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Comment évaluer la théorie de l'esprit? Revue systématique des outils d'évaluation destinés aux enfants d'âge préscolaire

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Résumé

La Théorie de l'Esprit (TDE), soit l'habileté à inférer des états mentaux à soi-même et à autrui, est un domaine de recherche ralliant plusieurs disciplines, incluant la psychologie sociale et développementale, la neuropsychologie, les neurosciences sociales et l'orthophonie. Les habiletés de la TDE ont été maintes fois reliées à plusieurs marqueurs d'adaptation sociale, telles des compétences relationnelles et communicationnelles de meilleure qualité. Par ailleurs, la TDE est altérée dans le contexte de nombreuses conditions cliniques. Malgré l'énorme quantité d'études dédiées à la TDE, identifier des outils de mesures appropriés destinés aux enfants d'âge préscolaire demeure un défi. Cet essai a pour but de faciliter l'identification d'outils de mesures de la TDE pour les enfants de 0-5 ans en créant un inventaire de ceux-ci et de leurs caractéristiques. Une introduction positionne l'importance de la TDE à titre d'habileté socio-cognitive, la définit et la distingue de construits socio-cognitifs apparentés, survole sa trajectoire développementale et soulève les défis reliés à son évaluation. Une revue systématique de la littérature, sous forme d'article scientifique, présente ensuite la méthodologie utilisée et l'inventaire des outils de mesures réalisé, et permet de souligner la grande variété d'outils évaluant la TDE, mais également de nombreux écueils méthodologiques et psychométriques associés à la création et au choix d'outils appropriés, incluant le nombre limité de sous-habiletés visées, le manque de standardisation et la pauvreté des informations psychométriques disponibles. Une discussion générale est ensuite fournie et relève les apports théoriques, méthodologiques et cliniques de cette recherche pour le domaine de la TDE.

Mots-clés : théorie de l'esprit, cognition sociale, revue systématique, préscolaire, enfant, psychométrie, évaluation, test, questionnaire, neuropsychologie clinique

Abstract

Theory of mind (TOM), the ability to infer mental states to self and others, has been a pervasive research theme across many disciplines including developmental, neuro-, and social psychology, social neuroscience and speech therapy. TOM abilities have been consistently linked to markers of social adaptation, such as better communication skills and quality social relationships, and are affected in a broad range of clinical conditions. Despite the wealth and breadth of research dedicated to TOM, identifying appropriate assessment tools for the preschool population remains challenging. This work aims to facilitate the choice and use of adequate measures for children aged 0 to 5 years by generating a comprehensive inventory of TOM measures and listing their characteristics. The introduction highlights the importance of TOM as a social-cognitive ability, defines TOM and distinguishes it from related yet distinct socio-cognitive constructs, provides information on its developmental trajectory and raises challenges associated with TOM assessment. A systematic review of the literature is then presented in the form of an article and provides details on the methods used and the inventory of TOM measures generated. The remarkable variety of measures that have been created to assess TOM is highlighted, but also the numerous methodological and psychometric challenges associated with developing and choosing appropriate measures, including issues related to the limited range of sub-abilities targeted, lack of standardisation across studies and paucity of psychometric information provided. Finally, a general conclusion provides the opportunity to discuss the theoretical, methodological and clinical contributions of this project.

Keywords : theory of mind, social cognition, systematic review, preschool, children, psychometry, assessment, test, questionnaire, clinical neuropsychology

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Liste des abréviations

ASD : Autism Spectrum Disorders

ADHD : Attention Deficit/Hyperactivity Disorder

CB: Cindy Beaudoin

CG : Charlotte Gagner

e.g. : For example

EL: Élizabel Leblanc

ex. : Par exemple

i.e. : That is

M : Mean

MHB : Miriam H. Beauchamp

NEPSY-II : A Developmental NEuroPSYchological Assessment, Second Edition

ODD : Oppositional Defiant Disorder

SES : Socio-Economic Status

SOME : Self to Other Model of Empathy

TBI : Traumatic Brain Injury

TD : Typically Developing

TDE : Théorie De l'Esprit

TOM : Theory Of Mind

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Introduction

La théorie de l'esprit (TDE) désigne la capacité à se créer une représentation cognitive des états mentaux des autres et de soi-même (H. M. Wellman, Fang, & Peterson, 2011). La TDE se développe rapidement dès l'âge préscolaire (Carlson, Koenig, & Harms, 2013) et est d'une grande importance pour le développement social de l'enfant et son adaptation à la société. Au fil des années, de très nombreux outils de mesure de la TDE ont été créés afin d'alimenter la recherche sur son développement typique et atypique. En résultat, le chercheur ou le clinicien à la recherche d'un outil de mesure de la TDE est actuellement confronté à des milliers d'articles présentant des centaines d'outils de mesures. Pourtant, le choix d'un bon outil de mesure demeure une entreprise complexe. Les défis de l'évaluation de la TDE sont nombreux, parmi lesquels figurent au premier plan la variété de conceptualisations et de définitions de la TDE, le besoin d'adapter constamment les méthodes d'évaluation au développement rapide de la TDE chez le jeune enfant, de même que plusieurs écueils psychométriques. Ce projet de recherche vise à faciliter la navigation du chercheur ou du clinicien à la recherche d'outils d'évaluation adaptés à ses besoins spécifiques, en créant un inventaire des instruments de mesure de la TDE destinés aux enfants d'âge préscolaire par l'entremise d'une revue systématique de la littérature.

Habiletés sociales et théorie de l'esprit

L'acquisition d'habiletés sociales est un objectif développemental d'une importance cruciale, puisque celles-ci permettront à l'individu de former et maintenir des relations sociales durables et favoriseront son adaptation à la société tout au long de sa vie (Cacioppo, 2002). L'émergence de telles habiletés sociales est un processus développemental complexe, soutenu par la maturation de plusieurs fonctions cognitives, auxquelles nous référons en utilisant le terme

« cognition sociale » (Beauchamp & Anderson, 2010). Parmi les composantes de la cognition sociale, la TDE a reçu un grand intérêt de la part des chercheurs au cours des quarante dernières années. La TDE désigne un ensemble d'habiletés cognitives permettant d'adopter la perspective d'une autre personne et d'attribuer des états mentaux à autrui et à soi-même, incluant par exemples les désirs, les émotions, les croyances et les intentions, ce qui permet, entre autres, de prédire les comportements (Wellman et al., 2011). Cette compétence se développe rapidement dès l'âge préscolaire (Carlson et al., 2013). Sans surprise, les enfants possédant de bonnes habiletés de TDE présentent aussi de nombreux indices d'adaptation sociale, tels que de bonnes habiletés de communication, des relations sociales de meilleure qualité, une plus grande popularité auprès des pairs, et même une meilleure réussite scolaire (Binnie, 2005; Slaughter, 2015; Slaughter, Imuta, Peterson, & Henry, 2015). En outre, de plus faibles habiletés en TDE ont été découvertes dans diverses conditions caractérisées par des difficultés sociales, tels les troubles du spectre autistique (Kimhi, 2014), la maltraitance (Luke & Banerjee, 2013), les troubles des conduites (ex.: Anastassiou-Hadjicharalambous & Warden, 2008), le traumatisme crânio-cérébral (ex.: Dennis et al., 2012) et la schizophrénie (ex.: Brune, 2005).

Défis de l'évaluation de la TDE

Malgré le grand intérêt scientifique suscité par le développement typique et atypique de la TDE, les conclusions des études dans ces domaines manquent souvent de robustesse, et certains auteurs, tels Hiller et ses collèguesHiller, Weber, and Young (2014), pointent du doigt la faiblesse des méthodes d'évaluation comme frein à la recherche sur la TDE. En effet, malgré le nombre impressionnant d'études réalisées sur le sujet au cours des quarante dernières années, la psychométrie dans ce domaine est peu systématique et encore qualifiée d'immature (Brune,

2001), rendant laborieuse la recherche de bons outils d'évaluation parmi les centaines retrouvés dans la documentation scientifique.

Les défis qui attendent le chercheur ou le clinicien à la recherche d'outils d'évaluation de la TDE sont nombreux. En premier lieu, il importe d'être informé du chevauchement du concept de TDE et de d'autres concepts impliquant également l'appréciation des états mentaux d'autrui, tels que l'empathie. Il est donc essentiel de définir clairement la TDE et de la distinguer des concepts apparentés afin d'être en mesure de bien comprendre le ou les concepts qu'un outil donné permet de mesurer. D'autre part, le développement continu et rapide de la TDE au cours de la petite enfance force l'évaluateur à disposer de méthodes d'évaluation variées suivant l'âge de la population ciblée. Enfin, il va sans dire que les qualités psychométriques des outils de mesure doivent pouvoir être examinées avant de poser un choix éclairé. Ces divers défis de l'évaluation de la TDE seront exposés dans les pages suivantes.

Définition de la théorie de l'esprit et distinctions

Bien que plusieurs définitions du concept de TDE aient été élaborées depuis sa première apparition en 1976 (Premack, 1976), il est généralement bien reconnu qu'il s'agit d'un ensemble d'habiletés cognitives permettant de raisonner au sujet des états mentaux, qu'ils soient cognitifs, telles les croyances, ou affectifs, telles les émotions. Certains auteurs réfèrent également à ces habiletés en utilisant les termes « *mind-reading* » (lecture de l'esprit), « *mentalizing* » (mentalisation) ou encore « *perspective-taking* » (prise de perspective). Bien qu'ils soient souvent utilisés comme synonymes de la TDE, ces termes peuvent parfois aussi référer à d'autres construits apparentés mais distincts, comme par exemples l'empathie ou la reconnaissance

d'émotions faciales. D'ailleurs, les liens étroits entre la TDE et d'autres aspects de la cognition sociale participent à rendre complexe sa définition et, par conséquent, le choix d'un outil de mesure qui lui est spécifique.

Dans leur modèle cognitif, Bird & Viding (2014) ont récemment proposé des définitions fort utiles afin de bien comprendre ce qui distingue la TDE d'autres aspects de la cognition sociale. Ainsi, les auteurs isolent la TDE, qui réfère à la représentation cognitive de ses propres états mentaux (cognitifs et affectifs) ou de ceux des autres, de l'empathie, qui réfère au phénomène qui se produit lorsque l'état affectif d'autrui provoque un changement de notre propre état affectif, alors même que nous sommes conscients que cet état est plus approprié à la situation de l'autre qu'à la nôtre. Dans ce modèle, la TDE est également vue comme étant distincte du « système de classification des indices affectifs », un processus perceptuel de plus bas niveau. Celui-ci permet de traiter et classer les stimuli perceptuels signalant des états affectifs, telles la prosodie et les émotions faciales. La TDE est de plus à distinguer du « système de compréhension situationnelle », qui réfère au traitement de base des indices situationnels qui aident à comprendre une situation sociale (ex. : « plusieurs personnes habillées de noir se rendent au cimetière = funérailles »). Finalement, un autre construit qui doit être distingué de la TDE est la « contagion émotionnelle ». Ce terme renvoie à la transmission d'un état affectif d'une personne à une autre, mais sans que l'individu ne soit conscient de cette correspondance entre son état affectif et celui de la personne qui le lui a transmis. Plusieurs études d'imageries cérébrales soutiennent ces distinctions entre TDE, empathie, classification d'indices affectifs, compréhension d'indices situationnels et contagion émotionnelle (Bird & Viding, 2014). En effet, il a été démontré que ces fonctions cognitives recrutent des réseaux neuronaux distincts.

Des études auprès de populations cliniques démontrent également que ces fonctions, bien qu'interreliées, peuvent être affectées de façon indépendante, engendrant ainsi des difficultés sociales différentes (Bird & Viding, 2014). Par exemple, la psychopathie implique un manque d'empathie, mais une bonne TDE, comme en témoignent de bonnes habiletés à prédire et manipuler le comportement d'autrui.

Il importe aussi de distinguer la TDE d'habiletés socio-cognitives plus larges qui, bien qu'elles s'appuient sur la TDE du participant, représentent plutôt des construits distincts. Par exemple, en prenant appui sur ses habiletés de TDE, un individu peut déployer une variété de comportements pro-sociaux ou visant à promouvoir ses objectifs personnels. Ceux-ci sont mieux évalués en utilisant des outils de mesures visant spécifiquement les construits ciblés, telles la coopération, l'adhérence aux normes sociales, l'utilisation de mensonges et la manipulation (Baurain & Nader-Grosbois, 2013; Slaughter, 2015). L'utilisation que font les individus de leurs habiletés de TDE au sein de leurs interactions sociales dépend de plusieurs facteurs, outre la compétence de TDE en soi, comme le tempérament, les expériences de vie, l'intégration de normes sociales et le fonctionnement exécutif (Beauchamp & Anderson, 2010; Slaughter, 2015; Vera-Estay, 2015). Ainsi, afin de mesurer spécifiquement les habiletés de TDE, il est essentiel de sélectionner des outils de mesure qui ciblent directement la TDE, plutôt que ceux visant à évaluer des habiletés sociales plus complexes et de plus haut niveau, comme le raisonnement moral (Vera-Estay, 2015), les prises de décisions stratégiques (Steinmann et al., 2014) ou la coopération (Leipold, Vetter, Dittrich, Lehmann-Waffenschmidt, & Kliegel, 2013).

Afin de mesurer spécifiquement la TDE, il apparait également important de porter attention à certaines considérations développementales. Il y a encore beaucoup de débats au sujet de la définition de la TDE, plus spécifiquement concernant quelles habiletés sociales précoces peuvent être considérées comme des manifestations directes de la TDE, et lesquelles en sont plutôt des précurseurs cognitifs distincts (Carlson et al., 2013). Bien que ces questions n'aient toujours pas trouvé de réponses empiriques hors de tout doute, la documentation scientifique suggère actuellement que les habiletés sociales précoces comme l'imitation, le suivi du regard d'autrui, le pointage et l'attention conjointe reflètent une conscience automatique et implicite des états mentaux (Carlson et al., 2013). Il est suggéré que ces comportements sont des précurseurs aux habiletés de TDE, qui pour leur part se caractérisent par une compréhension flexible, cohérente et conceptuelle des états mentaux (Carlson et al., 2013) et qui sont le sujet de la présente recherche. En somme, dans le cadre de cet essai, la TDE est conçue comme une habileté distincte de l'empathie, de la classification d'indices émotionnels et situationnels, des représentations précoces et implicites des états mentaux, tels l'attention conjointe et l'imitation, de même que des habiletés sociales plus complexes, comme la coopération et la manipulation.

La grande variété de construits apparentés à la TDE se traduit par une toute aussi grande variété d'outils de mesure présents dans la documentation scientifique. Conséquemment, la recherche d'un outil de mesure spécifique à la TDE nécessite un examen attentif du ou des construits évalués par les outils de mesure existants.

Développement de la TDE et outils d'évaluation associés

À l'intérieur même de la définition de la TDE, plusieurs habiletés cohabitent et peuvent être évaluées de façon simultanée, ou non, par un outil donné. Ces diverses habiletés reflètent en bonne partie les changements continus qui s'opèrent au cours du développement de la TDE, et ce, à un rythme différent d'un enfant à l'autre. L'évaluation de la TDE est donc amenée à s'adapter au fur et à mesure que la TDE de l'enfant évolue, complexifiant encore davantage le choix d'un outil de mesure approprié. Pourtant, parmi les problèmes de l'évaluation de la TDE figure au premier plan la grande tendance à se fier à une seule méthode d'évaluation, soit le paradigme classique de la *fausse croyance* (Hedger & Fabricius, 2011; Hiller et al., 2014). Ce paradigme fut initialement proposé par Wimmer & Perner (Wimmer & Perner, 1983), puis adapté et réutilisé à de multiples reprises (Wellman, Cross, & Watson, 2001). Typiquement, on présente à l'enfant un court scénario au cours duquel un personnage est amené à développer une fausse croyance. Par exemple, dans la tâche « *Sally-Ann* » (Baron-Cohen, Leslie, & Frith, 1985), deux marionnettes, Sally et Ann, sont présentées à l'enfant. Sally dépose une bille dans un panier, puis quitte la scène. Ann retire la bille du panier et la dépose dans une boîte, avant de quitter à son tour. Lorsque Sally revient sur scène, la question-clé suivante est posée à l'enfant : « Où Sally va-t-elle chercher sa bille? ». Afin de réussir la tâche, l'enfant doit répondre « dans le panier », malgré le fait que la bille se trouve réellement dans la boîte. En créant une contradiction entre la réalité des choses et la croyance d'un personnage, ce type de scénario permet de mettre en lumière la capacité de l'enfant à comprendre que l'état mental de l'autre n'est pas le simple reflet de la réalité observable. L'enfant serait donc à ce moment capable d'élaborer une théorie quant au contenu mental de l'autre, c'est-à-dire une « théorie de l'esprit ». À 3 ans, l'enfant est généralement incapable de réussir un paradigme de fausse croyance. Par exemple, s'il apprend la

vérité quant au contenu d'une boîte à l'apparence trompeuse (ex. : une boîte de pansements contenant des crayons), il jugera que n'importe quelle autre personne saura ce qu'elle contient réellement, même s'il ne l'a jamais ouverte (Carlson et al., 2013). L'habileté de l'enfant à réussir les paradigmes de fausses croyances se développe de façon importante entre l'âge de 3 et 5 ans (H. A. Wellman et al., 2001), ce qui a longtemps mené à penser que c'est l'âge à lequel la TDE apparaît (Slaughter, 2015). Pourtant, l'utilisation d'outils de mesure plus variés a permis de dévoiler une trajectoire développementale plus étendue et nuancée, au cours de laquelle différentes habiletés sont acquises dans un ordre généralement stable entre les âges de 3 et 7 ans (Wellman et al., 2011).

L'utilisation de méthodes d'évaluation non-verbales, s'intéressant par exemples aux comportements de pointage, au suivi du regard, au temps de fixation oculaire et aux comportements d'aide, a permis de mieux comprendre le développement de la TDE chez les plus petits. Ainsi, il semblerait qu'entre 12 et 18 mois, l'enfant démontre une certaine compréhension des intentions d'autrui. Par exemple, s'il voit un adulte essayer de placer un anneau sur une tige sans y parvenir, l'enfant va ensuite poser l'action-cible et la compléter, montrant ainsi sa compréhension de l'intention de l'adulte (Kristen, Sodian, Thoermer, & Perst, 2011). De plus, nous savons maintenant qu'aussi jeune que 18 mois, le bébé comprendrait que sa perception visuelle du monde n'est pas partagée par tous (ex. : « ma mère ne peut pas voir mon jouet si elle a les yeux bandés »; (Poulin-Dubois, Sodian, Metz, Tilden, & Schoeppner, 2007). À cet âge, l'enfant serait également capable d'inférence quant aux désirs, et parvient donc à offrir à un expérimentateur l'aliment que celui-ci semble préférer (ex. : brocoli) plutôt que l'aliment que lui-même préfère (ex. : biscuit) (Repacholi & Gopnik, 1997). Même un paradigme classique de

fausse croyance pourrait être réussi plus tôt si, au lieu de se fier aux réponses verbales de l'enfant, on se fie à des indices non-verbaux. Par exemple, à l'aide de la technique du suivi du regard, Southgate et ses collaborateurs ont montré que des enfants de 25 mois s'attendent à voir une marionnette chercher sa balle dans la boîte où elle l'a rangé, si elle ne l'a pas vu être déplacée ailleurs par une tierce personne (Southgate, Senju, & Csibra, 2007).

Alors que l'accès à une diversité d'outils de mesure permet de démontrer que la TDE débute son développement bien avant la compréhension du paradigme classique de fausse croyance, il permet aussi de mieux cerner comment la TDE se perfectionne ensuite. Après avoir émergé et s'être développée de façon fulgurante entre 3 et 5 ans (Carlson et al., 2013), une transition dans le développement de la TDE semble s'opérer. Ce changement est visible au niveau des outils de mesure utilisés, qui, après 6 ans, tendent surtout à complexifier les paradigmes en impliquant plusieurs autres fonctions cognitives, ajoutant par exemple une plus grande charge en fonctions exécutives et un plus grand niveau d'abstraction à une base de TDE déjà acquise (Carlson et al., 2013).

Il a été établi que la capacité de l'enfant à comprendre que les gens peuvent entretenir des croyances non seulement au-sujet d'objets, mais aussi au sujet de l'état mental des autres, se développe généralement entre 5 et 6 ans (ex. : « Je crois que Jean croit que Marie est triste *»*) (S. A. Miller, 2009). Cette compréhension est généralement évaluée par les paradigmes de *fausse croyance de deuxième ordre*. Par exemple, dans le scénario du « *Ice Cream Van Test* » (Perner & Wimmer, 1985), un vendeur de crème glacée annonce à Mary et John qu'il sera au parc tout l'après-midi. Mary quitte John pour aller chercher de l'argent à la maison. Plus tard, Mary et

John apprennent indépendamment que le vendeur de crème glacée s'est déplacé près de l'église. John part chercher Mary chez elle, mais apprend que celle-ci est partie acheter de la crème glacée. La question-test consiste à demander à l'enfant : « Où John croit-il que Mary est partie ? ». Afin de réussir, l'enfant doit répondre « au parc », montrant ainsi sa compréhension de la fausse croyance de John au sujet de la croyance de Mary. D'autres aspects de la TDE mettent encore plus de temps à être maîtrisés : c'est le cas des tâches mesurant la compréhension du sarcasme (dire le contraire de ce que l'on pense vraiment dans le but de faire preuve d'humour), des « faux pas » (propos embarrassant ou bizarre en fonction de la situation sociale, mais qui pourrait être approprié dans un autre contexte) et des mensonges pro-sociaux (mensonge dont l'intention est de protéger les sentiments du destinataire), qui n'atteignent toujours pas d'effet plafond à la fin de la période de l'enfance (Miller, 2009).

Il se dégage donc des quarante dernières années de recherche un portrait du développement de la TDE qui va bien au-delà de la réussite d'un paradigme de fausse croyance. L'ensemble de ces résultats démontrent l'importance d'avoir à sa disposition une variété d'outils de mesure afin d'évaluer de façon complète un construit complexe tel la TDE.

Qualités psychométriques des outils d'évaluation de la TDE

Notre connaissance limitée des qualités psychométriques des outils de mesure de la TDE a été soulevée à de multiples reprises (ex.: Brune, 2001; Carlson et al., 2013; Hiller et al., 2014). À titre d'exemple, en 2008, Hutchins et ses collègues ne répertoriaient que quatre études ayant évalué la fidélité test-retest de leurs outils de TDE utilisés (Hutchins, Bonazinga, Prelock, & Taylor, 2008). De plus, parmi les limites psychométriques se trouve la présence d'un grand

nombre de tâches à un ou deux items seulement, créant une situation « d'échec ou réussite ». Ces outils offrent peu de variation et de sensibilité afin de qualifier les compétences des enfants, contrairement à l'utilisation de batteries plus vastes, plus rarement utilisées dans le domaine (Cutting & Dunn, 1999; Garner, Curenton, & Taylor, 2005).

Une autre grande faiblesse dans l'évaluation de la TDE est le petit nombre d'outils standardisés et validés (Hiller et al., 2014). Le manque de standardisation implique entre autres qu'un même outil est largement adapté d'une étude à l'autre, rendant difficiles les comparaisons entre les études. Pourtant, ces différentes adaptations pourraient avoir des conséquences sur les résultats obtenus. Prenons par exemples les paradigmes de fausse croyance. Dans les tâches où les enfants doivent indiquer dans quel contenant un personnage cherchera un objet désiré, il a été démontré que ceux-ci préfèrent pointer un contenant où se trouve un autre objet, non désiré, plutôt qu'un contenant vide (Cassidy, 1998). La familiarité du matériel utilisé ne serait pas non plus sans conséquence. Par exemple, dans une tâche de fausse croyance où le contenu d'une boîte est différent de ce que son contenant laisse présager, utiliser un matériel bien connu de l'enfant (ex. : *Smarties*) plutôt qu'un matériel moins familier (ex. : allumettes) améliore sa performance (Adrien, Rossignol, Barthelemy, & Jose, 1995). Les personnages choisis pour incarner une histoire pourraient aussi influencer la performance de l'enfant. En effet, être soi-même un acteur dans l'histoire plutôt qu'un spectateur, de même qu'utiliser des enfants comme protagonistes plutôt que des peluches, amélioreraient la performance de l'enfant (Battacchi, Celani, & Bertocchi, 1997). Le langage utilisé pour présenter l'histoire aurait également un impact. Par exemple, les questions posées à la négative seraient plus difficiles à comprendre pour les petits et pourraient les induire en erreur malgré de bonnes capacités en TDE (Geangu, 2002).

Les questions plus pragmatiques seraient aussi mieux réussies que les questions plus abstraites (Abu-Akel & Bailey, 2001). Ces variations dans les tâches n'expliquent pas toute la variabilité de performance observée avec les tâches de fausses croyances, pas plus qu'elles ne remettent en question l'acquisition d'une compréhension des fausses croyances entre 3 et 5 ans (Wellman et al., 2001). Néanmoins, ces différentes adaptations posent des défis au chercheur ou au clinicien à la recherche du meilleur outil d'évaluation parmi la panoplie d'instruments retrouvés dans la documentation scientifique.

En somme, malgré un nombre impressionnant d'études sur le sujet, les méthodes d'évaluation de la TDE semblent souvent peu étudiées d'un point de vue psychométrique. De plus, elles se basent presque toujours sur un seul contexte (le laboratoire), une seule source d'information (l'enfant) et un seul type de tâche (ex. : un paradigme de fausse croyance) (Carlson et al., 2013). Dans sa revue au sujet de la TDE, Carlson (2013) juge important de diversifier les sources d'informations et les contextes d'évaluation, de même que d'élargir le spectre des compétences de TDE évaluées par les outils de mesure choisis dans les recherches futures au sujet de la TDE.

Malgré les difficultés à identifier de bons outils de mesure de la TDE, et malgré l'importance d'y parvenir, à notre connaissance, aucune revue systématique incluant tous les outils de mesures de TDE n'a été réalisée. En 2010, Sprung (2010) révisa la documentation scientifique afin de répertorier les outils d'évaluation de la TDE auprès de populations cliniques et s'intéressa en particulier aux outils « avancés et non-standards », jugés pertinents pour l'évaluation et l'intervention. D'autres revues non-systématiques ont été menées en poursuivant

un objectif similaire et ont permis de commenter les outils de mesures de la TDE destinés aux adultes (Henry, Cowan, Lee, & Sachdev, 2015), aux enfants d'âge scolaire et aux adolescents (Hayward & Homer, 2017). Bien que ces revues de la littérature démontrent la pertinence des mesures de la TDE pour la compréhension de plusieurs conditions cliniques, il ne s'agit pas de revues systématiques des outils existants. De plus, elles offrent peu d'informations quant aux qualités psychométriques des outils répertoriés. Ziatabar et ses collaborateurs (2015) ont récemment mené une revue systématique des outils de mesure de la TDE pour les enfants d'âge préscolaire, mais ont restreint le cadre de la recherche aux articles présentant le développement et la validation de mesures comprenant de multiples tâches. Ainsi, cette revue exclu les tâches isolées, comme les tâches de fausses croyances, qui constituent la majorité des outils utilisés dans les études sur la TDE (Hiller et al., 2014). De plus, la revue de Ziatabar et ses collaborateurs est limitée aux études de validation psychométrique, ce qui signifie qu'elle n'intègre pas les données empiriques et psychométriques issues des études qui ont utilisé des outils développés par d'autres auteurs.

L'objectif de ce projet de recherche était de répertorier les instruments de mesures existant de la TDE chez l'enfant d'âge préscolaire et d'intégrer ces informations dans un tableau synthèse qui permettrait aux chercheurs et cliniciens de mieux évaluer quels instruments sont les plus adaptés à leur contexte de recherche ou de clinique, de même qu'à identifier les limites des outils actuellement disponibles afin de stimuler la rechercher future. Les prochaines pages présentent l'article scientifique issu de la réalisation de cette recherche, suivi d'une discussion générale, visant à approfondir la réflexion concernant les retombées possibles de cette étude au niveau théorique, empirique et clinique.

Systematic review and inventory of Theory of Mind measures for preschool children

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Abstract

Theory of mind (TOM), the ability to infer mental states to self and others, has been a pervasive research theme across many disciplines including developmental, neuro-, and social psychology, social neuroscience and speech therapy. TOM abilities have been consistently linked to markers of social adaptation, such as better communication skills and quality social relationships, and have been shown to be affected in a broad range of clinical conditions. Despite the wealth and breadth of research dedicated to TOM, identifying appropriate assessment tools for the preschool population remains challenging. This systematic review presents a comprehensive inventory of TOM measures for children aged 0 to 5 years and provides details on their content, structure and characteristics. Electronic databases (1985-2017) and test publisher catalogues were systematically reviewed. In total, 179 measures, identified within 753 studies, were found to assess the understanding of 8 categories of mental states and social situations: emotions, desires, intentions, percepts, knowledge, beliefs, deception/lies and "faux pas", and pertained to 32 types of TOM sub-abilities. Information on the measures' mode of presentation, number of items, scoring options, and target populations (language, age, adverse conditions) were extracted, and references to psychometric details are listed in summary tables. The results of the systematic review highlight the remarkable variety of measures that have been created to assess TOM, but also the numerous methodological and psychometric challenges associated with developing and choosing appropriate measures, including issues related to the limited range of sub-abilities targeted, lack of standardisation across studies and paucity of psychometric information provided.

Keywords: theory of mind, systematic review, childhood, psychometrics, assessment

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Consolidating appropriate social skills is a an essential part of typical development, as they allow individuals to establish and maintain satisfying social relationships and promote community adaptation across the lifespan (Cacioppo, 2002). The emergence of social skills is a complex developmental process involving the maturation of a broad range of underlying cognitive functions, referred to as "social cognition" (Beauchamp & Anderson, 2010). Among these, Theory of Mind (TOM) has been a central focus of developmental and social psychology since Premack first coined the term TOM in the 1970s (Premack & Woodruff, 1978). More recently, TOM and other social cognitive constructs have resurfaced to the forefront of research and practice as a result of the establishment of the field of social neuroscience, which has generated a large body of consensual literature regarding the brain networks underlying TOM (Bellerose, Beauchamp, & Lassonde, 2011; Bird & Viding, 2014; Blakemore, 2008; Frith & Frith, 2006; Gallagher & Frith, 2003). Speech therapy is another field implicated in TOM research and provides insight on the links between TOM and communication abilities (Byom & Turkstra, 2012).

TOM refers to the cognitive ability to understand another person's perspective and to infer mental states to self and others, including desires, knowledge, beliefs, and intentions, in order to predict behavior (Premack & Woodruff, 1978). Children who have good TOM generally display markers of social adaptation, such as better communication skills, better quality social relationships, increased peer popularity and higher academic achievement (Binnie, 2005; Fink, Begeer, Peterson, Slaughter, & de Rosnay, 2015; Imuta, Henry, Slaughter, Selcuk, & Ruffman, 2016; Slaughter, 2015; Slaughter, Imuta, Peterson, & Henry, 2015). Conversely, poorer TOM has been identified in a number of conditions and contexts characterized by altered social

functioning, such as autistic spectrum disorders (Chung, Barch, & Strube, 2014; Kimhi, 2014; Leekam, 2016; Senju, 2012; Shaked & Yirmiya, 2004; Yirmiya, Erel, Shaked, & Solomonica-Levi, 1998), language impairment (Stanzione & Schick, 2014), attention-deficit/hyperactivity disorder (Bora & Pantelis, 2016), Tourette's syndrome (Eddy & Cavanna, 2013), childhood maltreatment (Benarous, Guilé, Consoli, & Cohen, 2015; Luke & Banerjee, 2013), conduct disorders (Anastassiou-Hadjicharalambous & Warden, 2008; Poletti & Adenzalo, 2013), anorexia nervosa (Bora & Köse, 2016), schizophrenia (Biedermann, Frajo-Apor, & Hofer, 2012; Bora, Yücel, & Pantelis, 2009; Brune, 2005; Cermolacce et al., 2011; Chung et al., 2014; Healey, Bartholomeusz, & Penn, 2016; Martin, Robinson, Dzafic, Reutens, & Mowry, 2014; Song et al., 2015; Sprong, Schothorst, Vos, Hox, & van Engeland, 2007), traumatic brain injury (Bellerose, Bernier, Beaudoin, Gravel, & Beauchamp, 2017; Dennis et al., 2012; McDonald, 2013; Snodgrass & Knott, 2006; Walz, Yeates, Taylor, Stancin, & Wade, 2010), epilepsy (Bora & Meletti, 2016; Stewart, Catroppa, & Lah, 2016), neurofibromatosis (Payne, Porter, Pride, & North, 2016) and Fragile X syndrome (Turkstra, Abbeduto, & Meulenbroek, 2014).

There is ongoing interest in furthering our understanding of the role of TOM in normative development as well as in clinical conditions. To do so, reliance on validated, developmentally appropriate assessment tools is crucial in both scientific and clinical settings, especially given that social cognition is now included in the assessment recommendations in the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-V; American Psychiatric Association, 2013), as well as in the context of research on disorders of mental health (Gur & Gur, 2016). Although a surfeit of measures has been developed to test TOM, identifying the best measure for particular clinical or research needs is not an easy enterprise. Evaluating TOM presents many challenges, some of which are related to the numerous and varied definitions and

conceptualisations of TOM that have been proposed (Abu-Akel & Shamay-Tsoory, 2011; Asakura & Inui, 2016; Bird & Viding, 2014; Dennis et al., 2013; Happé, Cook, & Bird, 2017; Leslie, 1987; Tager-Flusberg & Sullivan, 2000; Westby, 2014), the changeable manifestations of TOM at different developmental stages (Carlson, Koenig, & Harms, 2013; Slaughter, 2015; H. M. Wellman, Fang, & Peterson, 2011), and the many psychometric limitations associated with certain measures (Brune, 2001; Carlson et al., 2013; Hiller et al., 2014; Hutchins, Bonazinga, Prelock, & Taylor, 2008; Mayes, Klin, Tercyak, Cicchetti, & Cohen, 1996). This systematic review of the literature aims to facilitate the identification of adequate TOM measures and highlight gaps in TOM assessment by documenting existing TOM measures for children aged 0 to 5 years and detailing their characteristics and target populations.

Defining Theory of Mind and distinguishing it from other social constructs

TOM is a complex construct encompassing a range of abilities, which are variably targeted as a function of the measurement tool chosen (German & Cohen, 2012). There exist numerous definitions and theories related to TOM, each of which provides slightly different conceptions regarding the specificity of TOM and what behavioral manifestations reflect this ability (Abu-Akel & Shamay-Tsoory, 2011; Asakura & Inui, 2016; Bird & Viding, 2014; Dennis et al., 2013; Happé et al., 2017; Leslie, 1987; Tager-Flusberg & Sullivan, 2000; Westby, 2014). While many researchers and theorists rely on their own definition of TOM, it is generally accepted that it represents a set of cognitive skills that enable reasoning about cognitive (e.g., beliefs) or affective (e.g., emotions) mental states.

In the current review we use the Self to Other Model of Empathy (SOME; Bird & Viding, 2014) as a framework to define TOM and set the inclusion and exclusion criteria for the literature search. The SOME is a comprehensive model based on empirical data from clinical and

neuroimaging studies (Bird & Viding, 2014). It depicts how a number of social cognitive constructs, such as TOM, come together to determine empathic behavior rather than focusing solely on internal TOM processes. Importantly, the SOME distinguishes TOM from empathy: TOM is defined as a person's cognitive representation of self and other's mental states, whereas empathy is defined as an emotional contagion caused by exposure to another's emotion, while being conscious that this emotional state is experienced by the other (Bird & Viding, 2014). In the model, TOM is also differentiated from the « affective cue classification system », a lower perceptual system responsible for processing and categorizing stimuli signalling affective states, such as facial emotions and tones of voice. The SOME model further posits that TOM is distinct from a « situation understanding system » responsible for processing situational cues and deducing or associating estimated emotional states of others based upon the situational cues (e.g., people dressed in black at a cemetery = funeral) (Bird & Viding, 2014). The model is therefore useful for setting boundaries between TOM and other closely related social cognitive constructs, and was used in the current review to distinguish central TOM measures from those more distally related to TOM.

In addition to using a clear definition of TOM to identify and document relevant assessment tools, the construct of TOM should be distinguished from other abilities that, though they may build or rely on TOM, are best represented by other social cognitive function. For example, many overt prosocial and self-promoting behaviors rely on TOM, but can be more directly assessed through targeted measures such as those of cooperation, adherence to social norms, lies and manipulative interpersonal tactics (Baurain & Nader-Grosbois, 2013; Slaughter, 2015). The way in which TOM is used in everyday social interactions also depends on many other discrete factors, such as temperament, life experiences, integration of social values and

executive functioning (Beauchamp & Anderson, 2010; Slaughter, 2015; Vera-Estay, 2015). As a result, in order to identify assessment measures that specifically target TOM, it is also critical to choose those that elicit TOM specifically, rather than those that evaluate more complex social cognitive skills, such as moral reasoning (Vera-Estay, 2015), strategic social decision making (Steinmann et al., 2014) or cooperation (Leipold, Vetter, Dittrich, Lehmann-Waffenschmidt, & Kliegel, 2013), for example.

Other than the challenges associated with distinguishing TOM from related, higher-order social cognitive constructs and behaviors, there are developmental considerations that should be taken into account to constrain our search to the most unambiguous forms of TOM. There is still much debate around the definition of TOM with regards to which emerging social skills in infancy are considered direct, early manifestations of TOM, and which are distinct cognitive precursors allowing TOM to arise (Carlson et al., 2013). While this question remains to be answered empirically, current literature suggests that early social skills such as imitation, gaze following, pointing and joint attention, may reflect automatic, implicit manifestations of awareness of mental states (Carlson et al., 2013). These are thought to act as precursors of later-developing TOM skills that reflect an explicit, coherent, flexible and conceptual understanding of mental states (Carlson et al., 2013), and which are the topic of the current review. In sum, this review constrains TOM so as to present it as distinct from empathy, classification of affective and situational cues, early non-explicit cognitive representation of mental states such as joint attention and imitation, and more complex social abilities, such as cooperation or manipulation tactics.

The developmental trajectory of TOM and associated diverse measurement tools

Taking into account the diverse definitions and conceptions of TOM, it is not surprising that a broad variety of paradigms and measures have been developed to study the construct. Such measures capture human understanding of different mental states, such as emotion, knowledge, intents, beliefs or desires. Despite the range of mental states a child must learn to understand, there appears to be an over-representation of measures directed specifically at assessing one particular type of mental state : false beliefs (Hedger & Fabricius, 2011; Hiller, Weber, & Young, 2014). The false belief paradigm was initially proposed by Wimmer and Perner (1983b) and has since been adapted and applied to a range of contexts (Wellman, Cross, & Watson, 2001). Typically, children are presented with a short scenario depicting a contradiction between reality and a character's belief. For example, in the change of location paradigm named the "Sally & Ann task" (Baron-Cohen, Leslie, & Frith, 1985), two dolls, Sally and Ann, are presented to the child. Sally places her marble in a basket, and then leaves the scene. Ann takes the marble out of the basket and puts it in a box. When Sally comes back, the child is asked where will she search for her marble. To succeed in this task, children have to answer « in the basket », despite the fact that they know that the marble is really in the box. This type of scenario enables experimenters to determine a child's ability to understand that a person's mental state is not a simple reflection of reality, and in turn to demonstrate that the child is able to elaborate a theory about another person's mental content, a « theory of mind ».

Children typically complete false belief paradigms successfully somewhere between 3 and 5 years of age (H. A. Wellman et al., 2001), an observation which has long been linked to the assumption that this is the age when TOM develops. However, the use of a broader variety of measures has subsequently shown that TOM follows a more extended and nuanced

developmental trajectory (H. M. Wellman et al., 2011). In particular, the use of non-verbal tasks has been useful in showing that some aspects of TOM may already be detected in infancy (Slaughter, 2015). For example, children demonstrate some knowledge of the intentions of others around 12 to 18 months of age (Kristen, Sodian, Thoermer, & Perst, 2011), can appreciate other's desires around 18 months of age (Poulin-Dubois, Sodian, Metz, Tilden, & Schoeppner, 2007; Repacholi & Gopnik, 1997), and show some comprehension of false beliefs around 25 months of age (Senju, 2012; Southgate, Senju, & Csibra, 2007). Conversely, the use of a variety of more complex TOM tasks has also shown that TOM continues to develop after the age of 5. For example, children improve on their ability to understand second order false belief tasks (i.e. « Ann thinks that Sally thinks the marble is in the basket ») between 5 and 6 years of age, and continue to develop an increasingly mature appreciation of sarcasm, *faux-pas* and prosocial lies throughout adolescence (Miller, 2009). The ongoing maturation of TOM from adolescence to adulthood has also been highlighted by neuroimaging studies, depicting longitudinal changes in patterns of cerebral activation during a variety of TOM tasks and suggesting a protracted development of the ability well into adulthood (Blakemore, 2008, 2012). Together, these findings highlight that TOM cannot be seen as a unitary construct and must be appreciated in light of its ongoing development, and support the importance of relying on diverse TOM measures that are sensitive to developmental changes, in order to adequately document a complex and rapidly developing cognitive ability.

Psychometric challenges associated with TOM measures

Despite the spectacular advances in our understanding of both normative and altered TOM (Gallagher & Frith, 2003; Imuta et al., 2016; Kimhi, 2014; Poletti & Adenzalo, 2013; Vuadens, 2005; Wellman et al., 2001), it is still difficult to draw robust conclusions about its role

in typical development and clinical conditions, and some suggest that these limitations are primarily a result of the methodological weaknesses associated with the measures used to assess TOM (Henry, von Hippel, Molenberghs, Lee, & Sachdev, 2016; Hiller et al., 2014). Indeed, the psychometric standards of TOM measures have been qualified as unsystematic, suboptimal and immature (Brune, 2001; Carlson et al., 2013; Hiller et al., 2014; Hutchins, Bonazinga, Prelock, & Taylor, 2008; Mayes, Klin, Tercyak, Cicchetti, & Cohen, 1996). Among the methodological weaknesses in TOM assessment that have been identified, there is the reliance on measures with one or two tests items only (Cutting & Dunn, 1999; Garner, Curenton, & Taylor, 2005), the over-representation of false belief understanding as the sole measure of TOM (Carlson et al., 2013; Hiller et al., 2014; Wellman & Liu, 2004) and the fact that few TOM measures have empirically validated psychometric properties (Hiller et al., 2014; Hutchins et al., 2008; Ziatabar Ahmadi, Jalaie, & Ashayeri, 2015). In sum, despite the vast literature pertaining to TOM in preschool children, it appears that associated measures in research and clinical settings are not always supported by sound psychometric data and standards.

Existing sources of information on TOM measures

Despite the conceptual and methodological challenges raised here, to our knowledge, no systematic review has been conducted to document the characteristics of all existing TOM measures destined for preschool children. Non-systematic reviews have been published on TOM measures that are widely used in clinical population (Sprung, 2010), in adulthood (Henry, Cowan, Lee, & Sachdev, 2015), and in middle childhood and adolescence (Hayward & Homer, 2017). These reviews highlight the relevance of a number of TOM measures for understanding social functioning in clinical conditions and typical development and provide interesting insights in the ways to use them, but they are not systematic and do not cover measures destined for

preschoolers. Ziatabar and colleagues (2015) conducted a systematic review of TOM measures for preschoolers, but constrained its scope to articles presenting the development and validation of comprehensive measures composed of multiple tasks. Therefore, their review excluded single tasks measures (e.g., single false belief tasks) that essentially constitute the majority of measures used in TOM research (Hiller et al., 2014). In addition, the review conducted by Ziatabar and colleagues (2015) is limited to psychometric validation studies and does not consider empirical and psychometric data from other studies that have used these TOM measures.

The primary objective of this study was to systematically record an inventory of all existing TOM measures that assess TOM in children under 6 (0-5 years of age). This age range was chosen because the period between 3 to 5 years is widely recognized as a sensitive period for TOM development (Wellman et al., 2001). The range was extended down to infancy because there is no actual consensus regarding the age at which the first manifestations of TOM appear (Carlson et al., 2013). This inventory will assist researchers and clinicians in choosing measures that best fit their needs and will identify possible gaps or limits inherent to existing measures.

Method

A systematic review of the literature was conducted. Empirical studies referring to TOM measures used with preschool children were reviewed using a search protocol based on The Preferred Reporting Items for Systematic Reviews and Meta-Analyses statement (PRISMA; (Moher et al., 2015). Details pertaining to the TOM measures reported in the studies identified in the search were extracted. Eligibility criteria were pre-determined both at the level of study selection and identification of TOM measure (see Table 1 for the list of eligibility criteria and associated exclusion criteria).

Information sources and search strategy

The search strategy was created in collaboration with a psychology librarian at the University of Montreal. The following electronic databases were searched: Ovid PsycINFO, Health and Psychosocial Instruments, MEDLINE(R) In-Process & Other Non-Indexed Citations and MEDLINE(R). The dates of coverage were from 1985 to June 2017. The rationale for this search period was that measures that have not been used in the last 30 years are likely to have been judged less useful than others for research and clinical practice, and are not likely to take into account significant recent advances in TOM research.

The following search terms, referring to children (1), measures (2) and TOM (3) were used, in combination, and restrained to "all journals":

1. (child* or schoolchild* or toddler* or preschool* or infan*).mp [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]

2. (psychometric* or validation or questionnaire* or scale* or inventor* or instrument* or measure* or tool or assess* or evaluation*).mp [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]

3. (theory of mind or false belief* or perspective taking* or social attribution* or belief attribution* or desires reasoning).mp [mp=title, abstract, heading word, table of contents, key concepts, original title, tests & measures]

In addition to the standard electronic search databases, the catalogues of the following English or French publishers of testing materials were manually reviewed: Pearson Assessment Canada, Psychological Assessment Ressources, Institut de Recherches Psychologiques, Western Psychological Services, Hogrefe, Les Éditions du Centre de Psychologie Appliquée, Eurotests Editions, PsychTest, Schuhfried. Whenever the age range of participants could not be extracted

directly from an article, the correspondence author was contacted to obtain this information. Moreover, whenever the cited source of an assessment tool had not been retrieved using the search strategy, it was manually searched and included as a record to be screened alongside others in the selection process, even though it has been published before 1985.

Selection process

Search results were imported in an Endnote X7 database. Screening was performed in two phases. In phase 1, all search results were screened for eligibility criteria based only on the content of the title and abstract, by two of the authors (CB and CG). Two decisions were possible at this stage: exclusion based on an eligibility criterion or inclusion for Phase 2. In phase 2, full texts of all remaining search results were screened for eligibility criteria by either CB, EL or CG. Two decisions were possible at this stage: exclusion based on an eligibility criterion or inclusion in the systematic review. For each phase, the first 15% of search results were screened independently by all concerned reviewers in order to obtain an inter-rater agreement in terms of inclusion or exclusion of the search result. The inter-rater agreement was 89.9% at phase 1 and 93.9% at phase 2. All along the process, any discrepancies or difficulties in the identification of inclusion/exclusion criteria were resolved by discussion with the other reviewers and authors if needed.

Content analysis and data extraction

A qualitative content analysis of the measures included was performed by all authors throughout the selection process in order to extract the discrete mental states and social situations understanding that were assessed by the included measures. Eight categories of mental states and social situations were identified across the ensemble of studies: emotions, desires, intentions, percepts, knowledge, beliefs, deception/lies and faux pas (i.e., social gaffes). A ninth category,

called “comprehensive measures”, was added to represent measures encompassing the understanding of multiple mental states and social situations. These nine TOM categories were therefore used to classify the different measures during data collection.

Data collection was performed by CB, EL and CG using a comprehensive pre-determined form. This form included the following variables related to the measure: category of mental state or social situation assessed, name of measure, author(s) and year of publication, reference(s) of articles that use the measure, short description, administration format, number of items, scoring options and administration time. It was also noted which articles provided original psychometric information. The data extraction form also included the following information regarding the participants assessed with the measures: age range of normative population, language(s) spoken, presence of adverse clinical (e.g., hearing impairments or deafness, Williams syndrome), psychological (e.g., anxiety or depression, externalizing behavior problems) or environmental (i.e. low socio-economic status, maltreatment) conditions assessed with the measures.

Results

Figure 1 illustrates the steps in article selection. A total of 753 studies were included in data extraction. Given the large amount of studies and the numerous variations of the same measures found, a synthesis of the data was performed, which isolated 179 distinct measures and paradigms. These are presented in nine separate tables (Appendix II) according to the main TOM category they refer to: Emotions (table 2; 24 measures), Desires (table 3; 21 measures), Intentions (table 4; 15 measures), Percepts (table 5; 25 measures), Knowledge (table 6; 20 measures), Beliefs (table 7; 40 measures), Deception/lies (table 8; 9 measures), Faux pas (table 9; 1 measure) and Comprehensive measures (table 10; 24 measures). To further synthesize the results and provide clarity on the content of the tasks, the first eight categories were sub-divided

into 32 TOM sub-abilities or sets of abilities assessed in the measures. Category 9, Comprehensive measures, was subdivided according to the format of the measures (i.e., questionnaires/interviews and direct tests). For example, the Desires category was divided in three sub-abilities: 1) understanding that different people may have discrepant desires, 2) understanding the co-existence of multiple desires at the same time or successively in one person, and 3) understanding that people's emotions and actions are influenced by their desires/preferences. Table 11 provides an overview of the results and presents the first eight TOM categories and the 32 TOM sub-abilities, along with an example of a relevant measure and the number of measures and articles that were identified in relation to each sub-ability. Table 12 presents an overview of the measures included in the Comprehensive measures category.

When consulting the tables of results, the reader should be aware of some caveats associated with the data synthesis process. In particular, it is important to note that a specific measure or paradigm may tap more than one TOM category or sub-ability, but for practical reasons, it was placed under the one that was judged to best reflect its measurement scope. For example, the "Ella the Elephant" task (Harris, Johnson, Hutton, Andrews, & Cooke, 1989), which captures the emotions associated with false beliefs (e.g., happiness when seeing a can of a preferred beverage, without knowing the content has been replaced by a disliked beverage), was placed in the Beliefs category even though understanding of emotions is also secondarily involved in the task. Related to this and given the existence of multiple variations of the same paradigms, measures were placed under a common banner when they had strong similarities, even if the authors did not refer directly to the original source. For example, the "Ernie test" and "Linda test", presented by Ford and colleagues (2012), were referenced under the measure "Change-in-location paradigm/Sally & Ann task" because they rely on false beliefs associated

with the unseen displacement of an object, a paradigm typically attributed to Wimmer & Perner (1983a) by most authors. It is also important to note that the original source of a measure may have not been included in the review because of an exclusion criterion (e.g., the original reference for Howlin's "Emotion Understanding Assessment" is in a book; Howlin, 1999). In these cases, the source article was not included in the review, but the reference is provided in the tables, beside the name of the measure.

Measure characteristics

Modes of presentation. Many different presentation modalities are used across TOM measures, but most rely on direct testing with the child, using read-aloud stories enacted with figurines (18 sub-abilities*, e.g., Allen & Kinsey, 2013), or scenarios depicted with pictures (20 sub-abilities, e.g., Galende, de Miguel, & Arranz, 2011). Some measures rely on videos (10 sub-abilities, e.g., Mayes et al., 1996), audio-recordings or read-aloud scenarios (12 sub-abilities, e.g., Whitehouse & Hird, 2004), videogames (e.g., Swettenham, 1996), games or other realistic laboratory situations with the experimenter and/or other persons (17 sub-abilities, e.g., Brown, 2006). Many measures have variations in possible presentation modalities across studies. A good example of this is that all of the references cited in the first part of this section refer to assorted presentation modes of a single measure, the "Change-in-location/Sally & Ann task". Most TOM measures use visual support, with few relying solely on verbal information (e.g., "Faux pas task" used by Hoogenhout and Malcolm-Smith, 2014), and few being entirely non-verbal (e.g.: "Behavioral re-enactment procedure" used by Meltzoff, 1995) Only four measures using a questionnaire format were identified : "Everyday mindreading skills and difficulties scale"

* Number of TOM sub-abilities (out of 32) that were assessed using this mode of presentation in at least one measure and in at least one article.

(Peterson, Garnett, Kelly, & Attwood, 2009), "Theory of mind inventory" (Hutchins et al., 2008; Hutchins, Prelock, & Bonazinga, 2012), "Supplementary social and maladaptive items/Échelle d'adaptation sociale pour enfants" (Frith, Happe, & Siddons, 1994) and "Children's social understanding scale" (Tahiroglu et al., 2014). These are completed by parents and/or a third-party adult, such as a daycare provider or educator.

Number of items. The number of items in each measure vary from 1 to 54 in single category measures (Tables 2 to 9) and from 5 to 93 in comprehensive measures (Table 10). The number of items administered is highly variable from one study to another. For example, Wellman and Liu's "Theory of mind scale" (Wellman & Liu, 2004) is variably reported as being administered in 3,4,5,6 and 7-item formats, each using a different sampling of items from the original scale (e.g., (Davis, Meins, & Fernyhough, 2011; Dore & Lillard, 2015; Strasser & del Rio, 2014; Suway, Degnan, Sussman, & Fox, 2012; Wellman & Liu, 2004). Some authors also indicate that they used only a single task from the "Theory of mind scale" (e.g., O'Reilly, Peterson, & Wellman, 2014).

Scoring options. Many measures use a simple correct/incorrect scoring scheme (29 sub-abilities[†]) for the child's verbal (e.g., saying where a character will search for an object; Wang, Liu, & Su, 2014) or behavioral (e.g., giving the experimenter a book he showed a preference for; Laranjo, Bernier, Meins, & Carlson, 2010) response to test items. Some measures use a more elaborate scale or coding system (22 sub-abilities) to evaluate children's behavior (e.g., extent to which children adapt their behavior in order for their parent to see an object; Laranjo et al., 2010)

[†] Number of TOM sub-abilities (out of 32) that were scored using this method as presented in at least one measure and in at least one article.

or verbal explanation to open-ended questions (e.g., quality of justification when inferring an emotion; Nader-Grosbois, Houssa, & Mazzone, 2013). Timing and direction of eye gaze is also used as an indicator of TOM (9 sub-abilities), and assessed using observation coding systems (Poulin-Dubois & Yott, 2014) or eyetracking (Gliga, Senju, Pettinato, Charman, & Johnson, 2014). Of note, from one study to another, there are many adaptations of scoring schemes for the same measure. For example, in two studies using a "Change-in-location paradigm/Sally-Ann task" to assess false belief understanding, Adrian and colleagues (2005) asked questions and coded children's verbal answers in a correct/incorrect format, while Senju and colleagues (2011) coded children's eye movements using an eyetracker.

Administration time. While initially extracted from the articles included in the review, administration time was not reported in the final tables of results since only a small proportion (5.1%) of authors reported this information, and because it is highly probable that administration time varies substantially from one measure adaptation to another.

Psychometric properties. Basic information on internal structure and consistency, inter-rater reliability and test-retest reliability are listed in the tables of results (Tables 2 to 10) when available, along with the references providing this information. For many studies, the psychometric data was analysed using individuals pooled from many age groups and/or adverse conditions. For this reason, the reader is invited to directly consult the studies in order to carefully interpret the data provided. Some studies (e.g., Guajardo, Petersen, & Marshall, 2013; Yagmurlu, Berument, & Celimli, 2005) reported the psychometric properties of aggregates of TOM measures, but these were not included in the tables since they do not refer to one specific measure reviewed.

Internal structure and consistency. Internal consistency refers to the extent to which different items of an assessment tool are inter-correlated, and so refer to the same construct (Terwee et al., 2007). It is recommended to first analyse the structure of the measure, using factor analysis or principal component analysis, to determine/confirm the number of scales before measuring the internal consistency of each scale (Terwee et al., 2007). Internal consistency information was found for 34 TOM measures (19.0%) within 69 studies (9.2%). However, only nine measures also had formal structure analyses (5.0%): 3 emotions category measures and six comprehensive measures. Cronbach alpha is recognized as a good measure of internal consistency and is considered to be adequate when between .70 and .95 (Terwee et al., 2007). Only four measures had both their internal structure analysed and their Cronbach's alphas were always between .70 and .95 across all the included studies which provided both structure and consistency information: "Emotion Understanding Assessment" (Howlin, 1999), from the emotions category, and "Children's Social Understanding scale" (Tahiroglu et al., 2014), "TOM task battery" (Tiffany L. Hutchins, Prelock, & Chace, 2008) and "Social Meaning Scale (SELweb)" (McKown, Russo-Ponsaran, Johnson, Russo, & Allen, 2016), from the comprehensive measures category.

Reliability. Inter-rater reliability and test-retest reliability were reported using similar parameters. Weighted Cohen's Kappa coefficient is the most recommended method for reporting the reliability of ordinal measures, whereas an intraclass correlation coefficient is recommended for continuous measures (Terwee et al., 2007). Other reported inter-rater reliability parameters include percentage of agreement and Pearson correlations, which are judged as less adequate measures of reliability (Terwee et al., 2007). *Inter-rater reliability*: Inter-rater reliability was reported for 54 measures (30.3%) within 93 studies (12.4%). Weighted Cohen's Kappa is

available for 34 of these measures (19.0%), distributed through all TOM categories. Whenever reported, the Cohen's Kappa coefficients always met the 0.70 minimum standard for reliability (Terwee et al., 2007). *Test-retest reliability:* Test-retest reliability was tested in 14 measures (7.8%) within 13 studies (1.7%). Cohen's Kappa coefficient or intraclass correlation coefficient is available for seven measures (five in the Belief category, two in the Comprehensive measures category; 3.9%). The 0.70 minimal standard value was reached in one study for four measures: "Change-in-location paradigm/Sally-Ann task" (Baron-Cohen et al., 1985; Wimmer & Perner, 1983a), "Granddad story, Window story or Tom's crayon" (Astington, Pelletier, & Homer, 2002; Sullivan, Zaitchik, & Tager-Flusberg, 1994), "TOM test" (Muris et al., 1999) and "TOM task battery" (Hutchins et al., 2008).

Other psychometric information. Some studies (20 measures, 11.2%; 33 studies, 4.4%) also included other statistics related to a particular measure's psychometric properties. This information is detailed in the tables under "other psychometric information" and includes, for example, scalability (e.g., Guttman analyses) or construct validity testing, including analyses performed in order to test specific hypotheses regarding the construct validity of the measure (e.g., concurrent and discriminant validity). These additional types of psychometric properties were mostly tested in comprehensive measures (27 out of 33 studies providing specific validity information). In particular, each of the four questionnaires was reported to correlate with TOM scores from direct testing (Comte-Gervais, Giron, Soares-Boucaud, & Poussin, 2008; Houssa, Mazzone, & Nader-Grosbois, 2014; Hughes, Soares-Boucaud, Hochmann, & Frith, 1997; T. L. Hutchins et al., 2008; T. L. Hutchins et al., 2012; Peterson et al., 2009; Tahiroglu et al., 2014). Among the information retrieved for validity testing, only 6 measures explicitly tested and demonstrated the links between test scores and a measure of social ability: these were all from

the comprehensive measures except one test: “Theory of mind inventory” (Hutchins et al., 2012), “TOM storybooks” (Blijd-Hoogewys, van Geert, Serra, & Minderaa, 2008), TOM test (Muris et al., 1999), “TOM task battery” (Tiffany L. Hutchins et al., 2008), “Social meaning scale (SEL web” (McKown et al., 2016) and “Emotion situation knowledge task” (Garner, Jones, & Miner, 1994). It is important to note that only articles providing clear objectives to test the validity or fidelity of a measure were listed in the tables. However, multiple other articles may provide implicit cues regarding the validity of a measure, such as correlations with other relevant constructs.

Participant characteristics

Languages. While the majority of study samples were comprised exclusively of English-speaking participants (552 studies, 73.3%), some measures were also administered to children speaking 33 other languages (204 studies, 27.1%).

Age of typically developing children assessed. While this review specifically aimed to retrieve measures used with preschoolers, typically developing children and adolescents across the pediatric range have also been tested using the measures identified. The youngest typically developing participants reported were six months old (Sodian et al., 2016) and some studies included adults in their sample (Hirai et al., 2013; Reed, 1994). Infants have been tested using Intentions (age range: 6 months-17 years old), Percepts (age range: 11 months-40 years old), Desires (age range: 12 months- 11 years old), Beliefs (age range: 13 months-17 years old) and Knowledge (age range: 17 months- 25 years old) categories of TOM, whereas other categories

were limited to older preschoolers (Emotions: 23 months-11 years old; Deception/lies: 32 months-16 years old; Faux pas: 48 months-16 years old).

Adverse conditions. In addition to using the measures with typically developing participants, many researchers administered them to children, adolescents or adults with medical (e.g., deafness), psychological (e.g. anxiety or mood disorders), or environmental (i.e. low SES and maltreatment) adverse conditions (221 studies, 29.3%). Twenty-eight different conditions were studied using the included measures (Figure 2). The most frequently studied conditions were autistic spectrum disorders (102 studies, 13.5%), low socio-economic status (71 studies, 9.4%), hearing impairments and deafness (23 studies, 3.1%), intellectual disability and developmental delay (23 studies, 3.1%) and language impairments (19 studies, 2.5%).

Discussion

The peer-reviewed literature and relevant test publishers' catalogues were systematically studied in order to generate an inventory of existing TOM measures that have been used with children under six years of age. A total of 179 measures, identified through 753 studies, were found to assess the understanding of 8 different categories of mental states and social situations: Emotions, Desires, Intentions, Percepts, Knowledge, Beliefs, Deception/lies and Faux pas. In addition, a ninth category, Comprehensive measures, is comprised of tools assessing multiple categories. To our knowledge, this is the first time a comprehensive systematic review of all existing TOM measures has been performed for individuals of any age. This research extends the findings of previous non-systematic literature reviews in other populations (Hayward & Homer, 2017; Henry et al., 2015; Sprung, 2010) and of a systematic review of comprehensive and validated TOM measures in preschoolers (Ziatabar Ahmadi et al., 2015), and provides a

complete picture of existing TOM assessment methods that can be used with children under the age of six. Information gleaned from the measures and from the review as a whole provides an opportunity to identify some of the challenges and future directions associated with TOM assessment.

Contributions, challenges and possibilities in relation to TOM assessment

1) Diversity of TOM abilities. Synthesis of the data led to the identification of eight categories of mental states and social situations that can be targeted through TOM assessment in preschoolers. These were further divided into 32 distinct TOM sub-abilities that have been studied in preschool children. In the last 30 years, studies appear to have focused primarily on TOM abilities related to understanding of Beliefs (68% of studies), with very few studies focussing on other aspects of TOM, such as the understanding of Intentions (4.3% of studies), Knowledge (5.7% of studies) and Desires (7.0% of studies). However, it appears that an increasing number of studies use Comprehensive measures (23.2%) that tap more than one category of mental states and social situations understanding. These findings align with the remarks of a number of authors urging colleagues to diversify their sampling of TOM skills when assessing social cognition, in order to better capture its complex nature (Carlson et al., 2013; Hiller et al., 2014; Ziatabar Ahmadi et al., 2015). To this effect, Hiller and colleagues (2014) underscore the idea that isolated tests do not capture the rich manifestations of TOM abilities, limit the contributions of informative longitudinal assessment, and are an obstacle to our understanding of TOM development (Hiller et al., 2014). Social cues are among the most complex stimuli that the human brain has to process and are subject to both experiential and environmental influences; measures of social cognition should therefore reflect the complex nature of social stimuli and situations (Beauchamp, In press). The measurement of more diverse

TOM abilities, rather than a narrow focus on false belief understanding, could help enhance external validity, which was merely tested in the studies included in this review, and has not typically been supported in other research (Happé et al., 2017).

2) Applications/contributions of the TOM framework. This review of the literature led to the elaboration of a new TOM classification framework (8 categories, 32 sub-abilities). While its primary goal was to facilitate synthesis and to structure the presentation of the substantial amount of data collected, this empirically-driven framework also provides an exceptional opportunity to guide theoretical, methodological and clinical work pertaining to TOM. At a theoretical level, this TOM classification may contribute to better conceptualization of TOM as a construct, given that existing theoretical models mostly aim to explain the links between TOM and other socio-cognitive constructs, such as empathy, emotion recognition and pretend play (Abu-Akel & Shamay-Tsoory, 2011; Asakura & Inui, 2016; Bird & Viding, 2014; Happé et al., 2017; F. Happe & Frith, 2014; Leslie, 1987; Tager-Flusberg & Sullivan, 2000; Westby, 2014), but give few details on TOM itself. The lack of theoretical structure and shared taxonomy in TOM definitions and its underlying composition impedes our ability to fully integrate TOM in a coherent and comprehensive framework linking it to various socio-cognitive abilities, a pervasive issue observed across the social cognition domain (Beauchamp, In press; Happé et al., 2017). The classification proposed here provides a structure for detailing TOM sub-components and for associating then with a nomenclature that could be applied in other work. A fundamental strength of this proposed classification is that it stems directly from empirical work.

This classification may also contribute to guiding the development and interpretation of more comprehensive research protocols and clinical evaluations. The literature review indicated that many studies rely on the evaluation of limited TOM abilities, but also enabled us to

document all the abilities that have been assessed in preschoolers. This inventory may help enrich TOM evaluation by increasing and diversifying the TOM abilities that are targeted. It could also promote the creation of more comprehensive assessment tools, inspired by the multiple skills composing TOM and the variety of existing measurement methods highlighted in this review. In research and clinical settings, this also means that measures could be more precisely chosen and interpreted, targeting specific TOM abilities (Happé et al., 2017).

3) Diversity of measurement methods. This review sheds light on the creativity drawn on by those who develop new TOM measures, as reflected in the large variety of modes of presentation and administration of TOM tests: scenarios enacted directly with children and/or their entourage, scenarios enacted with the support of figurines, pictures, videos or audio-recordings, games played between the experimenter and the child, videogames, and so on. Measures have also been created or adapted for use with different populations, as evidenced by data showing they have been administered in 33 different languages and in the context of 28 distinct adverse conditions (e.g., hearing impairments, visual impairments, autistic spectrum disorders). Given that many other social measures have been limited to date to questionnaires (Crowe, Beauchamp, Catroppa, & Anderson, 2011), it is somewhat surprising that only four adult-report questionnaires were found that measure TOM in preschool children, and these were only used in 1.9% of studies. Direct testing with children is therefore largely prominent in TOM research and represents a strength in the domain, given that direct, laboratory testing provides an explicit opportunity for observing children's responses and may reduce bias associated with parental reports (Beauchamp, In press). However, sole reliance on direct testing may also have limits, as noted by Carlson (Carlson et al., 2013), who remarks that TOM studies often rely on a

single context (laboratory) and a single source of information (child). Given that triangulation of data is of great importance in clinical (American Educational Research Association & National Council on Measurement in Education, 2014; American Psychiatric Association, 2013) and research settings (Tashakkori & Teddlie, 2010), and given that TOM abilities exhibited in the laboratory are not consistently applied in everyday life (Happé et al., 2017), collecting third party observations on children's natural functioning in social environments via questionnaires or interviews could provide complementary information on behavioral aspects of TOM. Moreover, initial psychometric data on these questionnaire supports their convergent construct validity. Specifically, each of the four questionnaires was reported to correlate with TOM direct testing scores (Comte-Gervais et al., 2008; Houssa et al., 2014; Hughes et al., 1997; Hutchins et al., 2008; Hutchins et al., 2012; Peterson et al., 2009; Tahiroglu et al., 2014). Other promising avenues to conduct ecological evaluation are related to the use of virtual reality and naturalistic, real-world observation of children's behavior, approaches that have seldom been used to date, but that may become more feasible as technology advances and with greater awareness of the importance of real social stimuli in social cognitive assessment (Beauchamp, in press).

4) Enrichment of measurement tools. This literature review portrays the structure of TOM measures used to date. In particular, it was found that many measures reviewed here rely on only one or two test items when measuring a specific ability, essentially creating a "pass or fail" situation for the examinee, a problem which has also been raised by others (Cutting & Dunn, 1999; Garner et al., 2005). Such tools offer little score variation and sensitivity to qualify participants' social competence. Of note, the need to collect a sample of items large enough to adequately represent any psychological construct is a well-recognised issue in the establishment of adequate content validity and reliability (American Educational Research Association &

National Council on Measurement in Education, 2014; Slick, 2006). Given the numerous different measures listed in this review, the literature provides many examples of tests and test items that could be used in order to enrich the evaluation on any TOM category or sub-ability.

5) Standardization of TOM assessment. Performing this systematic review provided detailed information on the sizeable number of variations in single tasks across studies. Synthesizing the data extracted in this review presented a significant challenge, largely owing to the numerous "free" adaptations of unique measures found in the literature. This added a layer of complexity when deciding whether as adaptation of a measure or paradigm should be seen as distinct from the original or not. Problems associated with the wide assortment of TOM measures have previously been acknowledged and are thought to lead to poor comparability across studies (Hiller et al., 2014). This could an important issue since variations in the administration of a measure can have unfavourable consequence on the reliability of results (Slick, 2006). The inventory of TOM measures presented here provides a useful resource and key first step in identifying a TOM measure that fits a particular research or clinical need.

6) Psychometric properties of TOM measures. This systematic review confirms some of the critiques that have been raised regarding TOM psychometry (Hiller et al., 2014; Hutchins et al., 2008; Ziatabar Ahmadi et al., 2015). Notably, few TOM measures have empirically validated psychometric properties leading to the use of measures in research and practice for which reliability and validity are largely unknown: internal structure or internal consistency information was available for 34 measures, inter-rater reliability information was available for 54 measures, test-retest reliability was available for 14 measures, other psychometric information, including validity hypothesis testing, was available for only 20 measures. Nevertheless, the summary tables included here provide basic information to begin a more detailed search of

published psychometric properties for TOM measures. While pursuing such a search, readers are invited to exert their judgment about the psychometric properties reported and the methodological quality of the validation studies, since the same psychometric property may be more or less powerful depending on the design of the study (e.g., number of participants) and the characteristics of the measure (e.g., number of items). Guidelines providing criteria for evaluating the quality of measurement tools, such as those published by Terwee and colleagues (Terwee et al., 2007), may support scientists with regard to such questions by listing what are recognized as good psychometric properties and gold standard validation methodologies. Given the many adaptations of the same measures, it should also be noted that the psychometric properties are likely only to reflect the properties of the specific version of the measure used in the article listed, and not necessarily other adaptations of the measure. Of note, absence of psychometric properties for a specific measure does not reflect an absence of interest on the part of the authors in the psychometric properties of their assessment methods: some authors describe psychometric properties of aggregates of single measures (e.g., Guajardo et al., 2013; Yagmurlu et al., 2005), and these were not included in the current review since they did not refer to a specific measure.

Limitations

The results of this systematic review should be interpreted in the context of certain limitations. Given the large amount of search results obtained via electronic databases, publishers' catalogues and other sources (2224 records), additional searches of other sources of information, such as the screening of references in the 753 articles was not performed, even though it is possible that this may have revealed additional measures or additional information on the measures listed herein (Moher et al., 2015). Also, despite the numerous search terms used

and large amount of measures and articles found, the database search strategy failed to retrieve some pertinent articles (e.g. Meltzoff, 1995). This is probably partly due to the lack of common vocabulary in the field, with authors using different terms to refer to similar constructs somewhat interchangeably (i.e., “mentalizing”, “mind-reading” and “theory of mind”; Happé et al., 2017).

The existence of different theories and conceptualizations of TOM, inherent to the literature, should also be taken into account when interpreting the results of this review. The theoretical background (SOME model; Bird & Viding, 2014) used necessarily determined the inclusion and exclusion criteria. Using these criteria, this review excluded measures that other frameworks may have recognized as TOM tools. For example, measures that were judged to primarily assess classification of affective cues (e.g., "Reading the mind in the eyes task"; Baron-Cohen, Jolliffe, Mortimore, & Robertson, 1997) and cooperation and competition tasks were excluded (e.g., "Window task"; Russell, Mauthner, Sharpe, & Tidswell, 1991). Another method sometimes associated with TOM is to measure the use (e.g., number of mental state terms used by the child;"Internal state language questionnaire", Bellagamba, Laghi, Lonigro, Pace, & Longobardi, 2014) or understanding (e.g. understanding the difference between the words “know” and “believe”; "Certainty task", Adrian, Clemente, & Villanueva, 2007) of mental state language, and these tasks were not included. Nevertheless, the theoretical background used in this review is well supported by empirical data and meets the definition accepted by a majority of researchers, even though there is no actual consensus on the definition of TOM. Additionally, this review did not cover “control tasks”, that is, tasks that match TOM tasks in terms of cognitive demands and modes of presentation, but that do not require mental state inferences. For example, there exists a control task for the change-in-location paradigm called the “Natural false sign location” (e.g., Lackner, Sabbagh, Hallinan, Liu, & Holden, 2012). In this task, a character

likes to play in two different locations and usually uses a pointing gate to indicate where he is, until one day he switches location and fails to change the direction of the gate. The child needs to indicate the true location of the character. The use of control tasks is increasingly recommended in order to take into account the confounding effect of general cognitive abilities and to identify specific social cognition impairments (Henry et al., 2016).

Given the large amount of measures and studies included in this review, substantial efforts have been made to provide useful, organized and concise tables of results. However, this synthesis has consequences on the level of detail of the data reported. The proposed classification of measures within TOM categories and abilities is necessarily reductionist with regard to the numerous differences between and among measures, since a same measure/paradigm may tap more than one TOM category or ability. Measures grouped under one category or ability may present very different characteristics in terms of methods, modes of presentation, and task demands, which may impact child performance (Abu-Akel & Bailey, 2001; Geangu, 2002).

Conclusions

This systematic review of TOM measures destined for preschoolers identified 753 articles and 179 measures published in the last 30 years that have been administered in 33 different languages and in the context of 28 different medical, psychological and environmental adverse conditions, confirming the preponderance of TOM in many domains of research and practice. The detailed inventory of preschool TOM measures is accompanied by an empirically-driven classification of TOM categories of mental states and social situation understanding. The TOM framework pertains to categories and abilities that have been used in previous research

with preschoolers. The findings associated with the review underscore a number of important challenges in TOM assessment. Given that interest in TOM and associated social cognitive constructs persists across social psychology, developmental psychology, neuropsychology and neuroscience research, and that the need to assess and intervene within these domains is now recognized clinically (Beauchamp, In press; Henry et al., 2016; Hoddenbach et al., 2012; Lecce, Bianco, Devine, Hughes, & Banerjee, 2014; Sprung, 2010; Steerneman, Jackson, Pelzer, & Muris, 1996), this inventory of TOM measures contributes to both fundamental science and clinical practice.

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Table 1

Eligibility and exclusion criteria for the systematic review

Eligibility Criteria	Exclusion criteria
The document is accessible, in its full version, at the time of the search	Missing document: The document's reference is incomplete and does not allow identification of the full text or full text could not be found
	Unpublished: The document is not published or in press, or the in-press content is not accessible
The document is written in English or French. A list of possibly relevant titles in other languages is provided as supplemental material (Appendix I)	Other language: The document is written in another language than English or French
The document is from a peer-reviewed journal or published by a test publisher/editor	Non-reviewed or non-commercialized: The document is not published in a peer reviewed journal (e.g., books, book chapters, conference proceedings, are excluded), nor is it commercialized
The document reports the results of an empirical study, providing original data	Not an empirical study: The records do not report a study providing original data (e.g., theoretical articles, literature reviews, letters, editorials, etc.)
The measure is used with human subjects	Non-human subjects: The measure was not administered to humans (e.g., animal studies)
The measure is administered to preschool children (less than 6 years of age). Studies with participants 6 years of age or over are included, provided the sample is also composed of children under 6 years. The sample may be composed of adults, as long as the measure aims to evaluate TOM in a child under 6 years of age (e.g., parental report in a questionnaire)	Older participants: The measure is not administered to a child under 6 years of age
The measure provides a score or a classification. Subjective (i.e. questionnaires) or objective (i.e. direct testing, observational coding systems) are included	Lack of score: The measure does not provide a score or classification reflecting an individual's TOM (e.g., research paradigms used to solicit TOM during neuroimaging, but that do not score the participant's TOM abilities)
The measure can be used to assess TOM in normative or clinical conditions (physical, psychological or neurological)	Narrow utility: The measure is useful only in the case of a specific condition (e.g., blindness)

The measure aims to evaluate TOM as defined in the introduction, that is the ability to create a cognitive representation of self and other's mental states (SOME; (Bird & Viding, 2014)	No TOM or diverging TOM definition : The measure does not assess TOM or does not assess it in a way that is consistent with the chosen theoretical framework (Bird & Viding, 2014). Measures that assess a more complex social behavior or ability (e.g., moral reasoning), a precursor social cognitive skill (e.g., joint attention), or another social cognitive construct (e.g., empathy, affective cues classification) are excluded

Table 11

TOM categories and sub-abilities and associated number of measures and articles

Mental states and social situations categories	**TOM sub-abilities**	**Examples of measures/paradigms**	**Number of measures n (%)**	**Number of articles n (%)**
Emotions	1. Inferring a person's emotional reactions based on situations that typically elicit certain emotions/inferring a preceding event based on a person's emotional reaction	Affective knowledge understanding (Knafo et al., 2009)	14 (7.8%)	45 (6.0%)
	2. Inferring or explaining a person's emotional reactions based on situations eliciting emotions that are atypical compared to what is usually expected	Affective perspective-taking (Denham, 1986)	5 (2.8%)	41 (5.4%)
	3. Understanding that people may have discrepant feelings about an event	Affective perspective taking (Borke, 1971; SMITH, 1973)	1 (0.6%)	4 (0.1%)
	4. Understanding that people may feel mixed emotions or different emotions successively	Mixed emotion understanding task (Gordis, 1989)	2 (1.1%)	6 (0.8%)
	5. Comprehensive measure involving emotion understanding based on different factors/TOM categories (e.g., desires, beliefs, hiding emotions)	Test of emotion comprehension (Pons, 2000)	2 (1.1%)	14 (1.9%)
		Emotions category totals	24 (14.3%)	103 (13.7%)
Desires	1. Understanding that different people may have discrepant desires	Discrepant desires/Yummy-yucky task (Repacholi & Gopnik, 1997)	10 (5.6%)	31 (4.1%)
	2. Understanding the co-existence of multiple desires simultaneously or successively in one person	Multiple desires task (Bennett & Galpert, 1993)	5 (2.8%)	5 (0.7%)
	3. Understanding that people's emotions and actions are influenced by their desires/preferences	Desires task (H. M. Wellman & Bartsch, 1988; H. M. Wellman & Woolley, 1990)	6 (3.4%)	22 (2.9%)
		Desires category totals	21 (11.7%)	53 (7.0%)

Intentions	1. Understanding another person's intent, as demonstrated by completing their failed action	Behavioral re-enactment procedure (Meltzoff, 1995)	1 (0.6%)	10 (1.3%)
	2. Understanding that identical actions/results can be achieved with different intentions	Accidental transgression task (MoToM; (Killen, Lynn Mulvey, Richardson, Jampol, & Woodward, 2011)	7 (3.9%)	11 (1.5%)
	3. Predicting people's actions based on their intentions	Attention to intention (Phillips, Wellman, & Spelke, 2002)	5 (2.8%)	11 (1.5%)
	4. Tendency to attribute intentions to ambiguous visual figures	Valley task (Castelli, 2006)	1 (0.6%)	1 (0.1%)
	5. Producing plausible intention explanations for different types of observed social events	Intentions explanations (Smiley, 2001)	1 (0.6%)	1 (0.1%)
		Intentions category totals	15 (8.4%)	32 (4.3%)
Percepts	1. Acknowledging that others have different visual percepts and adopting the visual perspective of another person (i.e., simple visual perspective taking)	Visual perspective taking, Level 1/Picture identification task (Flavell, Everett, Croft, & Flavell, 1981; Masangkay et al., 1974)	15 (8.4%)	73 (9.7%)
	2. Adopting another person's visual perspective in tasks demanding complex mental rotation or visualisation (i.e., complex visual perspective taking)	Visual perspective taking and spatial construction task (Ebersbach, Stiehler, & Asmus, 2011)	9 (5.0%)	13 (1.7%)
	3. Considering the auditory percepts of another person	Auditory perspective taking (Williamson, Brooks, & Meltzoff, 2015)	1 (0.6%)	1 (0.1%)
		Percepts category totals	25 (14.0%)	85 (11.3%)
Knowledge	1. Understanding that someone who does not know something exists cannot engage in "pretend play" that incorporates that knowledge	Sarah task (Aronson & Golomb, 1999)	2 (1.1%)	2 (0.3%)
	2. Understanding that someone who does not have access to perceptual information (i.e. by looking, hearing, etc.) may not have access to knowledge	See-know task (Pillow, 1989; Ruffman & Olson, 1989)	11 (6.1%)	33 (4.4%)
	3. Understanding that someone who was not informed or is not familiar with something may not know	Awareness of a reader's knowledge task (Peskin, Prusky, & Comay, 2014)	6 (3.4%)	8 (1.1%)
	4 Understanding that something new is more interesting to someone than something already known	Familiary-focus of attention (Moll, Koring, Carpenter, & Tomasello, 2006)	1 (0.6%)	1 (0.1%)

		Knowledge category totals	20 (11.1%)	43 (5.7%)
Beliefs	1. Familiar container with an unexpected content: Understanding the false belief held by someone who never opened the container	Content false belief paradigm (Hogrefe, Wimmer, & Perner, 1986; Perner, Leekam, & Wimmer, 1987)	3 (1.8%)	289 (38.4%)
	2. Unseen change: Understanding the false belief held by someone who did not witness or was not informed of a displacement or change of action	Change-in-location paradigm/Sally-Ann task, (Baron-Cohen et al., 1985; Wimmer & Perner, 1983a)	5 (2.8%)	348 (46.2%)
	3. Understanding that when something looks/sounds/smells like something else, a person may hold a false belief about its identity	Appearance-reality test (Flavell, Green, Flavell, Watson, & Campione, 1986)	16 (8.9%)	135 (17.9%)
	4. Second-order belief: understanding the second-order belief or false belief held by someone who doe not know somebody else was informed (e.g., of a misleading identity, a misleading location, etc.)	Ice-cream van test (Perner & Wimmer, 1985)	7 (3.9%)	78 (10.4%)
	5. Inferring another person's action based on their stated false belief	The Tom task (Swettenham, 1996)	3 (1.8%)	19 (2.5%)
	6. Understanding the false belief created when a predictable sequence of stimuli is broken with the intrusion of an unexpected stimulus	Unexpected outcome (Brambring & Asbrock, 2010)	1 (0.6%)	1 (0.1%)
	7. Comprehensive measures of understanding beliefs	Battery of TOM tasks (Hughes et al., 2000)	5 (2.8%)	19 (2.5%)
		Beliefs category totals	40 (22.3%)	515 (68.4%)
Deception/lies	1. Understanding that someone may consciously lie about the location/content of an object in order to achieve a goal	Deception task (Guajardo & Watson, 2002)	2 (1.1%)	6 (0.8%)
	2. Understanding that other people may hide their emotions	Appearance reality of emotions (Harris, Donnelly, Guz, & Pitt-Watson, 1986)	3 (1.8%)	17 (2.3%)
	3. Understanding that other people may lie in order to be ironic/sarcastic	Lies and jokes task (Sullivan, Winner, & Hopfield, 1995)	2 (1.1%)	3 (0.4%)
	4. Measures tapping multiple aspects of lie comprehension	Strange stories (F. G. Happe, 1994)	2 (1.1%)	22 (2.9%)
		Deception/lies category totals	9 (5.0%)	51 (6.8%)

Faux pas	1. Ability to recognize “faux-pas” (social gaffe) situations	Recognition of faux pas (Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999)	1 (0.6%)	4 (0.5%)

Note. Percentages are calculated using the total number of measures (179) and studies (753) included in the review. Some TOM category total of articles are lower than the sum of articles assessing its sub-abilities because each article may assess more than one sub-ability.

Table 12

Comprehensive measures and associated number of measures and articles

Formats	**Examples of measure**	**Number of measures n (%)**	**Number of articles n (%)**
1. Multiple TOM abilities measured using questionnaires/interviews	Theory of mind inventory (ToMI) (Hutchins et al., 2012)	4 (2,2%)	14 (1,9%)
2. Multiple TOM abilities measured using direct testing	ToM scale (H. M. Wellman & Liu, 2004)	20 (11,1%)	161 (21.4%)
	Total comprehensive measures	24 (13,4%)	174 (23.2%)

Note. Percentages are calculated using the total number of measures (179) and studies (753) included in the review.

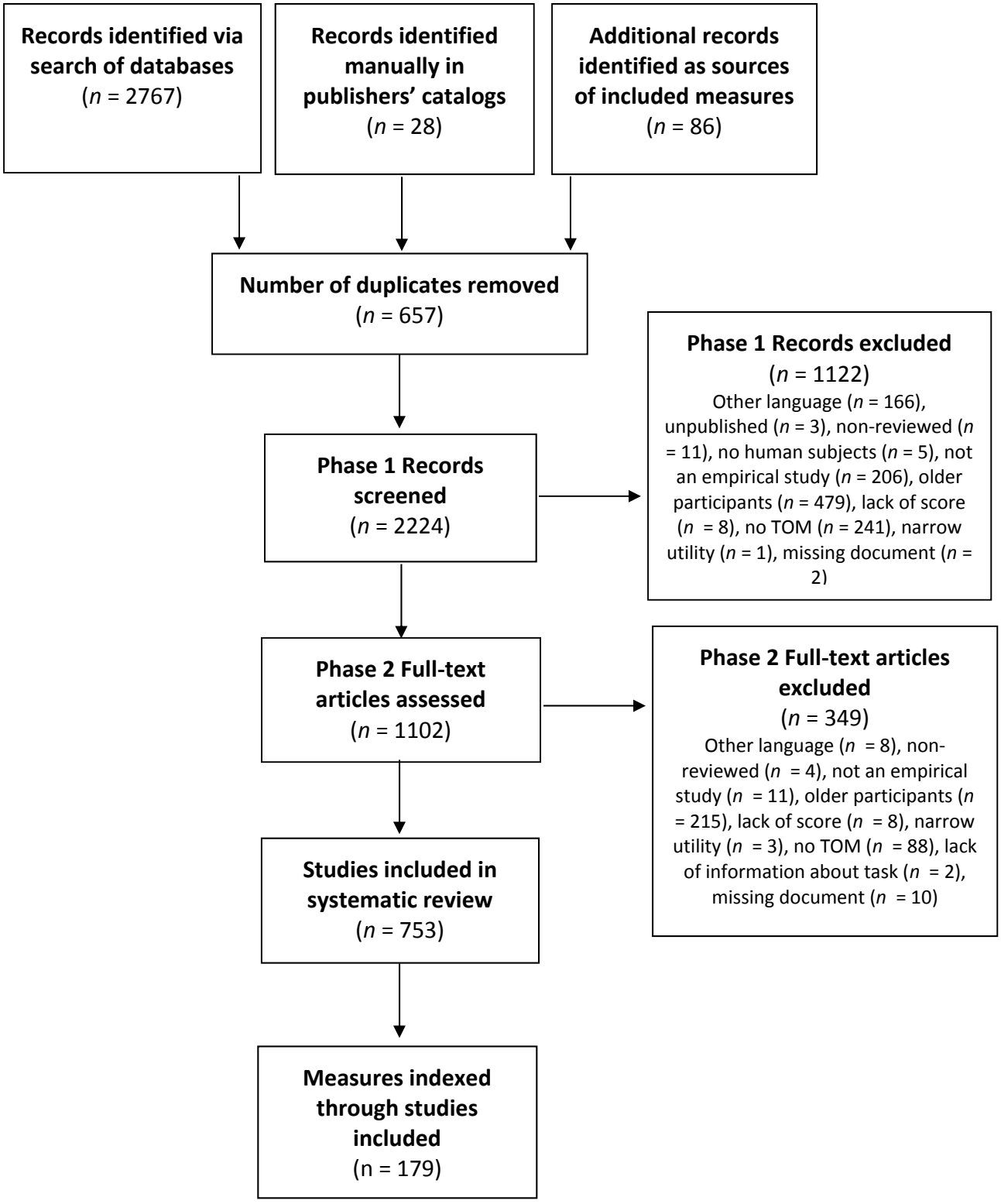

Figure 1. Flowchart of study identification and selection.

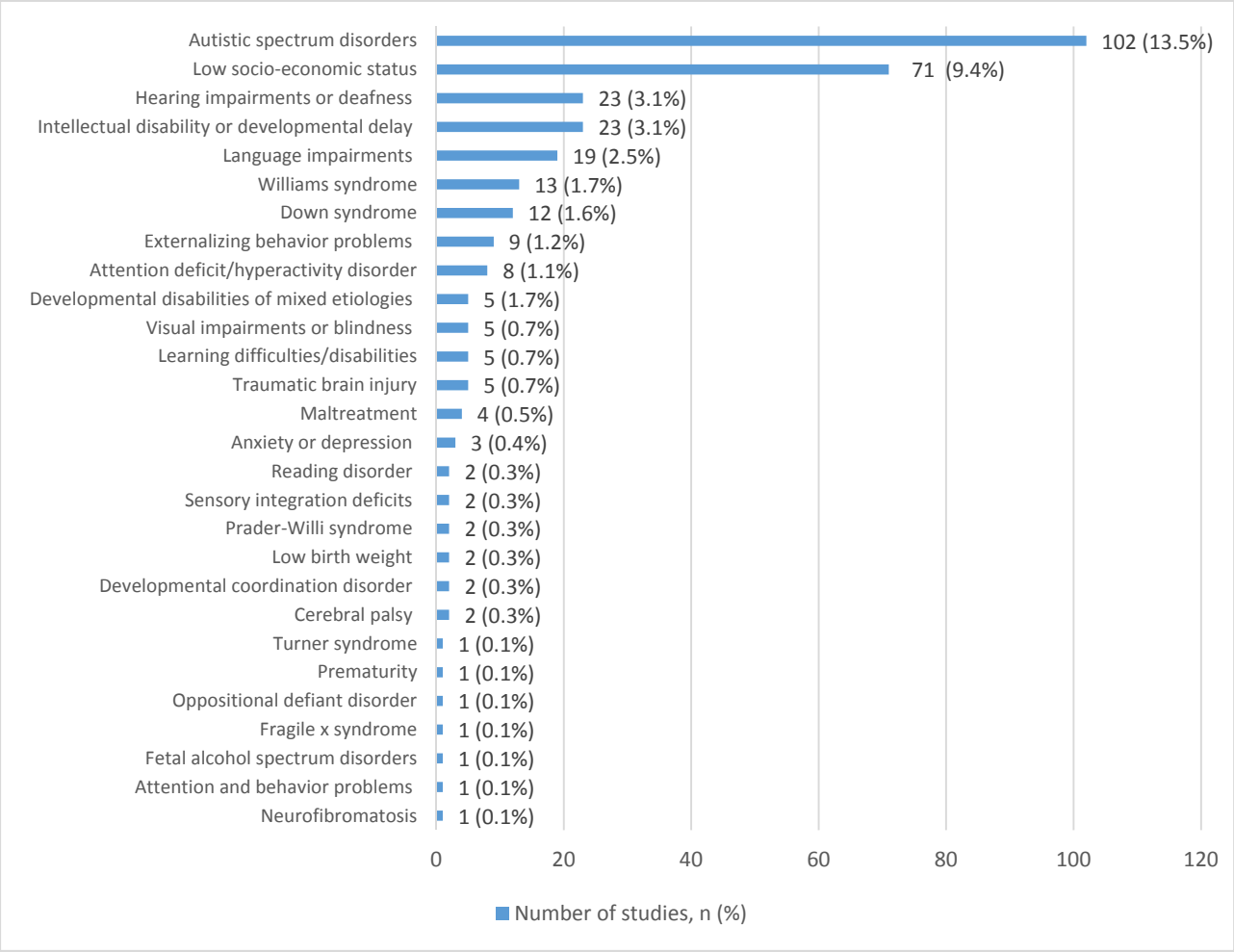

Figure 2. Number of studies including samples of children exposed to adverse medical, psychological or environmental conditions (n studies, %).

Conclusion générale

La présente étude visait à créer un inventaire des outils de mesures de la TDE destinés aux enfants âgés de 0 à 5 ans, de même qu'à identifier les forces et les défis de l'évaluation de la TDE. Pour ce faire, une revue systématique de la littérature scientifique des 30 dernières années a été effectuée, et les catalogues des plus importants éditeurs de matériel d'évaluation francophones et anglophones ont été révisés. Cette démarche a permis de répertorier 179 outils de mesure différents, utilisés dans les 753 articles inclus. En parallèle, une nouvelle classification de la TDE a été élaborée et permet de distinguer 32 sous-habiletés distinctes se rapportant à la compréhension de huit catégories d'états mentaux et de situations sociales : Émotions, Désirs, Intentions, Percepts, Connaissances, Croyances, Tromperie/mensonge et Faux pas sociaux. La synthèse de la grande quantité d'informations récoltées a présenté l'occasion de faire le point sur les méthodes d'évaluation de la TDE utilisées en recherche auprès des jeunes enfants. En particulier, plusieurs forces méthodologiques dans le domaine ont été constatées, dont la grande variété de modes de présentation des tests (jeux, vidéos, livres d'histoires, images, etc.) et de leurs méthodes de notation (réponses verbales, codifications du comportement, suivi du regard, etc.). De plus, la créativité des auteurs dans l'élaboration de paradigmes d'évaluation appropriés aux très jeunes enfants, comme des tâches non-verbales et des activités ludiques, doit être soulignée. Il en va de même pour l'adaptation des tests aux enfants présentant des conditions médicales ou développementales (ex. : surdité, cécité et troubles du langage). Néanmoins, plusieurs enjeux entourant l'évaluation de la TDE ont également été remarqués, en particulier le petit nombre d'items présents dans de nombreux tests, le manque de standardisation, le manque d'information sur les qualités psychométriques et la lourde tendance à se concentrer sur

l'évaluation de la catégorie de la compréhension des croyances au détriment des autres catégories et sous-habiletés de la TDE.

Classification des catégories et sous-habiletés de la TDE : un apport théorique et méthodologique

Un apport intéressant de cette recherche est l'élaboration d'une nouvelle classification de la TDE (8 catégories, 32 habiletés). D'abord motivée par un besoin de qualifier et synthétiser la grande quantité d'informations récoltées, la création de cette classification présente également le potentiel de structurer une démarche théorique, méthodologique et clinique entourant la TDE. Au niveau théorique, cette classification pourrait permettre d'amorcer une réflexion concernant le construit de la TDE en lui-même, et ainsi combler un manque dans la documentation scientifique. En effet, les modèles théoriques actuels semblent surtout s'attacher à décrire les relations qu'entretient la TDE avec d'autres construits socio-cognitifs, comme l'empathie, la reconnaissance d'émotions faciales ou la capacité à « faire semblant » (*pretend play)* (Abu-Akel & Shamay-Tsoory, 2011; Asakura & Inui, 2016; Bird & Viding, 2014; Happé, Cook, & Bird, 2017; Happe & Frith, 2014; Leslie, 1987; Tager-Flusberg & Sullivan, 2000; Westby, 2014), mais s'attardent peu à décrire le construit de TDE en lui-même. Cette absence de structure théorique et de taxonomie commune dans la définition de la TDE et des éléments qui la composent nuit à la capacité des chercheurs et des cliniciens à bien l'intégrer dans un modèle cohérent reliant les différentes habiletés socio-cognitives, un problème qui se retrouve dans le domaine de la cognition sociale en général (Beauchamp, In press; Happé et al., 2017). La classification proposée dans ce projet de recherche, incluant huit catégories d'états mentaux et situations sociales ainsi que 32 sous-habiletés de la TDE, permet de se créer une représentation plus

complète des composantes du construit de la TDE et de les nommer. Une des forces de cette classification est d'être issue directement des études empiriques passées.

Cette classification présente également le potentiel d'organiser l'évaluation de la TDE. En effet, alors que cette recherche a démontré que la majorité des études sur la TDE reposent sur l'évaluation de quelques sous-habiletés de TDE, cette étude a permis de faire l'inventaire de l'ensemble des catégories d'états mentaux et situations sociales et des sous-habiletés évaluées par le passé chez les enfants d'âge préscolaires. Cet inventaire peut permettre d'enrichir l'évaluation de la TDE par le biais de l'augmentation et la diversification des sous-habiletés de la TDE ciblées, en s'appuyant sur les nombreuses possibilités d'évaluation qu'il contient. Au niveau de la recherche comme de la clinique, ceci signifie aussi que les outils de mesure peuvent être plus précisément choisis et interprétés, en ciblant spécifiquement les sous-habiletés de la TDE (Happé et al., 2017).

Évaluation de la TDE en neuropsychologie clinique

La présente étude a fourni l'occasion de constater et discuter les défis et possibilités associées à l'évaluation de la TDE, principalement dans le domaine de la recherche. Il demeure néanmoins crucial de se questionner sur l'évaluation de la TDE en neuropsychologie clinique, sachant que la cognition sociale fait maintenant partie des domaines cognitifs qui sont jugés importants de considérer lors du diagnostic d'un trouble neurocognitif, au même titre que l'attention, les fonctions exécutives, le langage, l'apprentissage et la mémoire (American Psychiatric Association, 2013). De plus, nous savons maintenant que la TDE tend à être affectée chez plusieurs populations qui ont recours à l'évaluation neuropsychologique. C'est le cas, entre

autres, des individus présentant un trouble du spectre de l'autisme (Chung, Barch, & Strube, 2014), un trouble déficitaire de l'attention/hyperactivité (E. Bora & Pantelis, 2016), un trouble du langage (Stanzione & Schick, 2014), une schizophrénie (Chung et al., 2014), une épilepsie (Emre Bora & Meletti, 2016), un traumatisme cranio-cérébral (Bellerose, Bernier, Beaudoin, Gravel, & Beauchamp, 2017) ou un syndrome X-fragile (Turkstra, Abbeduto, & Meulenbroek, 2014).

Compte tenu de l'importance grandissante de l'évaluation de la TDE en neuropsychologie clinique, il fut étonnant de constater qu'un seul outil d'évaluation de la TDE chez les moins de 6 ans a pu être retracé dans les catalogues des neuf éditeurs de matériel d'évaluation consultés : le sous-test « Théorie de l'esprit » de la batterie NEPSY-II (Korkman, Kirk, Kemp, 2007; Korkman, Kirk, Kemp, 2012). Néanmoins, cet outil de mesure de la TDE est parmi ceux dont les qualités psychométriques ont été les plus détaillées, est formellement standardisé et est le seul à fournir des normes pour guider l'interprétation. Toutefois, il n'est pas destiné aux enfants de moins de 5 ans, laissant bon nombre d'enfants d'âge préscolaire sans outil d'évaluation normalisé. De plus, un examen plus attentif des qualités psychométriques du sous-test « Théorie de l'esprit », présenté dans le manuel de la batterie compréhensive de tests neuropsychologiques NEPSY-II, révèle des faiblesses, à tout le moins chez les enfants de 5 ans. Au niveau de la validité de construit, le sous-test n'est pas parvenu à distinguer les autistes de haut niveau des enfants typiques, et au niveau de l'interprétation, les normes francophones ont été réalisées auprès de 30 enfants de 5 ans seulement (Korkman, Kirk, Kemp, 2012).

Sachant combien la standardisation et l'appui sur des normes adéquates et de bonnes qualités psychométriques sont au cœur de l'évaluation neuropsychologique (Beauchamp, In press), l'évaluation de la TDE, tout comme l'évaluation des autres aspects de la cognition sociale, semble en retard comparativement à l'évaluation d'autres domaines de la cognition (Beauchamp, In press) et nécessitera la création de nouveaux outils ou l'adaptation et la standardisation d'outils de mesures existants. Les impacts possible de légères adaptations à un test, illustrés par les exemples présentés dans ce projet, mettent également en garde le clinicien face à l'interprétation d'un test standardisé dont les consignes ou le matériel ont été librement adaptés (Abu-Akel & Bailey, 2001; Adrien et al., 1995; Battacchi et al., 1997; Cassidy, 1998; Geangu, 2002).

Bon nombre d'éléments devront être pris en compte lors de la création d'outils de mesure ou de la planification d'une évaluation clinique de la TDE. En particulier, plusieurs facteurs confondants peuvent contaminer les outils de mesures, tout comme c'est le cas pour la plupart, sinon tous les tests cognitifs (Lezak, Howiwson, Bigler, & Travel, 2012). Plusieurs de ces facteurs ont été déjà été identifiés grâce à la multitude d'études passées dans le domaine de la TDE. Par exemple, nous savons que les habiletés langagières et la mémoire verbale à court terme sont cruciales à la compréhension des scénarios et syntaxes complexes souvent utilisées dans les tests de TDE (Abu-Akel & Bailey, 2001; Keenan, 1998; C. A. Miller, 2001; van Buijsen, Hendriks, Ketelaars, & Verhoeven, 2011), ce qui mène des auteurs à suggérer de limiter la composante verbale dans les tests (Miller, 2001), conseil qui devrait d'autant plus être appliqué lors de l'évaluation clinique auprès d'individus aux prises avec des difficultés langagières. Néanmoins, la TDE, à titre d'habileté complexe et de haut niveau, implique nécessairement le

bon fonctionnement de nombreuses fonctions cognitives et ne pourra probablement jamais être complètement isolée grâce à un outil de mesure. L'utilisation de méthodes d'évaluation de la TDE variées, dont les niveaux de complexité des fonctions cognitives confondantes varient, associées à une anamnèse rigoureuse, une évaluation neuropsychologique complète et le jugement clinique devront toujours être mis à contribution afin de cibler les causes des difficultés observées. Une stratégie fort prometteuse afin de départager les difficultés spécifiques à la TDE de celles dues à d'autres faiblesses cognitives est l'utilisation de tâches contrôles en concomitance avec les mesures de TDE, soient des tâches qui sont intimement semblables à la mesure de TDE visée en termes de diverses demandes cognitives (fonctions exécutives, langagières, etc.), mais qui ne requièrent pas l'inférence d'états mentaux (Henry, von Hippel, Molenberghs, Lee, & Sachdev, 2016).

Alors que le passage en revue des facteurs pouvant influencer la performance aux tests de TDE pourrait faire l'objet d'une étude à part entière, il peut être utile de considérer les recommandations générales élaborées par Beauchamp (Beauchamp, In press) concernant l'évaluation de la cognition sociale en neuropsychologie clinique. En particulier, les recommandations se rapportant à la conception et la structure des mesures de cognition sociale peuvent s'avérer pertinentes lors du choix et la conception d'outils de mesure de la TDE. Celles-ci suggèrent, par exemples, d'utiliser si possible des stimuli qui permettent au sujet de participer aux processus sociaux *in vivo*, qui représentent des situations qui risquent de lui être familières, et dont la méthode de notation offre une étendue adéquate de valeurs pour distinguer des différences cliniquement significatives et ainsi favoriser l'interprétation (Beauchamp, In press). Ces recommandations paraissent particulièrement pertinentes au domaine de la TDE, puisque tel que mentionné précédemment, des critiques ont été formulées à l'égard de chacun de ces points

au sujet des méthodes habituelles d'évaluation de la TDE (Adrien et al., 1995; Battacchi et al., 1997; Cutting & Dunn, 1999). Malheureusement, cette revue de la littérature n'a pas permis d'identifier un outil de mesure de la TDE qui réponde à l'ensemble de ces recommandations.

Par ailleurs, outre le problème de la complexité des tests de la TDE, il nous apparaît important de souligner que les habiletés de TDE, par leur complexité intrinsèque, semblent en elles-mêmes dépendantes de plusieurs autres fonctions cognitives et ce, non seulement dans les tests, mais également dans la vie quotidienne. Ainsi, des difficultés de TDE dans la vie quotidienne pourrait survenir en raison de difficultés langagières ou exécutives. Observées sous cet angle, les difficultés de TDE mis des en lumière dans des outils d'évaluation complexes peuvent être un reflet utile et informatif des difficultés de TDE vécues au quotidien, même si elles ne sont pas spécifiques uniquement aux habiletés de TDE.

Avenues futures

Bien que du travail reste à faire avant que la cognition sociale et la TDE ne fassent partie intégrante de l'évaluation neuropsychologique standard, cette revue systématique des outils de mesures de la TDE destinées aux enfants d'âge préscolaire se veut un pas de plus vers la possibilité d'évaluer la TDE de façon spécifique, détaillée, standardisée, sensible au développement, fiable et valide d'un point de vue psychométrique. Les prochaines étapes vers un tel objectif pourraient inclure la revue systématique des qualités psychométriques connues des outils d'évaluation répertoriés. Compte tenu de la pauvreté de nos connaissances sur les propriétés psychométriques des outils de mesures et l'absence de normes adéquates, la poursuite de la validation et de la normalisation de ces outils seraient nécessairement à envisager. Enfin, les vastes connaissances empiriques déjà existantes dans le domaine de la TDE, telles celles

concernant les facteurs qui influencent la performance aux tests (ex. : habiletés verbales, mémoire auditive immédiate, mémoire de travail et fonctions exécutives; Abu-Akel & Bailey, 2001; Albertson & Shore, 2008; Keenan, 1998; Miller, 2001; van Buijsen et al., 2011), pourront être utilisées afin d'améliorer ou de créer de nouveaux outils de mesures répondant aux critères méthodologiques et psychométriques les plus élevés. Un travail similaire devrait également être envisagé pour les outils de mesures de la TDE auprès de différents groupes d'âge, compte tenu du développement au long cours de cette habileté et de la nécessité d'adapter les outils de mesures à cette trajectoire développementale. Par ailleurs, plus les méthodes d'évaluation de la TDE et de la cognition sociale se standardiseront, plus il sera possible de dégager une « signature cognitive » des difficultés socio-cognitives associées à divers troubles neuropsychologiques, signature qui pourra guider l'interprétation clinique.

L'amélioration des méthodes d'évaluation de la cognition sociale, dont la TDE, est un passage obligé vers une meilleure compréhension du fonctionnement cognitif et social des individus, tant d'un point de vue fondamental que clinique. Alors que la TDE est un sujet d'étude très prolifique depuis plus de 40 ans, les chercheurs et cliniciens d'aujourd'hui ont la chance de pouvoir s'appuyer sur l'incroyable banque de données à leur disposition pour générer les meilleures pratiques d'évaluation qui soient.

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Appendice I

Liste d'articles possiblement pertinents rédigés dans une autre langue que le français ou l'anglais

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Appendice II

Tableaux de résultats 2 à 10

Table 2

Measures related to TOM – Emotions category

			Measures characteristics							Participants characteristics		
TOM abilities	**Measures (source author, year) [articles using this measure]**		**Internal structure and consistency information**	**Inter-rater reliability information**	**Test-retest reliability information**	**Other psychometric information**	**Modes of presentation**	**Number of items**	**Scoring options**	**Age ranges in TD population (months)**	**Languages**	**Adverse conditions**
Inferring a person's emotional reactions based on situations that typically elicit certain emotions/ inferring a preceding event based on a person's emotional reaction	a)	Social behavior and social situation subscales from the Assessment of children's emotion's skills (Schultz, Izard and Bear, 2004) [1]	a) -	a) –	a) –	b) Associated with prosocial behavior and emotion recogni-tion [2]	Direct testing using interview, short stories read aloud or audiotaped with or without pictures or photographs, computerized games	1 to 54	Correct/ incorrect, rating scales or coding of number of emotions named by the child	a) 41-61	Hebrew [37, 38]	Low SES [2-5]
	b)	Emotion situation knowledge task (Garner et al.,1994) [2, 3]	b) Cronbach's α: .66-.87 [2]	b) –	b) –					b) None	Spanish [5-7]	ASD [4, 8, 11]
	c)	Level 3 to 5 of the Emotion understanding assessment (Howlin, Baron-Cohen, & Hadwin, 1999) [4-12]	c) Structure analyzes were performed; Cronbach's α: .75-0.89; [5, 7, 12]	c) –	c) *r* = .54-.86 [5, 7]					c) 36-73	Japanese [13]	ADHD [4]
	d)	Emotion-situation task (Taumoepeau & Ruffman, 2006) [13, 14]	d) –	d) –	d) –					d) 23-39	French [16, 19-26]	ODD [4]
	e)	Emotional perspective taking task (Harwood & Farrar, 2006) [15-17]	e) –	e) –	e)					e) 36-76	Dutch [27, 44]	Low birth weight [9]
	f)	Parent-child affective perspective-taking scale (MacQuiddy, Maise & Hamilton, 1987) [18]	f) –	f) –	f) –					f) 67-96	Portuguese [11]	Behavior problems [18]
	g)	The cause of emotion task (Nader-Grosbois, Thirion-Marissiaux & Grosbois, 2008, Unpublished manual) [19-26]	g) –	g) –	g) –					g) 25-83	German [40]	Intellec-tual disability or develop-mental delay [19-24]
	h)	The embarrassment task (Colonnesi, 2010) [27]	h) –	h) –	h) –					h) 48-108	Chinese [42]	
	i)	Affective perspective taking (Cassidy, Parke, Butkovsky, and Braugart, 1992) [2, 28-33]	i) Structure analyzes were performed; Cronbach's α = .66-.85 [2, 33, 46]	i) Cohen's κ = 0.78-1.0 [2, 30-33]	i) –					i) 36-71		
	j)	Description of emotional situation (Feshbach & Cohen, 1988) [34]	j) –	j) % agreement = 100% [34]	j) –					j) 36-71		Hearing impair-ments or deafness [44]
	k)	Emotion recognition questionnaire (Ribordy, Camras, Stefani, & Spaccarelli, 1988) [35-39]	k) Structure analyzes were performed; Cronbach's α = .58-.73 [35, 37-39]	k) –	k) –					k) 36-72		
	l)	Affective perspective taking (Paulus & Leitherer, 2017) [40]	l) –	l) –	l) –					l) 57-72		

	m)	Knowledge of emotion cause (Denham, Zoller & Couchoud, 1994) [41, 42]		m) Cohen's κ = .76-.83 [41]	m) –					m) 35-132	
	n)	Emotion attribution in prototypical situation (Wiefferink et al., 2013)[43-45]	m) –	n) –	n) –					n) 30-77	
			n) –								
Inferring or explaining a person's emotional reactions based on situations eliciting emotions that are atypical compared to what is usually expected	a)	Affective perspective-taking tests (Denham, 1986) [2, 29, 30, 32, 41, 47-76]	a) Cronbach's α = .73- .93 [2, 30, 32, 67, 76]	a) % agreement = 100%; *r* = .75-90 [75]	a) –	Direct testing using figurines or pictures	4 to 23	Correct/ incorrect or rating scales	a) 24-96	Mandarin [58] Hebrew [69] Italian [72]	Maltreat-ment [52] Low SES [52, 53] ASD [77, 78] Language impair-ments [77] Developm ental coordinati on disorder [77] Behavior problems [75] Anxiety or depression [75]
	b)	Comprehension test and Unexpected outcomes test from the Emotion Recognition Scale (Dyck et al, 2001) [77, 78]	b)	b) –	b) –				b) None		
	c)	Emotion prediction and explanation task (Gnepp and Chilamkurti, 1988) [79]	c) –	c) –	c) –				c) 64-99		
	d)	Incongruent Expressions Task (Burns and Cavey, 1957) [80, 81]	d) –	d) –	d) –				d) 24-*M* =78		
	e)	Affective attribution and reasoning task, (Iannotti, 1978) [82]	e) Cronbach's α = .37-.55 [82]	e) % agreement = 91-100% [82]	e) –				e) *M* = 68-96		

Understanding that people may have discrepant feelings about an event	a)	Affective perspective taking (Borke,1971) [80, 83-85]	a) –	a) –	a) –	a) Associa-ted with age [85]	Direct texting using pictures	8	Rating scale or correct/incorrect	a) 24-96		Externali-zing behavior problems [84]
Understanding that people may feel mixed emotions or different emotions successively	a)	Mixed emotion understanding task (Gordis, Rosen, and Grand, 1989) [29, 86-89]	a) Cronbach's α = .69-.74 [29, 88]	a) Cohen's κ = .86 [89]	a) –		Direct testing under the form of a story-telling interview or using child and experimenter as protagonists	1-6	Correct/ incorrect or rating scale	a) 54-89	Italian [86-89]	
	b)	Surprise tasks (Gopnik & Astington) [90]	b) –	b) –	b) –					b) 42-54		
Comprehensive measure involving emotion understanding based on different factors/TOM categories (e.g., desires, beliefs, hiding emotions)	a)	Test of emotion comprehension (Pons & Harris, 2000) [74, 91-102]	a) Cronbach's α = .42-.74 [94, 95, 99]	a) –	a) –		Direct testing using pictures or naturalistic observations of child social interactions	3-38	Correct/in correct or rating scale	a) 36-101	Italian [91, 92, 96, 99] Spanish [91, 95, 102] Norwegian [97]	ASD [91, 101]
	b)	Want & think stories (Wellman & Bartsch, 1988) [103]	b) –	b) –	b) –					b) 50-60		

Note. –: no information provided in the articles. **Measures:** when authors provided no name for their measure, it was named according to its content in order to facilitate identification within the tables. The original source of a measure, written in brackets, may have not been included in the review and is provided to facilitate identification of measures. For a single article, there may be several variations of the same measure (e.g., different tasks using a classic change-in-location paradigm). **Age range in TD population**: "None" signifies the absence of TD children in the studies using the measure. "*M*" signifies the mean age of the sample and is presented only when no age range could be retrieved. **Languages**: Languages other than English in which the measure was administered, as reported in the studies. When the study specified no language of administration, nor language spoken by participants, it was assumed that it was administered in the language the article was written in. **Adverse conditions:** adverse clinical, psychological or environmental conditions. Children presenting adverse conditions may have different age ranges than the ones in TD population provided in the table.

Abbreviations: TD = Typically developing; SES = Socioeconomic Status; ASD = Autism Spectrum Disorders; ADHD = Attention-deficit/hyperactivity disorder; ODD = Oppositional Defiant Disorder.

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Table 3

Measures related to TOM – Desires category

Measures characteristics									Participants characteristics		
TOM abilities	**Measures (source author, year) [articles using this measure]**	**Internal structure and consistency information**	**Inter-rater reliability information**	**Test-retest reliability information**	**Other psychometric information**	**Modes of presentation**	**Number of items**	**Scoring options**	**Age range in TD population (months)**	**Languages**	**Adverse conditions**
Understanding that different people may have discrepant desires	a) Social activity desires task (Nguyen & Frye, 1999) [1] b) Charlie test/Four sweets task (Baron-Cohen et al., 1995) [2-5] c) Desire task (Slaughter, Dennis and Pritchard, 2002)/Other person's desire' situation (Arranz, Artamendi, Ollabarieta, 2002) [4, 6, 7] d) Discrepant desiresYummy-yucky task (Repacholi & Gopnik, 1997) [8-19] e) Diverse desire (Bartsch & Wellman, 1989) [20-22] f) Gift Task (Flavell, 1968)/ Gift selection task (Jin et al, 2017) [23] [24] g) Common and uncommon desires (Rieffe et al., 2001) [25-29] h) Conflicting emotion task (Slaughter, Dennis and Pritchard, 2002) [4] i) Not own desire tasks (Wellman & Wooley, 1990) [30] j) Matters of taste (Carpendale & Chandler, 1996) [31]	a) – b) – c) – d) – e) – f) – g) Cronbach's α = .77 [26] h) – i) – j) –	a) – b) – c) – d) % agreement = 88-100% [10, 16]; Cohen's κ = .92 e) Cohen's κ = .82-.88 [22] f) Cohen's κ = .958-1.0 [24] g) – h) – i) – j) –	a) – b) – c) – d) – e) – f) – g) – h) – i) – j) –		Direct testing using figurines, pictures, video or spoken narration; or using the child and experimenter as protagonists	1 to 12	Correct/ Incorrect or coding of affect, timing of affect, looking gazes, behavior or verbal answers	a) 36-73 b) 36-84 c) 37-81 d) 13-36 e) 28-42 f) 48-66 g) 12-77 h) 53-72 i) 33-39 j) 58-107	Basque [6] French [9, 11, 12, 14, 15, 17, 18] Japanese [20] Dutch [25, 26] Chinese [24] German [16]	ASD [3, 5, 7] Language impairments [3] Williams syndrome [10] Developmental disabilty of mixed etiologies [10] Intellectual disability [5] TBI [15, 18] Hearing impairments or deafness [25]

Understanding the co-existence of multiple desires simultaneously or successively in one person	a) b) c) d) e)	Multiple desires task (Bennett & Gapert, 1993) [32] Successive Desires task (Bennett & Gapert, 1993) [32] Conflicting-desires tasks (Moore et al.,1995) [33, 34] Desires and beliefs task (Bennett & Gasper, 1993) [32] Desire task (Gopnik & Slaughter, 1991) [35, 36]	a) – b) – c) – d) – e) –	a) – b) – c) – d) – e) –	a) – b) – c) – d) – e) –	Direct testing using stories read aloud with or without photographs or figurines, or games	1 to 4	Correct/incorrect	a) 64-141 b) 62-99 c) 37-64 d) 69-90 e) 42-54	German [33]	
Understanding that people's emotions and actions are influenced by their desires/ preferences	a) b) c) d) e) f)	Desire task (actions and emotions stories) (Wellman & Woolley, 1990) [6, 8, 12, 15, 18, 30, 37-47] Desire task (Terwogt & Rieffe, 2003) [48] Wicked desires task (Yuill, Perner, Pearson, Peerbhoy & van den Ende, 1996) [40, 41, 49, 50] Desire and intention task (Schult, 2002) [51, 52] No preference desire task (Wellman & Wooley, 1990) [30] Target-hitting game (Schult, 2002) [52]	a) Cronbach's α = .73-.79 [47] b) – c) – d) – e) – f) –	a) – b) – c) – d) % agreement = 83-97% [52]; Cohen's κ = .70 [51] e) – f) % agreement = 92% [52]	a) – b) – c) – d) – e) – f) –	Direct testing using figurines, pictures or games	1 to 9	Correct/ incorrect or rating scales	a) 24-80 b) 48-71 c) 30-120 d) 60-120 e) 33-39 f) 36-72	Basque [6] Polish [43] French [12, 15, 18, 53] Japanese [44] Dutch [48] Italian [47]	ASD [37, 42, 45, 46] Maltreatement [38] Low SES [38, 39] TBI [15, 18]

Note. –: no information provided in the articles. **Measures:** when authors provided no name for their measure, it was named according to its content in order to facilitate identification within the tables. The original source of a measure, written in brackets, may have not been included in the review and is provided to facilitate identification of measures. For a single article, there may be several variations of the same measure (e.g., different tasks using a classic change-in-location paradigm). **Languages**: Languages other than English in which the measure was administered, as reported in the studies. When the study specified no language of administration, nor language spoken by participants, it was assumed that it was administered in the language the article was written in. **Adverse conditions:** adverse clinical, psychological or environmental conditions. Children presenting adverse conditions may have different age ranges than the ones in TD population provided in the table.

Abbreviations: TD = Typically developing; SES = Socioeconomic Status; ASD = Autism Spectrum Disorders; TBI = Traumatic brain injury.

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Table 4

Measures related to TOM- Intentions category

			Measures characteristics							Participants characteristics		
TOM abilities	**Measures (source author, year) [articles using this measure]**		**Internal structure and consistency information**	**Inter-rater reliability information**	**Test-retest reliability information**	**Other psychometric information**	**Modes of presentation**	**Number of items**	**Scoring options**	**Age range in TD population (months)**	**Languages**	**Adverse conditions**
Understanding another person's intent, as demonstrated by completing their failed action	a)	Behavioral re-enactment procedure (Meltzoff, 1995) [1-10]	a) –	a) % agreement = 97%; *r* = .87-.98; Cohen's κ = .84-1.00 [1, 3, 4, 6, 9, 10]	a) –		Direct testing, using videos or the child and the experimenter as protagonists	2 to 9	Correct/ incorrect: the action of the child is coded	a) 9-60	Nonverbal task	Down syndrome [1] Developmental disabilities of mixed etiologies [1] Language impairments [1] Intellectual disability or developmental delay [7] ASD [7] Hearing impairments or deafness [8]
Understanding that identical actions/results can be achieved with different intentions	a) b) c) d) e) f) g)	Intention tasks (Browne & Woolley, 2001) [11, 12] Transparent intention task (Russell, Hill, and Franco, 2001) [6, 13, 14] Behavior-, skill- and awareness-intentionality measures (Astington & Lee, 1991) [15] Knee-jerk task (Williams & Happé, 2010) [13] Intention and beliefs (Choi & Luo, 2015) [16] Accidental transgression task (MoToM; Killen, Lynn Mulvey, Richardson, Jampol & Woodward, 2011) [17-19] Intention task (Gopnik & Slauther, 1991) [20]	a) – b) – c) – d) – e) – f) – g) –	a) – b) – c) % agreement = 94 % [15] d) – e) % agreement = 95% [16] f) Cohen's κ = .96-1.0 [19] g) –	a) – b) – c) – d) – e) – f) – g) –		Direct testing using figurines, pictures and/or videos	1 to 8	Correct/ incorrect, likert scale or coding of children's explanations	a) 40-97 b) 36-58 c) 38-119 d) *M* = 53.52 e) 11-14 f) 35-109 g) 42-54	Italian [6] Cantonese [18] German [19]	Developmental disabilities of mixed etiologies [13] ASD [13]
Predicting people's actions based	a)	Attention to intention (Phillips, Wellman & Spelke, 2002) [21, 22]	a) –	a) % agreement =	a) –		Direct testing using stories read aloud,	1 to 48	Correct/ incorrect and/or	a) 8-14	French [23, 24, 26, 29]	Williams syndrome [23, 25]

on their intentions				83-100% [22]		videos, pictures or live actors		coding of looking gazes or child's narration		German [19]	ASD [24]
	b)	Visual and verbal attribution of intention tasks (Santos & Deruelle, 2009) [23]	b) –	b) –	b) –				b) 48-204		Down syndrome [25]
	c)	Picture sequencing task (Baron-Cohen, Leslie & Frith, 1986) [24-27]	c) –	c) –	c) –				c) 41-140		Language impairment [26]
	d)	Visual habituation paradigm (Buresh & Woodward, 2007) [19, 28]	d) –	d) % agreement = 92-94%; $r \geq .90$ [19, 28]	d) –				d) 6-12		
	e)	Intention task (Phillips & Wellman, 2005) [29, 30]	e) –	e) % agreement = 79-100% [30]	e) –				e) 11-20		
Tendency to attribute intentions to ambiguous visual figures	a)	Visual habituation study using videos of two balls (Gergely, Nadasdy, Csibra & Biro, 1995) [31]	a) –	a) –	a) –	Direct testing using videos	4	Coding of looking gazes	a) 11-16		
Producing plausible intention explanations for different types of observed social events	a)	Intentions explanations (Smiley, 2001) [32]	a) –	a) –	a) –	Direct testing using videos	8	Coding of children's explanations	a) 19-39		

Note. –: no information provided in the articles. **Measures:** when authors provided no name for their measure, it was named according to its content in order to facilitate identification within the tables. The original source of a measure, written in brackets, may have not been included in the review and is provided to facilitate identification of measures. For a single article, there may be several variations of the same measure (e.g., different tasks using a classic change-in-location paradigm). **Languages**: Languages other than English in which the measure was administered, as reported in the studies. When the study specified no language of administration, nor language spoken by participants, it was assumed that it was administered in the language the article was written in. **Adverse conditions:** adverse clinical, psychological or environmental conditions. Children presenting adverse conditions may have different age ranges than the ones in TD population provided in the table.

Abbreviations: TD = Typically developing; ASD = Autism Spectrum Disorders.

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Table 5

Measures related to TOM – Percepts category

Measures characteristics										Participants characteristics		
TOM abilities	**Measures (source author, year) [articles using this measure]**	**Internal structure and consistency information**	**Inter-rater reliability information**	**Test-retest reliability information**	**Other psychometric information**	**Modes of presentation**	**Number of items**	**Scoring options**	**Age range in TD population (months)**	**Languages**	**Adverse conditions**
Acknowledging that others have different visual percepts and adopting the visual perspective of another person (i.e., simple visual perspective taking)	a) Penny game task (Gratch, 1964) [1-30] b) Non-deceptive, explicit deception and implied deception task (Dalke, 1995) [31] c) Blow-football game (Russell, Alexis & Clayton, 2010) [32] d) Visual perspective taking, level 1/Picture identification task (Flavell et al., 1968; 1981) [33-49] e) Visual perspective taking, level 2 (Masangkay, 1974; Flavell et al.,1981) [24-27, 33-35, 39, 40, 42, 44-48, 50-59] f) Gaze-following task (Meltzoff et Brooks, 2008) [60] g) Hide and seek (Peskin & Ardino, 2003) [61] h) Level 1 perspective taking (Sodian, Thoermer, and Metz, 2007) [62, 63] i) Move object task (Flavell, Shipstead, & Croft, 1978) [16, 62, 64, 65] j) Occluded object task (Moll and Tomasello, 2006) [16, 66, 67] k) Spatial view point of the other (Peisach & Hardeman 1985) [68] l) Visual perspective taking (Carlson et al., 2004) [40, 53, 54, 57, 69, 70] m) Level-1 perspective taking tasks (Ricard et al., 1999) [71] n) Policeman tasks (Hughes & Donaldson, 1979) [55, 72] o) Seeing tasks (Gonzales, Fabricius & Kupfer, 2017) [73]	a) Cronbach's α = .87 [1, 8] b) – c) – d) – e) – f) – g) – h) – i) – j) – k) – l) – m) – n) – o) –	a) % agreement ≥ 97% [9] b) – c) – d) – e) – f) Cohen's κ ≥ .90 [60] g) – h) – i) – j) Cohen's κ = .88-1.0 [66, 67] k) – l) – m) Cohen's κ = .73-1.0 [71] n) – o) –	a) – b) – c) – d) – e) – f) – g) – h) – i) – j) – k) – l) – m) – n) – o) –	a) Scaling analyzes [30] f) Intra-rater agreement: $\kappa \geq$ .90 [60]	Direct testing using figurines or a game between the child and experimenter/ parent	1 to 14	Correct/ incorrect or coding of children behavior/ instructions/ explanations/ looking gazes	a) 25-192 b) 40-59 c) 36-71 d) 24-81 e) 20-84 f) 11-18 g) 36-69 h) 12-*M* = 15 i) 26-48 j) 17-30 k) *M* = 58-84 l) 12-31 m) 18-30 n) 37-74 o) 24-82	German [8] Spanish [8] Cameroonian [8] Pacific Islandic languages [16] French [24-27, 39, 53, 69, 70] Italian [41, 55] Dutch [62] Norwegian [49] German [67]	Sensory integration deficits [1] ASD [5, 18-22, 29, 44, 74] Low SES [10-15] Intellectual disability or developmental delay [20, 24, 27] Externalizing behavior problems [3, 4, 24] Down syndrome [25, 26] Language impairments [33, 34] Maltreatment [36] Visual impairments or blindess [51]

Adopting another person's visual perspective in tasks demanding complex mental rotation or visualisation (i.e., complex visual perspective taking)	a) b) c) d) e) f) g) h) i)	Array visual perspective taking task (Langdon and Coltheart's, 2001) [33] Comprehension task (Nadig and Sedivy, 2002) [75, 76] Level 2 visual perspective taking (Hamilton, Brindley & Frith, 2009) [29, 74, 77] Referential communication game (Epley, Morewedge & Keysar, 2004) [78] Big bird visual perspective taking (Rosser, Chandler & Lane, 1993) [79] Visual perspective taking and spatial construction task (Ebersbach, Stiehler & Asmus, 2011) [80] Photographers perspective taking (Frick, Mohring & Newcombe, 2014) [81] Visual perspective-taking circle (Newcombe and Huttenlocher, 1992) [82, 83] Village construction task (Doise & Mugny, 1984) [84]	a) – b) – c) – d) – e) – f) – g) Guttman's split-half coefficient = .91 [81] h) – i) –	a) – b) – c) – d) – e) – f) Cohen's κ = .75-.98 [80] g) – h) – i) –	a) – b) – c) – d) – e) – f) – g) – h) – i) –		Direct testing using figurines or experimenter and child as protagonists	4 to 15	Correct/ incorrect or coding of looking gazes, construc-tions or verbal answers	a) 51-70 b) 44-82 c) 45-482 d) 48-144 e) 48- 120 f) *M* = 60-108 g) 48-108 h) 52-71 i) 63-78	German [80]	Language impairments [33] ASD [29, 74] Williams syndrome [77, 82]
Considering the auditory percepts of another person	a)	Auditory perspective taking (Williamson, Brooks, & Meltzoff, 2015) [85]	a) –	a) –	a) –		Direct testing using figurines	1	Correct/ incorrect	a) 26-37		

Note. –: no information provided in the articles. **Measures:** when authors provided no name for their measure, it was named according to its content in order to facilitate identification within the tables. The original source of a measure, written in brackets, may have not been included in the review and is provided to facilitate identification of measures. For a single article, there may be several variations of the same measure (e.g., different tasks using a classic change-in-location paradigm). **Age range in TD population**: "*M"* signifies the mean age of the sample and is presented only when no age range could be retrieved. **Languages**: Languages other than English in which the measure was administered, as reported in the studies. When the study specified no language of administration, nor language spoken by participants, it was assumed that it was administered in the language the article was written in. **Adverse conditions:** adverse clinical, psychological or environmental conditions. Children presenting adverse conditions may have different age ranges than the ones in TD population provided in the table.

Abbreviations: TD = Typically developing; SES = Socioeconomic Status; ASD = Autism Spectrum Disorders.

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Table 6

Measures related to TOM- Knowledge category

	Measures characteristics								Participants characteristics		
TOM abilities	**Measures (source author, year) [articles using this measure]**	**Internal structure and consistency information**	**Inter-rater reliability information**	**Test-retest reliability information**	**Other psychometric information**	**Modes of presentation**	**Number of items**	**Scoring options**	**Age range in TD population (months)**	**Languages**	**Adverse conditions**
Understanding that someone who does not know something exists cannot engage in "pretend play" that incorporates that knowledge	a) Sarah task (Aronson & Golomb, 1999) [1] b) Pretense tasks (Lillard, 1993) [1, 2]	a) – b) –	a) – b) –	a) – b) –		Direct testing using pictures or figurines	1	Correct/ incorrect	a) 47-70 b) 45-68		
Understanding that someone who does not have access to perceptual information (i.e. by looking, hearing, etc.) may not have access to knowledge	a) Cognitive perspective taking (Flavell, Botkin, Fry, Wright, and Jarvis, 1968) [3, 4] b) Knowledge-attribution task (Birch & Bloom, 2003) [5] c) Hide an object (Viranyi, Topal, Miklosi, & Csanyi 2006) [6] d) See-know task (Pillow, 1989; Ruffman and Olson, 1989) [7-20] e) Visual access tasks (Wimmer, Hogrefe and Perner, 1988) [21-24] f) Origin-of-belief task (O'Neill & Gopnik, 1991) [25-27] g) Inference tasks (Sodian & Wimmer, 1987) [25, 28] h) Theory of social mind (Abrams, Rutland, Pelletier & Ferrell, 2009) [29] i) Cow task (Luckett, Powell, Messer, Thornton, & Schulz, 2002) [30, 31] j) Hidden sticker games (Povinelli and deBlois,1992) [32-34] k) Knowing tasks (Gonzales, Fabricius & Kupfer, 2017) [35]	a) – b) – c) – d) – e) – f) – g) – h) – i) – j) – k) –	a) % agreement = 92% [4] b) – c) Cohen's κ = .90-.99 [6] d) – e) – f) – g) – h) – i) – j) – k) –	a) – b) – c) – d) – e) – f) – g) – h) – i) – j) – k) –		Direct testing using stories read-aloud, pictures and/or figurines, or the child and experimenter/ parent/another child as protagonists	1 to 24	Correct/ incorrect or coding of children's reaction/ behavioral response/ gaze/verbal explanation	a) 36-96 b) 39-69 c) 26-35 d) 28-306 e) 36-72 f) 30-77 g) 42-80 h) 60-132 i) 37-101 j) 35-80 k) 24-82	Hungarian [6] Spanish [8] Oriya [21] Indian [23] English sign language [32] Cantonese [33] French [34]	ASD [7, 9-11, 14, 17, 30, 31] Intellectual disability or developmental delay [9, 17] Visual impairments or blindness [32]

Understanding that someone who was not informed or is not familiar with something may not know	a) b) c) d) e) f)	Opacity task (Kamawar & Olson, 2009) [36, 37] Modified ToM test (Kovacs, 2009) [38] Misinformation story (Perner et al., 1994) [39, 40] Awareness of a reader's knowledge task (Peskin, Prusky & Cromay, 2014) [41] Cognitive perspective taking (Brice & Torney- Purta, 1981) [42] Linguistic access task (Wimmer, Hogrefe & Perner, 1988) [24]	a) – b) – c) – d) – e) Cronbach's α = .61 [42] f) –	a) – b) – c) – d) – e) – f) –	a) – b) – c) – d) – e) – f) –	Direct testing using a read-aloud story, pictures and/or, or using another child and the experimenter as protagonists	1 to 4	Correct/ incorrect	a) 49-202 b) 34-42 c) 37-70 d) 60-96 e) 24-48 f) 38-70	Turkish [39]	Low SES [39]
Understanding that something new is more interesting to someone than something already known	a)	Familiary-focus of attention (Moll, Koring, Carpenter & Tomasello, 2006) [43]	a) –	a) Cohen's κ = .82-.93 [43]	a) –	Direct testing using child and experimenter/ parent as protagonists	6	Coding of children's reaction /behavioral response/ gaze	a) 17-24	German [43]	

Note. –: no information provided in the articles. **Measures:** when authors provided no name for their measure, it was named according to its content in order to facilitate identification within the tables. The original source of a measure, written in brackets, may have not been included in the review and is provided to facilitate identification of measures. For a single article, there may be several variations of the same measure (e.g., different tasks using a classic change-in-location paradigm). **Languages**: Languages other than English in which the measure was administered, as reported in the studies. When the study specified no language of administration, nor language spoken by participants, it was assumed that it was administered in the language the article was written in. **Adverse conditions:** adverse clinical, psychological or environmental conditions. Children presenting adverse conditions may have different age ranges than the ones in TD population provided in the table.

Abbreviations: TD = Typically developing; SES = Socioeconomic Status; ASD = Autism Spectrum Disorders.

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18. Leduc, K., et al., *The contributions of mental state understanding and executive functioning to preschool-aged children's lie-telling.* British Journal of Developmental Psychology, 2017. **35**(2): p. 288-302.
19. Ruffman, T. and D. Olson, *Children's ascriptions of knowledge to others.* Developmental Psychology, 1989. **25**(4): p. 601-606.
20. Pillow, B.H., *Early understanding of perception as a source of knowledge.* Journal of Experimental Child Psychology, 1989. **47**(1): p. 116-129.
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25. Bright-Paul, A., C. Jarrold, and D.B. Wright, *Theory-of-mind development influences suggestibility and source monitoring.* Developmental Psychology, 2008. **44**(4): p. 1055-1068.
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39. Yagmurlu, B., S.K. Berument, and S. Celimli, *The role of institution and home contexts in theory of mind development.* Journal of Applied Developmental Psychology, 2005. **26**(5): p. 521-537.
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41. Peskin, J., C. Prusky, and J. Comay, *Keeping the reader's mind in mind: Development of perspective-taking in children's dictations.* Journal of Applied Developmental Psychology, 2014. **35**(1): p. 35-43.
42. Denham, S.A., *Social cognition, prosocial behavior, and emotion in preschoolers: Contextual validation.* Child Development, 1986. **57**(1): p. 194-201.
43. Moll, H., et al., *Infants Determine Others' Focus of Attention by Pragmatics and Exclusion.* Journal of Cognition and Development, 2006. **7**(3): p. 411-430.

Table 7

Measures related to TOM- Beliefs category

	Measures characteristics								Participants characteristics		
TOM abilities	**Measures (source author, year) [articles using this measure]**	**Internal structure and consistency information**	**Inter-rater reliability information**	**Test-retest reliability information**	**Other psychometric information**	**Modes of presentation**	**Number of items**	**Scoring options**	**Age range in TD population (months)**	**Languages**	**Adverse conditions**
Familiar container with an unexpected content: Understanding the false belief held by someone who never opened the container	a) Content false belief paradigm (Hogrefe, Wimmer, & Perner, 1986; Perner, Leekam, & Wimmer, 1987) [1-236][237-244]	a) –	a) % agreement = 82.6-100%; Cohen's κ = 1.0 [77, 185, 198, 212, 219, 222, 226]	a) Test-retest, κ = .29-.53 [237]	a) Intra-rater reliability ≥ 82.6% [222]	Direct testing using figurines or another child or a video or the experimenter and the child as protagonists	1 to 6	Correct/ incorrect or coding system for children's explana-tions	a) 17-210	English sign language [148, 194] Hebrew [150, 265, 272] Cantonese [4, 67, 128] Chinese [187, 240] Mandarin [9, 176, 196, 205] Korean [5, 135, 161] Farsi [250] Basque [143, 144] Indian [99] Greek [11, 12, 125] French [19, 32, 36, 40, 50, 94, 95, 102, 165, 170, 172, 186, 213, 214, 227, 263, 268] Yapese [21] Ulithian [21] Spanish [55, 103, 143, 144, 217, 225, 244]	Language impairment [3, 50, 65, 76, 103, 217, 225] Visual impairment or blindness [30, 86, 290, 292] Hearing impairment or deafness [52, 81, 85, 89, 145, 148, 194, 293] Developmental Coordination Disorder [3, 65] Learning difficulties [80, 210] Low SES [6, 8, 53, 63, 64, 107, 122, 173, 206, 207, 218, 237, 256, 276, 285, 287] ASD [49, 50, 93, 211][2, 8, 19, 24, 26, 29, 33, 34, 43, 55, 65, 71, 73, 80, 97, 98, 101, 102, 116, 124, 135, 137, 153, 154, 159, 169, 178, 190, 204, 210, 265] ADHD [39, 43, 93] Attention and behavior problems [119] Intellectual disability or developmental delay [50, 94, 101, 114, 116, 153] Externalizing behavior problems [94, 288, 289] Reading disorder [50] Williams syndrome [36, 51, 60, 114, 213, 214]
	b) Ella the Elephant or Emotion false belief task (Harris, Johnson, Hutton, Andrews, & Cooke, 1989) [3, 17, 33, 35, 48, 65, 73, 75, 83, 84, 112, 119, 131, 136, 143, 144, 172, 197, 237, 239, 245-269]	b) –	b) –	b) Test-retest, κ = .43-.56 [237]					b) 35-147		
	c) Deceptive contents FB task (Bartsch & Wellman, 1989) [6, 47, 222, 238, 248, 249, 254, 255, 258, 262-264, 266, 268, 270-289]	c) Cronbach's α = .80 [283, 288]	c) % agreement ≥ 82.6-97% ; Cohen's κ = .89 [77, 222, 289]	c) –	c) Intra-rater reliability ≥ 82.6% [222]				c) 32-89		

										Italian [2, 23, 55, 83, 84, 197, 219, 266, 274] German [27, 37, 54, 127, 234, 290] Dutch [93, 192, 290] English sign language [52, 81, 89] Norwegian [87] Turkish [109, 128, 191, 291]	Prader-Willi syndrome [60, 114] Down Syndrome [2, 26] Developmental disabilities of mixed etiologies [93, 116] Prematurity [108] Anxiety or depression [93] Maltreatment [173] TBI [162]
Unseen change: Understanding the false belief held by someone who did not witness or was not informed of a displacement or change of action	a) Change-in-location paradigm (Wimmer & Perner, 1983)/Sally-Ann task, (Baron-Cohen, Leslie & Frith, 1985) [1-15, 17, 19, 20, 24, 27, 28, 30, 32, 35-37, 41, 42, 45-47, 52, 53, 58, 59, 63, 64, 68, 71, 74, 77, 79, 80, 89, 96, 100, 107, 109-114, 119-125, 127-130, 132, 139-141, 148, 150, 154, 157, 158, 160, 162, 164-167, 170-172, 177, 181, 183, 185, 187, 189, 192, 194, 196, 197, 201-203, 205, 207, 210, 213, 214, 218, 247, 250, 253, 257-259, 261, 263, 265, 270, 275, 276, 279, 285, 290, 292, 294-375][23, 25, 26, 29, 31, 33, 34, 38, 43, 48-50, 55, 65-67, 69, 73, 76, 79, 81, 82, 85, 90, 91, 93-95, 97-99, 101, 102, 104, 106, 108, 115, 131, 134-138, 143, 144, 146, 151, 152, 159, 168, 175-180, 190, 191, 199, 200, 202, 204, 212, 216, 220-222, 224-227, 229, 230, 237-241, 243, 244, 258, 266, 272, 274, 287, 309, 323, 324, 340, 342, 360, 363, 367, 376-442]	a) Kuder-Richardson 20 formula = .86; Cronbach's α = .40-.51 [59, 261, 297] b) –	a) % agreement ≥ 83.6-100%; *r* = .96; Cohen's κ = .74-1.0 [77, 185, 212, 222, 226, 338-340, 351, 353, 355, 387, 407, 423, 444] b) –	a) % agreement = 54-100%; Test-retest, κ = 0-1.0 [237, 356] b) –	a) Intra-rater reliability ≥ 82.6 % [222]	Direct testing using a narrated story, figurines, pictures, computerized games, CD-ROM, videos, live actors and/or the child and experimenter as protagonists	1 to 32	Correct/ incorrect or coding of children's explana-tions, facial expres-sions or eye gaze, or eyetra-cking, or measuring distances between child's answer and correct response on a continuous scale	a) 13-207 b) 34-164	Spanish [55, 143, 144, 203, 217, 225, 244, 320, 321, 380] Cantonese [4, 67, 128, 179, 297] Chinese [187, 189, 240, 331] Greek [11, 12, 125, 390] German [27, 37, 127, 290, 300, 304-306, 308, 321, 322, 338, 353, 420, 422, 424] Mandarin [9, 196, 205] Turkish [109, 128, 176, 191, 203, 218] Polish [307, 318] Italian [23, 55, 197, 266, 274, 330, 400, 434] English sign language [52, 81, 89, 148, 194, 389, 406] Farsi [250, 312]	Sensory integration deficits [321] Low SES [6, 8, 53, 63, 64, 107, 122, 207, 237, 285, 287, 291, 299, 329, 332, 333, 447] Hearing impairments or deafness [10, 52, 81, 85, 89, 148, 194, 389, 391, 400, 409, 441] Visual impairments or blindness [30, 290, 292] Cerebral palsy [343, 385] ASD [2, 3, 8, 13, 19, 24, 26, 29, 33, 34, 43, 49, 50, 55, 71, 73, 80, 93, 97, 98, 102, 123, 134, 135, 137, 154, 159, 178, 190, 200, 204, 210, 211, 305, 315, 342, 358, 378, 379, 384, 386-388, 396, 403, 405, 413, 416, 428, 432, 437, 439, 443, 445, 448] Fetal alcohol spectrum disorders [309] Language impairments [50, 65, 76, 225, 388, 410, 417, 418, 445] TBI [162, 362] Williams syndrome [114, 337, 342]

	b) Social activity false belief task (Nguyen & Frye, 1999) [180, 230, 299, 303, 314, 318] c) Changing appearance tasks (Leekam & Perner, 1991) [172, 443] d) Change-of location own false-belief (Buttelmann et al., 2016) [220] e) Sandbox task (Begeer, Bernstein, van Wijhe, Scheeren & Koot, 2012) [241]	c) – d) – e) –	c) – d) – e) –	c) – d) – e) –	e) Associated with age and other location false belief test. Discriminant validity: not associated with other types of false belief tests and inhibition measures [241]			c) 41-99 d) 33-52 e) 36- 90	Hebrew [150, 265, 272] Oriya [314] Basque [143, 144, 317] French [19, 32, 36, 50, 94, 95, 102, 165, 172, 201, 213, 214, 227, 360, 425, 445] Cameroonian [321, 322] Dutch [93, 290, 326, 363, 409, 410] Hungarian [346] Romanian [346] Indian [2, 99] Japanese [375, 377, 403, 431] Swedish [385, 391] Korean [5, 135, 446] Portuguese [203] Filipino [433]	Prader-Willi syndrome [114] Intellectual disability or developmental delay [50, 94, 114, 213, 214, 345, 384, 403, 439, 448] Down syndrome [2, 26, 36, 214, 343, 352, 437] Developmental coordination disorder [3, 65] Reading disorder [50] Externalizing behavior problems [94] Attention and behavior problems [119] Malteatment [402] Prematurity [108] ADHD [43, 93] Anxiety or depression [93] Learning difficulties [80, 378]
Understanding that when something looks/sounds/ smells like something else, a person may hold a false belief about its identity/chara-cteristics/locati on	a) Ambiguity task (Taylor, 1988) [6, 42, 96, 143, 144, 160, 195, 216, 326, 367, 381, 449-456] b) Appearance-reality tasks (Flavell, 1986) [10-12, 14, 17, 29, 36, 38-40, 43, 47, 52, 58, 59, 62, 76, 99, 100, 109, 110, 115, 118, 120, 125, 127, 129, 130, 134, 140-144, 150, 152, 160-162, 164, 166, 168, 181, 182, 187, 189, 192, 195, 207, 213-216,	a) – b) Cronbach's α = .78-.84 [59, 261]	a) Cohen's κ = .84- .95 [454, 455] b) % agreement ≥ 97% [77]	a) – b) –		Direct testing using pictures, storybooks, computerized animations, peep-through books and/or figurines	1 to 22	Correct/ incorrect or coding of children's explana-tions, pointing gestures or eye gazes	a) 34-138 b) 25-189	Dutch [192, 326] Spanish [143, 144] Basque [143, 144] Greek [11, 12, 125] German [127, 308] Chinese [187, 189] French [36, 39, 40, 165, 170, 172, 213, 214, 263, 360, 374, 468, 469]	Hearing impairments or deafness [10, 52, 471, 472] TBI [162] ASD [29, 39, 134] Maltreatment [134, 173] Low SES [6, 53, 134, 173, 206, 207, 218, 256, 276, 285, 287, 458, 464-467] ADHD [39] Down syndrome [36, 214]

	241, 256, 261, 263, 276, 296, 308, 334, 374, 430, 457-463]						
c)	Droodle task (Chandler & Helm, 1984; Hughes, Dunn & White 1998) [52, 53, 146, 158, 165, 166, 170, 172, 173, 206, 248, 249, 254, 255, 258, 262, 264, 270, 285-287, 464-470]	c) –	c) Inter-rater agreement: *r* = 0.98 [470]	c) –	c) 24-138	Hebrew [150] English sign language [52, 472] Korean [161] Turkish [109, 291] Indian [99] Swedish [385]	Intellectual disability or developmental delay [213] TBI [468] William syndrome [337] Cerebral Palsy [385] Prematurity [108] Language impairment [76]
d)	Thought pictures/Balloon task (Wellman, Hollander & Schult,1996) [10, 79, 108, 177, 337, 385, 471-473]	d) –	d) –	d) –	d) 34-117	Samoan [478] Oriya [314] Cantonese [477]	
e)	Appareance-reality task (Taylor and Hort, 1990) [133]	e) –	e) –	e) –	e) 45-65		
f)	Lexical ambiguity (Carpendale & Chandler, 1996) [90, 438, 474-477]	f) –	f) Cohen's κ > .86 [476]	f) –	f) 49-135		
g)	Picture false-belief task (Callaghan, Rochat & Corbit, 2012) [212, 478]	g) –	g) % agreement = 100% [212] g) –	g) –	g) 34-168		
h)	Mother-infant separation test (MIST) (de Rosnay & Harris, 2002) [251, 269]	h) –	h) –	h) –	h) 43-76		
i)	Little Red Riding Hood (Bradmetz & Gauthier, 1999)[479]	i) –	i) –	i) –	i) 36-83		
j)	Deception task (Ruffman, Olson, Ash, and Keenan, 1993)[218, 235]	j) –	j) –	j) –	j) 43-70		
k)	Understanding of pretense (Watson & Guajardo, 2000) [480]	k) –	k) –	k) –	k) 50-76		
l)	False belief story (Riggio & Cassidy 2009) [481]	l) –	l) Cohen's κ = .72- 1.0 [481]	l) –	l) *M* = 51.87		
m)	The deception stories (Johnson, 1997) [184]	m) –	m) -	m) –	m) 48-108		
n)	Misinformation tests (San Juan & Astington, 2017) [430]	n) –	n) –	n) –	n) 30-53		
o)	Ambiguous referential communication (Carpendale & Chandler, 1996) [438]	o) –	o) –	o) –	o) 58-107		

	p) Ambiguous figures (Carpendale & Chandler, 1996)[438]	p) –	p) –	p) –				p) 58-107		
Second-order belief: understanding the second-order belief or false belief held by someone who doe not know somebody else was informed (e.g., of a misleading identity, a misleading location, etc.)	a) Ice-cream van test (Perner & Wimmer, 1985) [6, 8, 10, 24, 25, 46, 65, 73, 81, 93, 97, 98, 156, 170, 172, 190, 194, 234, 237, 238, 241, 247, 253, 329, 360, 382, 400, 428, 440, 482-486]	a) –	a) Cohen's κ = .79 [428]	a) Test-retest, κ = .48 [237]	Direct testing using figurines, pictures, videos or CD-ROM	1 to 4	Correct/ incorrect, coding systems of children's explana-tion	a) 42-174	Swedish [391] French [170, 172, 360] German [234, 322, 420, 483]	Hearing impairments or deafness [81, 85, 194, 391, 400, 406] Low SES [6, 237, 329, 500] Developmental coordination disorder [65]
	b) Granddad story, Window story or Tom's crayon (Astington, Pelletier & Homer, 2002; Sullivan, Zaitchik, & Tager-Flusberg, 1994) [41, 48, 61, 75, 112, 129, 143, 144, 150, 179, 197, 229, 237, 255, 258, 360, 375, 376, 391, 398, 402, 406, 440, 449, 476, 485-495]	b) Cronbach's α =.79 [492]	b) Cohen's κ = .78-.92 [476, 491]	b) Test-retest, κ= .40-.72 [237]				b) 36-156	English sign language [81, 194, 406] Italian [83, 84, 197, 266, 274, 400] Dutch [93] Cameroonian [322]	Language impairments [65] ASD [8, 24, 65, 73, 93, 97, 98, 154, 159, 190, 237] ADHD [93] Anxiety or depression [93] Maltreatement [402]
	c) Birthday puppy (Sullivan, Zaitchik, & Tager- Flusberg, 1994) [83, 84, 154, 156, 159, 179, 238, 258, 266, 274, 322, 420, 485, 495-498]	c) –	c) % agreement = 100% [497]	c) –				c) 47-105	Spanish [143, 144, 493, 495] Cantonese [179] Japanese [375]	
	d) Second order false belief with deception (Miller, 2013b) [499]	d) –	d) –	d) –				d) 64-81	Hebrew [150]	
	e) Mean looking dog (Bradmetz & Gauthier, 2005) [360]	e) –	e) –	e) –				e) 60-107	Polish [492] Basque [143, 144]	
	f) Second order false belief task (Miller, 2013a) [499]	f) –	f) –	f) –				f) 63-92		
	g) ToM task (Kim & Phillips, 2014) [500]	g) Cronbach's α = .71-.73 [500]	g) –	g) –				g) 60-97		
Predicting another person's action based on their stated false belief/Inferring	a) Belief tasks (Wellman & Bartsch, 1988) [10, 79, 88, 140, 189, 273, 413, 458, 501-507]	a) –	a) % agreement ≥ 97% [77]	a) –	Direct testing using pictures	1 to 9	Correct/ incorrect	a) 24-76	Japanese [503] German [127]	Maltreatment [458] Low SES [458, 501]
		b)	b) –	b) –				b) 36-77	French [201, 508]	ASD [26, 413, 502]

another person's belief based on their stated action	b) False belief justification (Wellman, 1991) [201, 508] c) The Tom task (Swettenham, 1996) [26, 127]	c) –	c) –	c) –				c) 39-46	Chinese [189] Italian [504]	Down Syndrome [26] Hearing impairments or deafness [10]
Understanding the false belief created when a predictable sequence of stimuli is broken with the intrusion of an unexpected stimulus	a) Unexpected outcome (Newly Learned & Previously learnes) (Brambring & Asbrock, 2010) [290]	a) –	a) –	a) –	Direct testing using audiotracks	6	Correct/ incorrect	a) 42-72	German [290] Dutch [290]	Visual impairments or blindess [290]
Comprehensi-ve measures of understanding beliefs	a) TOM belief tasks (Nader-Grosbois & Thirion-Marissiaux, 2011) [509-511] b) Theory-of-mind tasks protocol (Sparrevohn & Howie, 1995) [78, 482, 512, 513] c) False-belief explanation task (Villiers & de Villiers, 2000) [23, 145, 434] d) Battery of TOM tasks (Hughes, Adlam, Happe, Jackson, Taylor & Caspi, 2000) [84, 171, 197, 237, 266, 274, 514, 515] e) False-belief suspence (Moll, Kane & McGowan, 2016) [423]	a) – b) – c) Cronbach's α = .60 [434] d) Cronbach's α = .65-.85 [237, 274, 515] e) –	a) – b) – c) – d) – e) Cohen's κ = .80-.90 [423]	a) – b) – c) – d) r = .76 [237] e) –	Direct testing using figurines, pictures or videos	2 to 12	Correct/ incorrect, coding of child's explana-tion, coding of use of mental state terms, or coding of children's facial expression	a) 39-83 b) 32-72 c) 46-75 d) 43-108 e) 36-42	French [509-511] Italian [23, 84, 197, 266, 274, 434]	Intellectual disability or developmental delay [509] Hearing impairments or deafness [145] ASD [513] Externalizing behavior problems [515]

Note. –: no information provided in the articles. **Measures:** when authors provided no name for their measure, it was named according to its content in order to facilitate identification within the tables. The original source of a measure, written in brackets, may have not been included in the review and is provided to facilitate identification of measures. For a single article, there may be several variations of the same measure (e.g., different tasks using a classic change-in-location paradigm). **Age range in TD population**: "*M*" signifies the mean age of the sample and is presented only when no age range could be retrieved. **Languages**: Languages other than English in which the measure was administered, as reported in the studies. When the study specified no language of administration, nor language spoken by participants, it was assumed that it was administered in the language the article was written in. **Adverse conditions:** adverse clinical, psychological or environmental conditions. Children presenting adverse conditions may have different age ranges than the ones in TD population provided in the table.

Abbreviations: TD = Typically developing; SES = Socioeconomic Status; ASD = Autism Spectrum Disorders; ADHD = Attention-deficit/hyperactivity disorder; TBI = Traumatic brain injury

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511. Nader-Grosbois, N. and M. Houssa, *La Batterie de tâches de Théorie de l'esprit: Validation de la version francophone. [Validation of the French version of the ToM Task Battery.].* Enfance, 2016. **68**(2): p. 141-163.
512. Cunningham, S.J., et al., *Exploring early self-referential memory effects through ownership.* British Journal of Developmental Psychology, 2013. **31**(3): p. 289-301.
513. Sparrevohn, R. and P.M. Howie, *Theory of mind in children with autistic disorder: evidence of developmental progression and the role of verbal ability.* J Child Psychol Psychiatry, 1995. **36**(2): p. 249-63.
514. Martins, E.C., et al., *Emotion understanding in preschool children: The role of executive functions.* International Journal of Behavioral Development, 2016. **40**(1): p. 1-10.
515. van Dijk, A., A.M.G. Poorthuis, and T. Malti, *Psychological processes in young bullies versus bully-victims.* Aggressive Behavior, 2017: p. No Pagination Specified-No Pagination Specified.

Table 8

Measures related to TOM – Deception/lies category

Measures characteristics										Participants characteristics		
TOM abilities	**Measures (source author, year) [articles using this measure]**		**Internal structure and consistency information**	**Inter-rater reliability information**	**Test-retest reliability information**	**Other psychometric information**	**Modes of presentation**	**Number of items**	**Scoring options**	**Age range in TD population (months)**	**Languages**	**Adverse conditions**
Understanding that someone may consciously lie about the location/content of an object in order to achieve a goal	a)	Deception task (Guajardo & Watson, 2002) [1-5]	a) –	a) –	a) –		Direct testing using figurines	1 to 2	Correct/ incorrect	a) 33-71	Mandarin [4]	
	b)	Change in location and deceive (Murray, Woolgar et al., 1999) [6]	b) –	b) –	b) –					b) M = 60		
Understanding that other people may hide their emotions	a)	Display rules (Ketelaars, van Weerdendurg, Verhoeven, Cuperus & Jansonieus, 2010) [7]	a) –	a) –	a) –		Direct testing using read-aloud stories and/or using pictures or figurines	2 to 10	Correct/ incorrect or coding of child's justifica-tion	a) 59-99	Dutch [7]	Low SES [13]
	b)	Appearance reality of emotions (Harris, Donnelly, Guz, and Pitt-Watson, 1986); Affective false-belief task (Davis, 1998) [8-22]	b) –	b) % agreement = 90-97%; Cohen's κ = .86 [17, 22]	b) –					b) 32-139	Spanish [18]	TBI [24]
	c)	Emotional and emotive faces task (Dennis et al., 2013) [23]	c) –	c) –	c) –					c) 63-184		
Understanding that other people may lie in order to be ironic/sarcastic	a)	Lies and jokes task (Tager-Flusberg & Sullivan, 1995) [25, 26]	a) –	a) –	a) –		Direct testing using pictures	1 to 8	Correct/ incorrect or coding of children justifica-tion or likert scales	a) None		ASD [25, 26, 28, 29]
	b)	Irony task (Filippova & Astington, 2008) [27]	b) –	b) Cohen's κ = .82-1.0 [27]	b) –					b) 61-121		
Measures tapping multiple aspects of lie comprehension	a)	Ironic criticism and empathic praise task (Dennis et al., 2001) [30]	a) –	a) –	a) –		Direct testing using pictures and/or audio recordings	2 to 12	Correct/ incorrect or coding of children justifica-tions	a) 63-184	Farsi [45]	TBI [30]
	b)	Strange stories (Happé, 1994) [27-29, 31-48]	b) Cronbach's α = .67-.85 [40, 46, 49]	b) % agreement = 90-97%; Cohen's κ = .72-.98; Inter-rater reliability's alpha = .92-.95 [27, 28,	b) –					b) 36-192	English Sign Language [28, 29]	Developmental coordination disorder [31, 36]
											Chinese [47]	Language impairments [31, 35, 36, 43]
												ADHD [32, 51]

	40, 44-46, 50]	ASD [28, 32, 35, 37, 38, 40, 42, 51] Reading disorder [32, 51] Hearing impairments or deafness [28, 29]

Note. –: no information provided in the articles. **Measures:** when authors provided no name for their measure, it was named according to its content in order to facilitate identification within the tables. The original source of a measure, written in brackets, may have not been included in the review and is provided to facilitate identification of measures. For a single article, there may be several variations of the same measure (e.g., different tasks using a classic change-in-location paradigm). **Age range in TD population**: "None" signifies the absence of TD children in the studies using the measure. "*M*" signifies the mean age of the sample and is presented only when no age range could be retrieved. **Languages**: Languages other than English in which the measure was administered, as reported in the studies. When the study specified no language of administration, nor language spoken by participants, it was assumed that it was administered in the language the article was written in. **Adverse conditions:** adverse clinical, psychological or environmental conditions. Children presenting adverse conditions may have different age ranges than the ones in TD population provided in the table.

Abbreviations: TD = Typically developing; SES = Socioeconomic Status; ASD = Autism Spectrum Disorders; ADHD = Attention-deficit/hyperactivity disorder; TBI = Traumatic brain injury.

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2. Guajardo, N.R. and A.C. Watson, *Narrative discourse and theory of mind development.* Journal of Genetic Psychology, 2002. **163**(3): p. 305-25.
3. Guajardo, N.R., J. Parker, and K. Turley-Ames, *Associations among false belief understanding, counterfactual reasoning, and executive function.* British Journal of Developmental Psychology, 2009. **27**(Pt 3): p. 681-702.
4. Lu, H., Y. Su, and Q. Wang, *Talking about others facilitates theory of mind in Chinese preschoolers.* Developmental Psychology, 2008. **44**(6): p. 1726-1736.
5. Guajardo, N.R. and K.B. Cartwright, *The contribution of theory of mind, counterfactual reasoning, and executive function to pre-readers' language comprehension and later reading awareness and comprehension in elementary school.* Journal of Experimental Child Psychology, 2016. **144**: p. 27-45.
6. Murray, L., et al., *Children's social representations in dolls' house play and theory of mind tasks, and their relation to family adversity and child disturbance.* Social Development, 1999. **8**(2): p. 179-200.
7. Ketelaars, M.P., et al., *Dynamics of the theory of mind construct: A developmental perspective.* European Journal of Developmental Psychology, 2010. **7**(1): p. 85-103.
8. Cassidy, K.W., et al., *The Relationship Between Psychological Understanding and Positive Social Behaviors.* Social Development, 2003. **12**(2): p. 198-221.
9. Miller, M.R., et al., *The contribution of executive function and social understanding to preschoolers' letter and math skills.* Cognitive Development, 2013. **28**(4): p. 331-349.
10. Rice, K., et al., *Amygdala volume linked to individual differences in mental state inference in early childhood and adulthood.* Developmental Cognitive Neuroscience, 2014. **8**: p. 153-163.
11. Choe, D.E., et al., *Developmental precursors of young school-age children's hostile attribution bias.* Developmental Psychology, 2013. **49**(12): p. 2245-56.
12. Lucariello, J.M., T.M. Durand, and L. Yarnell, *Social versus intrapersonal ToM: Social ToM is a cognitive strength for low- and middle-SES children.* Journal of Applied Developmental Psychology, 2007. **28**(4): p. 285-297.

13. Holmes-Lonergan, H.A., *Understanding of affective false beliefs, perceptions of parental discipline, and classroom behavior in children from Head Start.* Early Education and Development, 2003. **14**(1): p. 29-46.
14. LaBounty, J., et al., *Mothers' and fathers' use of internal state talk with their young children.* Social Development, 2008. **17**(4): p. 757-775.
15. Lane, J.D., et al., *Theory of mind and emotion understanding predict moral development in early childhood.* British Journal of Developmental Psychology, 2010. **28**(Pt 4): p. 871-89.
16. Ruffman, T., et al., *How language relates to belief, desire, and emotion understanding.* Cognitive Development, 2003. **18**(2): p. 139-158.
17. Banerjee, R. and N. Yuill, *Children's understanding of self-presentational display rules: Associations with mental-state understanding.* British Journal of Developmental Psychology, 1999. **17**(Pt 1): p. 111-124.
18. Azurmendi, A., et al., *Cognitive abilities, androgen levels, and body mass index in 5-year-old children.* Hormones & Behavior, 2005. **48**(2): p. 187-95.
19. Misailidi, P., *Children's understanding of display rules: The role of second-order intentions.* Hellenic Journal of Psychology, 2007. **4**(1): p. 36-51.
20. Harris, P.L., et al., *Children's Understanding of the Distinction between Real and Apparent Emotion.* Child Development, 1986. **57**(4): p. 895-909.
21. Davis, T.L., *Children's understanding of false beliefs in different domains: Affective vs. physical.* British Journal of Developmental Psychology, 2001. **19**(1): p. 47-58.
22. Tarullo, A.R., et al., *Emotion understanding, parent mental state language, and behavior problems in internationally adopted children.* Development and Psychopathology, 2015. **28**(2): p. 371-383.
23. Ryan, N.P., et al., *Theory of mind mediates the prospective relationship between abnormal social brain network morphology and chronic behavior problems after pediatric traumatic brain injury.* Social Cognitive & Affective Neuroscience, 2016. **11**(4): p. 683-92.
24. Ryan, N.P., et al., *Relationships between acute imaging biomarkers and theory of mind impairment in post-acute pediatric traumatic brain injury: A prospective analysis using susceptibility weighted imaging (SWI).* Neuropsychologia, 2015. **66**: p. 32-8.
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26. Tager-Flusberg, H. and K. Sullivan, *Attributing mental states to story characters: A comparison of narratives produced by autistic and mentally retarded individuals.* Applied Psycholinguistics, 1995. **16**(3): p. 241-256.
27. Filippova, E. and J.W. Astington, *Further development in social reasoning revealed in discourse irony understanding.* Child Development, 2008. **79**(1): p. 126-38.
28. Peterson, C.C., H.M. Wellman, and V. Slaughter, *The mind behind the message: advancing theory-of-mind scales for typically developing children, and those with deafness, autism, or Asperger syndrome.* Child Development, 2012. **83**(2): p. 469-85.
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31. Dyck, M. and J. Piek, *How to distinguish normal from disordered children with poor language or motor skills.* International Journal of Language & Communication Disorders, 2010. **45**(3): p. 336-44.
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36. Wisdom, S.N., et al., *Can autism, language and coordination disorders be differentiated based on ability profiles?* European Child & Adolescent Psychiatry, 2007. **16**(3): p. 178-86.
37. Dyck, M.J., et al., *The relationship between symptoms and abilities in autism.* Journal of Developmental and Physical Disabilities, 2007. **19**(3): p. 251-261.
38. Hoogenhout, M. and S. Malcolm-Smith, *Theory of mind in autism spectrum disorder: Does DSM classification predict development?* Research in Autism Spectrum Disorders, 2014. **8**(6): p. 597-607.
39. Shaked, M., I. Gamliel, and N. Yirmiya, *Theory of mind abilities in young siblings of children with autism.* Autism, 2006. **10**(2): p. 173-87.
40. Russo-Ponsaran, N.M., et al., *Social-emotional correlates of early stage social information processing skills in children with and without autism spectrum disorder.* Autism Research, 2015: p. No Pagination Specified.
41. Kirk, E., et al., *A longitudinal investigation of the relationship between maternal mind-mindedness and theory of mind.* British Journal of Developmental Psychology, 2015. **33**(4): p. 434-445.
42. Kang, E., et al., *Predictors and Moderators of Spontaneous Pretend Play in Children with and without Autism Spectrum Disorder.* Frontiers in Psychology, 2016. **7**: p. 1577.
43. Andres-Roqueta, C., et al., *Social cognition makes an independent contribution to peer relations in children with Specific Language Impairment.* Research in Developmental Disabilities, 2016. **49-50**: p. 277-90.
44. Lapan, C. and J.J. Boseovski, *Theory of mind and children's trait attributions about average and typically stigmatized peers.* Infant and Child Development, 2016. **25**(2): p. 158-178.
45. Shahaeian, A., et al., *Cultural and family influences on children's theory of mind development: A comparison of Australian and Iranian school-age children.* Journal of Cross-Cultural Psychology, 2014. **45**(4): p. 555-568.
46. Dyck, M., K. Ferguson, and I. Shochet, *Do autism spectrum disorders differ from each other and from non-spectrum disorders on emotion recognition tests?* European Child & Adolescent Psychiatry, 2001. **10**(2): p. 105-116.
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48. McKown, C., et al., *Web-based assessment of children's social-emotional comprehension.* Journal of Psychoeducational Assessment, 2016. **34**(4): p. 322-338.
49. Lecce, S., et al., *Promoting theory of mind during middle childhood: a training program.* Journal of Experimental Child Psychology, 2014. **126**: p. 52-67.
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Table 9

Measures related to TOM – Faux pas category

	Measures characteristics								Participants characteristics		
TOM ability	**Measures (source author, year) [articles using this measure]**	**Internal structure and consistency information**	**Inter-rater reliability information**	**Test-retest reliability information**	**Other psychometric information**	**Modes of presentation**	**Number of items**	**Scoring options**	**Age range in TD population (months)**	**Languages**	**Adverse conditions**
Ability to recognize "faux-pas" (social gaffe) situations	a) Recognition of faux pas (Baron-Cohen, O'Riordan, Stone, Jones, & Plaisted, 1999) [1-4]	a) –	a) Cohen's κ = .78-.98 [3]	a) –		Direct testing using audio stories or figurines	2 to 10	Correct/ incorrect	a) 48-192	German [4]	ASD [1] Language impairments [4]

Note. –: no information provided in the articles. **Measures:** The original source of a measure, written in brackets, may have not been included in the review and is provided to facilitate identification of measures. For a single article, there may be several variations of the same measure (e.g., different tasks using a classic change-in-location paradigm). **Languages**: Languages other than English in which the measure was administered, as reported in the studies. When the study specified no language of administration, nor language spoken by participants, it was assumed that it was administered in the language the article was written in. **Adverse conditions:** adverse clinical, psychological or environmental conditions. Children presenting adverse conditions may have different age ranges than the ones in TD population provided in the table.

Abbreviations: TD = Typically developing; ASD = Autism Spectrum Disorders.

1. Hoogenhout, M. and S. Malcolm-Smith, *Theory of mind in autism spectrum disorder: Does DSM classification predict development?* Research in Autism Spectrum Disorders, 2014. **8**(6): p. 597-607.
2. Peskin, J., C. Prusky, and J. Comay, *Keeping the reader's mind in mind: Development of perspective-taking in children's dictations.* Journal of Applied Developmental Psychology, 2014. **35**(1): p. 35-43.
3. Filippova, E. and J.W. Astington, *Further development in social reasoning revealed in discourse irony understanding.* Child Development, 2008. **79**(1): p. 126-38.
4. Jester, M. and C.J. Johnson, *Differences in theory of mind and pretend play associations in children with and without specific language impairment.* Infant and Child Development, 2016. **25**(1): p. 24-42.

Table 10

Measures related to the TOM – Comprehensive measures category

Measures characteristics									Participants characteristics		
Format	**Measures (source author, year) [articles using this measure]**	**Internal structure and consistency information**	**Inter-rater reliability information**	**Test-retest reliability information**	**Other psychometric information**	**Modes of presentation**	**Number of items**	**Scoring options**	**Age range in TD population (months)**	**Languages**	**Adverse conditions**
Multiple TOM abilities measured using questionnaires/interviews	a) Everyday mindreading skills and difficulties scale (Peterson, Garnett, Kelly & Attwood, 2009) [1]	a) Cronbach's α = .82 [1]	a) –	a) –	a) Discriminates between ASD and TD, associated with TOM tests [1]	Questionnaires completed by parents and/or other adults	8 to 85	Likert scale or response continuum of 20 metric units	a) *M* = 117	French [4, 6, 10, 11, 13] Spanish [8]	ASD [1-3, 5, 7-12, 14] ADHD [5] Language impairments [11] Intellectual disability or developmental delay [11] Reading disorder [11] Learning disabilities [12]
	b) Theory of mind inventory & Perceptions of children's theory of mind measure-experimental version (Hutchins, Prelock & Bonazinga, 2012; Hutchins, Bonazinga, et al., 2008) [2-9]	b) Cronbach's α = .96-.98; Structure analyzes were performed [3, 4, 8, 9]	b) –	b) *r* = .86-.98 [2-4]	b) Discriminates between age groups and between ASD and TD; associated with TOM tests, social, verbal and communication abilities, age [2-4, 8, 9]				b) 24-168		
	c) Supplementary social and maladaptive items/Échelle d'adaptation sociale pour enfants (Frith, Happé & Sidons, 1994) [4, 6, 10-13]	c) Cronbach's α = .77-79 [10, 11]	c) Spearman's rho = 20-75 [10]	c) –	c) Discriminates between clinical groups and TD, associated with TOM tests, age [10, 11]				c) 36-74		
	d) Children's social understanding scale (Tahiroglu, Moses, Carlson, Mahy, Olofson & Sabbagh, 2014) [14]	d) Cronbach's α = .81-.94, Structure analyzes were performed [14]	d) –	d) *r* = .88 [14]	d) Associated with TOM tests, age, working memory; divergent validity: prospective memory and planning [14]				d) 28-84		

Multiple TOM abilities measured using direct testing	a)	Theory of mind subtest of a developmental neuropsychological assessment (NEPSY-II; Korkman, Kirk & Kamp, 2007) [15-26]	a) Mean consistency coefficient (split-half and Cronbach's α): *r* = .84 [23, 24]	a) % agreement = 99% [23, 24]	a) *r* = .84; % consistency of percentile rank = .91-.96 [23, 24]	a) Discriminates between ASD and TD; measurement error and norms are available [23, 24]	Direct testing using web vignettes, pictures, read aloud stories, storybooks, figurines and/or games	1 to 93	Correct/ incorrect or likert scales or coding children's explanta-tions	a) 34-191	Finnish [18] [15, 26] Italian [21, 26, 28, 29, 143, 163] French [6, 13, 24, 157] Dutch [27, 30, 144-150] Spanish [82, 98] Farsi [53-55] English sign language [52, 61, 62] Auslan [61] German [64, 68, 76, 83, 97, 106] [117, 120, 121, 123, 140] Mandarin [96, 102, 116] Cantonese [142] Bahasa Indonesia [91] Turkish [103, 152] Portuguese [108] Swedish [153] Chinese [136]	Language impairments [15, 39, 58, 140] ASD [2, 3, 5, 15-17, 19-21, 23, 24, 27, 31-33, 46, 47, 52, 57, 60, 63, 79, 95, 109, 130, 132, 134, 136, 146, 154, 155, 165, 171-173] ADHD [5, 16, 20, 146] Reading disorder [16] Turner syndrome [22] Fragile x syndrome [60] Down syndrome [60, 95, 133] Learning difficulties [20] Anxiety or depression [20, 146] Hearing impairments or deafness [47, 48, 52, 61, 62, 141, 153, 169] Low birth weight [75] Maltreatment [89] Low SES [91, 104, 105] Williams syndrome [160, 164]
	b)	ToM storybooks (Blijd-Hoogewys et al., 2008) [27-31]	b) Intercorrela-tions between 4 parrallel parts (books): *r* = .67-.79; structure analyzes were performed; Cronbach's α = .47-.90 [27, 28]	b) Cohen's κ = .81-.99 [27]	b) *r* = .86-.98 [27]	b) Scaling analysis was performed, norms are available; discriminates between ASD and TD; associated with sociability, verbal ability, IQ and TOM tests [27]				b) 31-132		
	c)	Comic strip Task (Cornish et al. 2010) [32, 33]	c) Cronbach's α = -.04-.79 [32]	c) –	c) –	c) Discriminates between ASD and TD, associated with verbal ability [32]				c) 48-147		
	d)	ToM scale (Wellman and Liu, 2004) [13, 14, 34-142]	d) Cronbach's α = .76-.80 ; Kuder-Richardson's formula = .98 [122, 139] Cronbach's α = .63-.87 [78, 118, 126, 128, 139, 170]	d) % agreement = 95-100% [13, 52, 93, 106] Cohen's κ = .82-1.00 [53, 92, 122, 171]	d) –	d) Scaling analyzes were performed, discriminates between ASD, Down syndrome and TD and between deafness and TD, associated with age and other TOM tests [34, 52, 53, 76, 93, 95, 96, 116, 136, 140]				d) 14-156		
	e)	Theory of mind test (Pons & Harris, 2002) [143]	e) Cronbach's α = .69 [143]	e) –	e) –					e) *M* = 53		
	f)	TOM test (Muris, Steerneman, Meesters, Merckelbach, Horselenberg, van den Hogen & van Dongen, 1999) [144-150]	f) Cronbach's α = .62-.98 [146-148, 150]	f) Cohen's κ = .80-1.00 [146, 150]	f) *r* = .88; intraclass correlation = .80-.99 [146]	f) Discriminates between ASD and other clinical groups (anxiety, ADHD), associated with age, emotion recognition, social abilities				f) 48-156		

					and other TOM tests [146]		Filipino [138]	Prader-Willi syndrome [164]
g)	Perspective-taking (Krcmar & Vieira, 2005) [151]	g) Structure analyzes was performed [151]	g) Cohen's κ > .80 [151]	g) –		g) 60-144		Intellectual disabilitity or developmental delay [165, 172]
h)	Perspective-taking tests (Kurdek & Rodgon,1975) [152]	h) –	h) –	h) –		h) 60-72		Neurofibromato-sis [161]
i)	Socio-emotional ToM test (Sundqvist, Lyxell, Jonsson, Heimann, 2014) [153]	i) –	i) –	i) –		i) 24-152		
j)	TOM task battery (Hutchins, Prelock, Chace, 2008) [2, 3, 5, 6, 154, 155]	j) Cronbach's α = .73-.94; Structure analyzes was performed [6, 154]	j) % agreement = 97-100% [6, 154]	j) *r* = .86; Test-retest, κ = .08-.84 [6][154]	j) Associated with age, other TOM tests and social abilities [6]	j) 36-165		
k)	Perspective taking task (Edelstein, Keller & Wahlen; 1984) [156]	k) –	k) % agreement = 93% [156]	k) –	k) Scaling analyzes were performed [156]	k) *M*= 70-*M*= 106		
l)	Five movies for assessing the use of mental words and the aqcuisition of a TOM (Bouchand & Caron, (1999) [157]	l) –	l) –	l) –		l) 36-78		
m)	Perspective taking tasks (Howlin, Baron-Cohen & Hadwin, 1999) [158, 159]	m) –	m) –	m) –		m) 57 to 70		
n)	Picture sequencing task (Langdon et al., 1997) [160, 161]	n) –	n) –	n) –		n) 48-144		
o)	Perspective taking ability test (Hudson, Forman, and Brion, 1982; Shin, 1996) [162]	o) –	o) –	o)-		o) 60-71		
p)	Psychological explanation task (Colonnesi, Rieffe, Koops & Perucchini, 2008) [163]	p) –	p) Cohen's κ = .93-.95 [163]	p) –		p) 38-40		
q)	Explanation of Action task (Tager-Flusberg and Sullivan, 1994) [164, 165]	q) –	q) % agreement = 100% [164]	q) –		q) 39-123		
r)	Past to future reasoning task (Lagattuta & Sayfan, 2011) [166, 167]	r) –	r) –	r) –		r) 48- 300		
s)	Social meaning scale from the SELweb (McKown, Russo-Ponsaran, Johnson, Russo & Allen, 2016) [168]	s) Cronbach's α = .78-.80; Structure analyzes were peformed [168]	s) –	s) *r* = .62-.69 [168]	s) Associated with social skills, social acceptance and academic competence; diververgent validity with behavior problems [168]	s) *M* = 87.6-91.2		
t)	Deaf children series (Serra, Spinato, Cocuzza et al. 2017) [169]	t) –	t) –	t) –		t) 54-74		

Note. –: no information provided in the articles. **Measures:** when authors provided no name for their measure, it was named according to its content in order to facilitate identification within the tables. The original source of a measure, written in brackets, may have not been included in the review and is provided to facilitate identification of measures. For a single article, there may be several variations of the same measure (e.g., different tasks using a classic change-in-location paradigm). **Age range in TD population**: "None" signifies the absence of TD children in the studies using the measure. "*M*" signifies the mean age of the sample and is presented only when no age range could be retrieved. **Languages**: Languages other than English in which the measure was administered, as reported in the studies. When the study specified no language of administration, nor language spoken by participants, it was assumed that it was administered in the language the article was written in. **Adverse conditions:** adverse clinical, psychological or environmental conditions. Children presenting adverse conditions may have different age ranges than the ones in TD population provided in the table.

Abbreviations: TD = Typically developing; SES = Socioeconomic Status; ASD = Autism Spectrum Disorders; ADHD = Attention-deficit/hyperactivity disorder.

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