essaie d'amener M à l'imiter ou remarque rapidement et prend plaisir quand M l'imite de sa propre initiative.

87. Si M rit ou approuve quelque chose qu'il a fait, il recommence maintes et maintes fois. *Atypique: n'est pas particulièrement influencé de cette manière par les réactions de M.*

88. Lorsque quelque chose le bouleverse, il reste où il est et pleure. *Atypique: vient vers M quand il pleure. N'attend pas que M vienne vers lui.*

89. Ses expressions faciales sont claires et marquées quand il joue avec quelque chose.

90. Si M s'éloigne très loin de lui, il la suit et continue son jeu dans ce nouvel endroit. (N'a pas à être sollicité ou amené dans l'autre pièce. N'arrête pas de jouer ou ne devient pas bouleversé). *Neutre: s'il n'est pas autorisé ou s'il n'y a pas de pièces où il soit vraiment loin de M.*

Annexe E

Système de codification du soutien maternel à l'autonomie

Whipple, N., Bernier, A., & Mageau, G. (2011). Broadening the study of infant security of attachment: Maternal autonomy support in the context of infant exploration. *Social Development*, *20*(1), 17–32. https://doi.org/10.1111/j.1467-9507.2010.00574.x

Système de codification du soutien maternel à l'autonomie

Ne soutient pas l'autonomie		Soutient moyennement l'autonomie		Soutient beaucoup l'autonomie
1	2	3	4	5

<u>Notes générales</u>

***Si la mère est très contrôlante à **un ou plusieurs** moments durant l'interaction, ne pas donner plus de 3 sur l'échelle de soutien à l'autonomie.

***Pour donner un 1 ou un 5, il doit n'y avoir rien à redire.

Soutien verbal

Définition : Tous les indices, instructions, suggestions, questions et encouragements formulés par la mère verbalement.

5 - Soutient beaucoup l'autonomie

- *Mère **encourage** son enfant dans la poursuite de la tâche (de façon constante).*
- *Mère **félicite** son enfant (de façon constante).*
- *Mère donne des instructions, indices ou suggestions **adaptés aux besoins** ou **suite à la demande** de l'enfant.*
- *Mère emploie un ton qui communique qu'elle est une **source d'aide** pour son enfant.*

4- Soutient l'autonomie

- *Mère émet trois de ces quatre sortes de verbalisations de manière constante.*

3 – Soutient moyennement l'autonomie

- *Mère émet une de ces quatre sortes de verbalisations.*

<u>OU</u>

- *Mère émet deux de ces quatre sortes de verbalisations, mais de façon inconstante.*

2 – Soutient peu l'autonomie

- *Mère émet seulement une de ces quatre sortes de verbalisations de façon inconstante.*

1 – Ne soutient pas l'autonomie

- *Mère n'émet aucune de ces quatre sortes de verbalisations.*

Flexibilité et empathie

Définition : Le degré avec lequel la mère prend la perspective de son enfant et démontre de la flexibilité dans sa façon de gérer l'attention de son enfant durant la réalisation de la tâche.

5 - Soutient beaucoup l'autonomie

- *Mère démontre de la **flexibilité** dans ses efforts pour garder l'enfant centré sur la tâche.*
- *Mère **prend la perspective** de son enfant et reconnaît ses sentiments, tout en le recadrant vers la tâche.*

3 – Soutient moyennement l'autonomie

- *Mère présente un de ces deux éléments.*

<u>OU</u>

- *Mère présente les deux éléments, mais de façon inconstante.*

1 – Ne soutient pas l'autonomie

- *Mère ne présente aucun de ces éléments.*

***Aucun score n'est donné à cette échelle si l'enfant ne dévie pas durant la tâche

Respect du rythme et des choix

Définition : Mesure dans laquelle l'enfant a l'opportunité d'être un acteur plutôt qu'observateur dans la réalisation de la tâche. Mesure dans laquelle la mère **guide** l'enfant en lui laissant ensuite le temps de faire des essais de façon à ce que celui-ci soit actif dans la tâche. Mesure dans laquelle la mère offre des choix à l'enfant plutôt qu'imposer les siens.

5 - Soutient beaucoup l'autonomie

- *Mère **respecte le rythme** de l'enfant. L'enfant joue un rôle d'**acteur** dans l'interaction.*
- *Mère laisse l'enfant faire des **choix** (p. ex., quels crayons utiliser, quel morceau placer en premier, etc.). Le choix peut être explicite ou implicite.*

4 – Soutient l'autonomie

- *Mère respecte le rythme, mais elle ne laisse pas l'enfant faire des choix.*

3- Soutient moyennement l'autonomie

- *Mère laisse l'enfant faire des choix, mais ne respecte pas son rythme.*

<u>OU</u>

- *Mère laisse l'enfant faire des choix et elle respecte son rythme, mais de façon inconstante. L'enfant n'est pas toujours acteur.*

1 – Ne soutient pas l'autonomie

- *Mère ne respecte pas le rythme de l'enfant et elle ne lui laisse pas l'opportunité de faire des choix.*

*** La mère doit être active dans l'interaction pour obtenir un score de soutien à l'autonomie. Si l'enfant établit le rythme parce que la mère est inactive, celle-ci ne doit pas obtenir un score élevé de soutien à l'autonomie.

Soutien de la compétence de l'enfant

Définition : Façon dont la mère adapte la tâche pour créer un défi optimal pour l'enfant.

5 - Soutient beaucoup l'autonomie

- *Mère intervient au **moment approprié** (<u>seulement</u> lorsque la tâche devient trop difficile pour l'enfant).*

<u>ET</u>

- *Mère **adapte** la tâche de façon à ce que celle-ci présente un défi optimal pour son enfant, c'est-à-dire de façon à ce que celle-ci corresponde mieux aux habiletés de l'enfant.*

3 – Soutient moyennement l'autonomie

- *Mère intervient au moment approprié, mais n'adapte pas la tâche pour que celle-ci corresponde aux habiletés de l'enfant.*

<u>OU</u>

- *Mère adapte la tâche, mais elle ne le fait pas au moment approprié.*

1 – Ne soutient pas l'autonomie

- *Mère n'intervient pas au moment approprié et elle n'adapte pas la tâche de façon à ce que celle-ci corresponde aux habiletés de l'enfant*.

Annexe F

Article en collaboration avec une autre étudiante

Hébert, É., Regueiro, S., & Bernier, A. (sous presse). Investigating the associations between family alliance and executive functioning in middle childhood. *Journal of Cognition and Development*.

Abstract

There is now wide consensus that the quality of family relationships is involved in the development of child executive functioning (EF), a set of cognitive skills that bear critical importance for social and academic adjustment at school. This body of research has, however, focused almost exclusively on dyadic parent-child interactions and failed to consider higher-level family processes. Consequently, the current study focused on family alliance, that is, the degree of coordination that father, mother, and child achieve while interacting together, as a predictor of individual differences in children's EF. A community sample of 87 intact families (45 boys) participated in a triadic mother-father-child interaction when children were in kindergarten to assess family alliance. Children were assessed again when they were in Grade 4 with tasks of inhibition, cognitive flexibility, and working memory. Hierarchical regression analyses showed that higher-quality family alliance was predictive of better child performance on some cognitive flexibility and working memory tasks. These results indicate that some of the individual differences in child EF at school age may originate in the quality of the early family environment.

Keywords: family alliance, executive functioning, triadic interactions, Lausanne Trilogic Play, middle childhood

Investigating the Associations between Family Alliance and Executive Functioning in Middle Childhood

It has been almost twenty years since researchers began to call attention to family influences as antecedents of individual differences in child executive functioning (EF; Carlson, 2003; Hughes & Ensor, 2005). EF consists of a set of high-level cognitive skills, such as inhibition, working memory, cognitive flexibility, and planning, that govern the conscious control of action, thinking, and emotions in order to achieve one's goals (Zelazo & Carlson, 2012). A large body of research now shows that the quality of family relationships is a reliable predictor of child performance on EF tasks (see Valcan et al., 2018 for meta-analysis). However, in nearly all EF papers considering familial influences, the family environment is operationalized uniquely in a dyadic perspective (i.e., mother–child or father–child interactions). This stands in contrast to family systems theory, which proposes that the family consists of several equally important subsystems, including the two parent–child dyads as well as the triad including both parents and their child (Minuchin, 1985). Family systems theory further posits that the family is continuously shaped by transactions between the subsystems and hence, that all subsystems influence each other as well as influence each individual member of the family (Feldman, 2007; Minuchin, 1985). Consequently, the well-documented associations between parent–child dyadic interactions and child EF should theoretically indicate that triadic mother– father–child interactions bear on the development of child EF as well. To our knowledge, however, such a family-level question has yet to be investigated in the EF literature. The current report examines the prospective links between family alliance, namely the degree of coordination that fathers, mothers, and children achieve when they are interacting together (Fivaz-Depeursinge & Corboz-Warnery, 1999), and subsequent child EF.

Executive Functioning in Middle Childhood

Middle childhood is an important developmental period during which children face many challenges. Notably in school settings, children must deal with changing social interactions involving both adults and children, respect rules of conduct and adopt appropriate behavior, adapt to increasingly difficult academic demands, and plan multistep problem-solving sequences.

How children thrive during this period bears meaning for their future. For instance, better cognitive development between ages 5 and 10 years is predictive of higher income and less social exclusion in adulthood (Feinstein & Bynner, 2004) and poorer peer relationships at 9 years are associated with under-achievement and unemployment at 18 years (Woodward & Fergusson, 2000). It is therefore important to identify the factors that promote children's optimal functioning in middle childhood, and research suggests that EF may be of key importance in this regard.

EF is considered crucial to facilitate school adjustment (Blair & Raver, 2015) and indeed, empirical research indicates that executive skills contribute significantly to arithmetic problem-solving and reading comprehension at school age (Follmer, 2018; Viterbori et al., 2017). EF is also associated with several aspects of socio-emotional functioning in middle childhood: better EF is related to more prosocial behavior (Hao, 2017), less externalizing and internalizing behavior problems (Karasinski, 2015), superior theory of mind (Austin et al., 2014; Bock et al., 2015), and lower levels of depression and worries (Fenesy & Lee, 2019; Geronimi et al., 2016). Due to this convincing picture, it appears crucial to identify the factors that bolster EF during middle childhood. Because the family constitutes one of the most important socialization contexts in childhood, growing research attention in the last two decades has been devoted to family influences.

Family Systems and Child EF

Several studies suggest that different indices of the past or current quality of dyadic parent–child relationships are associated with EF in middle childhood. In mother–child dyads, maternal positive parenting (Helm et al., 2020), sensitivity (Friedman et al., 2014), scaffolding and autonomy support (Landry et al., 2002; Regueiro et al., 2020), as well as mother–child attachment security (Matte-Gagné et al., 2018) have all been found predictive of better EF performance in school-aged children. Comparable results have been reported with father–child dyads: paternal positive parenting (Roskam et al., 2014), involvement (Rollè et al., 2019), and support (Meuwissen & Englund, 2016) as well as mutual responsiveness during father–child interactions (Hertz et al., 2019) are associated with child EF at school age. Furthermore, the father–mother dyadic subsystem has been studied in the EF literature through the notion of coparenting, namely the manner in which two adults who have joint responsibility for the care of a child organize themselves and cooperate in their parental roles (Van Egeren & Hawkins, 2004). Karreman et al. (2008) observed that the quality of coparenting assessed in the context of triadic interactions with the child is associated with child effortful control, a construct with close connections to some aspects of EF (Nigg, 2017). Albeit conducted with younger children (i.e., preschoolers), Karreman and colleagues' (2008) study suggests, in line with family systems theory, that children's EF may be affected not only by the relational processes at play when they are interacting with one of their parents, but also by processes taking place in more complex triadic interactive contexts involving both of their parents.

Consistent with this, some studies, although few, suggest that family-level variables relate to child EF at different ages. For instance, it has been observed that preschoolers show poorer performance on EF tasks when they live in a family characterized by a certain level of dysfunction (Hughes & Devine, 2018; Hughes & Ensor, 2009). In fact, a recent meta-analysis concluded that household chaos, which describes families who lack organization and suffer from instability, is negatively associated with child EF from ages 2 to 17 (Andrews et al., 2021). Parents in chaotic households tend to be less responsive, less stimulating of the child, and less supportive of his or her exploration while showing more negative parenting behaviors (Ackerman & Brown, 2010). Such negative parenting is likely to have a negative impact on child EF (Hughes & Devine, 2018). Overall, these results suggest that functional, well-organized families may foster the orderly development of EF in children. In line with this, parents who report better organization and cohesion in their family also concomitantly report that their child has better EF skills (greater behavioral control and regulation of metacognitive abilities; Schroeder & Kelley, 2009, 2010).

Theoretically, one may expect triadic mother–father–child interactions to recruit and thus promote the development of child EF skills. Triadic interactions are more complex than dyadic interactions, and EF are particularly needed to navigate complex situations. When interacting in a triadic context with both their parents, children must use their inhibition skills and wait for their turn to play or speak. Children's working memory is also challenged by the load of information to hold in mind simultaneously (e.g., respond to their father's initiative while remembering what their mother said immediately before). Children also need to divide their attention between the exchanges that they have with each parent as well as the exchange going on between their two parents, and attend to whichever is most salient at the moment, which requires cognitive flexibility. In sum, due to their inherent interactive complexity, triadic interactions are likely to require children to use their executive skills. Therefore, high-quality triadic interactions may provide a rich context for children to practice and thus develop their EF.

Family Alliance

One way to operationalize the quality of triadic father–mother–child interactions is through the notion of family alliance. Family alliance is concerned with the family's ability to work together as a team and is assessed by considering both parents' as well as the child's behaviors during three-way interactions. Family alliance is optimal when all members participate in the interaction, respect each other's roles, share a common goal, have positive and authentic affects, and resolve conflicts and misunderstandings by taking into account the perspective of all parties (Favez et al., 2011; Fivaz-Depeursinge & Corboz-Warnery, 1999).

Although family alliance is likely to play a meaningful role at all stages of child development, it may be especially salient around the time children are in kindergarten because by the preschool and early school-age periods, children's socio-cognitive development allows them to have a more active role in family interactions: they have increased awareness of parental disagreement (Frosch & Mangelsdorf, 2001), are more skilled at understanding their parents' perspective, and can more efficiently work with them toward achieving common goals (Moss & St-Laurent, 2001). In addition, school entry is a crucial moment for family adjustment, when children are expected to show a degree of autonomy but still need their parents' presence and support. School entry is also considered one of the most important developmental transitions of childhood (Pianta & Rimm-Kaufman, 2006) and EF is particularly needed when negotiating novel and complex situations (Hughes & Devine, 2019). Consequently, the quality of triadic interactions that take place during this pivotal transition may bear meaningfully on child executive development and have long-lasting implications as children continue their journey in the school system.

Current Study

There is much indirect evidence to suggest that the quality of triadic mother–father–child interactions may play a role in the development of child EF (e.g., Andrews et al., 2021; Schroeder & Kelley, 2009, 2010). To our knowledge, however, research has yet to address these links directly. This was the purpose of the current study. We aimed to examine the predictive links between family alliance and individual differences in children's three core executive functions as defined by Diamond (2013), namely inhibition, cognitive flexibility, and working memory. Inhibition represents one's ability to deliberately inhibit dominant, automatic, or prepotent responses; cognitive flexibility is the ability to shift back and forth between multiple tasks, operations, or mental sets; and working memory is the ability to hold information in mind and mentally work with it (Baddeley & Hitch, 1974; Diamond, 2013).

As described above, family alliance potentially plays a salient role around the time of school entry. Moreover, substantial research shows that EF is centrally involved in cognitive and socio-emotional adjustment in middle childhood. Considering this, as well as the need to avoid cross-sectional data and related problems in interpretation, a longitudinal design was used, with family alliance assessed in kindergarten (school entry) and child EF in the 4th grade of elementary school. It was expected that higher-quality family alliance would predict child superior performance on tasks tapping into inhibition, cognitive flexibility, and working memory four years later. Given the dearth of prior research on the links between family alliance and child EF, differential hypotheses about specific executive functions could not be formulated.

Method

Participants

Participants in the current study were 87 intact families (mother, father, and child: 42 girls and 45 boys) living in a large Canadian metropolitan area. These families are part of an on-going longitudinal study of child development (Bernier et al., 2020). They were recruited from birth lists randomly generated and provided by the Ministry of Health and Social Services. Parents provided written informed consent at recruitment (7 months) and all study procedures were approved by the university's research ethics committee. Criteria for participation were full-term pregnancy (i.e., ≥ 37 weeks of gestation) and the absence of any known physical or mental disability or severe developmental delay in the infant. Almost half of the children were first-born (49.4%), 26 were second-born (29.9%), and 17 were third- to fifth-born (19.5%). Family income varied from less than 20,000$ to over 100,000$, with an average in the 60,000$-79,000$ bracket. Mothers were between 20 and 45 years old (*M* = 32.27 years; *SD* = 4.61) and fathers between 23 and 58 years old (*M* = 34.64 years; *SD* = 6.09). The majority of mothers (65.4%) and fathers (60.9%) held a college degree (*M* = 15.98 years of education for mothers; *SD* = 1.94, and 15.58 for fathers; *SD* = 2.16) and were White (88.5% of mothers and 79.3% of fathers). A composite index of family socioeconomic status (SES) was computed by standardizing paternal and maternal education and family income, and averaging these three standardized scores.

Procedure

The families took part in two home visits, when children were in kindergarten (T1; *M* = 6.05 years; *SD* = 0.23, ranging from 5.64 to 6.53 years) and in Grade 4 (T2; *M* = 9.92 years; *SD* = 0.29, ranging from 9.17 to 10.48 years). The aim of the first visit was to assess family alliance. Parents and their children were invited to participate in a 15-min videotaped board game using the Lausanne Trilogic Play procedure, which was later coded using the Family Alliance Assessment Scales. Child EF was assessed at T2 with standardized tests tapping into working memory, cognitive flexibility, and inhibition.

Measures

Family Alliance

Lausanne Trilogic Play (LTP; Fivaz-Depeursinge & Corboz-Warnery, 1999) and the Family Alliance Assessment Scales (FAAS; Favez et al., 2011). The LTP consists of a semi-structured interaction task in four parts. In the first two parts, each parent plays with the child in turn while the second parent is asked to remain nearby in an observer position. These two parts are used in the coding because the behavior displayed by the parent who is not playing with the child provides indication as to the quality of the triadic interaction (e.g., nodding, laughing along, offering support vs. criticizing, interfering, not paying attention). In the third part, both parents and the child play together. Finally, the child takes the third-party position while the parents play together. This part is also used for the coding because the parents are still in charge of the child and thus interact with him or her while attending to their own dyadic game. In the current study, the parents and their child were asked to play in the above order a competitive board game for 15 minutes. They were further instructed that the three of them could negotiate which parent would play first with the child, and that they could decide the duration of each part.

The FAAS is a coding system that assesses family alliance during mother–father–child interaction. It is used to score family alliance during the LTP overall, taking into account all four parts of the procedure, rather than by assigning separate scores to each part. Five FAAS scales are scored. 1) Participation evaluates the extent to which the non-verbal cues of the family members indicate readiness and willingness to interact with each other and the inclusion of every member in the game (e.g., body orientation toward or away from partners, leaning in or out, making visual contact with partner or not). 2) Organization assesses whether each partner sticks to his/her role and the respect of each part of the game (e.g., interferences, interruptions of the other parent, duration of each part being relatively equivalent and sufficient to allow for interaction). 3) Focalization focuses on the extent to which there is turn-taking and whether the parents stimulate the child according to his or her developmental stage (e.g., each partner's contribution to evolution of the game, parental limit-setting and scaffolding of the child). 4) Affect sharing taps into the degree to which affects are mainly positive during the interaction, the degree of parental validation of child affect, and whether partners' affects are congruent with the situation (e.g., reciprocal smiles, affectionate gestures, empathy, parental attention to and correct interpretation of child emotional indices). 5) Finally, Timing/synchronization taps into interactive errors during shared activities and during the transitions between parts of the game (e.g., body gestures cutting off the interaction, unresolved misunderstandings, change in body orientation not appropriate when transitioning to a new part). Four of the scales (i.e., participation, organization, focalization, timing/synchronization) are scored on a 0–4 scale and Affect sharing is scored on a 0–6 scale. These five subscale scores are then summed into a global score of family alliance that can vary between 0 (*very poor*) and 22 (e*xceptional*). This global score was used in all further analyses.

The FAAS has been used in several cultures (e.g., Gueron-Sela et al., 2015; see McHale et al., 2018) and shows excellent validity (Favez et al., 2011). Sample cases were assessed by one of two coders who had both been trained and certified as reliable by the FAAS team. Inter-rater reliability between the two coders on 25% of randomly chosen cases was excellent, $r_{icc} = .81$ for the global family alliance score.

Child Executive Functioning

Forward and Backward Digit Span (Wechsler, 2003). Forward and Backward digit span tasks were used consecutively to assess working memory. The Forward digit span measures the child's capacity to hold information in memory without any manipulation, whereas the Backward digit span assesses the child's capacity to hold information in memory while actively manipulating it. Children were first asked to repeat lists of digit numbers in the same order they heard it (forward). Next, they were asked to repeat other lists of digits in reverse order (backward). In both tasks, list size increased (from 2 to 8 or 9 digits) with each succeeded level. Each level had two trials and the task ended when children erred two consecutive times at a given level. The number of succeeded trials, ranging from 0 to 16 (or 18), was used in data analyses for each task.

Color-Word Interference Test (CWIT) of the Delis-Kaplan Executive Function System (D-KEFS; Delis et al., 2001). Conditions 1 and 2 of the CWIT assess color naming and word reading respectively. In Condition 1, children were presented with a sheet displaying colored squares and had to name the color of each square. In Condition 2, children were presented with a sheet displaying color names printed in black ink and had to read the words. Administration of these two conditions is required before proceeding with Conditions 3 and 4, which were the conditions of interest in this study. Condition 3 assesses inhibition whereas Condition 4 assesses cognitive flexibility. In Condition 3, children were presented with a series of color names printed in dissonant ink colors (e.g., the word "blue" printed in green). They were asked to name the color of the ink that the words were printed in (and not read the word), one after the other and as quickly as possible. In order to succeed in this condition, children had to inhibit an automatic and overlearned response (i.e., reading the words). In Condition 4, children were presented with the same type of stimuli, except that half of the words were enclosed in boxes. Children had to name the color of the ink that the words were printed in as quickly as possible (as they previously did in Condition 3), except when the word appeared inside a box. In these cases, they had to read the word instead of naming the ink color. Like Condition 3, Condition 4 requires inhibition, but also cognitive flexibility, in that children have to switch between two sets of rules (naming the ink colors or reading the words).

For Condition 3 and Condition 4, completion time in seconds as well as uncorrected and self-corrected errors were recorded. Preliminary analyses showed that there were no significant differences between uncorrected and self-corrected errors; accordingly and in line with previous adult and child studies (Lippa & Davis, 2010, Lueke & Lueke, 2019; Sørensen et al., 2014), these two scores were summed into a total score of errors (hereafter named accuracy as it is reverse-scored). Completion time and accuracy in each of the conditions (expressed in scaled scores as per the D-KEFS manual; $M = 10$, $SD = 3$, range = 1–19) were used separately in the analyses. Higher scores indicate better performance in both cases, namely more rapid and more accurate responses. We also used one contrast score, namely inhibition/switching versus combined color naming and word reading. This score, hereafter called Cognitive flexibility minus basic skills, describes children's residual, "pure" cognitive flexibility after controlling for their basic color naming and reading skills. As per the D-KEFS manual, it is calculated by subtracting the combined completion time scaled score for naming and reading, assessed with the first two conditions, from the completion time scaled score for Condition 4. A new scaled score is then computed from the obtained difference score (Delis et al., 2001).

Planned Analyses

Variable distributions were screened first. Zero-order correlations were then computed to identify potential covariates and examine bivariate associations between study variables. Next, data were submitted to hierarchical regression analyses. A distinct regression model was fit for each EF variable that was found to be significantly or marginally correlated to family alliance. Block 1 included covariates, and block 2 included family alliance. All preliminary and main analyses were carried out with SPSS 26. Lastly, since the data used in this study are part of a larger study, and thus were already available, we did not run an a priori power analysis to determine a needed sample size. However, post-hoc power analyses were conducted on all regressions to verify that the models were adequately powered and thus ensure proper result interpretation.

Results

Preliminary Analyses

Descriptive statistics and correlations among the study variables are presented in Tables 1 and 2, respectively. All variables showed satisfactory variability. Child age at T2 was significantly associated with completion time in Condition 3 (r = -.30, p = .001) and Condition 4 of the CWIT (r = -.31, p < .001), and marginally associated with performance on the Forward digit span (r = -.15, p = .084). Child sex was significantly associated with accuracy in both Condition 3 (t = -1.99, p = .050) and Condition 4 (t = -2.55, p = .013) of the CWIT: boys made more mistakes than girls in both conditions. Consequently, child age and sex were covaried in the main analyses. Family SES was not associated with any of the dependent variables (all ps > .115) and therefore not considered further. Completion time in Condition 3 of the CWIT was marginally correlated with family alliance, while accuracy in both CWIT conditions as well as performance on the Backward digit span were unrelated to family alliance. All other EF variables were positively and significantly associated with family alliance.

Main Analyses

Results of the hierarchical regressions are presented in Table 3. These analyses revealed that, after accounting for child age and sex, family alliance significantly predicted completion time in Condition 4 of the CWIT (β = .26, p = .011), cognitive flexibility minus basic skills (β = .22, p = .042), and performance on the Forward digit span (β = .27, p = .011), though not completion time in Condition 3 of the CWIT (β = .17, p = .086). Family alliance predicted between 3.0% and 7.3% of unique variance in EF outcomes. Post-hoc power analyses were conducted using the following parameters: the observed effect size of family alliance as reported in Table 3, the number of predictors in each regression block (two for Block 1 and one for Block 2), the probability level (α = .05), and the sample size (N = 87). These analyses showed satisfactory statistical power (over .96) for all four regressions. In all cases, associations were positive, indicating that children involved in family interactions in which there is harmonious organization, pleasant interactions, appropriate stimulation, and active participation of all members show better executive performance four years later.

Discussion

EF provides children with crucial skills to thrive in several aspects of their lives, including in socio-emotional and academic spheres (Follmer, 2018; Hao, 2017; Karasinski, 2015; Viterbrori et al., 2017). However, not all children are equally well equipped executively, and this study suggests that some of these individual differences may have originated in the quality of their early family environment. We aimed to investigate the predictive links between family alliance observed when children were in kindergarten and 4th graders' EF performance on tasks tapping into inhibition, cognitive flexibility, and working memory. We hypothesized that better family alliance, characterizing families in which all have the opportunity to participate in the interaction, where family members harmoniously organize themselves to respect their respective roles and turns, where interactions are generally pleasant and where the child is appropriately stimulated by both parents, would predict better child EF. This hypothesis was partially supported. The results showed that higher-quality family alliance contributed to predict children's faster response time when performing a cognitive flexibility task (Condition 4 of CWIT), whether adjusting for their basic reading and naming skills or not (Cognitive flexibility minus basic skills). In contrast, we found no evidence for a predictive link between family alliance and child response accuracy in inhibition or cognitive flexibility tasks, and only a marginal trend with child inhibition (Condition 3 of the CWIT). Finally, family alliance was predictive of children's better working memory as measured with the Forward digit span, but not the Backward span. The results of this study are the first, to our knowledge, to suggest an association between the quality of triadic mother–father–child interactions and certain aspects of child EF, at any age.

Numerous studies have demonstrated the importance of the family environment for child EF development (Deater-Deckard, 2014; Hughes & Devine, 2018). However, these findings were almost always obtained at the dyadic level, generally through the analysis of parental behaviors in dyadic mother–child interactions and more rarely, in father–child interactions. Very few studies have attempted to look for family correlates or antecedents of child EF at higher-order family levels and to our knowledge, those that did used concurrent parental reports for both family functioning and child EF (Schroeder & Kelley, 2009, 2010). This almost exclusive focus on dyadic interactions is of note given that children who live with both their parents are affected not only by their separate dyadic relationship with each parent but also by how the different dyadic subsystems influence each other dynamically and become coordinated into the higher-order mother–father–child system (Feldman, 2007). The current findings suggest that children who live in families characterized by a better alliance later possess better working memory and higher processing speed for cognitive flexibility. These results are consistent with previous findings suggesting that parents who report better organization and cohesion in their family also concomitantly report that their child has better EF skills (Schroeder & Kelley, 2009, 2010). The results reported here add significantly to these prior findings by suggesting that family alliance (which includes organization and cohesion) predicts child subsequent EF in a longitudinal multi-method design, which strengthens conceptual inference by diminishing the role potentially played by shared method variance. The current results are also reminiscent of the household chaos literature, notably the observation that preschoolers show less improvement in EF between the ages of two and four years when their mother considers their family life to be disorganized and unpredictable (Hughes & Ensor, 2009).

There are several ways in which family alliance may promote EF in children. One may argue that the family organization and cohesion that characterize family alliance provide children with multiple opportunities to observe and gradually integrate the kind of well-regulated behaviors that form the core of EF. Children living in cohesive and organized families wherein all members participate in exchanges, enjoy well coordinated interactions, and respect each other's roles and turns are likely to frequently observe appropriate planning of tasks, inhibition of certain behaviors to stay organized, and flexibility when unforeseen events occur. Parents leading organized and cohesive families may also deliberately involve their children in such well-regulated behavioral patterns (e.g., plan an outing, make new plans to adapt to changing circumstances) and be well equipped to model and scaffold them. Through witnessing and participating in such well organized interactions, children may, with time, become increasingly skilled at organizing their own thoughts and behaviors (Schroeder & Kelley, 2010).

The particular context of triadic interactions may also provide unique opportunities to use and directly practice EF skills. For instance, waiting for one's turn to play or speak, which generally takes longer in a triadic than dyadic situation, requires inhibition; holding in mind an idea that the child wants to bring up while listening to what his or her parents are saying to each other solicits working memory; and adapting his or her next action according to what just happened between the two parents implies cognitive flexibility. In other words, in addition to providing a context in which children can witness and integrate appropriate executive manifestations displayed by their parents, triadic interactions offer children multiple executive challenges due to their increased complexity relative to dyadic interactions and hence, opportunities to practice and refine their EF skills.

A complementary explanation pertains to the role potentially played by parents' own EF skills, in that research suggests that there is intergenerational transmission of EF (see Deater-Deckard, 2014 for a review). Even though shared genes most likely play a role in this intergenerational transmission (Deater-Deckard, 2014), there is environmental transmission as well. For instance, Distefano et al. (2018) reported that parenting behavior played a significant mediating role in the association between parental and child EF. We propose that part of this environmental transmission is likely to occur in triadic interactions, which are arguably demanding not only for children's EF but also for their parents' EF. In a triadic context, parents must frequently exercise self-control, for example, when the child shows challenging behavior and parents must coordinate themselves to intervene properly, when one parent disagrees with how the other parent is interacting with the child but refrains from intervening, or when one parent notices that the other parent is excluded and plans a strategy to reintegrate him or her into the interaction. Hence, triadic interactions might provide an especially well-suited platform for parents to demonstrate proper use of EF skills to their child (deliberately or not), and therefore may constitute one of the contexts in which parental EF is transmitted to the next generation. On the other hand, the special context of triadic interactions may sometimes be too challenging for some parents' executive capacities and lead to negative parental behaviors. Parents with less effective self-control are likely to be less patient and more irritable when facing challenging triadic caregiving contexts and adopt negative behaviors towards the child or even the other parent

(Deater-Deckard, 2014). Negative parenting, in turn, is likely to have a negative impact on child EF (Hughes & Devine, 2018).

Contrary to expectations, family alliance did not predict children's working memory performance on the Backward digit span. The Backward digit span requires involvement of the central executive to hold information in mind while actively manipulating it, whereas the Forward digit span refers to the phonological loop, only requiring to hold elements in memory. Thus, these two tasks recruit different systems of working memory (Baddeley & Hitch, 1974). Future studies are needed to ensure the robustness of our results suggesting that family alliance is associated with the phonological loop only. If the results replicate, though, they may indicate that playful triadic interactions mainly elicit children's capacity to hold information in memory, for instance when remembering what they want to say while they wait for their turn to speak. More demanding contexts, such as triadic problem solving, may be more likely to trigger the more complex capacity to manipulate information at the same time.

Family alliance also did not predict accuracy of responses in the CWIT, although it did predict response speed (completion time). Albeit speculative, one explanation pertains to variability in the accuracy scores: although variability was satisfactory by usual standards as mentioned earlier, it was relatively modest, as careful examination of the data shows that the majority of children (73.4% for Condition 3 and 71.1% for Condition 4) made four errors or fewer. Therefore, there was relatively little variance in these scores to be predicted, and the shorter completion times appear to represent more efficient information processing.

Finally, although family alliance predicted faster information processing in a cognitive flexibility and inhibition task (Condition 4 of the CWIT), its contribution to information processing in an inhibition task (Condition 3) failed to reach statistical significance. This may have to do with the fact that the process of EF differentiation is still ongoing in middle childhood. Adult EF is characterized by a three-factor structure: inhibition, updating (i.e., working memory) and shifting (i.e., cognitive flexibility). However, this differentiation develops during childhood and is believed to be incomplete in middle childhood, such that some studies suggest that only two factors can readily be differentiated: updating and a combined inhibition-shifting factor (Bardikoff &

Sabbagh, 2017). In the current study, such a combined inhibition-shifting factor was assessed with Condition 4 of the CWIT, which requires both inhibition and shifting. The failure to predict performance in Condition 3, which requires inhibition only, may perhaps be due to the fact that children's inhibition and shifting are not differentiated yet. A different possibility is that triadic interactions, due to their inherent interactive complexity, recruit several executive functions simultaneously and thus perhaps mostly promote child performance on tasks requiring more than one executive function, such as inhibition and cognitive flexibility in Condition 4.

Overall, though, the pattern of results was mixed, with a fair amount of non-significant findings. Because this is, to our knowledge, the first study to address the association between the quality of triadic mother-father-child interactions and any aspect child EF, at any age, one cannot tease apart different explanations for the overall pattern of findings. Studies are needed to determine whether the specificity of the results replicates in independent samples, suggesting that family alliance is relevant to some but not all aspects of child EF, whether this differs across developmental periods, or if, perhaps, the links between child EF and family alliance are less convincing than those between child EF and dyadic parent-child interactions.

Limitations, Contributions and Future Research

This study has some limitations that need to be considered when interpreting the results. Family alliance was assessed in a play context and as mentioned above, triadic interactions in cognitively more demanding contexts such as problem solving may be more salient for child EF development. At this point, we cannot determine whether the observation that family alliance predicts some but not all aspects of child EF is robust or sample-specific. In addition, the design was longitudinal but not experimental; hence, a putative influence of family alliance on child EF was suggested but not demonstrated by the findings. Along similar lines, we did not control for child initial EF and thus cannot rule out the possibility of reverse causation, namely that kindergarteners with better EF contributed to a better family alliance. In fact, the links between family factors and child EF, as most developmental processes, are likely bidirectional (Sameroff, 1975) in that children with high EF are thought to elicit caregiving that is conducive to the further growth of EF (Eisenberg et al., 2015). In all likelihood, then, the links between family alliance and child EF emanate from complex transactions between children and their parents, which only large-scale longitudinal studies will be able to identify. It is also important to note that, even though statistical power was satisfactory as described above, thus lessening the risk of Type 2 error, Type 1 error cannot be excluded, considering the number of regression analyses conducted (four in total). Finally, the sample was predominantly composed of White, heterosexual, and college-educated parents, which limits the possibility to generalize findings to other segments of the population.

Despite those limitations, the results of this study are the first to suggest that family alliance may forecast some aspects of subsequent child EF, namely better working memory and more efficient processing in cognitive flexibility. These findings add to the EF literature by suggesting that not only dyadic parent–child processes but also higher-order family-level processes may be implicated in child EF. However, in this sample, triadic processes did not predict all executive aspects investigated. Thus, further research including both dyadic and triadic measurements as well as higher-level family systems (including siblings) is necessary to tease apart the respective and complementary roles of these levels of influence on children's executive development. While family systems theory has been known for decades, it has hardly reached the EF literature yet. More thorough consideration of how different family subsystems interact within and across hierarchy levels (e.g., dyadic, triadic, whole family) may shed new light on the ways in which family life comes to influence children's executive development.

References

Ackerman, B. P., & Brown, E. D. (2010). *Physical and psychosocial turmoil in the home and cognitive development.* In G. W. Evans & T. D. Wachs (Eds.), *Decade of behavior (science conference). Chaos and its influence on children's development: An ecological perspective* (p. 35–47). American Psychological Association. https://doi.org/10.1037/12057-003

Andrews, K., Atkinson, L., Harris, M., & Gonzalez, A. (2021). Examining the effects of household chaos on child executive functions: A meta-analysis. *Psychological Bulletin, 147*(1), 16–32. https://doi.org/10.1037/bul0000311

Austin, G., Groppe, K., & Elsner, B. (2014). The reciprocal relationship between executive function and theory of mind in middle childhood: A 1-year longitudinal perspective. *Frontiers in Psychology*, *5*, Article 655. https://doi.org/10.3389/fpsyg.2014.00655

Baddeley, A. D., & Hitch, G. (1974). Working memory. In G. A. Bower (Ed.), *The psychology of learning and motivation* (Vol. 8, pp. 47–89). Academic Press.

Bardikoff, N., & Sabbagh, M. (2017). The differentiation of executive functioning across development: Insights from developmental cognitive neuroscience. In N. Budwig & P. Zelazo (Eds.), *New perspectives on human development*. Cambridge University Press. http://dx.doi.org/10.1017/CBO9781316282755

Bernier, A., Beauchamp, M. H., & Cimon-Paquet, C. (2020). From early relationships to preacademic knowledge: A sociocognitive developmental cascade to school readiness. *Child Development*, *91*(1), e134–e145. https://doi.org/10.1111/cdev.13160

Blair, C., & Raver, C. C. (2015). School readiness and self-regulation: A developmental psychobiological approach. *Annual Review of Psychology, 66*, 711–731. https://doi.org/10.1146/annurev-psych-010814-015221

Bock, A. M., Gallaway, K. C., & Hund, A. M. (2015). Specifying links between executive functioning and theory of mind during middle childhood: Cognitive flexibility predicts social understanding. *Journal of Cognition and Development*, *16*(3), 509–521. https://doi.org/10.1080/15248372.2014.888350

Carlson, S. M. (2003). Executive function in context: Development, measurement, theory, and experience. *Monographs of the Society for Research in Child Development*, *68*(3), 138–151. https://doi.org/10.1111/j.1540-5834.2003.06803012.x

Deater-Deckard, K. (2014). Family matters: Intergenerational and interpersonal processes of executive function and attentive behavior. *Current Directions in Psychological Science*, *23*(3), 230–236. https://doi.org/10.1177/0963721414531597

Delis, D., Kaplan, E., & Kramer, J. (2001). *Delis-Kaplan executive function scale*. The Psychological Corporation.

Devine, R. T., & Hughes, C. (2014). Relations between false belief understanding and executive function in early childhood: A meta-analysis. *Child Development*, *85*(5), 1777–1794. https://doi.org/10.1111/cdev.12237

Diamond, A. (2013). Executive functions. *Annual Review of Psychology*, *64*, 135–168. https://doi.org/10.1146/annurev-psych-113011-143750

Distefano, R., Galinsky, E., McClelland, M. M., Zelazo, P. D., & Carlson, S. M. (2018). Autonomy-supportive parenting and associations with child and parent executive function. *Journal of Applied Developmental Psychology*, *58*, 77–85.

Eisenberg, N., Taylor, Z. E., Widaman, K. F., & Spinrad, T. L. (2015). Externalizing symptoms, effortful control, and intrusive parenting: A test of bidirectional longitudinal relations during early childhood. *Development and Psychopathology*, *27*(4pt1), 953–968. https://doi.org/10.1017/S0954579415000620

Favez, N., Frascarolo, F., Carneiro, C., Montfort, V., Corboz-Warnery, A., & Fivaz-Depeursinge, E. (2006). The development of the family alliance from pregnancy to toddlerhood and children outcomes at 18 months. *Infant and Child Development*, *15*(1), 59–73. https://doi.org/10.1002/icd.430

Favez, N., Scaiola, C. L., Tissot, H., Darwiche, J., & Frascarolo, F. (2011). The family alliance assessment scales: Steps toward validity and reliability of an observational assessment tool for early family interactions. *Journal of Child and Family Studies*, *20*(1), 23–37. https://doi.org/10.1007/s10826-010-9374-7

Feinstein, L., & Bynner, J. (2004). The importance of cognitive development in middle childhood for adulthood socioeconomic status, mental health, and problem behavior. *Child Development*, *75*(5), 1329–1339. https://doi.org/10.1111/j.1467-8624.2004.00743.x

Feldman, R. (2007). Maternal versus child's risk and the development of parent–infant and family relationships in five high-risk populations. *Development and Psychopathology*, *19*(2), 293–312. https://doi.org/10.1017/S0954579407070150Fenesy, M. C., & Lee, S. S. (2019). Association of ADHD and executive functioning with childhood depression. *Journal of Attention Disorders*, *23*(11), 1368–1378. https://doi.org/10.1177/1087054717723983

Fivaz-Depeursinge, E., & Corboz-Warnery, A. (1999). *The primary triangle: A developmental systems view of mothers, fathers and infants*. Basic Books.

Follmer, D. J. (2018). Executive function and reading comprehension: A meta-analytic review. *Educational Psychologist*, *53*(1), 42–60. https://doi.org/10.1080/00461520.2017.1309295

Friedman, S. L., Scholnick, E. K., Bender, R. H., Vandergrift, N., Spieker, S., Hirsh Pasek, K., ... & NICHD Early Child Care Research Network. (2014). Planning in middle childhood: Early predictors and later outcomes. *Child Development*, *85*(4), 1446–1460. https://doi.org/10.1111/cdev.12221

Frosch, C. A., & Mangelsdorf, S. C. (2001). Marital behavior, parenting behavior, and multiple reports of preschoolers' behavior problems: Mediation or moderation? *Developmental Psychology*, *37*, 502–519. http://dx.doi.org/10.1037/0012-1649.37.4.502

Geronimi, E. M., Patterson, H. L., & Woodruff-Borden, J. (2016). Relating worry and executive functioning during childhood: The moderating role of age. *Child Psychiatry & Human Development*, *47*(3), 430–439. https://doi.org/10.1007/s10578-015-0577-4

Gueron-Sela, N., Atzaba-Poria, N., Meiri, G., & Marks, K. (2015). The caregiving environment and developmental outcomes of preterm infants: Diathesis stress or differential susceptibility effects? *Child Development*, *86*(4), 1014–1030. https://doi.org/10.1111/cdev.12359

Hao, J. (2017). Do children with better inhibitory control donate more? Differentiating between early and middle childhood and cool and hot inhibitory control. *Frontiers in Psychology*, *8*, Article 2182. https://doi.org/10.3389/fpsyg.2017.02182

Helm, A. F., McCormick, S. A., Deater-Deckard, K., Smith, C. L., Calkins, S. D., & Bell, M. A. (2020).

Parenting and children's executive function stability across the transition to school. *Infant and Child Development*, *29*(1), Article e2171. https://doi.org/10.1002/icd.2171

Hertz, S., Bernier, A., Cimon-Paquet, C., & Regueiro, S. (2019). Parent–child relationships and child executive functioning at school entry: The importance of fathers. *Early Child Development and Care*, *189*(5), 718–732. https://doi.org/10.1080/03004430.2017.1342078

Hughes, C., & Devine, R. T. (2018). Parental influences on children's executive function: A differentiated approach. In S. A. Wiebe & J. Karbach (Eds.) *Executive Function: Development across the life span* (pp. 160–171). Routledge.

Hughes, C., & Devine, R. T. (2019). For better or for worse? Positive and negative parental influences on young children's executive function. *Child Development*, *90*(2), 593–609. https://doi.org/10.1111/cdev.12915

Hughes, C., & Ensor, R. (2005). Executive function and theory of mind in 2 years old: A family affair? *Developmental Neuropsychology*, *28*(2), 645–668. https://doi.org/10.1207/s15326942dn2802_5

Hughes, C., & Ensor, R. (2009). How do families help or hinder the emergence of early executive function? *New Directions for Child and Adolescent Development*, *2009*(123), 35–50. https://doi.org/10.1002/cd.234

Jacobvitz, D., Hazen, N., Curran, M., & Hitchens, K. (2004). Observations of early triadic family interactions: Boundary disturbances in the family predict symptoms of depression, anxiety, and attention-deficit/hyperactivity disorder in middle childhood. *Development and Psychopathology*, *16*(3), 577–592. https://doi.org/10.1017/S0954579404004675

Karasinski, C. (2015). Language ability, executive functioning and behaviour in school-age children. *International Journal of Language & Communication Disorders*, *50*(2), 144–150. https://doi.org/10.1111/1460-6984.12104

Karreman, A., van Tuijl, C., van Aken, M. A. G., & Deković, M. (2008). Parenting, coparenting, and effortful control in preschoolers. *Journal of Family Psychology, 22*(1), 30–40. http://dx.doi.org/10.1037/0893-3200.22.1.30

Landry, S. H., Miller-Loncar, C. L., Smith, K. E., & Swank, P. R. (2002). The role of early parenting in children's development of executive processes. *Developmental Neuropsychology*, *21*(1), 15–41. https://doi.org/10.1207/S15326942DN2101_2

Lippa, S. M., & Davis, R. N. (2010). Inhibition/switching is not necessarily harder than inhibition: An analysis of the D-KEFS color-word interference test. *Archives of Clinical Neuropsychology*, *25*(2), 146–152. https://doi.org/10.1093/arclin/acq001

Lueke, A., & Lueke, N. (2019). Mindfulness improves verbal learning and memory through enhanced encoding. *Memory & Cognition*, *47*(8), 1531–1545. https://doi.org/10.3758/s13421-019-00947-z

Matte-Gagné, C., Bernier, A., Sirois, M. S., Lalonde, G., & Hertz, S. (2018). Attachment security and developmental patterns of growth in executive functioning during early elementary school. *Child Development*, *89*(3), e167-e182. https://doi.org/10.1111/cdev.12807

McHale, J. P., Favez, N., & Fivaz-Depeursinge, E. (2018). The Lausanne Trilogue Play paradigm: Breaking discovery in family process and therapy. *Journal of Family Studies*, *27*(10), 3063–3072. https://doi.org/10.1007/s10826-018-1209-y

McHale, J.P., Fivaz-Depeursinge, E., Dickstein, S., Robertson, J., & Daley, M. (2008). New evidence for the social embeddedness of infants' early triangular capacities. *Family Process*, *47*(4), 445–463. https://doi.org/10.1111/j.1545-5300.2008.00265.x

Meuwissen, A. S., & Englund, M. M. (2016). Executive function in at-risk children: Importance of father-figure support and mother parenting. *Journal of Applied Developmental Psychology, 44*, 72–80. https://doi.org/10.1016/j.appdev.2016.04.002

Minuchin, P. (1985). Families and individual development: Provocations from the field of family therapy. *Child Development, 56*(2), 289–302. https://doi.org/10.2307/1129720

Moss, E., & St-Laurent, D. (2001). Attachment at school age and academic performance. *Developmental Psychology*, *37*, 863-874. http://dx.doi.org/10.1037/0012-1649.37.6.863

Nigg, J. T. (2017). Annual research review: On the relations among self-regulation, self-control, executive functioning, effortful control, cognitive control, impulsivity, risk-taking, and inhibition for developmental psychopathology. *Journal of Child Psychology and Psychiatry*, *58*, 361–383. https://doi.org/10.1111/jcpp.12675

Pharo, H., Sim, C., Graham, M., Gross, J., & Hayne, H. (2011). Risky business: Executive function, personality, and reckless behavior during adolescence and emerging adulthood. *Behavioral Neuroscience, 125*(6), 970–978. https://doi.org/10.1037/a0025768

Pianta, R. C., & Rimm-Kaufman, S. (2006). The social ecology of the transition to school: Classrooms, families, and children. In K. McCartney & D. Phillips (Eds.), *Blackwell handbook of early childhood development* (pp. 490–507). https://doi.org/10.1002/9780470757703.ch24

Regueiro, S., Matte-Gagné, C., & Bernier, A. (2020). Patterns of growth in executive functioning during school years: Contributions of early mother–child attachment security and maternal autonomy support. *Journal of Experimental Child Psychology*, *200*, Article 104934. https://doi.org/10.1016/j.jecp.2020.104934

Rollè, L., Gullotta, G., Trombetta, T., Curti, L., Gerino, E., Brustia, P., & Caldarera, A. M. (2019). Father involvement and cognitive development in early and middle childhood: A systematic review. *Frontiers in Psychology*, *10*, Article 2405. https://doi.org/10.3389/fpsyg.2019.02405

Roskam, I., Stievenart, M., Meunier, J. C., & Noël, M. P. (2014). The development of children's inhibition: Does parenting matter? *Journal of Experimental Child Psychology*, *122*, 166–182. https://doi.org/10.1016/j.jecp.2014.01.003

Sameroff, A. (1975). Transactional models in early social relations. *Human Development*, *18*(1–2), 65–79. https://doi.org/10.1159/000271476

Schroeder, V. M., & Kelley, M. L. (2009). Associations between family environment, parenting practices, and executive functioning of children with and without ADHD. *Journal of Child and Family Studies*, *18*(2), 227–235. https://doi.org/10.1007/s10826-008-9223-0

Schroeder, V. M., & Kelley, M. L. (2010). Family environment and parent-child relationships as related to executive functioning in children. *Early Child Development and Care*, *180*(10), 1285–1298. https://doi.org/10.1080/03004430902981512

Sørensen, L., Plessen, K. J., Adolfsdottir, S., & Lundervold, A. J. (2014). The specificity of the Stroop interference score of errors to ADHD in boys. *Child Neuropsychology*, *20*(6), 677–691. https://doi.org/10.1080/09297049.2013.855716

Tissot, H., Favez, N., Udry-Jorgensen, L., Frascarolo, F., & Despland, J. N. (2015). Mothers' and fathers' sensitive parenting and mother–father–child family alliance during triadic interactions. *The Family Journal*, *23*(4), 374–380. https://doi.org/10.1177/1066480715601110

Valcan, D. S., Davis, H., & Pino-Pasternak, D. (2018). Parental behaviours predicting early childhood executive functions: A meta-analysis. *Educational Psychology Review*. https://doi.org/10.1007/s10648-017-9411-9

Van Egeren, L. A., & Hawkins, D. P. (2004). Coming to terms with coparenting: Implications of definition and measurement. *Journal of Adult Development*, *11*(3), 165–178. https://doi.org/10.1023/B:JADE.0000035625.74672.0b

Viterbori, P., Traverso, L., & Usai, M. C. (2017). The role of executive function in arithmetic problem-solving processes: A study of third graders. *Journal of Cognition and Development*, *18*(5), 595–616. https://doi.org/10.1080/15248372.2017.1392307

Wechsler, D. (2003). *Wechsler intelligence scale for children (4th ed.)*. The Psychological Corporation.

Zelazo, P. D., & Carlson, S. M. (2012). Hot and cool executive function in childhood and adolescence: Development and plasticity. *Child Development Perspectives*, *6*(4), 354–360. https://doi.org/10.1111/j.1750-8606.2012.00246.x

Table 1

Mean, Standard Deviation and Range for all Study Variables

Variables	*M*	*SD*	Range
Family alliance	12.55	4.82	3–22
Inhibition – response time [bc]	12.10	2.40	3–19
Cognitive flexibility – response time [ac]	11.98	2.29	3–16
Inhibition – accuracy [bc]	10.79	2.52	3–15
Cognitive flexibility – accuracy [bd]	10.80	2.74	1–15
Cognitive flexibility minus basic skills [b]	10.37	1.80	6–14
Working memory – Forward	8.75	1.93	5–16
Working memory – Backward digit span	6.67	1.60	4–11
Child sex [a]	1.48	0.50	1–2
Child age at T2	9.92	1.11	9–10
Family SES	0.18	0.66	-1.49–1.24

[a] Child sex is coded: 1 = boy; 2 = girl. [b] Measures from the Color-Word Interference Test expressed in scaled scores; higher scores indicate better performance. [c] Assessed with Condition 3 of the Color-Word Interference Test. [d] Assessed with Condition 4 of the Color-Word Interference Test.

Table 2

Correlations among all Study Variables

	1	2	3	4	5	6	7	8
1.Inhibition – response time [ab]	…	.57**	.11	-.08	.13	.26**	.26**	.21^t
2.Cognitive flexibility – response time [ac]	…	…	.23*	.18*	.51**	.11	.16	.29**
3.Inhibition – accuracy [ab]	…	…	…	.45**	.27**	.13	.15	.13
4.Cognitive flexibility – accuracy [ac]	…	…	…	…	.32**	.02	-.001	.05
5.Cognitive flexibility minus basic skills [a]	…	…	…	…	…	-.04	.01	.22*
6.Working memory – Forward	…	…	…	…	…	…	.38**	.28**
7.Working memory – Backward	…	…	…	…	…	…	…	.10
8.Family alliance	…	…	…	…	…	…	…	…
9.Child age at T2	-.30**	-.31**	-.06	-.06	-.07	-.15^t	.15	-.06
10.Child sex	.15	.13	.21*	.21*	.08	.07	.11	.10
11.Family SES	.14	.04	-.06	.02	.07	.05	.04	.17

Note. SES = socioeconomic status.

[a] Measures from the Color-Word Interference Test; higher scores indicate better performance. [b] Assessed with Condition 3 of the Color-Word Interference Test. [c] Assessed with Condition 4 of the Color-Word Interference Test.

$^t p < .10$. $*p < .05$. $**p < .01$.

Table 3

Summary of Regression Analyses Predicting Child EF Performance

Block	Inhibition – response time [ab]	Cognitive flexibility – response time [ac]	Cognitive flexibility minus basic skills [a]	Working memory – Forward
	β	β	β	β
1.Child sex	.15	-.03	-.01	.01
Child age	-.33**	-.27*	.03	-.17
2.Family alliance	.17[t]	.26*	.22*	.27*
Family alliance unique R^2 (%)	3.0%	6.9%	5.0%	7.3%
Total R^2 (%)	18.8%	15.7%	5.0%	10.8%

Note. EF = executive functioning.

[a] Measures from the Color-Word Interference Test; higher scores indicate better performance.

[b] Assessed with Condition 3 of the Color-Word Interference Test. [c] Assessed with Condition 4 of the Color-Word Interference Test.

[t] $p < .10$. * $p < .05$. ** $p < .01$.