Do you know what I know? Investigating the depth of infants' concept of belief

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A Thesis

In

The Department

of

Psychology

Presented in Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy (Psychology) at

Concordia University

Montréal, Québec, Canada

December 2019

CONCORDIA UNIVERSITY

SCHOOL OF GRADUATE STUDIES

This is to certify that the thesis prepared

By: Kimberly Burnside

Entitled: Do you know what I know? Investigating the depth of infants' concept of belief

and submitted in partial fulfillment of the requirements for the degree of

Doctor Of Philosophy (Psychology)

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ABSTRACT

Do you know what I know? Investigating the depth of infants' concept of belief

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The main objective of the present dissertation was to investigate the depth of infants' understanding of beliefs. Specifically, it was crucial to address the "rich" vs. "lean" debate of theory of mind understanding in infancy. The aim of Study 1 was to directly examine whether infants' looking time pattern commonly observed in the VOE task was replicated when a mechanical toy crane replaced the human agent. Results revealed that infants in the incongruent group did look longer at test than the infants in the congruent group, thus suggesting that infants overattribute false beliefs to inanimate agents.

The goal of Study 2 was to examine whether infants' looking time pattern in the VOE task was replicated using a switch agent paradigm. Specifically, infants watched as a true or false belief was attributed to an agent and then watched as a second, naïve agent search for the object at test. As in Study 1, infants in the incongruent group looked longer at test than the infants in the congruent group, indicating that infants formed expectations for this naïve agent's actions, once again suggesting that infants overattribute beliefs.

Taken together, the findings from the two studies demonstrate that infants broadly overattribute beliefs to any agents, even those to whom adults would not attribute beliefs. These findings challenge the "rich" view of theory of mind understanding in infancy given that this view posits that infants have a sophisticated understanding of mental states.

ACKNOWLEDGMENT

First, I would like to thank my supervisor, Dr. Diane Poulin-Dubois, for her continued support and encouragement throughout my graduate studies as well as for all the opportunities she provided throughout the years. Further, her enthusiasm for research paved the way for outstanding performances and permitted me to grow to my full potential. I would also like to thank my committee members, Dr. Dale Stack, and Dr. Ben Eppinger for being a part of my dissertation committee, as well as for their help and support.

I would like to thank my parents and my sister for their help and support throughout these years. My mother taught me to strive for greatness and how to overcome obstacles. My father taught me to be diligent and to work hard for the goals I have set myself. You are both my inspirations and I am forever grateful the love you continue to give me. I would also like to express my heartfelt gratitude to my friends for the happiness and joy they bring to my heart. A special thank you to Lucy for always being there for me. To previous and current students of the Cognitive and Language Development Lab, thank you for your help, guidance, and support. We are a stronger team because of our friendship. Special thanks to the Honours students who have worked incredibly hard on these studies

I would like to thank the Social Sciences and Humanities Research Council of Canada (SSHRC) and the National Institute of Child Health and Human Development for awarding grants to Dr. Diane Poulin-Dubois, as well as SSHRC and Concordia University for awarding me fellowships. Lastly, I would like to thank the children and families that participated in these studies.

CONTRIBUTIONS OF AUTHORS

This dissertation consists of two manuscripts.

Study 1 (see Chapter 2)

Burnside, K., Severdija, V., & Poulin-Dubois, D. (2019). Infants Attribute False Beliefs to a Toy Crane. *Developmental Science*, e12887. doi:10.1111/desc.12887

Study 2 (see Chapter 3)

Burnside, K., Neumann, C., & Poulin-Dubois, D. (2019). *Infants generalize beliefs across individuals*. Manuscript revised and resubmitted for publication to *Developmental Psychology*.

Relative Contributions

Conceptualization of the studies (i.e., research question) was completed by myself and my thesis supervisor, Dr. Diane Poulin-Dubois. Following a complete review of the literature, we designed the methodologies, chose the experimental tasks, and finalized the procedure. The physical preparation of the experimental tasks, including preparing the testing materials, scripts, and testing documents (e.g., consent forms and demographic questionnaires) was completed by myself and the Honours students (Vivianne Severdija and Cassandra Neumann). I helped the laboratory manager (Catherine Delisle and Jean-Louis René) prepare for recruitment, including preparing recruitment letters to be mailed to potential participants. Recruitment of participants was conducted by the laboratory's recruiter Melanie Joly. Data collection of both studies required three testers: I live-coded infants' looking time for both studies, Vivianne Severdija and Carolina Gil (research assistant) manipulated the stimuli of the VOE task in Study 1 and Cassandra Neumann and Adina Gazith (research assistant) manipulated the stimuli of the VOE task in Study 2. In addition, Mallorie Brisson, Jessy Burdman-Villa Catherine Delisle, Maude Poulin, Jean-Louis René, Tiffany Resendes, and Alexa Ruel assisted with data collection. I recoded (offline) all the participants' looking time during all trials of the VOE task. Vivianne Severdija was the reliability coder for Study 1 and Cassandra Neumann was the reliability coder for Study 2. I entered all the data in SPSS and the Honours students (Vivianne Severdija and Cassandra Neumann) double-check my data entry. I conducted all of the statistical analyses and interpreted the data. Following a revision of the results with Dr. Poulin-Dubois, I wrote the two manuscripts and Dr. Poulin-Dubois provided revisions and feedback. The two Honours students on the first and second manuscripts (Vivianne Severdija and Cassandra Neumann) also provided feedback as co-authors. Lastly, I created a summary of the findings of Study 1 and 2, which were included in a newsletter that was sent to all the families that participated in the studies. Dr. Poulin-Dubois provided guidance and feedback throughout every step of my dissertation.

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Chapter 1

Introduction

Theory of mind (ToM) is a complex socio-cognitive ability that is defined as the understanding that others have mental states, such as desires, intentions, knowledge, and beliefs, and that these mental states can differ from one's own, such as false belief (Wellman, 2014). As such, it plays an essential role in human interactions, permitting the explanation and prediction of another person's behavior. ToM was traditionally thought to emerge in the preschool years because early studies included tasks requiring verbal responses from the participants, thus limiting the ages at which it could be tested (Scott, 2017; Wellman & Liu, 2004). In order to test younger children whose verbal abilities are not as developed, researchers have designed implicit tasks using non-verbal procedures (e.g., anticipatory looking, violation-of-expectation (VOE)) (Clements & Perner, 1994). Using these implicit tasks, researchers were able to find evidence of ToM in infants as young as 7 months of age (Kovács, Téglás, & Endress, 2010). However, it remains unclear whether these tasks measure a fully formed ToM or basic cognitive skills that are precursors to this ability (i.e., also known as the ToM in infancy debate). For example, despite many replication successes (see Scott & Baillargeon, 2017 and Baillargeon, Buttelmann, & Southgate, 2018 for reviews) most implicit tasks can be difficult to replicate, thus making the interpretation of their findings more challenging (Kulke, Johannsen, & Rakoczy, 2019; Kulke, Reiß, Krist, & Rakoczy, 2018).

Although failures to replicate are often due to methodological changes, such as within-subjects instead of between-subject designs (Yott & Poulin-Dubois, 2016) or not enough time allotted to process the belief induction phase in the VOE task (Powell, Hobbs, Bardis, Carey, and Saxe, 2018), such instability could be interpreted as reflecting a fragile infant understanding of false beliefs. Given the numerous studies with positive findings, many researchers have interpreted infants' successful performances on these implicit tasks as reflecting a sophisticated understanding of ToM (Baillargeon, Scott, & He, 2010; Scott, 2017). This view is labeled as mentalistic or "rich" because it argues that, once task demands are reduced, a deep and sophisticated understanding of ToM—an understanding similar to adults and older children—is revealed, implying that ToM is stable across the lifespan. However, there is a lack of consensus in the field as other researchers have adopted a "lean" view, stating that implicit tasks measure domain-general abilities, such as basic learning principles, rather than a complex socio-cognitive ability such as ToM (Heyes, 2014a; Ruffman, 2014). Given that there is evidence that supports both views, there is no clear consensus as to which model is the better one. Therefore, the main goal of the current series of two studies was to directly address the lean vs. rich debate of ToM development in infancy by attempting to determine: 1) whether implicit tasks elicit the same pattern of behavior from infants when an inanimate object (i.e., an agent that does not, by definition, hold beliefs) plays the role of agent, and 2) whether infants understand that beliefs are person-specific (i.e., non-transferable without an exchange of knowledge).

Theory of Mind

Although ToM is defined as the understanding of others' mental states, it is actually an umbrella term that covers several different sub-concepts (Wellman & Liu, 2004). For example, one can understand that someone else has a different desire than one's own (e.g., a desire to eat broccoli rather than a chocolate chip cookie). Individuals can also have different goals (e.g., aspiring to become a psychologist vs. aspiring to become a mechanic). ToM can also encompass understanding others' intentions (e.g., my intention when I listen to the radio is to anticipate traffic on my commute). Individuals may also have different beliefs about a situation (e.g., I believe that my ice cream is in the freezer even though my roommate ate the entire pint). This last example is called “false belief.” Testing false belief understanding involves assessing whether individuals can perceive others’ unobservable mental states independent from their own; it is considered the “litmus test” for ToM understanding (Dennett, 1978; Wimmer & Perner, 1983). A classic example of a false belief task designed to test children is the Sally-Anne task (Baron-Cohen, Leslie, & Frith, 1985). In this task, Sally puts her marble inside a basket before she leaves to go to take a walk. While Sally is gone, Anne takes the marble from Sally’s basket and puts it in a box. When Sally returns from her walk, participants are asked where they think she will look for her marble. To pass this task, participants need to respond that she will look in the basket as she is unaware of the change of location of her marble (i.e., she has a false belief about the location of the marble).

Traditionally, children were thought to understand false belief, with tasks like the Sally-Anne task, between 4 and 5 years of age (Wellman & Liu, 2004). These tasks require children to produce an explicit response either verbally or by pointing to a given location. Therefore, these tasks are categorized as “explicit” false belief tasks. When assessed on these explicit tasks, children aged 3 years and younger typically fail to accurately predict the protagonist’s actions, and thus were initially thought not to have a fully developed false belief understanding (Wellman, Cross, & Watson, 2001). Repeated evidence of these failures on explicit tasks inspired researchers to modify task demands to determine if a more rudimentary false belief understanding was present in younger populations with immature executive function skills; these are termed “implicit” tasks.

Implicit Tasks

Clements and Perner (1994) were the first to use an implicit task to capture false belief understanding in children whose ages ranged from 2 years 5 months to 4 years 6 months. In this study, children viewed pictures of two mice. One mouse placed cheese in a blue box and then fell asleep. The second mouse changed the location of the cheese and hid it in a red box. The first mouse then wakes up and expresses that he is hungry. Children are prompted by the statement "I wonder where he's going to look?". Following this prompt, children's anticipatory looking (i.e., their eye-gaze) was measured to obtain an implicit measure of where they thought the protagonist would look for the cheese. They were also asked to explicitly report where they believed the mouse would search for the cheese so that the authors could compare the developmental progression of both implicit and explicit false belief understanding. Children aged 2 years 11 months and older demonstrated an implicit false belief understanding (i.e., their gaze correctly anticipated where the mouse would look), whereas only children aged 3 years 8 months and older demonstrated an explicit false belief understanding (i.e., they were able to correctly state where the mouse would search). Therefore, it was concluded that false belief understanding develops earlier than previously believed and that this ability could be captured by spontaneous-response tasks.

Clements and Perner's (1994) study sparked an increase in research on implicit false belief understanding in an attempt to determine how early this ability develops. These implicit tasks typically use eye-gaze to measure anticipatory looking or looking duration. In their seminal study using a VOE paradigm, Onishi and Baillargeon (2005) were able to show that infants as young as 15 months of age have an implicit false belief understanding. In the VOE paradigm, infants view a series of events, one of which is deemed surprising. The duration of infants' looking at a scene is measured; it is expected that infants will look longer at a scene when they are surprised; that is, when their expectations are violated. In Onishi and Baillargeon's (2005) task, infants are familiarized to an actor repeatedly retrieving a toy placed in one of two boxes. Following this, a false belief is induced: when the actor is absent, infants see the toy move to the second box. When the actor returns, she either searches the empty box (i.e., congruent with her false belief) or the box containing the toy (i.e., incongruent with her false belief). Infants in the incongruent condition are expected to look longer at the scene compared to the infants in the congruent condition, showing that they are surprised because their expectation of the actor's actions was violated. In this study, Onishi and Baillargeon (2005) used both an FB1 and an FB2 condition. In the FB1 condition, the agent sees one change of location before exiting the scene, while in the FB2 condition, the agent does not see a change in location and therefore has a false belief that the object is in the box the agent placed it in. In both conditions, infants in the incongruent group looked longer at the scene than those in the congruent group. Furthermore, as a control, the researchers also assessed infants in two true belief conditions (i.e., the actor is present during the location change and therefore knows where the object is located). Again, infants in the incongruent group (i.e., empty box) looked longer than the infants in the congruent group (i.e., box containing the toy). This was a pioneering study as it demonstrated both true belief and false belief understanding in young infants. Since then, researchers have reported that infants as young as 7 months of age exhibit looking behavior consistent with false belief understanding (see Scott & Baillargeon, 2017 for a review).

Since Onishi and Baillargeon's (2005) seminal study, many researchers have found evidence of false belief understanding in infancy using various paradigms (e.g., Scott & Baillargeon, 2009; Song & Baillargeon, 2008; Surian & Geraci, 2012; Yott & Poulin-Dubois, 2012). For example, using an anticipatory looking task, Southgate, Senju, and Csibra (2007) were able to provide evidence that 25-month-olds have an implicit false belief understanding. In this task, infants viewed two familiarization trials during which an agent watches as a puppet places a ball in one of two boxes, after which the agent reaches for the ball. The purpose of these familiarization trials is to demonstrate that the agent's intention is to retrieve the ball. Following familiarization, the agent gets distracted and fails to see that the ball is removed from the scene. When the agent returns, the infants' anticipatory looks were measured to examine in which box they anticipated the agent to search for the ball—assessing the infant's understanding of the agent's false belief. In this task, the ball was absent from the scene to avoid biasing the infants' looks to the actual location of the target object. Furthermore, the puppet, along with the ball, had exited from the middle of the scene to avoid biasing infants' looks to either side of the scene. As such, the authors ensured that the infants' eye movements would only be due to their anticipation of where the agent would look for the ball. The researchers found that 85% of the 25-month-olds correctly anticipated the protagonist's actions. This study provided a rigorous test of false belief using infants' anticipatory looking.

Other researchers have pooled their efforts to demonstrate that infants have a false belief understanding when assessed using interactive tasks. Interactive tasks rely on infants' elicited interventions rather than eye-gaze. As such, they are considered more explicit than implicit, but without the linguistic demands of traditional explicit tasks. For example, Buttelmann, Carpenter, and Tomasello (2009) used a helping task to demonstrate that 18-month-olds understood an agent's false belief. In this task, an experimenter (E1) is sitting next to the infant while another experimenter (E2) explores two boxes. E2 leaves the room to fetch a toy. While E2 is gone, E1 teaches the child how to lock and unlock the boxes. When E2 returns, s/he places an attractive toy in one of the boxes and then leaves the room again. While E2 is gone, E1 sneakily changes the location of the toy to "play a trick" on E2. When E2 returns, he attempts and fails to open the box where he had last seen the toy and expresses puzzlement. If the infant helped E2 retrieve the toy from the other box, it reflected a demonstration of false belief understanding (i.e., the infant helped retrieve the object that they understood E2 wanted to retrieve, and understood that E2 held a false belief about the location of the object). Southgate, Chevallier, and Csibra (2010) also used an interactive task to measure false belief understanding in 17-month-olds. In this task, infants were first familiarized with the set-up whereby the experimenter (E1) hid two familiar toys in two boxes, placed on each side of E1, and infants were then asked to retrieve each toy one at a time. Then, infants were introduced to two novel objects, which were also placed in each box. Following this, E1 left the room while announcing that she would return shortly. While E1 was gone, a second experimenter (E2) entered and sneakily switched the objects' locations to induce a false belief in E1, after which E2 left the room. Then E1 returned and asked the infants to hand her the "sefo" while pointing to one of the two boxes. For infants to demonstrate an understanding of false belief, they should infer that E1 wants what she believes is in the box (i.e., the object that was in that box before the switch). As such, for the infants to pass this task, they must fetch the object in the opposite box than the one E1 points to. These interactive tasks require more executive function skills than the spontaneous-response tasks based on eye-gaze, which explains why only older infants (e.g., 17-19 months) have shown successful performances.

Replication Crisis

Recently, spontaneous-response and interactive implicit false belief tasks have been shown to be difficult to replicate (Sabbagh & Paulus, 2018). For example, recent studies failed to replicate both Buttelmann and colleagues' (2009) false belief task and Southgate and colleague's (2010) "sefo" task (Crivello & Poulin-Dubois, 2018; Dörrenberg, Rakoczy, & Liszkowski, 2018). The spontaneous-response false belief tasks have also been difficult to replicate.

Burnside, Ruel, Azar, and Poulin-Dubois (2018) used the autobox task with children and adults—two age groups who should excel at false belief tasks. The autobox task, developed by Thoermer, Sodian, Vuori, Perst, and Kristen (2012), is an anticipatory looking task in which an agent watches as a toy car moves from one garage to another—both located at the opposite ends of the screen. At the end of two familiarization trials, the agent reaches for the toy car, thus demonstrating a clear goal of retrieving the toy car. At the test trial, the agent gets distracted as the car is halfway to the second garage—while the agent is not looking, the car reverses and exits the scene on the side opposite of where it was heading when the agent was watching. Infants' anticipatory looks are measured to determine whether, and where, they predict the agent will go to reach for the car. Burnside and colleagues' (2018) goal was to attempt to generalize the infancy findings to older age groups—if false belief understanding in infancy is sophisticated and comparable to these age groups, than one would expect comparable performances. Only 38% of children, and only 55% of the adults, correctly anticipated the agent's actions (Burnside et al., 2018). Interestingly, despite the fact that their first look was often to the wrong location, adults spent significantly more time looking at the correct location, indicating that they were able to disengage their attention from the wrong location and redirect it to the correct location. This suggests that advanced executive functioning (i.e., inhibitory control) may be needed to succeed on this task. As such, this task may not reliably capture false belief understanding given that it heavily relies on executive functioning.

Importantly, the original false belief task based on the VOE paradigm has also been proven to be difficult to replicate. For example, Dörrenberg and colleagues (2018), Powell and colleagues (2018), and Yott and Poulin-Dubois (2016) all failed to replicate the VOE task. Further, Kulke, von Duhn, Schneider, and Rakoczy (2018) attempted to replicate four different false belief paradigms, including Southgate and colleagues' (2007) anticipatory looking task, which they were unable to replicate. Additionally, recent studies have not found any convergent validity between the tasks that allegedly tap into the same ability (Dörrenberg et al., 2018; Poulin-Dubois & Yott, 2018). These (lack of) replication studies suggest that either 1) false belief understanding in infancy is not a robust phenomenon that cannot be reliably measured using implicit tasks, 2) the currently available tasks do not have adequate validity to measure this abstract construct (i.e., the non-replications can be due to methodological changes, thus indicating that the competence is fragile or unstable), or 3) these tasks tap into other abilities that are likely precursors to false belief understanding. Baillargeon and colleagues (2018) brought forward several explanations for these failed replications: making the events more ambiguous thus confusing the infants, changing the timing of events thus preventing the infants from having time to form expectations, changing the duration of the pauses during which infants' looking is measured, and differences in populations studied, among other possible reasons. Therefore, it remains unclear whether implicit tasks have strong construct validity, which is why they are currently being investigated in the field in a large-scale replication study to clarify this issue (ManyBabies2; Frank, Tamnes, Reschke, Rocha-Hidalgo, & Lieberman, 2019).

Interpretations of Implicit Tasks

The most popular interpretation of infants' behaviors in implicit tasks is that infants have a sophisticated false belief understanding, akin to older children and adults. Proponents of this "rich" mentalistic view of ToM understanding argue that infants and younger children fail the traditional, explicit ToM tasks simply because they are heavily reliant on language abilities and executive functions, rather than due to an undeveloped ToM (Baillargeon, Scott & Bian, 2016; Baillargeon et al., 2010; Scott, 2017; Carruthers, 2018). This may also explain the difficulty involved in replicating performances on implicit false belief tasks that require executive functioning abilities (e.g., autobox task). This "processing-demands account" posits that, when children are asked the test question in explicit false belief tasks, they have to engage in (a) a "response-selection process" by analyzing the question and choosing to answer, (b) a "response-inhibition process" by inhibiting themselves from answering that the object is in its current location, and (c) working memory processes in order to remember the story sequence and the protagonist's false belief (Scott, 2017). Since infants' spontaneous responses are measured (i.e., looking behavior), they do not have to "select" a response, or "inhibit" themselves from looking where the object is located (because, in most cases, the object is not located in the scene during the anticipatory looking period). In other words, their behavior reflects infants' unsolicited expectation of the actor's behavior, which thus reflects their understanding of the actor's false belief. However, Wellman (2014) notes that it is unlikely that implicit tasks tap into "unvarnished theory-of-mind competence" and that the only reason preschoolers fail explicit tasks is because of immature executive functioning. As such, there is no consensus in the field of infant cognition on whether infants have an *understanding* of ToM and whether implicit tasks permit us to test this hypothesis effectively.

Since the emergence of these findings, some researchers have opposed this view and argued that infants' performance on implicit tasks reflect their understanding of simple behavioral rules (Perner & Ruffman, 2005; Ruffman, 2014). Specifically, Ruffman (2014) argues that stimulus-response behavioral rule understanding is rooted in advanced statistical learning abilities, which is an ability to learn patterns in behaviors (e.g., in the VOE task, the agent's hand repeatedly goes where the object is located). Statistical learning, paired with biases towards facial features and motion, play an active role in directing infants' attention towards agentive behaviors (e.g., a person will look for an object where they last saw it; Perner, 2010; Ruffman, 2014). Therefore, according to this “lean” account, infants’ performances on implicit false belief tasks is guided by behavioral rule understanding rather than mentalizing abilities (Low & Perner, 2012; Ruffman, 2014). Understanding behavioral rules could be considered a precursor ability to understanding goals/intentions, which are early markers for ToM understanding. As such, this theory accounts for positive longitudinal findings using implicit false belief tasks. Other researchers argue that implicit tasks measure more domain-general abilities, which are—by definition—abilities that are generalizable to different situations (i.e., overall learning abilities). For example, Heyes (2014a) argues that infants’ behaviors in implicit tasks likely reflect their ability to detect low-level properties (e.g., colours, shapes, and movements) inherent in the tasks. She argues that in Onishi and Baillargeon’s (2005) VOE task, infants look longer during one of the two test events (i.e., the incongruent conditions) because of the perceptual novelty present in that test event. Specifically, prior to the test trial, infants see the toy move to the other box while the actor is absent (e.g., in the false belief green condition the toy moves to the yellow box). Heyes (2014a) argues that this action reduces the novelty of the yellow box test event because the previous movement was to the yellow box. As such, the green box test event is more novel than the yellow box test event, which would explain why the infants look longer during the green box test event. If this theory is true, implicit false belief tasks like the VOE task do not measure false belief, but infants’ ability to detect the perceptual novelty, or other low-level properties, present in the test condition.

Scott and Baillargeon (2014) have challenged Heyes’s (2014a) theory by citing extensive research demonstrating that infants do not only respond to colour, shape, and movement. For example, they argue that associative learning cannot explain infants’ understanding of identity false belief. Specifically, Scott and Baillargeon (2014) state that Scott and Baillargeon's (2009) findings are in contrast with this "lean" view. In one experiment, an agent demonstrated a clear goal of hiding a key in a 2-piece toy penguin that needed to be assembled by the agent. At test, the 2-piece penguin was previously assembled by another experimenter and therefore looked identical to the 1-piece penguin that was also present during the familiarization trials. The 1-piece penguin was hidden under an opaque cover and the assembled 2-piece penguin was under a transparent cover. Infants looked longer when the agent reached for the penguin under the transparent cover because they were surprised that she reached for what she believed was the 1-piece penguin (i.e., they expected her to reach for the penguin under the opaque cover to hide her key). In a second experiment, the agent's goal of hiding the key was removed and everything else (e.g., colours, shapes, and movements) remained perceptually similar. Findings revealed that infants' looking patterns differed (i.e., equal looking when the agent reached for the transparent or opaque covers) from the first experiment because they did not have any expectations for the agent's actions in the absence of a clear goal. Scott and Baillargeon (2014) argue that these results are in contrast with Heyes's (2014a) perceptual novelty account because despite yielding different looking time patterns, both experiments looked perceptually identical. If Scott and Baillargeon's (2014) argument is correct, then the same argument should hold for the VOE task. In order to directly test the submentalizing hypothesis, Heyes (2014b) suggested replacing the human agent in the VOE task with an inanimate object, while keeping all other elements of the original task intact, to determine if infants are truly behaving based on low-level properties. Therefore, the goal of the first study in this dissertation is to test whether infants' looking patterns change when an inanimate agent, which does not hold beliefs, replaces the human agent in the VOE task.

An alternative perspective is to question whether implicit false belief develops separately from explicit false belief. For example, Apperly and Butterfill (2009) proposed that implicit and explicit false belief tasks might be measuring two separate systems of overall ToM understanding (i.e., a two-systems theory). Specifically, they proposed an "efficient mindreading system [that] is evolutionarily and ontogenetically ancient, operates quickly, and is largely automatic and independent of central cognitive resources" (i.e., System 1; implicit), and a "flexible mindreading system [that] develops late, operates slowly, and makes substantial demands on executive control processes" (i.e., System 2; explicit) (Low, Apperly, Butterfill, & Rakoczy, 2016). According to this theory, and corroborated by mounting empirical studies, implicit false belief is thought to develop before explicit false belief. As such, implicit and explicit false belief are believed to develop separately, and in parallel, which would imply a dissociation when both these concepts are measured concurrently. Various studies report such a dissociation in 3- and 4-year-olds (Burnside, Azar, & Poulin-Dubois, 2017; Grosse Wiesmann, Friederici, Disla, Steinbeis, & Singer, 2018; Grosse Wiesmann, Friederici, Singer, & Steinbeis, 2016; Low & Watts, 2013). These dissociations either provide support for the two-systems theory or indicate that the tasks used in infancy do not tap into ToM.

In summary, there is a "lean" vs. "rich" debate about infants' false belief understanding and there are results to support both sides of this debate (e.g., studies demonstrating sophisticated identity belief attribution and studies demonstrating a dissociation between implicit and explicit false belief understanding, supporting Apperly and Butterfill's (2009) two-systems theory). Given that a sophisticated false belief understanding involves understanding which agents should hold beliefs—as older children and adults do—this dissertation was designed to contribute to this debate by directly investigating whether infants have this ability.

The Present Studies

The present set of studies was designed to answer the following research question: do implicit false belief tasks used in infancy truly measure a sophisticated understanding of false belief understanding? This question was answered with two studies. Study 1's objective was to directly test Heyes's (2014b) theory by replacing the actor in Onishi and Baillargeon's (2005) VOE task with an inanimate agent. The inanimate object used would have as few animacy cues as possible (i.e., non-anthropomorphized) to avoid the generalization of false belief attribution. To conceptually-replicate the original study, a between-subjects design enabled a comparison between infants' looking time in the false belief congruent group and infants' looking time in the false belief incongruent group. If the pattern of infants' performance on the modified VOE false belief task was the same as the pattern found by Onishi and Baillargeon (2005) (i.e., longer looking at the incongruent condition), then it would indicate that infants overattribute beliefs to an inanimate object or that the task measures other abilities, such as perceptual novelty. In other words, if this task reflects infants' sophisticated understanding of false belief, then they should not ascribe a false belief to an inanimate object. However, if the presence of an inanimate agent generates a different looking pattern, then infants failed to attribute a false belief to an inanimate object and perceptual novelty is unlikely to account for the results yielded in the VOE task. Thus, results from this study would contribute to the debate about the construct validity of the VOE task.

Study 2 builds from the first study by examining in a more conservative way if infants truly understand which agents should hold beliefs. Specifically, a switch agent paradigm was used in the VOE task such that infants saw one agent in the familiarization trials and the belief induction trial and then see a second agent in the test trial. This second agent was naïve as she never had visual access to the location of the object and therefore should not hold any beliefs about its location. Once more, if the looking time pattern found by Onishi and Baillargeon (2005) was replicated, then infants either overattributed beliefs to a naïve agent or the task does not measure false belief understanding. However, if a different pattern of looking is observed, then infants have the sophisticated understanding of which agent should hold a specific belief. As such, results from this study would further contribute to the "rich" vs. "lean" debate of ToM in infancy.

Overall, results from this set of studies will provide an innovative approach by addressing the sophistication of infants' false belief understanding when measured with the VOE paradigm. This is important because this task is often used to measure false belief understanding without questioning its construct validity. Further, this dissertation has theoretical value because the results from this set of studies will provide evidence for one side of the debate (i.e., the results will either be in line with the "rich", mentalizing view, or with a lean view (e.g., submentalizing, two-systems theory)). This is also of importance because it will inform the field regarding whether ToM is a cognitive instinct (i.e., a specific ability unique to humans that is present from birth) or if it is learned throughout development (i.e., a cognitive gadget) (Heyes, 2018). Tomasello (2018) has recently brought forward an interesting alternative hypothesis in which he argued that implicit false belief tasks, like the VOE task, measure knowledge understanding, rather than belief understanding. He argues that infants are not yet able to differentiate subjective and objective perspectives and that this ability develops in childhood. This "shared intentionality" account posits that following the development of joint attention, children attend to social interactions and learn about their subjective perspectives. They then learn how to coordinate their subjective perspectives with the objective perspective and that both of these perspectives can conflict with someone else's perspective (e.g., the agent in the VOE task). Since these abilities only develop in childhood, Tomasello (2018) argues that false belief can only be fully-developed around age 4 or 5—the age when traditional explicit false belief tasks are succeeded. Therefore, in a series of two studies the goal of this dissertation was to determine whether infants have a sophisticated false belief understanding.

Chapter 2

Burnside, K., Severdija, V., & Poulin-Dubois, D. (2019). Infants Attribute False Beliefs to a Toy Crane. *Developmental Science*, e12887. doi:10.1111/desc.12887

Infants Attribute False Belief to a Toy Crane

The ability to understand and reason about one's own and others' mental states, also known as Theory of Mind (ToM), is a foundational cognitive ability (Wellman, 2017). Among mental states, false belief understanding—originally reported to develop around the age of 4 years—is considered the marker of a fully developed ToM (Wimmer & Perner, 1983). A decade ago, this conceptual shift was challenged in a landmark study reporting false belief understanding in 15-month-old infants using the violation-of-expectation (VOE) paradigm (Onishi & Baillargeon, 2005). This striking finding led to the conclusion that "infants already attribute false beliefs to agents, calling into question the conclusion that false-belief understanding is not achieved until about 4 years of age" (page 238) and that "false-belief understanding emerges early in life and is *robust* and *sophisticated*" (Scott & Baillargeon, 2017, page 246). This mentalistic account posits that this ability is masked by the high task demands of the standard false belief task, which requires well-developed executive functioning abilities and verbal skills (Baillargeon et al., 2010; Scott, 2017). Over the past decade, a large number of experiments have replicated and extended the original findings using a range of procedures all based on spontaneous responses, including anticipatory looking and prompted helping (see Scott & Baillargeon, 2017, for a review). However, a number of recent studies have failed to replicate the original VOE findings with human infants, calling into question the *robustness* of false belief understanding in infancy. Most studies conducted conceptual, rather than strict, replications as they incorporated minor or major procedural changes to the original design (Dörrenberg et al., 2018; Poulin-Dubois, Polonia, & Yott, 2013; Powell et al., 2018; Yott & Poulin-Dubois, 2016). Yet, the fact that methodological changes, such as the duration of infant-directed pauses or within- vs between-subjects design, could impact the findings provides some evidence for the lack of robustness of false belief understanding in infancy as measured with this paradigm.

Other paradigms have been developed to test false belief understanding in infancy (e.g., anticipatory looking, helping) but they have also proven difficult to replicate (Burnside et al., 2018; Crivello & Poulin-Dubois, 2018; Priewasser, Rafetseder, Gargitter, & Perner, 2018; Schuwerk, Priewasser, Sodian, & Perner, 2018). Additionally, there appears to be a lack of convergence in performance when the same infants are administered pairs of nontraditional false belief tasks (e.g., anticipatory looking and VOE) (Dörrenberg et al., 2018; Poulin-Dubois & Yott, 2018; Powell et al., 2018). Finally, when adults are presented with false belief scenarios identical to those shown to infants in the VOE paradigm, they only refer to the protagonist's mental states when instructed to do so, casting doubt on rich interpretations of infants' mentalizing abilities (Low & Edwards, 2018). Nevertheless, it is important to note that some researchers have reported successful replications of the original results with the VOE paradigm (e.g., Kovács et al., 2010; Luo, 2011; Surian, Caldi, & Sperber, 2007; Träuble, Marinović, & Pauen, 2010; Yott & Poulin-Dubois, 2012). Some of these conceptual replications included methodological changes to the original paradigm, such as replacing the human agent with animate agents (e.g., caterpillar, Smurf). In sum, there are mixed findings regarding the construct validity of this task.

In contrast to the mentalistic account, leaner views have been proposed to explain the behaviors observed in procedures based on looking patterns or prompted actions (Ruffman, 2014). For instance, it has been argued that infants' responses in the VOE task can be explained by infants' learning of stimulus-response behavioral rules, such as "people look for an object at the last place they saw it" (Ruffman & Perner, 2005). Another lean account suggests that infants may solve implicit false belief tasks by submentalizing, a behavior that appears as if it is controlled by reasoning about mental states, but it is not (Heyes, 2014b). According to this view, rather than tracking the agent's false belief, infants encode the shallow visual properties of the stimuli—such as colors, shapes, and movements—during the familiarization trials and respond to the novelty of their configurations at the test trial. Thus, infants look longer during the incongruent test event than during the congruent test event because they witness a more perceptually novel event than that in the congruent condition (Heyes, 2014a). In order to determine whether there is a rich false belief understanding that is stable from infancy to childhood, the sophistication of such reasoning must be further examined. To investigate this, one of Heyes's (2014b) suggestion was to replace the agent with an inanimate object.

Although anthropomorphism is observed even in adults in certain contexts, sophisticated psychological reasoning entails reserving mental states to humans and animals (Abell, Happé, & Frith, 2000; Epley, Waytz, & Cacioppo, 2007; Oatley & Yuill, 1985). By preschool age, children deny mental states to inanimate agents (Opfer, 2002; Poulin-Dubois & Héroux, 1994). For example, Opfer (2002) asked 4-, 5-, 7-, 10-year-olds, and adults a series of questions after showing them an irregularly shaped dark dot moving in a goal-directed or non-goal-directed way. Specifically, the questions were addressing whether the participants ascribed biological, cognitive, and physiological properties to the inanimate agent. Although older children and adults considered the object as alive, even 5-year-old children did not attribute mental states (e.g., does it think?) to the inanimate agent (Opfer, 2002; Poulin-Dubois & Héroux, 1994). Interestingly, a number of studies have examined infants' attribution of motivational states (e.g. goals) to goal-directed inanimate agents. A stimulus is considered agentive when it displays animacy cues (e.g., morphology, goal-directed action, internal control, etc.), while an agent is considered sentient when it shows psychological reasoning abilities (e.g., think, remember). For example, by 5 or 6 months, infants attribute goals to a human but not to an inanimate agent such as a mechanical claw (Woodward, 1998). However, when unambiguous agency cues are provided (e.g., initiate motion in plain view), infants as young as 3 months detect the change of goals of inanimate agents such as a self-propelled box and can anticipate the goal of a mechanical claw by 11 months of age (Adam, Reitenbach, & Elsner, 2017; Luo & Baillargeon, 2010). This type of evidence has been interpreted as supporting the hypothesis that there exists an innate specialized psychological reasoning system that is activated whenever infants process the actions of individuals.

To our knowledge, only a handful of studies have been conducted on infants' attribution of *epistemic* states to inanimate agents. Surian and Geraci (2012) used animated geometric shapes in anticipatory looking false and true belief tasks. Infants watched two familiarization trials where a triangle followed a disc in a Y-shaped tunnel and entered a box at the end of one of the tunnels. In the true belief test trial, once the disc entered a box at the end of the Y-shaped tunnel, it changed location while the triangle was present. The triangle then entered the tunnel and infants' anticipatory looks to one of the two tunnel exits were recorded. In the false belief test trial, the triangle was absent from the scene during this change of location. Infants aged 17 months, but not 11-month-olds, attributed both true and false belief to the triangle, that is, anticipated the disk to come out of the Y-shaped tunnel on the side that was consistent with the triangle's "beliefs". The authors concluded that by 17 months infants can attribute beliefs to a self-moving, interacting object lacking agent-like morphological features. More recently, Tauzin and Gergely (2018) showed that 13-month-olds attribute knowledge to geometric agents who displayed two agentive cues: goal-directed action and turn-taking, contingent communication. In this task, a blob appeared to have the goal to find a ball hidden in one of two boxes—a second blob was also present throughout the sequence of events. During the task, a ball hid in one location unbeknownst to the first agent (i.e., naïve agent), while the second agent “knew” the location of the ball. They found that only when the agents engaged in unpredictable/variable contingent exchanges (i.e., communication), did the infants expect the naïve agent to find the object. Communicative contexts play an important role in ToM research. According to relevance theory, communicative utterances provide ostensive cues to observers (Sperber & Wilson, 1995). As such, results from Song and Baillargeon (2008) demonstrating that infants expect that an agent’s false belief would be corrected after being informed of the actual location of an object, as well as Tauzin and Gergely’s (2018) results indicating that infants recognized that animated agents can communicate information about the location of an object are in line with relevance theory and are in contrast with Heyes’s (2014a) lean view (Scott & Baillargeon, 2014). Therefore, communication is a crucial aspect in ToM understanding in the early years. Finally, one recent study tested apes with a design in which the human agent was replaced with an inanimate agent to test false belief (i.e., moving geometric shape), and the pattern of anticipatory looking initially observed with a human agent was not replicated (Kano, Krupenye, Hirata, Call, & Tomasello, 2017). This was a follow-up to a previous study that reported that apes anticipated where a person would look for an object after the apes witnessed a change of location in her absence (Krupenye, Kano, Hirata, Call, & Tomasello, 2016). Given that apes only correctly anticipated the person’s actions it was concluded that submentalizing cannot be responsible for apes' anticipatory looks in a false belief task.

The goal of the present study was to modify the design of the VOE task in order to shed additional light on the debate regarding the nature of infants’ false belief understanding. The aim was to answer the question "does the VOE task measure mentalizing abilities or submentalizing?" The results are an extension of Santiesteban, Catmur, Hopkins, Bird, and Heyes's (2014) findings, who addressed this question with the dot perspective task, but with Onishi and Baillargeon's (2005) VOE task. To our knowledge, no study has investigated whether human infants' responses in the VOE false belief paradigm are different when the agent is an inanimate object instead of a person. A remote-controlled mechanical crane performed the same movements as the human agent in the original false belief VOE task (Onishi & Baillargeon, 2005). The crane lacked many predictive cues of agency, including human-like morphology (e.g., eyes, human-shaped body), biological motion, texture (e.g., skin, fur), as well as contingent interaction with another object. However, the exact replication of the original design required the toy crane to display other agency cues (goal-direction, self-propulsion). Although self-propulsion is insufficient to attribute agency, the perception of internal control tends to generate the attribution of agency, that is, an entity having goals (Baillargeon et al., 2016). Two experiments were conducted: 1) the original implicit paradigm with infant participants and 2) an explicit version of the same task with adults. If infants already have the sophisticated false belief understanding tapped by traditional false belief tasks, then they should not attribute a false belief to an inanimate agent. Specifically, they should expect the crane to behave at test as it had behaved in the familiarization trials—they should look longer at the event in which the crane moves to a different location than in the familiarization trials (i.e., congruent test event), similar to the looking pattern recently reported in apes with an anticipatory looking task (Krupenye et al., 2016). In contrast, if infants' looking patterns from the original study are replicated when using an inanimate object, then this would provide evidence that infants might be mentalizing but are overattributing this mental state to all types of agents (i.e., sentient and non-sentient).

Such pattern of results could also signal that infants might be submentalizing when reacting to changes in the test events, creating associations between boxes, objects, and hands or shapes. Finally, if adults have a sophisticated false belief understanding and therefore understand that cranes do not have mental states, then they should anticipate that the crane will repeat the same movements as seen in the familiarization trials. In contrast, if adults attribute beliefs to inanimate agents, then they will predict that the crane will turn in a belief-congruent way such that they will anticipate the crane to turn to the empty box.

Method

Experiment 1

Participants. Participants were comprised of fifty-three infants (29 boys and 24 girls, M_{age} = 16.51 months, range = 15.60 – 17.87 months). Each infant was randomly assigned to one of two conditions: congruent (*n* = 28) or incongruent (*n* = 25). Fourteen additional infants were tested and excluded from the analyses due to fussiness, preventing completion of the study (*n* = 6), lack of attention during the procedure (*n* = 3), parental interference (*n* = 2), or experimental error (*n* = 3). Parents were asked to report if their child was previously exposed to a remote-controlled toy at home or at daycare. Given that the toy crane was activated using a remote control, all infants with prior exposure to remote-controlled toys were excluded from further analyses (*n* = 17). Therefore, the final sample was comprised of 18 infants in the congruent group and 18 infants in the incongruent group.

Procedure and materials. A warm-up session preceded the administration of the tasks to ensure that the infants were comfortable with the primary experimenter. During this time, parents were asked to complete a short demographic questionnaire, including a question about their child's exposure to remote-controlled toys. At the end of the session, infants received a gift and a certificate of merit for their participation. Parents received $20 as compensation.

VOE false belief task. In order to conduct a strict replication of the original task, a detailed script of the task was approved by one of the original authors (Baillargeon, personal communication, October 9th, 2017). The task was administered on a stage-like apparatus (107 cm x 97 cm x 104 cm). A yellow box and a green box (14 cm x 14 cm x 14 cm each) were placed 37 cm apart at each end of the stage. The boxes had a 14 cm x 14 cm opening on the side, covered with fabric. The boxes were placed such that the openings faced each other (see Figure 1). A yellow remote-controlled Playmobil™ toy crane (77 cm x 32 cm x 32 cm) was positioned at the center of the stage, exactly in the middle of the two boxes. The crane's arm extended 45 cm from the crane's body. A white board (110 cm x 52 cm) was used in the belief induction trial to block the crane from the participants' view. An orange cup (4.5 cm x 9 cm x 3 cm) covered in stickers with a magnet inside was used as the toy being manipulated by the crane. Another magnet was placed underneath the stage, such that the experimenter could slide the cup across the stage. A Panasonic™ camera was also located beneath the stage and was focused on the infant's face, which was displayed on an LCD monitor. An iMac 2011 OSX Yosemite 10.10.5 was used to live-code infants' looking behavior using the Habit 2000 program (University of Texas).

Infants were seated on a highchair 110 cm from the stage. The parent sat 180 cm behind the infant. If infants refused to sit in the highchair, they were seated on their parent's lap (congruent: $n = 3$, incongruent: $n = 6$) and parents were asked to wear a sleep mask to cover their eyes. Infants viewed three familiarization trials, one belief-induction trial, and one test trial. Each trial was followed by an infant-directed pause, which ended when the infants either 1) looked away from the scene for 2 consecutive seconds after looking at it for a minimum of 2 cumulative seconds, or 2) looked at the scene for 30 cumulative seconds. Between each trial, an attention getter sound accompanied the rising and lowering of the screen.

In the first familiarization trial, lasting a maximum of 12 seconds, the screen was raised, revealing a crane positioned between two boxes (a yellow box and a green box) and a small cup hanging from the crane's hook. The crane's arm moved slightly from side-to-side for 8 seconds, to mimic playing with the toy. The crane then rotated and placed the cup inside the green box. The crane paused in this position until the end of the infant-directed pause (Figure 1). In the second and third familiarization trials, lasting a maximum of 6 seconds each, the crane's arm rotated towards the inside of the green box (i.e., where the cup was hidden) and paused in this position until the end of the infant-directed pause (Figure 2). The goal of these familiarization trials was to show that the crane, like the human actor in the original experiment, reached for the cup in the green box.

In the false belief induction trial, lasting a maximum of 24 seconds, the screen was raised, revealing the crane oriented straight between the two boxes with a white board covering the lower portion of the crane. At the start of the trial, an experimenter hidden below the stage used a magnet to move the cup from the green box to the yellow box (Figure 3A). Following this, the upper half of the board was lifted, such that the crane disappeared from the scene. Using the magnet, the cup was then moved back into the green box (Figure 3B). This change of location is typically labelled as a false belief induction trial because the human agent in the original study held a false belief that the toy was in the yellow box. An infant-directed pause started once the cup entered the green box.

Infants then viewed one of two test trials, lasting a maximum of 6 seconds (Figure 4). For the congruent group, the crane was rotated toward the yellow box (i.e., empty box). For the incongruent group, the crane was rotated toward the green box (i.e., where the cup was located). For both conditions, the crane's arm was paused in this position until the end of the infant-directed pause. Infants' total looking time (in seconds) at the scene during the infant-directed test pauses were recorded by another experimenter. If infants do not ascribe mental states to a crane, then they were expected to look longer at the test event that shows the crane moving toward the box that is different from the box where it went to during the familiarization trials (i.e., infants should look longer if they viewed the yellow box [belief-congruent] test event). Thus, unlike the case with the human agent, infants should not consider the change of location of the object during the induction phase as having an impact on the crane's behavior during the test event. Three experimenters were needed to administer this task. One experimenter sat behind a wall (out of view of the infant), and activated the crane using a remote control and moved the cup with the magnet during the induction trial. A second experimenter, hidden by the puppet theatre wall (also out of view of the infant), raised the curtain at the start of the trials and lowered the curtain at the end of the trials. The third experimenter sat behind the puppet theatre wall at the computer and live-coded the infant's looking time at the scene in order to transition to the next trial after the infant-directed pauses. During the entire administration of this task, no experimenter was visible from where the infant was sitting.

Coding and reliability. Looking time during the infant-directed pauses was live-coded using Habit 2000 (University of Texas) as part of the procedure. To obtain a more precise measurement, infants' looking time was recoded offline using INTERACT 8.0 (Mangold, 2010). To assess reliability, a second coder who was blind to the hypothesis of the study coded 25% of the video recordings. Cohen's kappa reliability was .83.

Experiment 2

Participants. Thirty undergraduate students (11 males and 19 females, M_{age} = 24.49 years, range = 20.08 – 35.67 years) were recruited to participate in a manipulation check of the procedure administered to the infants. They were asked to make predictions while watching a pre-recorded video of the VOE paradigm. Participants were undergraduate students enrolled in Psychology (13), Natural Sciences (9), Exercise Science (2), Engineering (2), Business/Finance (2), and Other (3) in a large Canadian University.

Procedure and materials. Participants were asked to complete a short demographic questionnaire, including their field of study. Participants were entered in a draw to win one of two $20 prizes. The VOE false belief task viewed by the infant participants in Experiment 1 was filmed. Prior to watching the video, adults were instructed to carefully watch the short video and were told that they would answer two short questions after the video ended. Adults viewed the three familiarization trials and induction trial – the video ended when the curtain was lifted at the start of the test trial, revealing the crane centered between the two boxes. Participants were then asked to answer "do you think the crane will go to into the yellow box or the green box?" on a sheet and were asked to explain why.

Results

Experiment 1

Using z-scores with cut-offs of ± 3.0, one participant's response in the test trial of the congruent condition was identified as an outlier. This score was replaced with the next highest value within 3 standard deviations of the condition mean. In their review of how to analyze looking-time data, Csibra, Hernik, Mascaro, Tatone, and Lengyel (2016) suggested that raw looking-time scores should be transformed using the logarithmic formula. As such, all analyses were conducted on transformed data, but the raw looking time is reported in text for comparison purposes.

On average, infants in the congruent group looked at the scene for 6.48 seconds (*SD* = 2.26) during the infant-directed pauses of the familiarization trials. During these same trials, infants in the incongruent group looked at the scene for 8.97 seconds (*SD* = 5.16). To determine if the two groups differed in their attention to the scene, infants' looking time during the infant-directed pauses of the three familiarization trials was analyzed in a 3 (trials) x 2 (group) repeated measures ANOVA. A main effect of trial was observed ($F(2, 68) = 6.42$, $p = .003$, $\eta^2 = .16$), and there were no main effect of group or interaction. Post-hoc analyses revealed that infants looked longer during the first familiarization trial ($M = 9.61$ seconds, $SD = 5.88$) than during the second familiarization trial ($M = 6.87$seconds, $SD = 4.50$, $t(35) = 2.57$, $p = .02$, $d = .52$). Infants also looked longer during the first familiarization trial than after the third familiarization trial ($M = 6.70$ seconds, $SD = 1.13$, $t(35) = 2.44$, $p = .02$, $d = .46$). Infants' looking time after the second familiarization trial did not differ from their looking time after the third familiarization trial ($t(35) = .14$, $p = .89$, $d = .03$). Additionally, infants' average looking time during the three familiarization trials did not differ between the congruent group and the incongruent group ($t(34) = 1.47$, $p = .15$, $d = .63$). Since the two groups' performance did not differ during the familiarization trials, infants' looking time during the test trial was compared between the two groups. The infants in the congruent group looked for 6.52 seconds (*SD* = 3.38) after the test trial, and infants in the incongruent group looked for 11.43 seconds (*SD* = 7.54) after the test trial (see Figure 5). The infants in the incongruent group looked longer than the infants in the congruent group ($t(34) = 2.44$, $p = .02$, $d = .89$). This longer looking indicates that the infants were surprised when the crane turned to the green box (i.e., where the cup is actually located) compared to when the crane turned to the yellow box.

Experiment 2

Overall, 77% (23/30) of adults predicted that the crane would turn to the green box (binomial p = .005). When asked to justify their prediction, 61% of adults (14/23) said that the crane would turn to the green box because that was where the crane always turned in the familiarization trials. Six (26%) adults responded that the crane's movements were linked to the cup's current location and three (13%) adults provided other answers (e.g., "it didn't see it go back to the green box").

Discussion

The main goal of the present study was to investigate whether infants behave similarly when an inanimate object replaces a human agent in the false belief VOE task. It was expected that if infants possess a sophisticated psychological reasoning system, similar to that of older children and adults, they would behave differently across these two conditions and attribute false belief only to the human agents. Thus, they should not attribute a false belief to an inanimate agent, or display the same looking patterns as in the original task, given that the only animacy cue the toy crane displayed was goal-directedness—a cue that has been found to be sufficient to categorize an agent as alive, but not as sentient. Nevertheless, this distinction may be too sophisticated for infants. In the present study, infants behaved similarly as in the original experiment with a human agent. In contrast, adults' testimony revealed that they expected the crane to turn to the green box given that this is the only movement the crane had previously exhibited. In other words, adults used a simple associative rule to predict the crane's movements and did not expect it to be guided by a belief about the location of the object following the belief induction phase. This is likely a result of their sophisticated false belief understanding and their advanced understanding of mechanical agents. However, it is important to acknowledge key methodological differences between the VOE task administered to the infants (i.e., implicit with a continuous variable) and to the adults (i.e., explicit with a dichotomous variable)—these two types of tasks do not have the same demands. Future studies should examine adults' spontaneous looking behaviors on this modified VOE task and compare them to infants' responses. To our knowledge, only one study has administered false belief tasks based on the VOE paradigm to adults (Low & Edwards, 2018). After being exposed to the agent's actions, adults were either assigned to a mental-state tracking group (i.e., explain motives, beliefs, or perspectives), an object-tracking group (i.e., explain location), or a neutral group (i.e., explain events). Only the adults in the mind-tracking group provided explicit references to mental states. These results indicated that adults are not implicitly processing the VOE task as a mental-state task—it is only when they were instructed to do so that they referred to mental states in their narratives. It would be interesting for future research to replicate and extend this procedure by replacing the human agent with the mechanical crane. Further, Santiesteban and colleagues (2014) investigated adults' mental state attribution with a Dot-Perspective Task. In this task, adults are asked to report how many dots they could see (self-task) and how many dots the avatar could see (other task). This task includes consistent (i.e., same number of dots visible to the participant and to the avatar) and inconsistent trials (i.e., the participant can see more dots than the avatar can). Santiesteban and colleagues (2014) compared a condition with a human avatar to a condition with an inanimate object (i.e., an arrow). Adults' performance did not differ across the two conditions—adults were slower in the inconsistent trials. The authors suggested that the results yielded in such tasks might reflect submentalizing. However, a toy crane, unlike arrows, exhibits an agentive feature (i.e., similar to the Heider and Simmel (1944) geometric figures). As such, the goal-directed action exhibited by the toy crane may explain why infants attributed mental states to this inanimate agent.

The main contribution of the present study is to demonstrate that infants' looking pattern in Onishi and Baillargeon's (2005) VOE false belief task was replicated using an inanimate agent. The 16-month-old infants did not expect the crane to turn towards the green box as it had done in the familiarization trials and were surprised when the crane turned towards the new location of the toy cup in the test trial. These results are consistent with Surian and Geraci's (2012) findings using an anticipatory looking task with animated geometrical shapes that showed agency cues of goal-directed and interactive behaviors. An important difference between our toy crane and Surian and Geraci's (2012) blobs are that the crane displayed one animacy cue (goal-directed action), while the blobs displayed goal-directed action and contingent communication with another agent. As previously mentioned, communication is an important aspect of ToM attribution and Surian and Geraci's (2012) results, as well as Tauzin and Gergely's (2018) findings, are in line with this relevance theory (Sperber & Wilson, 1995). The VOE task in the present study did not involve such a communicative feature. There is evidence that infants reason about the actions of inanimate agents such as boxes and geometric shapes by attributing goals to such agents (Baillargeon et al., 2016). Such overattribution of motivational states has been previously reported in an experiment demonstrating that even 3-month-olds attribute goal-directed actions to a self-propelled box (Luo & Baillargeon, 2010).

One interpretation of the current results that is in line with the mentalistic interpretation is that infants attribute false belief to any object that displays agentive features—in the present case, an object that appears to be capable of autonomous movement and that acts in a "goal-directed" manner (Luo & Baillargeon, 2005). This interpretation is compatible with System 1 of Apperly and Butterfill's (2009) 2-system theory. System 1 is inflexible because it is "efficient, evolutionarily and ontogenetically ancient, operates quickly, and is largely automatic and independent of central cognitive resources" (Low et al., 2016, page 185). We argue that our results are in line with this inflexible system as infants automatically attribute mental states to all agents. It is only later, by preschool years that they employ the flexible system (i.e., System 2) and only attribute mental states to sentient agents (Low et al., 2016; Opfer, 2002; Poulin-Dubois & Héroux, 1994; Wellman et al., 2001). It has recently been proposed that key processes in constructing a flexible understanding of belief are social and mental coordination with other persons and their (sometimes conflicting) perspectives (Tomasello, 2018). False belief understanding requires engaging in social and mental coordination and involves shared intentionality (developed joint attention, linguistic communication) as well as well-developed executive functioning skills that permit such coordination. According to this shared intentionality account, in implicit tasks, infants are tracking simple epistemic states (e.g., knowledge). Knowledge attribution is a simpler ToM construct that is typically mastered earlier in infancy (Moll, Koring, Carpenter, & Tomasello, 2006; Moll & Tomasello, 2007; Tomasello & Haberl, 2003). Our findings are compatible with such a leaner mentalistic view but specify that infants are less selective than older children and track the epistemic states of all agents. One would expect that such rich social experiences would allow children to gradually narrow the scope of attribution of mental states to the animate agents with which they interact such as people, and animals. However, this account should be tested across the lifespan to investigate the context in which System 1 operates in adulthood, as well as the context when System 2 overrides System 1 (e.g., Low & Edwards, 2008; Silva, Ten Hope, & Tucker, 2014 for methodological suggestions).

If there is developmental stability in false belief understanding (from implicit to explicit mentalizing) as some results from longitudinal studies have suggested (Thoermer et al., 2012; Sodian, Licata, Kristen-Antonow, Paulus, Killen, & Woodward, 2016; but see Burnside, Azar, & Poulin-Dubois, 2018), then one would expect that infants would deny mental states to inanimate agents when tested with non-traditional false belief tasks based on spontaneous responses.

Another interpretation that is also compatible with the current findings is the perceptual novelty account that posits that infants simply analyze the perceptual, shallow properties of the scene and compare these across the familiarization and test trials. According to this submentalizing account, the last time infants saw the crane (during the first part of the induction trial) it was associated with the object located in the yellow box, so the incongruent test event is the one that differed most from the last "crane event" encoded (Heyes, 2014a). Such a type of novelty effect most probably did not impact the reasoning of adults, as they instead used their conceptual knowledge and inferred that toys do not mentalize. Thus, they ignored the belief induction trial and used a simple rule, such as "the crane always turns to the green box". Unfortunately, the design of the current study does not allow us to tease apart the various accounts that explain infants' looking behaviors in the VOE paradigm. Therefore, the current results cannot clearly demonstrate whether infants operate with submentalizing abilities—more research is needed to determine which mechanism is underlying infants' behaviors in the VOE task. The next step is to determine how infants interpret the crane (i.e., as an agent or as an inanimate object); results would help elucidate this issue.

In order to control for experience with self-propelled inanimate agents, we selected infants with no exposure to any type of remote-controlled toys. Future research should directly compare infants with previous exposure to a remote-control toy to "naïve" infants. If a better understanding of mechanical agents does in fact affect individuals' performance, then one would expect a difference in performance between these two groups. Unfortunately, the current sample was not large enough to adequately compare and interpret these two groups' performances. It would also be interesting to use a within-subject comparison where infants would be administered a task with a human agent and a task with an inanimate agent to directly investigate if the same infants behave differently across agents. We also recommend future research that would adopt the same design with other implicit tasks that are commonly used to assess false belief in infancy in order to determine whether the same patterns of results are replicated when using a nonhuman agent.

To conclude, the purpose of the current study was to examine whether infants attribute beliefs to inanimate agents in the VOE paradigm given that most studies investigating false belief attribution to inanimate agents were conducted using the anticipatory looking task (e.g., Kano et al., 2017; Surian & Geraci, 2012); very few studies used looking time tasks (e.g., Tauzin & Gergely, 2018). These studies yielded conflicting findings. When the anticipatory looking paradigm was used with apes, they behaved differently when a geometric shape performed the actions in the change of location task, that is, they did not anticipate an arrow to act as knowing the new location of a displaced object. In contrast, by 17 months, infants attributed false belief to a simple animated shape. It is possible that adult apes may possess a different concept of false belief than human infants (see Heyes, 2017 for critical comments on the original findings) or that the anticipatory looking procedure is a more conservative test of false belief. More likely, the presence of contingent interactions between the stimuli in Surian and Geraci's (2012) study might have been sufficient to trigger their psychological reasoning system. It is possible, as some researchers have suggested, that infants process the visual elements of the scene in the VOE task rather than interpret the storyline with regards to the actors' beliefs. If this is the case, then the properties of the agent are irrelevant as infants submentalize when exposed to such scenarios. In the present case, infants appear to be able to generate rapid, on-line predictions of agents' actions toward objects based on their prior actions. Nonetheless, these submentalizing or "overmentalizing" abilities might provide the building blocks for the development of a sophisticated ToM. With the development of language and executive functions, paired with experience interacting with others, infants will gradually narrow down the concept of sentient agent. Some outstanding questions are: which mechanism underlies infants' behaviors during implicit tasks (i.e.., overmentalizing, submentalizing, simple behavioral rules) and under what conditions (i.e., which agents) do infants display these behaviors? Much remains to be done to better understand how infants' ability to reason about others' mental states improves with age.

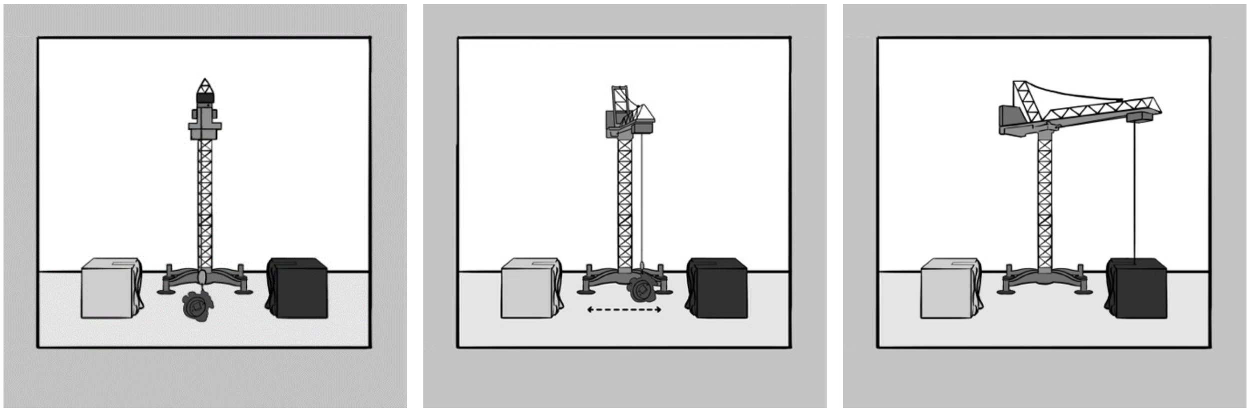


Figure 1. Depiction of actions during the first familiarization trial, where the light grey box is the yellow box and the dark grey box is the green box.

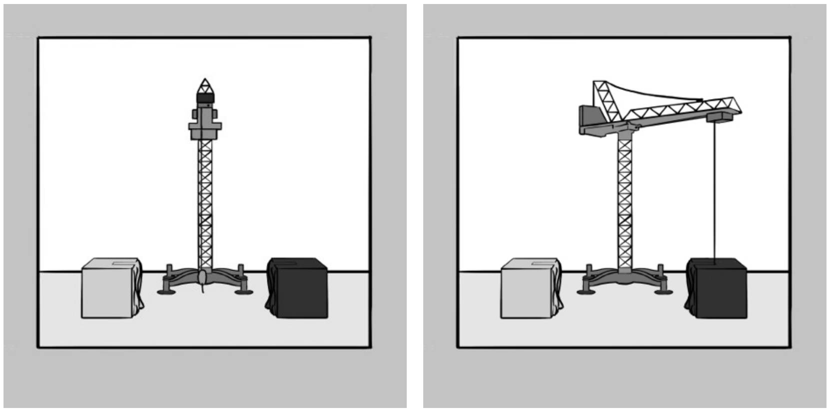


Figure 2. Depiction of actions during the second and third familiarization trials.

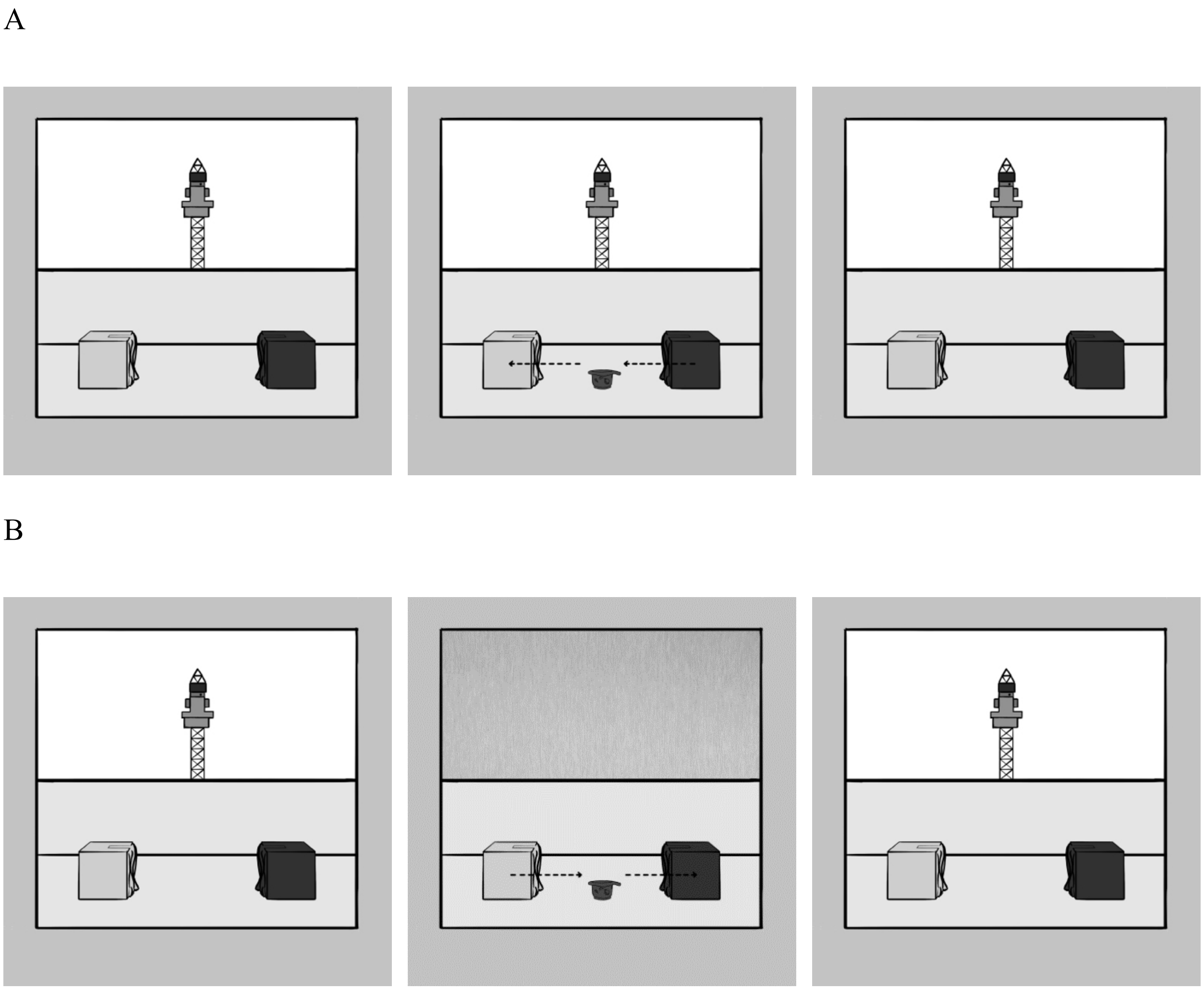
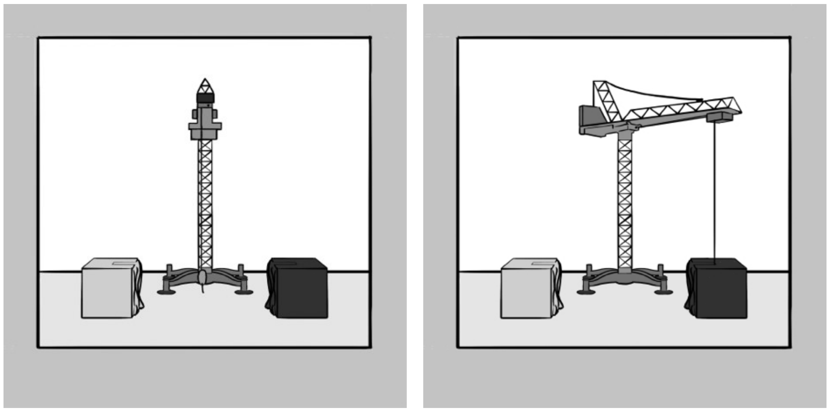


Figure 3. Depiction of actions during the first location-change (A) and the second location-change (B) of the false belief induction trial, equivalent to the FB-yellow condition in the original study (Onishi & Baillargeon, 2005).

Green-box condition (incongruent)



Yellow-box condition (congruent)

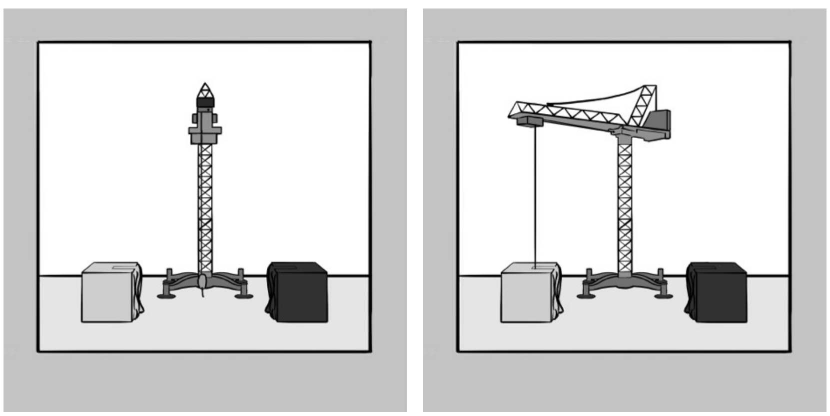


Figure 4. Depiction of actions during the test trial for both conditions

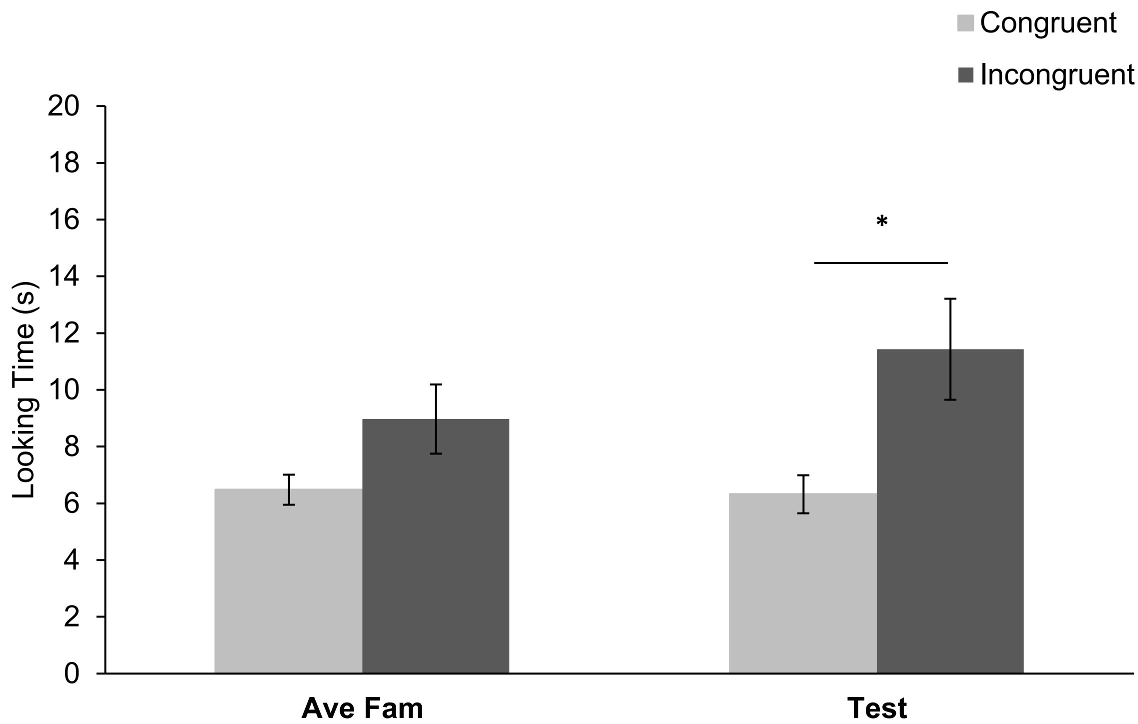


Figure 5. Infants’ average looking time across the three familiarization trials and at test for both conditions.

Chapter 3

Burnside, K., Neumann, C., & Poulin-Dubois, D. (2019). *Infants generalize beliefs across individuals*. Manuscript revised and resubmitted for publication to *Developmental Psychology*.

Infants generalize beliefs across individuals

The depth of infants' theory of mind (ToM) is currently a subject of heated debate. For decades, researchers have attempted to determine exactly when this foundational socio-cognitive ability develops. Traditionally, ToM was thought to emerge between 3 and 5 years of age (Wellman et al., 2001; Wellman & Liu, 2004). Over the past decade, a large number of studies have challenged this view by providing evidence for early ToM understanding in infancy with tasks that have minimal processing demands (Clements & Perner, 1994; Gergely, Nádasdy, Csibra, & Bíró, 1995; Onishi and Baillargeon, 2005; Phillips & Wellman, 2005; Scott, 2017). These implicit tasks, which measure infants' spontaneous looking or actions, provided further insight into precocious ToM in infants as young as 7 months of age. However, the interpretation of findings based on these implicit ToM tasks is currently the focus of an intense debate. One side of the debate (i.e., the rich, mentalistic view), founded on the numerous studies that demonstrate an early understanding of ToM, argues that it can be reliably measured using implicit tasks (Baillargeon et al., 2018; Baillargeon et al., 2016; Baillargeon et al., 2010; Scott & Baillargeon, 2017). Conversely, other researchers support leaner interpretations of infants' behaviors measured by these tasks (Apperly, & Butterfill, 2009; Heyes, 2014a; Poulin-Dubois et al., 2018; Ruffman, 2014). Given the current relevance of this debate, the goal of the current study is to determine if the construct measured by implicit tasks corresponds to a fully-formed, sophisticated ToM understanding—equivalent to the ToM understanding found in preschoolers using explicit, elicited-response tasks as is suggested by the mentalistic view.

ToM is defined as the understanding that others have mental states (Wellman, 2014). As such, it plays an essential role in human interactions—it is an ability that permits us to understand another person's perspective and to behave accordingly. ToM is an umbrella term that covers several different sub-concepts, such as desires, intentions, and beliefs that permit us to understand others' mental states (Wellman & Liu, 2004). A fully formed understanding of beliefs requires mastery of true and false belief scenarios. A true belief is when an individual's belief is congruent with the world. The most important milestone in the development of ToM is the understanding of false beliefs, as it assesses whether an individual can truly perceive others' unobservable mental states independent from one's own (Dennett, 1978; Perner, 1991). Understanding false beliefs implies the understanding that an agent's beliefs about the world can be false (e.g., believing an object is in a location when in fact it is in another location). A classic false belief task is the Sally-Anne task, which measures whether children can answer where Sally will look for her marble after Anne changed the marble's location without her knowing (Baron-Cohen et al., 1985). This explicit task requires a verbal response on the part of the participant. In contrast, implicit false belief tasks are often based on the same type of story line (e.g., a change of location), but instead of requesting overt responses to a verbal question, implicit tasks rely on the participant's spontaneous looking behavior (e.g., time spent looking at the scene). In a landmark study, Onishi and Baillargeon (2005) used a violation-of-expectation (VOE) task to test belief understanding in 15-month-olds. VOE tasks assess whether infants look longer (i.e., find it surprising) when an agent acts in a way that is inconsistent with her beliefs. During a series of familiarization trials, infants saw an agent play with a toy and then place it inside a green box. In the belief-induction trial, the toy changed location (e.g., to a yellow box) with either the agent present, inducing a true belief, or absent, inducing a false belief. During the test trials, half of the infants saw the agent reach into the green box and the other half into the yellow box. If the infants expected the agent to search for her toy on the basis of her belief about its location (and not its actual location), then the infants should look longer when that expectation was violated. Results revealed that infants were able to attribute both true and false beliefs to the agent. Thus, the authors concluded that “false-belief understanding provides evidence for a sophisticated (and possibly uniquely human) ability to consider the information available to an agent when interpreting and predicting the agent's actions—even if this information is inaccurate and incompatible with one's own” (Baillargeon et al., 2010, p. 110). According to that view infants and young children fail the traditional explicit ToM tasks because they are heavily based on language abilities and executive functions, rather than due to an undeveloped ToM (Baillargeon et al., 2010; Scott, 2017). This “processing-demands” account argues that, in explicit tasks, children must first select the correct response (response-selection process), inhibit the response of the actual location of the object (response-inhibition process), as well as remembering the agent’s false belief (working memory).

There are several proposals that posit leaner interpretations of behaviors observed with implicit ToM paradigms (see Krupenye & Call, 2019 for a brief summary). For example, Apperly and Butterfill (2009) argue that infants’ behaviors observed in implicit tasks might not be based on the same mechanisms as in older children and adults, but rather reflect a separate ToM system altogether that develops independently (i.e., Minimalist account). Specifically, it has been proposed that there is an “efficient mindreading system [that] is evolutionarily and ontogenetically ancient, operates quickly, and is largely automatic and independent of central cognitive resources” (i.e., System 1), and a “flexible mindreading system [that] develops late, operates slowly, and makes substantial demands on executive control processes” (i.e., System 2; Low et al., 2016). System 1 is analogous to implicit ToM whose function is to quickly track individuals’ mental states, whereas System 2 is analogous to explicit ToM whose function is to assess and process information leading to extrapolating individuals’ mental states. It is believed that these two systems develop in parallel to one another, where System 1 develops early in infancy and remains functional into adulthood, while System 2 develops only in childhood. However, when measured concurrently, implicit and explicit false belief appear to be dissociated (Burnside et al., 2018; Grosse Wiesmann et al., 2016; Grosse Wiesmann et al., 2018). If this is the case, then infants' looking behaviors in implicit tasks might measure a more primitive ability than what is believed to be a fully formed ToM understanding. On the other hand, researchers like Ruffman (2014) believe that infants' responses in VOE tasks can be explained by the learning of simple behavioral rules (i.e., Behavioral Rule account). Whereby, infants rely on rules such as "people look for an object where they last saw it and not necessarily where the object actually is" (Perner & Ruffman, 2005, p. 215). This rule is known and applied based on behavior without any inference about mental states.

Another lean view proposes that infants are solving implicit false belief tasks by submentalizing (Heyes, 2014b). Submentalizing is when individuals' behaviors seem as though they are thinking about mental states but instead, their looking patterns are a result of the violation of the participants' expectations of superficial associations created in the previous trials (i.e., perceptual novelty of the test trial). For example, in Onishi and Baillargeon's (2005) VOE task, the last time that infants saw the agent in the scene, the object was paired with the yellow box (i.e., the association agent-yellow is made). At test, when infants see the agent reaching for the green box it violates the agent-yellow association made in the previous trial (Heyes, 2014a). In other words, infants are simply responding to the novelty of the configuration of colors, shapes and movements and are not attributing mental states to the agent. The hypothesis that infants might be submentalizing in the VOE task was recently examined—a human agent was replaced by an inanimate agent (i.e., a toy crane lacking morphological animacy cues such as eyes; Burnside, Severdija, & Poulin-Dubois, 2019). Onishi and Baillargeon's (2005) results with a human agent were replicated, suggesting that 16-month-old infants attributed a false belief to the inanimate agent. Adults, however, did not attribute a belief to the toy crane. Although a plausible explanation would be that infants responded to the novelty of the perceptual features of the scene (i.e., submentalizing), another plausible interpretation is that infants over attributed mental states too broadly (i.e., to a clearly non-sentient agent). Similar results were observed by Tauzin and Gergely (2018) who found that infants over-attributed mental states to blobs. However, proponents of the rich view argue that many of the lean views outlined above can be ruled out (see Baillargeon et al., 2018 as well as Scott and Baillargeon, 2014 for arguments against lean views). Needless to say, the lack of consensus has fueled a heated debate.

If, in fact, infants are overattributing mental states to inanimate agents, then this would suggest that their false belief understanding is more rudimentary than the mentalistic account posits. It is recognized that a mature ToM involves understanding that mental states reside in *individuals* (i.e., person-specific; Wellman, 1990). Adults understand that thoughts are not transferred across individuals without some form of communication. Therefore, another way to assess the maturity or sophistication of infants' ToM is to examine if infants also over-attribute beliefs to naïve agents, that is, agents who have not witnessed or been informed of an event. If infants overattribute beliefs, then their understanding of beliefs is not as sophisticated as that of older children and adults. This hypothesis has been tested in the case of simple, motivational mental states. Buresh and Woodward (2007) used a switch agent version of the visual habituation paradigm to test 13-month-olds' ability to track goals. First, they familiarized infants with two actors who looked noticeably different. In the habituation trials, infants were shown an actor repeatedly playing with an object until the infant habituated to the scene. At test, infants in the single-actor condition looked longer, as expected, in the new-goal trials (i.e., actor reached for a different object) than in the new-side trials (i.e., actor reaches for the same object as in the habituation trials). The infants in the switch-actor condition looked equally long during the new-goal and new-side trials. This suggests that infants were able to understand that a goal belongs to a particular person and that this goal cannot be transferred to others (i.e., person-specific). Henderson and Woodward (2012) conducted a similar paradigm—they used a habituation paradigm with 9-month-old infants. In the training phase, infants viewed an event during which an experimenter demonstrated a clear preference for one of two novel objects. Then, the infants were administered a habituation phase during which the experimenter repeatedly referred to his or her preferred object. Finally, the infants were administered a phase during which the initial experimenter (Same Actor condition) or the new experimenter (Switch Actor condition) alternately picked the target object and the distractor object six times while consistently labelling the objects. The authors found that infants did not generalize object preference to the new experimenter, suggesting that 9-month-old infants understand that preferences are person-specific (i.e., non-transferable).

Kampis, Somogyi, Itakura and Király (2013) used a similar switch agent procedure to assess 10-month-old's understanding of preference—referred to as "attitude". In this paradigm, infants were either assigned to an "occlusion" group or to a "no-occlusion" group. First, infants were shown an agent (Agent A) and two objects placed in front of her, but behind translucent barriers. Infants in the no-occlusion group saw a hand remove one of the two objects. Following this, Agent A reached for the remaining object—because this object was the only available object for Agent A to take, no preference could be inferred. However, infants in the occlusion group saw a hand place an opaque barrier between the object and Agent A. Then, the hand removed the object located behind this barrier—Agent A did not see the removal of this object and "thinks" that both objects are available. Following this, Agent A reached for the object that was not occluded—as such, it is assumed that this object is preferred because it is inferred that Agent A made a choice (i.e., her attitude towards this object). At test, both groups saw a different agent (i.e., Agent B) reach for one of the two objects—consistent or inconsistent with Agent A's choice. Only the infants in the occlusion group looked longer when Agent B's choice was inconsistent with Agent A's choice. This implies that they were surprised that Agent B chose a different object from Agent A, suggesting that infants generalized Agent A's preference to Agent B. Therefore, Kampis and colleagues (2013) provided some evidence showing that infants do not make person-specific preference attributions.

The studies using the switch-agent paradigm all assessed infants' understanding of motivational states, such as goals and preferences. However, to the best of our knowledge, none has examined if infants also treat *epistemic* states as person-specific. In other words, it is still unclear how infants would behave to a change of agent in a typical false belief paradigm. Given the ongoing debate about the depth of false belief understanding in infancy, it was crucial to investigate whether infants understand that beliefs are unique to individuals—a marker of a sophisticated ToM understanding. Therefore, the main goal of the present study was to determine whether infants generalize beliefs across individuals in the classic false belief task based on the VOE paradigm. Specifically, infants watched an agent interact with an object followed by a belief-induction trial that induced a true or false belief to this agent. At test, a naïve agent, never exposed to the location of the toy, reached in one of the two boxes. If infants have a sophisticated belief understanding, they should not form the expectation that the naïve agent possesses a belief, recognizing that beliefs require perceptual access to the object during the familiarization trials—

and that such experience is not transferable across different individuals. If infants have no expectation about the naïve agent's actions in the test trial, then those in the congruent group should look equally long as those in the incongruent group (here, the terms congruent and incongruent are based on the initial agent's beliefs to keep consistent with the original study). Therefore, if infants have a sophisticated understanding of beliefs, then we expect no group differences in looking time. However, if infants' looking patterns replicate those found in Onishi and Baillargeon's (2005) study (i.e., longer looking in the incongruent group compared to the congruent group), then infants overattribute beliefs to naïve agents. Finally, as a manipulation check, a filmed version of this paradigm was shown to adult participants to confirm that adults would attribute ignorance to the naïve agent and predict a random search behavior.

Method

Participants

True belief. The sample comprised 50 infants (27 boys and 23 girls, M_{age} = 16.80 months, range = 15.43 – 17.99 months). Infants were randomly assigned to one of two conditions: congruent (*n* = 25) or incongruent (*n* = 25). Eight additional infants were tested and excluded from the analyses due to fussiness during the task administration.

False belief. Participants were 54 infants (26 boys and 28 girls, M_{age} = 16.40 months, range = 15.20 – 17.80 months). Infants were randomly assigned to one of two conditions: congruent (*n* = 27) or incongruent (*n* = 27). Five additional infants were tested and excluded from the analyses due to fussiness during the task administration.

Adults. Thirty students (8 males and 22 females, $\mathrm{M}_{\mathrm{age}}$ = 22.88 years, range = 18.83 – 32.99 years) were recruited on a university campus in a large Canadian city. Participants were students enrolled in Psychology (13), Natural Sciences (11), Business/Finance (4), and Exercise Science (2).

Procedure and Materials

This project received approval from the research ethics committee of The University Human Research Ethics committee. Prior to the testing period, infants were familiarized to the testing environment and the caregiver completed a short demographic questionnaire. At the end of the session, infants received a certificate of merit for their participation and a small gift. Infants' caregivers were given $20 as compensation for their participation.

The task was administered on a stage-like apparatus (107 cm x 97 cm x 104 cm). This apparatus has a back wall (107 cm x 97 cm) that is separated in four small doors (the right top and bottom doors: 56.5 cm x 43.5 cm and the left top and bottom doors: 55 cm x 43.5 cm). As in Onishi and Baillargeon's (2005) design, these doors permit the agents to be out of sight of the infants when they are closed. A yellow box and a green box (14 cm x 14 cm x 14 cm each) were placed 37 cm apart at each end of the stage. The boxes had a 14 cm x 14 cm opening on the side, covered with fabric. The boxes were placed such that the openings faced each other. An orange cup (4.5 cm x 9 cm x 3 cm) covered in stickers with a magnet inside was used as the toy being manipulated by the agents. Another magnet was placed underneath the stage, such that it could slide across the stage. A Panasonic™ camera was positioned to focus on the infant's face, which was displayed on an LCD monitor. An Apple™ G5 computer was used to live-code infants' looking behavior using the Habit 2000 program (University of Texas). Infants were seated on a highchair 110 cm from the stage and their caregiver sat behind the infants. If infants refused to sit in the highchair, they sat on their caregiver's lap (true belief: $n = 9$, false belief: $n = 13$). In these cases, the caregivers wore a sleep mask over their eyes to avoid biasing the infants' looking behavior.

True belief. As in the original version of this task (Onishi & Baillargeon, 2005), infants viewed three familiarization trials, one belief-induction trial, and one test trial. An additional trial was shown prior to the familiarization trials to introduce the two different agents (E1 and E2) to the infants (i.e. an exposure trial). One agent was dressed in white, wearing a white visor, glasses and had long hair and the other agent was dressed in black, wearing a black visor, no glasses and had her hair tied up. The color of the agents' clothing as well as the role the agent played (E1 vs. E2) was counterbalanced, creating four pairings. In this exposure trial, both agents smiled and waved to the infant until the infant looked away for 2 consecutive seconds after looking at the scene for a minimum of 2 cumulative seconds. Infants could look up to 30 seconds in total. Given that the end of the trial was completely determined on the infant's response, it is henceforth referred to as "infant-directed". Between each trial, an attention-getting sound accompanied the rising and lowering of the screen. Infants' looking was measured during the infant-directed pause that followed each trial, including the waving pre-trial. These trials ended when the infants 1) looked away from the scene for 2 consecutive seconds after looking at it for a minimum of 2 cumulative seconds, or 2) looked at the scene for 30 cumulative seconds.

The first familiarization trial (12s) begins with the screen rising to reveal E1 sitting (at eye-level with the infants) behind two boxes (a yellow box and a green box) and a small cup placed on the table in between the two boxes. E1 raised her head for a brief moment to ensure that the infants recognized her. E1 then grabbed the toy cup in front of her and gently played with it for 8 seconds by passing it from hand to hand. After this, E1 placed the toy in the green box and remained in this position until the end of the infant-directed pause. In the second and third familiarization trials (6s each), after the screen was raised E1 reached and placed her hand inside the green box (i.e., where the cup was hidden) and remained in this position until the end of the infant-directed pause. The goal of these familiarization trials was to show that E1's goal is to obtain the cup in the green box. During these trials, E2 was raising and lowering the screen following the attention-getting sound.

In the belief induction trial (8s), the two bottom doors behind the two boxes were closed such that E1 was now standing behind these doors watching the toy cup being moved from the green box to the yellow box. The toy cup changed location without the involvement of E1, who observed the change of location in this scene while E2 moved the toy cup using the magnet from under the stage. Once the toy cup was inside the yellow box, the infant-directed pause began, during which E1 kept her gaze on the yellow box (i.e., E1 has a *true* belief that the cup is located in the yellow box). Once this infant-directed pause ended and the curtain was lowered, E1 and E2 switched positions, such that E1 was now raising/lowering the curtain and E2 was the agent in the scene. When the test trial (6s) began, the curtain was raised to reveal E2 sitting behind the two boxes. E2 raised her head for a brief moment to ensure the infants noted the change of agent. Infants in the congruent group saw E2 reach in the yellow box (congruent with E1's belief) and infants in the incongruent group saw E2 reach in the green box (incongruent with E1's belief). E2 paused with her hand inside the box until the end of the infant-directed pause. The third experimenter live-coded the infant's looking time at the scene in order to transition to the next trial after the infant-directed pauses. Infants' total looking time (in seconds) at the scene during the infant-directed test pauses was recorded. The waving pre-trial and agent-switch in the test trial excluded, this paradigm is an exact replication of Onishi and Baillargeon's (2005) VOE task, which was approved by the original author (Baillargeon, personal communication, October 9th, 2017).

False belief. Infants in the false belief condition saw the same waving pre-trial and three familiarization trials as in the true belief condition. During the belief-induction trial (24s), infants also saw E1 watch as the toy cup moved to the yellow box. However, once the toy disappeared inside the yellow box, E1 closed the two upper white doors, thus disappearing from the scene. Following this, the toy cup moved back to the green box (i.e., E1 has a *false* belief that the toy cup is in the yellow box when it is actually located in the green box). The infant-directed pause started once the cup entered the green box. Again, once the screen was lowered at the end of the belief-induction trial, E1 and E2 switched positions. When the test trial (6s) began, the curtain was raised to reveal E2 positioned behind the two boxes. As in the true belief condition, E2 raised her head for a brief moment then reached either in the yellow box (congruent condition) or in the green box (incongruent condition). Again, infants' total looking time (in seconds) at the scene during the infant-directed test pauses was recorded by a third experimenter.

Adults. Prior to viewing the pre-recorded video, participants completed a demographic questionnaire and were entered in a draw with the possibility of winning a $20 prize. The video consisted of the exposure trial, three familiarization trials and the induction trial of the false belief switch-agent condition. The video ended after the curtain was raised at the start of the test trial, showing the novel agent sitting behind both boxes. This scene was paused, and the adults were asked to answer "do you think the actor will search in the yellow box or the green box?".

Coding and Reliability

For the VOE task, Habit 2000 was used to live-code the infants' looking time during the infant-directed pauses. To obtain a more precise measurement, infants' looking time was recoded offline using INTERACT 8.0 (Mangold) by the primary experimenter. To assess reliability, a second coder who was blind to the hypothesis of the study coded 25% of the video recordings. Cohen's kappa reliability was .85 for the false belief videos and .82 for the true belief videos.

Results

Using z-scores with cut-offs of ± 3.0, one participant's response in the test trial of the congruent condition in the true belief condition and one in the test trial of the congruent condition in the false belief condition were identified as an outlier. These scores were replaced with the next highest value within 3 standard deviations of the congruent condition mean. Following this modification, the distribution of infants' looking time at the screen during all trials was normally distributed.

Manipulation Checks

True belief. Firstly, analyses were conducted to make sure that the infants looked at both agents during the waving pre-trial. A 2 (side) X 4 (pairing) ANOVA was conducted to determine if the infants developed an agent/color preference during the waving pre-trial – the side variable refers to infants' looking time to each side of the stage during this trial given that the position of the two agents was counterbalanced across infants. No main effect of side ($F(1, 46) = .001$, $p = .98$, $\eta^2 < .001$) or pairing ($F(3, 46) = 1.19$, $p = .33$, $\eta^2 = .07$) nor an interaction ($F(3, 46) = .32$, $p = .81$, $\eta^2 = .02$) were found, indicating that infants looked equally to both agents across all four pairings. In other words, no agent, color, or side preference was found. Next, a 3 (familiarization trials) X 2 (group) ANOVA was used to analyze whether infants in the two groups differed in their pattern of looking during the familiarization trials. A significant main effect of trial was found ($F(2, 96) = 47.71$, $p < .001$, $\eta^2 = .50$). No main effect of group ($F(1, 48) = 2.28$, $p = .14$, $\eta^2 = .05$) nor an interaction ($F(2, 96) = .67$, $p = .51$, $\eta^2 = .01$) were observed. Planned comparisons indicated that infants looked longer during the first familiarization trial (M = 15.30s, SD = 7.53s) than during the second (M = 8.81s, SD = 6.25s; Mean Difference = 6.49, $p < .001$, d = .94) and third familiarization trials (M = 5.92s, SD = 3.71s; Mean Difference = 9.38, $p < .001$, d = 1.58). Further, infants looked longer during the second familiarization trial than during the third familiarization trial (Mean Difference = 2.89, p = .01, d = .56). On average, infants in the incongruent group looked at the scene for 10.97s (SD = 5.35s) during the familiarization trials and those in the congruent group looked for 9.06s (SD = 3.37s). Infants' overall looking during the three familiarization trials did not differ between the two groups ($t(48) = 1.51$, p = .14, d = .43).

False belief. Once more, a 2 (side) X 4 (pairing) ANOVA was conducted to determine if the infants developed an agent/color preference during the waving pre-trial. No main effect of side ($F(1, 50) = .51$, p = .48, η^2 = .01) or pairing ($F(3, 50) = .42$, p = .74, η^2 = .02) nor an interaction ($F(3, 50) = 1.26$, p = .30, η^2 = .07) were found. This indicated that there was no agent, color, or side preference during the waving pre-trial. A 3 (familiarization trials) X 2 (group) ANOVA was conducted to determine if infants' looking during the familiarization trials differed across the two groups. As in the true belief condition, a significant main effect of trial was found ($F(2, 104) = 57.40$, $p < .001$, η^2 = .53). No main effect of group ($F(1, 52) = .17$, p = .69, η^2 = .003) nor an interaction ($F(2, 104) = 1.48$, p = .23, η^2 = .03) were found. Planned comparisons indicated that infants looked longer during the first familiarization trial (M = 17.89s, SD = 7.56s) than during the second (M = 8.00s, SD = 4.01s; Mean Difference = 9.89, $p < .001$, d = 1.63) and third familiarization trials (M = 7.88s, SD = 6.67s; Mean Difference = 10.01, $p < .001$, d = 1.40). There was no difference between infants' looking in the second and third familiarization trials (Mean Difference = .12, p = 1.0, d = .02). On average, infants in the incongruent group looked at the scene for 11.51s (*SD* = 5.14s) during the familiarization trials and those in the congruent group looked for 11.06s (*SD* = 3.41s). Infants' overall looking during the three familiarization trials did not differ between the two groups ($t(52) = .38$, $p = .70$, $d = .10$).

Adults. Adults predicted that the agent was equally likely to reach for the yellow box (n = 16) than for the green box (n = 14). These predictions are not different than what would be expected from chance (binomial $p = .86$).

Main Analyses

First, a 2 (condition) X 2 (group) ANOVA was conducted and revealed a main effect of condition ($F(1, 100) = 11.58$, $p = .001$, $\eta^2 = .10$ and a main effect of group ($F(1, 100) = 16.49$, $p < .001$, $\eta^2 = .14$). Post-hoc analyses revealed that infants looked longer in the false belief condition (*M* = 15.47s, *SD* = 7.26s) than in the true belief condition (*M* = 11.38s, *SD* = 5.65s, $t(102) = 3.18$, $p = .002$, $d = .63$). Further, overall, infants in the incongruent group looked longer (*M* = 15.94s, *SD* = 7.36s) than those in the congruent group (*M* = 11.07s, *SD* = 5.26s, $t(102) = 3.89$, $p < .001$, $d = .76$).

Discussion

An issue that has been raised in the context of the infant ToM debate is the poor construct validity of the tasks traditionally used to assess ToM in infancy—especially false belief tasks (Baillargeon et al., 2018; Poulin-Dubois et al., 2018; Sabbagh & Paulus, 2018). Further, the VOE task has also been difficult to replicate, albeit not impossible (Burnside et al., 2019; Dörrenberg et al., 2018; Powell et al., 2018; Yott & Poulin-Dubois, 2012; Yott & Poulin-Dubois, 2016). However, regardless of the replicability of the tasks, the question remains: Is infants' understanding of false belief as sophisticated as posited by the mentalistic view? The goal of the present study was to attempt to answer this question using a switch-agent paradigm and the classic VOE task. We aimed to replicate Onishi and Baillargeon's (2005) methodology with two important modifications: two agents were introduced during a pre-trial and a naïve agent replaced the agent with a belief at the test trial – akin to the paradigm used by Buresh and Woodward (2007). Given that it was important to replicate the original VOE paradigm as closely as possible to limit potential confounds, we designed the study to include an infant-directed exposure trial at the beginning of the VOE paradigm so that the only modification to the VOE paradigm was the naïve actress at test. We reasoned that if infants have a sophisticated understanding of beliefs, then they should understand that a naïve agent does not hold the same beliefs as the agent who acquired information about the location of an object during the familiarization and belief-induction trials. In other words, infants' looking patterns should reveal equal looking time for both the congruent and incongruent groups (i.e., no expectations violated). Alternately, we would expect the incongruent group to look longer if the naïve agent is believed to possess the same beliefs as the knowledgeable agent (i.e., shared mental states). Results in both the true and false belief conditions demonstrated that infants transferred the first agent's beliefs to a naïve agent that was only present during the test trial. Specifically, infants were surprised, and thus looked longer, when the second agent searched for the toy cup in the location that was inconsistent with the first agent's beliefs. This longer looking observed in the incongruent group indicates that infants' expectations of the naïve agent's actions were violated as they expected her to have a true or false belief based on the knowledgeable agent's prior behaviors. Interestingly, this finding replicates the looking pattern found by Onishi and Baillargeon (2005), who used only one agent.

This overgeneralization of beliefs across agents challenges the mentalist view of ToM understanding in infancy because infants with a sophisticated understanding of beliefs should conclude that the novel agent possesses no belief (true or false) about the object's location. This is what adults expected when we asked them to predict where the naïve agent would search for the object in the FB condition. They correctly assumed that without some prior access to objects or events, beliefs cannot form unless through interactions with a knowledgeable agent—beliefs are person-specific. The developmental trajectory of this full-fledged understanding of belief remains to be determined. One could speculate that it coincides with the emergence of explicit belief reasoning during the preschool years and future research will be required to address this issue (Wellman et al., 2001). Another possible pathway is that the development of a mature false belief concept requires a sense of self, so that the ability to metarepresent one's own mental states triggers the emergence of the attribution of representations to others (Southgate, in press). According to this view, without cognitive self-awareness infants show an altercentric bias in that they orient to others' focus of attention and encode a belief that does not belong to a specific individual. In other words, the content of the representation (i.e., the belief), and the agent to which the representation is attached, are encoded and updated separately. For example, Kovács and colleagues (2010) found results that indicated that "the mere presence of social agents is sufficient to automatically trigger online belief computations […]. Once the beliefs have been computed, adults and infants maintain them even in the absence of the agent, presumably for later use in social interactions" (page 1832). Therefore, it appears that infants' attribution of beliefs is automatic, rather than reasoned.

The present findings challenge the view that infants already possess a sophisticated, rich ToM and suggest that there is a gap between infants' understanding of belief and a full-blown theory of mind. The present results indicate that infants overgeneralize beliefs broadly across agents—in other words, they might be capable of mentalizing but seem to be overattributing mental states as they are applying this ability too widely (i.e. to another agent). Such interpretation is compatible with recent findings showing that 16-month-olds overattributed false belief to a toy crane that displayed only one agentive cue (i.e., goal-directed movement toward the boxes; Burnside et al., 2019). This single agentive cue was sufficient for infants to react to the toy crane as if it was an agent that could hold mental states, which implies that infants follow lenient, broad rules when attributing beliefs to agents. Thus, although some research has shown that younger infants understand that motivational mental states, such as goals (Buresh & Woodward, 2007) and preferences (Henderson &Woodward, 2012), are person-specific, infants do not seem to apply the same rule in the case of epistemic mental states, such as beliefs. Infants appear to attribute beliefs relatively indiscriminately and automatically. It is possible that infants perceive goals as person-specific "behavioral tendencies" rather than mental states (Buresh & Woodward, 2007). Thus, they have an easier time understanding that one individual's behavioral tendency is exclusive to that individual because behaviors are observable. Mental states are unobservable and therefore, harder to grasp, which is likely why infants have difficulty understanding that *beliefs* are person-specific. The understanding of goals is mastered by 5–6 months, an earlier age than belief understanding (Csibra, 2008; Király, Jovanovic, Prinz, Aschersleben, & Gergely, 2003; Woodward, 1998). By 9 months, infants seem to understand that goals are person-specific (Buresh & Woodward, 2007; Henderson & Woodward, 2012). However, there are mixed reviews regarding infants understanding of the binding properties of preferences (i.e., Kampis et al., 2013; Moore, 1999), indicating that this phenomenon might not be robust before the first year of life. Since belief understanding develops later, it is possible that 16-month-olds' understanding of this concept is rudimentary enough for them to generalize across agents. The present findings conflict with the prediction that the ability to bind mental states to specific individuals should emerge after the first year of life, around 13–14 months (Kampis et al., 2013). Future research will be needed to identify the developmental trajectory of the critical ability to encode beliefs as person-specific.

Importantly, both true and false belief conditions were administered in the present study. False belief, being the litmus test of ToM understanding, was a necessary condition to test the full extent of ToM sophistication at this age. Alternately, the true belief condition permitted an assessment of the seeing = knowing hypothesis recently brought forward by Tomasello (2018) to interpret infants' behaviors in the VOE paradigm. According to this leaner mentalist view, infants can pass implicit false belief tasks with simple knowledge inference abilities, that is, what an agent sees and does not see. Tomasello (2018) argues that the concept of beliefs is not yet fully formed in infancy, but rather emerges when explicit ToM tasks are succeeded (see Wellman et al., 2001 and Wellman & Liu, 2004). Therefore, implicit false belief tasks, such as the one used in the present study, tap into a more rudimentary ToM ability (i.e. knowledge inference). Thus, if one agent sees the cup go to a location, he or she holds knowledge about the toy cup's location. Infants look longer in the VOE task because their expectations of the agent's knowledge state are violated. The second agent in the switch agent paradigm is said to be naïve because she never sees the location of the cup, and therefore should not have any knowledge about the location of this toy cup. Therefore, if Tomasello's (2018) seeing = knowing theory is correct, then infants should not have any expectations about the second, naïve agent's knowledge state. Results from the present study do not support this interpretation.

There are, of course, alternative interpretations for the current findings. On possibility is that infants believed that they were in a situation of natural pedagogy so that all information they were shown is generalizable to all observers. By the display of ostensive cues (looking at and waving at the infant) during the exposure phase, it could be argued that infants developed the "expectation that the content of the demonstration represents shared cultural knowledge and is generalizable along some relevant dimension to other objects, other occasions or other individuals"(Csibra & Gergely, 2011, p. 1150). Thus, they might expect that all experimenters have the same knowledge about the location of the object. Although we acknowledge that infants are biased to interpret ostensive-referential communication as conveying information that is generalizable, it is difficult to explain why natural pedagogy did not generate similar findings in the context of infants' understanding of person-specific goals (Buresh & Woodward, 2007). A second account is that infants might have inferred that E1 communicated to E2 the location of the object. Given that among the 16 adults (out of 31) who chose the yellow box, only one mentioned communication of the information from E1 to E2, it is unlikely that infants could have made such inference. A third, simple alternative interpretation is that that infants did not detect the change of experimenter from familiarization to test in spite of the cues manipulated to maximize their distinct physical appearance and the fact that they appeared side by side during the exposure trial. Although we are confident that infants could tell the experimenters apart, future studies might add additional cues (e.g., gender) in order to ensure that the present results are not due to an artifact. Importantly, Apperly and Butterfill (2009) state that "[Infants] do not expect people to acquire beliefs about an object merely by virtue of standing on it, and they do not take close proximity to an object to be a necessary condition for having a belief about it; instead, some kind of purposive interaction with the object appears to be required (Dunham, Dunham, & O'Keefe, 2000; Moll & Tomasello, 2006, 2007; O'Neill, 1996)" (page 957). Therefore, it is unlikely that the present findings can solely be explained by natural pedagogy.

Taken together, the results of the present study indicate that belief understanding in infancy is not as sophisticated as previously believed. Rather, it appears that infants are using an automatic, inflexible cognitive system such that they attribute beliefs broadly to all agents and across agents. This is also in line with Fenici and Zawidzki's (2017) interpretation of infants' responses on implicit false belief tasks which is an elaboration of Butterfill and Apperly's (2013) minimalistic theory. Specifically, they argue that the infants in Kampis and colleagues' (2013) study did not recognize "enduring mental states", which would be bound to an individual. Instead, they suggest that infants track relational properties of "bouts" of behaviors, which lead to the attribution of goals, which are "non-enduring" to individual agents. In other words, they argue that once a goal is detected by infants, they will behave in accordance to this goal indiscriminately of whom (or what; Burnside et al., 2019) the agent is. Infants are likely observing events in an object-centered manner, such that mental states about said objects are generalizable to any agent. This is a perspective that is situated at the center of the ToM debate spectrum, with submentalizing and the minimalist view at one end and the rich, mentalistic view at the other end. This is a view that concedes that infants are implicitly deducing mental states but are attributing these mental states broadly as the skills necessary to *understand* exactly whom should hold beliefs emerge later in childhood (e.g., executive functioning, language, and shared intentionality). This is also consistent with Sirois and Jackson's (2007) view that "social cognition [is] an emerging (rather than innately specified) ability, rooted in joint attention" (p. 59). In fact, joint attention has been shown to be an important precursor ability to ToM understanding later in childhood (Charman, Baron-Cohen, Swettenham, Baird, Drew, & Cox, 2003; Colonnesi, Rieffe, Koops & Perucchini, 2008; Kristen, Sodian, Thoermer, & Perst, 2011). It appears that as infants interact with the social world, they attend to ostensive, pedagogical cues exhibited by conspecifics, jointly attend to objects/events in object-centered ways. As infants develop, they are gradually able to use person-centered ways to process events, which facilitates perspective-taking such that as children build other skill sets (e.g., language, executive functioning) they are able to *reason* about other individual's mental states (i.e., in the preschool years). In the meantime, infants use a more rudimentary, automatic, and broadly applicable belief-tracking ability, which is likely the ability captured by implicit ToM tasks. The present findings are in line with Apperly and Butterfill's (2009) System 1, which is efficient, quick, and evolutionarily useful. Infants' limited reasoning about mental states does not yet allow them to understand that different humans have individual thoughts. It is still unclear how this "implicit ToM" develops into an explicit ToM understanding (e.g., Baillargeon et al., 2010; Scott, 2017) or if these abilities develop in parallel to one another (e.g., Apperly & Butterfill, 2009).

Future research should be directed at answering this outstanding question: is "implicit" ToM a precursor to "explicit" ToM or do these two abilities develop in parallel? This question is important because it would provide insight into the developmental processes involved in socio-cognitive development from infancy to childhood. A few longitudinal studies have started to answer this outstanding question. However, most longitudinal studies in this domain have investigated whether simple motivational mental state understanding (e.g., goal-understanding) predicted later ToM understanding in childhood (e.g., Aschersleben, Hover, & Jovanovic, 2008; Wellman, Phillips, Dunphey-Lelii, & Lalonde, 2004; Yamaguchi, Kuhlmeier, Wynn, & vanMarle, 2009). To our knowledge, only one study has found a relation between implicit false belief understanding, using an anticipatory looking task, and later false belief understanding in childhood (Thoermer et al., 2012). Therefore, additional conceptual longitudinal studies should attempt to replicate this design using other implicit tasks to investigate whether this is a robust phenomenon.

In sum, this study provides additional evidence that the rich, mentalistic view of ToM understanding should be toned down. Instead, it appears that infants are, in fact, attributing mental states to agents, but too broadly for this ability to be considered as “sophisticated” as in older children and adults. Such broad attribution of mental states is likely adaptive for younger infants, but as they develop, they gradually form more sophisticated understanding of mental states, starting with goals and preferences, and eventually beliefs, as children enter the preschool years.

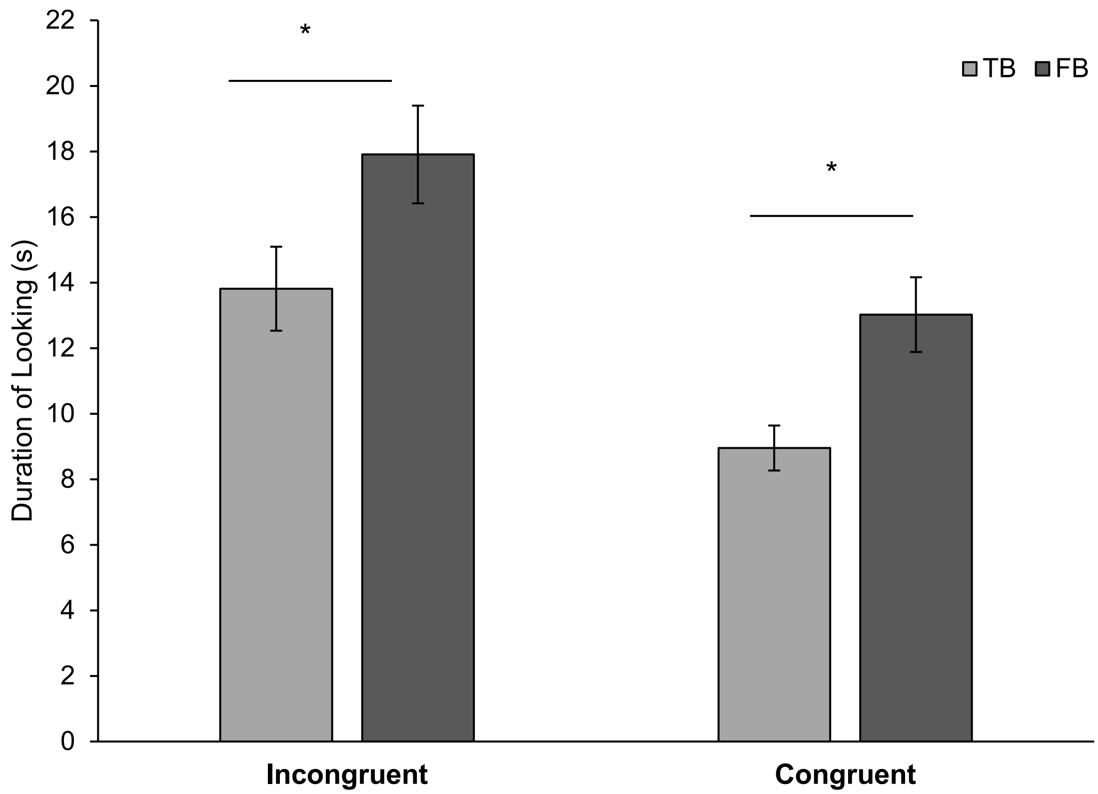


Figure 6. Mean looking time during the test trials for both the incongruent and congruent groups of the true and false belief conditions.

Note. The error bars represent the standard error of the mean.

Chapter 4

General Discussion

The main goal of the present dissertation was to directly address the rich vs. lean debate about ToM understanding in infancy. According to the "rich" view, infants possess a robust and sophisticated false belief concept but fail explicit ToM tasks because they do not have the linguistic and executive functioning skills to match the task demands (Baillargeon et al., 2010; Scott & Baillargeon, 2017). Proponents of this view believe that there is no conceptual shift in the understanding of ToM established in infancy. This theory has been supported by a multitude of studies demonstrating that infants understand false belief (and other ToM constructs) using spontaneous-response, or implicit, tasks. However, replication of implicit false belief understanding has not always been successful. In fact, file drawer problem aside, several failed replications have recently been published (Poulin-Dubois et al., 2018; Sabbagh and Paulus, 2018), adding fuel to the debate about the developmental origins of ToM. Barone, Corradi, and Gomila (2019) published a meta-analysis on infants' performances on implicit false belief tasks, demonstrating that there is a strong likelihood of a publication bias in this field. Further, they demonstrated that effect size for many paradigms decreases with time—it is possible that once a paradigm yields positive results, replication attempts are not as successful.

This "rich" view has been challenged by a number of "lean" views arguing that the implicit ToM tasks do not tap into a sophisticated ToM understanding, but a more rudimentary ToM system (Apperly & Butterfill, 2009), or domain-general skills such as behavioral rules learning (Ruffman, 2014), or submentalizing (Heyes, 2014b). There is an urgent need for studies that could contribute to this debate by shedding light on exactly how this complex socio-cognitive ability develops (or emerges) in humans. As such, in a series of two studies, this dissertation investigated false belief understanding in infants. The first study directly tested Heyes's (2014) suggestion of using an inanimate agent in an implicit task—a toy crane replaced the human agent in Onishi and Baillargeon's (2005) VOE task—and the second study used a switch agent paradigm similar to Buresh and Woodward's (2007) with the same VOE task. Paired together, the findings speak to the construct validity of the VOE paradigm and add crucial information to the ToM debate, consequently tempering the "rich" view.

Overview of Findings

Study 1 was designed to directly address Heyes's (2014b) suggestion of replacing the human agent in implicit tasks with an inanimate object. The reasoning behind this suggestion is that a sophisticated ToM understanding entails attributing mental states to sentient agents only. If the "rich" view is correct, when all other elements of the design are unchanged (i.e., identical methodology), infants' behavior should differ when an inanimate object plays the role of agent. Heyes's (2014b) hypothesis is that infants do not mentalize in implicit ToM tasks, instead she believes that they submentalize; infants behave as if they are mentalizing, but their behavior is a result of low-level property processing. For example, Heyes (2014b) argues that infants in the incongruent group look longer during the test trial of the VOE task than those in the congruent group because the test trial is more perceptually different from the last salient event (i.e., perceptual novelty). Thus, she theorizes that infants' looking patterns would be identical when an inanimate or animate agent is used. Results from Study 1 confirmed this prediction and revealed an identical looking pattern as reported by Onishi and Baillargeon (2005)—infants looked longer when the toy crane turned to the green [belief incongruent] box than when it turned to the yellow [belief congruent] box.

At first glance, these results appear to support Heyes's (2014b) submentalizing theory. However, an important factor prevents such a clear-cut conclusion: the presence of animacy cues. In order to replicate the VOE task as closely as possible and mimic the human agent's movements, the toy crane needed to display both self-propulsion and goal-directed behavior. Displaying goal-directed behavior is sufficient for infants to process an inanimate object such as a box as agentive (Adam et al., 2017; Luo & Baillargeon, 2010; Woodward, 1998), but not necessarily as sentient by older children (Opfer, 2002; Poulin-Dubois & Héroux, 1994). Thus, although submentalizing remains a possible interpretation for the current findings, it is also possible that infants are mentalizing, but much more broadly than are children and adults (i.e., overattributing mental states). In other words, infants may be attributing beliefs to any entity they consider agentive. If this is the case, then their understanding of beliefs—and who should hold them—is not as "sophisticated" as postulated by proponents of the "rich" view. In fact, even children aged 5 years and older (around the same age classic explicit false belief tasks are passed) understand that goal-directed behavior does not equate sentiency (Opfer, 2002). This implies that the discrimination between agency and sentiency develops in early childhood and that the understanding of which entities can *think* is involved in a sophisticated understanding of ToM later in development.

Also in accordance with a "lean" view, adults in Study 1 behaved differently than did the infants. They predicted that the toy crane would turn to the green [belief incongruent] box. When asked to justify their responses, the majority of adults explained that they believed the toy crane would turn to the same side it turned during previous trials, indicating that they employed a simple behavioral rule to predict the toy crane's actions—adults did not ascribe beliefs to a mechanical object. Once more, these results indicate that there is a developmental progression from infancy to adulthood in the understanding of which entity can hold beliefs. Thus, despite the fact that the crane displayed animacy cues, the results of Study 1 support a leaner view of ToM understanding than the one proposed by Baillargeon and colleagues (2010), one where infants overattribute mental states to any entity they believe is agentive. Of note, adults completed an explicit version of the VOE task, which means that the variable measured is not identical to the one measured with infants. It is possible that this methodological difference explains the difference between the infant and adult findings and that older children and adults behave like infants when tested with a looking time paradigm. Future cross-sectional research should administer both an implicit and an explicit version of the VOE crane adaptation to both children and adults in order to determine if their explicit responses are equivalent to their implicit looking behavior.

Study 2 also tested the depth of infants' understanding of beliefs with a switch-agent paradigm. Specifically, the goal of this study was to determine whether infants understand that beliefs are person specific. In the Sally-Anne task, children aged 4 and older understand that although Anne has a true belief about the location of the marble, they do not generalize this belief to Sally—they understand that beliefs are person specific, that Sally and Anne have different beliefs, and that, specifically, Sally has a *false* belief (Baron-Cohen et al., 1985). Do infants have the same sophisticated understanding that thoughts are person specific? Previous studies testing some simple ToM concepts have revealed mixed findings. Some studies demonstrate that infants understand that goals (Buresh & Woodward, 2007) and preferences (Henderson & Woodward, 2012)—both motivational states—are person specific. However, when a switch-agent task manipulates both preferences *and* beliefs, the results are not as conclusive. Kampis and colleagues (2013) found that infants generalized an agent's preference, which was inferred given her false belief about the presence of two objects (i.e., epistemic state), to a second agent who had not demonstrated a preference prior to the test trial. It is possible that Kampis and colleagues (2013) did not replicate Henderson and Woodward's (2012) findings because this task involved the understanding of both motivational and epistemic states. Do infants understand that epistemic states, like motivational states, are person specific unless there is communication between agents?

In Study 2, the VOE design was amended to include a switch agent manipulation. Infants in both the congruent and incongruent groups saw one agent in the familiarization and belief induction trials, and a second agent in the test trial. This second agent was deemed naïve because she was never exposed to the object or its location. Therefore, infants who understand that beliefs are person specific should not form an expectation about this naïve agent's actions during the test trial (i.e., both groups should look equally during the test trial). Results revealed that the infants in the incongruent group looked longer during the test trial than did the infants in the congruent group in both the true and false belief conditions, indicating that they had formed an expectation that was violated when the agent reached for the green box. Infants in this study did not understand that, in this scenario, the first agent's beliefs are not generalizable to others—a sophisticated comprehension of beliefs involves such an understanding. In a task involving communication between two agents, as in Tauzin and Gergely's (2018) study, infants attribute beliefs to "naïve" agents following a communicative exchange. This communication permitted infants to assume that the location of the object was shared to the "naïve" agent, which led the infants to form an expectation of this "naïve" agent's behavior. The present scenario did not provide any cue that there was communication between the two agents and thus infants had no basis on which to generalize beliefs across agents.

Although the false belief condition was the critical test of ToM sophistication given its "litmus test" status in this field, the true belief condition was particularly important in this design. True belief is an easier concept to grasp than false belief as it is less abstract because it is congruent with the observer's belief as well as with reality (i.e., the agent's belief about the location of the object is the same as the observer's belief about the location of the object, and both these beliefs are true). As such, the observer—infants in this case—does not need to inhibit his or her own belief, that is, fewer executive functions are involved in true belief tasks compared to false belief tasks. Therefore, assessing the understanding of true belief specificity is a conservative test of the sophistication of ToM understanding. Furthermore, in the false belief condition of the VOE task, the agent disappears from the scene during the belief induction trial and then returns during the test trial, which requires more memory abilities—no such disappearance occurs in the true belief condition. There are several possible interpretations for the current findings; as in Study 1, they could either indicate that infants process the visual properties of the scene and respond to the perceptual novelty in the test trial (i.e., submentalizing), or that infants are overattributing beliefs indiscriminately to any agent present at test. However, as discussed in Study 2, the fact that the second agent is wearing a different coloured shirt and visor than the first agent also violates the association between colour, shape, and movement—this violation of perceptual information is present in both the incongruent and congruent groups. Given that a group difference was found, the overmentalizing hypothesis appears to be more likely than strict submentalizing. However, given that the design of the study was not aimed to tease these two possible interpretations apart, future research should aim to directly test these hypotheses.

Main Contributions

The results from both studies yielded a coherent message: infants do not have a sophisticated understanding of beliefs to the same extent as older children and adults. Past research clearly demonstrates that at approximately 5 years of age, children understand that goal-directed behavior is not sufficient for an agent to be sentient (Opfer, 2002; Poulin-Dubois & Héroux, 1994) and therefore understand that only certain agents, such as humans and other animals, have mental states, like false beliefs, that guide their behavior (Baron-Cohen et al., 1985; Gopnik & Astington, 1988; Wellman et al., 2001). Results from this set of studies indicate that infants do not have this same ability. The present results are also in line with Kampis and colleagues' (2013) results who found that infants overattribute mental states to novel agents when *epistemic* states are involved. Taken together, it appears that infants have a sophisticated understanding of motivational states, but not epistemic states. Instead, when epistemic states (e.g., beliefs) are involved, infants broadly attribute them to any agent indiscriminately, thus indicating that the "rich" view should be "toned down" to be replaced by a more developmental perspective. Yet, the results of the present set of studies cannot clearly parse out *which* lean view correctly explains the mechanism involved in ToM development.

Tomasello (2018) recently brought forward a different theory about infants' performance on implicit tasks. According to this view: 1) false belief is not fully developed in infancy, and that 2) the implicit tasks actually measure knowledge inference, not false belief (i.e., seeing = knowing). The results of Study 2 are also in contrast with Tomasello's (2018) view that seeing = knowing is what guides infants' behaviors in implicit tasks: the second agent never saw the object or its location in neither the true or false belief conditions and therefore should not have any "knowledge". The true belief is a particularly stringent test of this hypothesis as the first agent has true knowledge of where the object is located, but the second agent does not, yet the infants attributed the first agent's true belief/knowledge to this naïve agent. Nevertheless, Tomasello (2018) suggested an interesting developmental theory on *how* explicit ToM comes to fruition, coined the shared intentionality account. He posits that joint attention, an early form of perspective triangulation, highlights the relation between two perspectives. This enables infants to practice recognizing when their perspective is different from someone else's and then aligning their individual perspective with someone else's perspective. Extensive practice engaging in perspective-taking in infancy, paired with language development in early childhood, permit children to have access to mental content and to practice engaging in mental content joint attention (i.e., having a conversation about a mutually understood topic).

Tomasello (2018) hypothesizes that these conversations begets children to develop an understanding of subjective and objective perspectives, which they can then triangulate, that is, an understanding that their subjective perspective can be similar or different to someone else's perspective and that either one of these subjective perspectives are either in line or in contrast with an objective perspective (i.e., facts/reality). Existing longitudinal studies provide partial support for this view by showing that joint attention skills in infancy predict ToM understanding in childhood (Charman et al., 2003; Colonnesi et al., 2008; Kristen et al., 2011). The ability to triangulate emerges around the age of 4 – 5 years, which explains why it is at this age that children can understand that the objective perspective, as well as their own subjective perspective, is that the marble is in the box, but that Sally's subjective perspective is that the marble is in the basket. If Tomasello's (2018) theory is true, then 16-month-olds are not yet proficient in understanding different individual's perspectives. The results of the second study are in line with this view—infants are not able to discriminate between several subjective perspectives which may explain why they overattribute epistemic states to naïve agents.

Results of the current set of studies have important theoretical implications. Specifically, they permit a narrowing of the competing views that have been developed to explain ToM understanding in infancy. The "rich" mentalistic view needs to be revised given that there is now an accumulation of studies that contradict this view, including those that show the fragility of the concept across tasks, as well as the lack of sophistication revealed by the present studies (e.g., Dörrenberg et al., 2018; Heyes, 2014a; Kulke et al., 2018; Powell et al., 2018; Ruffman, 2014; Yott & Poulin-Dubois, 2016). However, this does not imply that the existing lean views provide the best interpretations. In fact, there are also studies that have yielded findings that are not in accordance with lean views, including that infants' performance on false belief tasks cannot be fully explained by Heyes's (2014b) low-level properties account (Song & Baillargeon, 2009), or Apperly and Butterfill's (2009) two-systems theory (Király, Oláh, Csibra, & Kovács, 2018). The present findings seem to indicate that infants overattribute mental states, but it is still unclear when and how overattributing evolves into the appropriate attribution of mental states.

An amended theory that combines the present findings with Tomasello's (2018) developmental theory may better explain infants' performance on implicit tasks as well as how this relates to explicit ToM and its development. Accumulated evidence show that infants *appear* to be attributing beliefs, but the main question is whether or not infants are in fact tracking belief-like states, rudimentary mental states such as knowledge, mere behaviors, or low-level properties. As previously mentioned, there exists evidence for and against many of these theories, which were all brought forward to explain the observed findings, thus lending some merit to each of these theories. However, given that there also exists evidence against these theories, they might not accurately explain the developmental trajectory of ToM from infancy to childhood. As such, we propose an integrative theory that explains infants' varied performances on various implicit tasks in relation to ToM development. Assuming that ToM is not innate, but rather develops in early childhood, this human capacity develops to facilitate social interactions (e.g., understanding one's peers' perspectives and mental states helps one better predict their peers' behaviors). ToM likely develops very similarly to how Tomasello (2018) suggests—given that human infants are innately social, they attend to social information in their environment and consequently learn to engage in joint attention with other humans. This practicing of perspective-taking in infancy very likely paves the way for a comprehensive understanding of perspectives later-on in childhood. However, as the present findings does not support Tomasello's (2018) theory that implicit false belief tasks measure knowledge inference (seeing = knowing), we propose that these tasks are likely tapping into a System 1-like form of perspective-taking.

Given that infants are able to engage in joint attention as of 9 months, by the time they "succeed" on implicit false belief tasks (15 – 16 months), they are presumably able to engage in perspective-taking (i.e., they know what the agent saw and did not see) (Moll, Carpenter, & Tomasello, 2007; Moll & Tomasello, 2006). This ability is likely automatic, akin to the two-system's System 1. Infants thus form implicit expectations of how an agent would behave with a given perspective, and because this ability is automatic (i.e., not reasoned), it is likely applied to any agent that could have the same perspective. For example, in the VOE false belief task, infants see an agent display a clear goal: to find the object. According to this agent's perspective (or engagement as Wellman (2014) calls it), and the agent's goal to obtain the object, the agent should reach in the yellow box. Rather than reasoning about another individual's mental states (i.e., mentalizing as stipulated by the "rich" view), infants are engaging in perspective-taking (e.g., if I wanted to grab the object and I did not see it go back to the green box, then I would reach in the yellow box). Therefore, we posit that infants are aware of agents' perspectives and, as the present evidence suggests, overattribute perspectives to any agent in the scene. With accumulated practice engaging in perspective-taking, language development, engaging in mental content perspective-taking, and learning how to triangulate, children eventually learn to reason about others' beliefs—around 4 – 5 years of age. If this theory is true, then it is possible that the various implicit false belief tasks yield mixed results (i.e., numerous non-replications) because they are designed to measure a construct that is not fully developed in infancy.

Limitations and Future Directions

One limitation of the results from the current set of studies is that is does not provide direct evidence for which lean view correctly accounts for the findings yielded by implicit false belief tasks (e.g., submentalizing vs. behavioral rules vs. two-systems vs. seeing = knowing). Instead, it permitted an investigation of whether infants' performance on the VOE task reflects a sophisticated false belief understanding, thus pitting the "rich" and "lean" views against each other. Future studies should attempt to determine which "lean" view accounts for the majority of findings. For example, replicating the VOE task with opaque and transparent visors, similar to Senju, Southgate, Snape, Leonard, and Csibra's (2011) paradigm, would directly test if the submentalizing account explains infants' performance on the VOE task. Prior to the VOE task, infants would be given the opportunity to inspect and engage with the visor (either opaque or transparent) so that they would know if the agent can see through it or not. According to the submentalizing hypothesis, the infants look longer when they view the green [belief incongruent] box event because this event is more perceptually novel than the last event that occurred when the agent was present—in the belief induction trial, a yellow box–agent association is made because the last time the agent was present, the object was paired with the yellow box. This association is broken in the green [belief incongruent] box event, yielding longer looking durations. However, this theory stands only if the agent is absent during the movement of the object back to the green box. Therefore, the visor paradigm would permit the agent to remain in the scene while inducing a true (transparent visor) or false (opaque visor) belief. If infants are genuinely processing the agent's belief/perspective/knowledge, then the infants in the opaque visor condition should look longer when the agent reaches in the green box because she could not see the toy return to the green box, while the infants in the transparent visor condition should look longer if the agent reaches in the yellow box because she saw the object return to the green box. However, if infants are submentalizing, then the green box–agent association is made because the last time the agent was present, the object was paired with the green box (as she never leaves the scene). Therefore, infants in both the transparent and opaque conditions should look longer when they view the yellow [belief congruent] box event because it breaks the green box–agent association that was made and is therefore more perceptually novel. Therefore, if a main effect of condition is found, then the submentalizing hypothesis does not accurately explain infants' performance on the VOE task, thus ruling out one of the "lean" views. If no such main effect is observed, then infants submentalize and their performance on the VOE task does not reflect mentalizing abilities.

Another limitation of the current study is that it does not directly compare infants' and children's ToM understanding. Longitudinal studies would permit this comparison and would investigate the developmental trajectory of ToM development in the same individuals—how does overattributing mental states to any agent evolve into the appropriate attribution of mental states to sentient beings? For example, Tomasello's (2018) theory about how ToM precursors (e.g., knowledge inference) develops into explicit ToM understanding could be investigated in the same individuals from infancy to 5 years of age. According to Tomasello's (2018) shared intentionality account, joint attention as well as knowledge inference are precursor abilities to explicit ToM and therefore, infants' performance on knowledge inference tasks should predict their performance on explicit tasks (e.g., Wellman and Liu (2004) ToM scale) in childhood. Importantly, children's verbal abilities should also be measured given that the shared intentionality account stipulates that communication is one of the mechanisms underlying the development of mental content perspective-taking, and thus the discrimination between subjective and objective perspectives. This theory is best investigated within individuals as the shared intentionality account is a developmental theory. As such, a longitudinal study would be the best design to directly test Tomasello's (2018) theory.

Future research should also focus on determining which implicit tasks more reliably measure belief-like states. A large-scale multi-laboratory replication study (ManyBabies2) was recently designed to gather data on three "implicit false belief" tasks: anticipatory looking, VOE, and interactive (Frank et al., 2018). The goal is to determine whether the three selected tasks can be replicated and therefore determine whether they measure the intended construct. However, such efforts should be made to determine which construct is actually present in infancy (e.g., beliefs, belief-like states, perspective-taking, knowledge inference, etc.) and then efforts should be made to establish reliable tasks that measure said construct in order to accurately determine the developmental progression of ToM in early childhood.

Having a comprehensive understanding of ToM development in early childhood also entails important clinical implications. Specifically, ToM impairments are an important aspect of Autism Spectrum Disorder (ASD) (Baron-Cohen et al., 1985; Burnside, Wright, & Poulin-Dubois, 2017). In fact, (explicit) ToM training is frequently used in interventions (Begeer, Gevers, Clifford, Verhoeve, Kat, Hoddenbach, & Boer, 2011; Gevers, Clifford, Mager, & Boer, 2006; Fisher, & Happé, 2005). Thus, a comprehensive understanding of the precursors to an explicit ToM understanding could lead to earlier diagnosis as well as earlier treatment interventions for individuals with ToM impairments.

Conclusion

To conclude, the goal of the present set of studies was to determine whether infants have a sophisticated false belief understanding when measured using the VOE task developed by Onishi and Baillargeon (2005). This task was chosen because it was the first to report false belief attribution in infants and has frequently been used in studies (but not always replicated) despite the fact that its construct validity was not established. Onishi and Baillargeon's (2005) study is also frequently cited as a milestone study that has revealed that infants have a sophisticated ToM understanding—such a claim should be investigated more closely before it is treated as a fact. The present results revealed that 16-month-old infants overattribute "beliefs" inappropriately—to a toy crane and to a naïve agent; if infants' understanding was indeed sophisticated, both of these agents should be denied such "beliefs". As such, the results suggest that the "rich" mentalistic view needs to be revised and that a leaner view is likely more accurate regarding ToM development. However, it remains to be confirmed which "lean" view is correct. Future research should continue investigating which construct is actually being measured by these implicit tasks, as well as which implicit tasks are more reliable. This is important to establish because tasks that do not yield robust findings prevent conclusive interpretations.

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Appendix A: Recruitment materials

English Recruitment letter – Study 1

French Recruitment letter – Study 1

English Recruitment letter – Study 2

French Recruitment letter – Study 2

UNIVERSITÉ Concordia UNIVERSITY

November 13, 2017

Dear parent(s),

The Cognitive and Language Development Laboratory, which is part of the Center for Research and Human Development at Concordia University, is presently conducting a study on **how children understand that others have different thoughts from their own.** The Commission d'Accès à l'Information du Québec has kindly given us permission to consult birth lists provided by the Agence de la santé et des services sociaux de Montréal. Your name appears on the birth list of August 2016, which indicates that you have a child of an age appropriate for our study. Our research has been funded by federal and provincial agencies for the past twenty-five years and our team is internationally recognized for its excellent work on early child development. Our articles are frequently published in prestigious journals, such as "Infancy" and "Developmental Science". You also might have heard about our studies on national radio or on the *Discovery Channel*. If you have participated in a study in the past, we would like to thank you for your enthusiasm and commitment to research.

For the present study, your child will have the opportunity to participate in a few short games. In the first game, your child will observe as the experimenter, hidden from view, rotates a toy crane from one location to another while moving a toy. A second experimenter will record live the eye movement of your child. Other tasks will involve playing with toys with an experimenter, such as finding hidden objects. During these tasks, your child will be sitting in a seat or on your lap. We will videotape the entire session and all recordings will be treated in the strictest of confidentiality.

Overall, your participation will involve approximately **one 45-minute visit** to our laboratory at the Loyola Campus of Concordia University, located at 7141 Sherbrooke Street West, in Notre-Dame-de-Grace. Appointments can be scheduled at a time which is convenient for you and your child, including weekends. Free parking is available on the campus and we offer babysitting for siblings who come to the appointment. Upon completion of the study, a Certificate of Merit for Contribution to Science will be given to your child, and you will be offered a financial compensation of 20$ for participating. A summary of the results of our study will be mailed to you once it is completed.

For the purposes of this study, we are looking for infants who are **16-17 months of age**, who hear English or French at home or at daycare, and who do not have any visual or hearing difficulties. If you are interested in having your child participate in this study, or would like any further information, please contact Kimberly Burnside at (514) 848-2424 ext. 2279, or Dr. Diane Poulin-Dubois at (514) 848-2424 ext. 2219. For more information on our studies, please visit our website at http://crdh.concordia.ca/dpdlab/. We will try to contact you by telephone within a few days of receiving this letter.

We are looking forward to speaking with you in the near future.

Sincerely yours,

Diane Poulin-Dubois

Diane Poulin-Dubois, Ph.D.
Professor
Department of Psychology

Kimberly Burnside, M.A.
Ph.D. Student
Department of Psychology

UNIVERSITÉ Concordia UNIVERSITY

13 novembre 2017

Chers parent(s),

Le Laboratoire de Recherche sur le Développement de la Cognition et du Langage, qui fait partie du Centre de Recherche en Développement Humain de l'Université Concordia, aimerait vous inviter à participer à une nouvelle étude passionnante **qui porte sur la façon dont les enfants comprennent que les autres ont des pensées différentes des leurs**. La Commission d'Accès à l'Information du Québec nous a généreusement autorisé à consulter les listes de naissance de l'Agence de la Santé et des Services Sociaux de Montréal. Votre nom apparaît sur la liste du mois d'août 2016, ce qui indique que vous avez un enfant dont l'âge correspond à celui que nous étudions. Nos recherches sont subventionnées depuis près de 25 ans par des organismes fédéraux et provinciaux, et notre équipe de recherche est internationalement reconnue pour son excellent travail sur le développement du jeune enfant. Nos articles sont souvent publiés dans des revues prestigieuses telles que "Infancy" et "Developmental Science". Vous avez peut-être aussi entendu parler de nos études à la radio ou sur la chaîne de télévision "*Discovery Channel*". Si vous avez participé à l'une de nos études dans le passé, nous vous sommes très reconnaissants de votre enthousiasme et de votre engagement envers la recherche.

Pour le projet de recherche en cours, votre enfant aura l'occasion de participer à quelques jeux. Dans le premier jeu, votre enfant observera le mouvement d'un jouet qui sera opéré par une expérimentatrice hors de la vue de votre enfant. Une deuxième expérimentatrice enregistrera en direct le mouvement des yeux de votre enfant. Pour les autres jeux, votre enfant jouera avec une expérimentatrice, comme de trouver des objets qu'elle cachera. Au cours de toutes ces tâches, votre enfant sera assis dans un siège pour enfant ou sur vos genoux. Les réactions de votre enfant seront filmées et les vidéos, ainsi que toutes les informations recueillies, seront traitées de façon strictement confidentielle.

Votre participation impliquerait **une visite d'environ 45 minutes** à notre centre de recherche situé sur le campus Loyola de l'Université Concordia, au 7141 rue Sherbrooke Ouest, à Notre-Dame-de-Grâce. Vous pourrez prendre rendez-vous à un moment qui vous convient, y compris les fins de semaine. Le stationnement du campus est gratuit. Suite à sa participation, votre enfant recevra un Certificat de Mérite pour sa contribution à la science de l'Université Concordia, et vous recevrez un montant de 20$ pour votre participation. Un sommaire des résultats vous sera posté dès que l'étude sera complétée.

Pour cette étude, nous recherchons des enfants qui sont âgés de **16-17 mois,** qui entendent le français ou l'anglais à la maison ou à la garderie, et qui n'ont aucun problème auditif ou visuel. Si vous désirez que votre enfant participe à cette étude, ou si vous désirez obtenir de plus amples renseignements, veuillez contacter Kimberly Burnside au (514) 848-2424 poste 2279, ou Dr. Diane Poulin-Dubois au (514) 848-2424 poste 2219. Pour plus d'informations sur nos études, vous pouvez visiter notre site web : http://crdh.concordia.ca/dpdlab/. Nous tenterons de vous contacter par téléphone quelques jours après la réception de cette lettre afin de répondre à vos questions concernant cette recherche.

Recevez l'expression de nos sentiments distingués,

Diane Poulin-Dubois

Diane Poulin-Dubois, Ph.D.
Professeure titulaire
Département de Psychologie

Kimberly Burnside, M.A.
Doctorante
Département de Psychologie

Université Concordia University

November 2018

Dear parent(s),

The Cognitive and Language Development Laboratory, which is part of the Center for Research and Human Development at Concordia University, is presently conducting a study on **how children understand that others have different thoughts from their own**. The Commission d'Accès à l'Information du Québec has kindly given us permission to consult birth lists provided by the Centre intégré universitaire de santé et de services sociaux (CIUSSS). Your name appears on the birth list of July 2017, which indicates that you have a child of an age appropriate for our study. If you have participated in a study in the past, we would like to thank you for your enthusiasm and commitment to research. Our research has been funded by federal and provincial agencies for the past twenty-five years and our team is internationally recognized for its excellent work on early child development. Our articles are frequently published in prestigious journals, such as "Infancy" and "Developmental Science." You also might have heard about our studies on national radio or on the *Discovery Channel*. If you have participated in a study in the past, we would like to thank you for your enthusiasm and commitment to research.

For the present study, your child will have the opportunity to participate in a few short games. In the first game, your child will observe as the experimenter hide a toy in one of two boxes. A second experimenter will record live the eye movements of your child. Other tasks will involve playing with toys with an experimenter, such as finding hidden objects. During these tasks, your child will be sitting in a seat or on your lap. We will videotape the entire session and all recordings will be treated in the strictest of confidentiality.

Overall, your participation will involve approximately **one 45-minute visit** to our laboratory at the Loyola Campus of Concordia University, located at 7141 Sherbrooke Street West, in Notre-Dame-de-Grace. Appointments can be scheduled at a time which is convenient for you and your child, including weekends. Free parking is available on the campus and we offer babysitting for siblings who come to the appointment. Upon completion of the study, a Certificate of Merit for Contribution to Science will be given to your child, and you will be offered a financial compensation of 20$ for participating. A summary of the results of our study will be mailed to you once it is completed.

For the purposes of this study, we are looking for infants who are **15-18 months of age**, who hear English or French at home or at daycare, and who do not have any visual or hearing difficulties. If you are interested in having your child participate in this study, or would like any further information, please contact Kimberly Burnside at 514-848-2424 ext. 2279, or Dr. Diane Poulin-Dubois at 514-848-2424 ext. 2219. For more information on our studies, please visit our website at http://crdh.concordia.ca/dpdlab/. We will try to contact you by telephone within a few days of receiving this letter.

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Sincerely yours,

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Professor
Department of Psychology

Kimberly Burnside

Kimberly Burnside, M.A.
Ph.D. Student
Department of Psychology

UNIVERSITÉ Concordia UNIVERSITY

Novembre 2018

Cher(s) parent(s),

Le Laboratoire de Recherche sur le Développement de la Cognition et du Langage, qui fait partie du Centre de Recherche en Développement Humain de l'Université Concordia, aimerait vous inviter à participer à une nouvelle étude passionnante **qui porte sur la façon dont les enfants apprennent que les autres ont des pensées différentes des leurs**. La Commission d'accès à l'information du Québec nous a autorisés à consulter certaines listes de naissance de la région de Montréal. Nous avons obtenu vos coordonnées à partir de la liste du mois de juillet 2017, provenant du Centre intégré universitaire de santé et de services sociaux (CIUSSS) qui indique que vous avez un enfant dont l'âge correspond à celui que nous étudions. Nos recherches sont subventionnées depuis près de 25 ans par des organismes fédéraux et provinciaux, et notre équipe de recherche est internationalement reconnue pour son excellent travail sur le développement des jeunes enfants. Nos articles sont souvent publiés dans des revues prestigieuses telles que *Infancy* et *Developmental Science*. Vous avez peut-être aussi entendu parler de nos études à la radio ou sur la chaîne de télévision *Discovery Channel*. Si vous avez participé à l'une de nos études dans le passé, nous vous sommes très reconnaissants de votre enthousiasme et de votre engagement envers la recherche.

Dans le cadre du projet de recherche en cours, votre enfant aura l'occasion de participer à quelques jeux. Tout d'abord, votre enfant observera une expérimentatrice placer un jouet dans une boite. Une deuxième expérimentatrice enregistrera en direct le mouvement des yeux de votre enfant. Durant les autres jeux, votre enfant jouera avec une expérimentatrice à trouver des objets qu'elle cachera. Au cours de toutes ces tâches, votre enfant sera assis dans un siège pour enfant et vous serez assis(e) sur une chaise juste derrière. Les réactions de votre enfant seront filmées et les enregistrements, ainsi que toutes les informations recueillies, seront traitées de façon strictement confidentielle.

Votre participation impliquerait **une visite d'environ 45 minutes** à notre centre de recherche situé sur le campus Loyola de l'Université Concordia, au 7141 rue Sherbrooke Ouest dans Notre-Dame-de-Grâce. Vous pourrez prendre rendez-vous à un moment qui vous convient, y compris les fins de semaine. Le stationnement du campus est gratuit. Suite à sa participation, votre enfant recevra un Certificat de Mérite pour sa contribution à la science de l'Université Concordia, et vous recevrez un montant de 20$ pour votre participation. Un compte-rendu des résultats vous sera posté dès que l'étude sera complétée.

Pour cette étude, nous recherchons des enfants qui sont âgés de **15-18 mois**, qui entendent le français ou l'anglais à la maison ou à la garderie, et qui n'ont aucun problème auditif ou visuel. Si vous désirez que votre enfant participe à cette étude, ou si vous désirez obtenir de plus amples renseignements, veuillez contacter Kimberly Burnside au 514-848-2424 poste 2279, ou Dr. Diane Poulin-Dubois au 514-848-2424 poste 2219. Pour plus d'informations sur nos études, vous pouvez visiter notre site web : http://crdh.concordia.ca/dpdlab/. Nous tenterons de vous contacter par téléphone quelques jours après la réception de cette lettre afin de répondre à vos questions concernant cette recherche.

Recevez l'expression de nos sentiments distingués,

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Diane Poulin-Dubois, Ph.D.
Professeure titulaire
Département de Psychologie

Kimberly Burnside, M.A.
Doctorante
Département de Psychologie

Appendix B: Consent forms

English Consent form – Study 1

French Consent form – Study 1

English Consent form – Study 2

French Consent form – Study 2

UNIVERSITÉ Concordia UNIVERSITY

Parental Consent Form

This is to state that I agree to allow my child to participate in a research project being conducted by Dr. Diane Poulin-Dubois, in collaboration with PhD student Kimberly Burnside.

A. PURPOSE

I have been informed that the purpose of the research is to examine infants' theory of mind understanding.

B. PROCEDURES

The present study involves one visit to the Concordia Cognitive and Language Development Laboratory. First, you will be invited to complete a brief demographic questionnaire about your family (e.g., siblings, education). Then, your child will participate in a series of short games with three female researchers. Your child will observe as the experimenter, hidden from view, rotates a toy crane from one location to another while interacting with a toy. A second experimenter will record live the eye movement of your child. Other tasks will involve playing with toys with an experimenter. During these tasks, your child will be sitting in a seat or on the floor with the experimenter.

We will videotape your child's responses and all tapes will be treated in the strictest of confidentiality. That means that the researcher will not reveal your child's identity in any written or oral reports about the study. You and your child will be assigned a coded number, and that code will be used on all materials collected in this study. All materials and data will be stored in secure facilities in the Department of Psychology at Concordia University. Only members of the research team will have access to these facilities. Questionnaires and electronic data files will be identified by coded identification numbers, unique to each family. Information collected on paper (questionnaires) or videotapes (observed behaviours) will be entered into computer databases. Raw data will be kept for a minimum of 5 years. When it is time for disposal, papers will be shredded, hard-drives will be purged, and videotapes and computer disks will be magnetically erased.

As well, because we are only interested in comparing children's group performance, no individual scores will be provided following participation. The whole session should last approximately 45 minutes.

C. RISKS AND BENEFITS

Your child will be given a certificate of merit at the end of the session as a thank-you for his/her participation. You will also be offered 20$ for your participation.

There is one condition that may result in the researchers being required to break the confidentiality of your child's participation. There are no procedures in this investigation that inquire about child maltreatment directly. However, by the laws of Québec and Canada, if the researchers discover information that indicates the possibility of child maltreatment, or that your child is at risk for imminent harm, they are required to disclose this information to the appropriate agencies. If this concern emerges, the lead researcher, Dr. Diane Poulin-Dubois, will discuss the reasons for this concern with you and will advise you of what steps will have to be taken.

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D. CONDITIONS OF PARTICIPATION

- I understand that I am free to withdraw my consent and discontinue my participation at any time without negative consequences, and that the experimenter will gladly answer any questions that might arise during the course of the research.
- I understand that my participation in this study is confidential (i.e. the researchers will know, but will not disclose my identity).
- I understand that the data from this study may be published, though no individual scores will be reported.

I would be interested in participating in other studies within the Centre for Research in Human Development (CRDH) with my child in the future (YES/NO): ______

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOUNTARILY AGREE TO HAVE MY CHILD PARTICIPATE IN THIS STUDY.

MY CHILD'S NAME (please print) ______________________________

MY NAME (please print) ______________________________

SIGNATURE ______________________ DATE ________________

WITNESSED BY ____________________ DATE ________________

If at any time you have questions about your rights as a research participant, you are free to contact the Research Ethics and Compliance Officer of Concordia University, at (514) 848-2424 ext 7481 or by email at ethics@alcor.concordia.ca.

Diane Poulin-Dubois, Ph.D.
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Kimberly Burnside, M.A.
Ph.D. Student
Department of Psychology
514-848-2424 ext.2279
dpdlab@crdh.concordia.ca

Participant # ____________

Researcher: ______________________

Formulaire de Consentement Parental

J'autorise par la présente mon enfant à participer à un projet de recherche dirigé par la professeure Diane Poulin-Dubois, avec la collaboration de Kimberly Burnside de l'Université Concordia.

A. BUT

On m'a informé(e) que le but de cette étude est d'étudier la théorie de l'esprit chez les nourrissons.

B. PROCÉDURE

La présente étude comprend une visite au Laboratoire de Recherche sur le Développement de la Cognition et du Langage. Vous serez d'abord invité à compléter de courts questionnaires sur le vocabulaire de votre enfant et des informations démographiques (fratrie, éducation). La visite comprendra la participation de votre enfant à quelques courtes activités avec trois expérimentatrices. Votre enfant observera le mouvement d'un jouet qui sera opérée par une expérimentatrice hors de la vue de votre enfant. Une deuxième expérience enregistrera en direct le mouvement des yeux de votre enfant. Pour les autres tâches, votre enfant va jouer avec une expérimentatrice. Au cours de toutes ces tâches, votre enfant sera assis dans un siège pour enfant ou sur le sol avec l'expérimentatrice.

Les réactions de votre enfant seront filmées et les vidéos, ainsi que toutes les informations recueillies, seront traitées de façon strictement confidentielle. Cela signifie que le chercheur/euse ne révélera pas votre identité ou celle de votre enfant dans tous les rapports écrits ou oraux au sujet de cette étude. Nous attribuerons un code numérique à votre enfant, et celui-ci sera utilisé dans tous les matériaux recueillis. Tous les matériaux et données seront conservés dans des lieux sécuritaires au département de psychologie de l'université. Seuls les membres de l'équipe de recherche auront accès à ces lieux. Les questionnaires et les données électroniques seront identifiés par des numéros d'identification propre à chaque famille. Les informations recueillies sur papier (questionnaires) ou sur vidéo (comportements observés en laboratoire) seront entrées dans notre système informatique. Les données brutes seront conservées pendant une durée minimum de 5 ans. Lorsqu'il sera temps de les éliminer, les papiers seront déchiquetés, et les disques durs et les vidéos seront effacés.

Par ailleurs, puisque nous sommes seulement intéressées à comparer la compréhension des enfants en fonction de leur âge, aucun score individuel ne sera fourni suite à votre participation. La session devrait durer environ 45 minutes.

C. RISQUES ET AVANTAGES

Nous offrirons à votre enfant un certificat de mérite à la fin de la session pour le ou la remercier pour sa participation. Aussi, vous recevrez un montant de $20 pour la visite.

Il y a une condition où le chercheur/eure se doit de rompre la confidentialité de participation de votre enfant. Il n'y a aucune procédure dans la présente recherche qui porte directement sur la maltraitance des enfants.

Par contre, en vertu des lois du Québec et du Canada, si les chercheurs/euses découvrent des informations qui indiquent la possibilité que votre enfant soit maltraité, ou que votre enfant risque un tel danger dans un avenir immédiat, ils sont requis de divulguer ces informations aux agences appropriées. Si cette situation se présente, la chercheure principale, la Dr. Diane Poulin-Dubois, discutera avec vous les raisons à l'origine de cette inquiétude et vous conseillera sur les étapes à suivre.

UNIVERSITÉ Concordia UNIVERSITY

D. CONDITIONS DE PARTICIPATION

- Je comprends que je suis libre d'interrompre ma participation à tout moment sans conséquences négatives, et que les chercheurs répondront avec plaisir à toutes questions qui pourrait être soulevées au cours de la recherche. Je suis en droit de garder le montant total de 20$ si je choisis de retirer ma participation à cette étude.
- Je comprends que ma participation dans cette étude est confidentielle (les chercheurs sauront, mais ne révéleront pas notre identité).
- Je comprends que les données résultant de cette étude seront possiblement publiées, mais qu'aucun résultat individuel ne sera rapporté.

Je serais intéressé(e) à être contacté(e) de nouveau pour participer avec mon enfant à de futures études menées par le Centre de Recherche en Développement Humain (OUI/ NON) : __________

J'AI LU ATTENTIVEMENT L'INFORMATION PRÉCÉDENTE ET COMPREND CETTE ENTENTE. JE CONSENS LIBREMENT ET VOLONTAIREMENT À CE QUE MON ENFANT PARTICIPE À CETTE ÉTUDE.

NOM DE MON ENFANT (imprimer s'il-vous-plait) ________________________________

MON NOM (imprimer s'il-vous-plait) ________________________________

SIGNATURE ____________________________ DATE ____________________

SIGNÉ EN PRESENCE DE ____________________ DATE____________________

Si vous avez des questions à propos de vos droits comme participant à la recherche, veuillez contacter la Conseillère sur l'éthique en recherche de l'Université Concordia, au (514) 848-2424 ext. 7481 ou par courriel à l'adresse ethics@alcor.concordia.ca.

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Doctorante
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514-848-2424 ext. 2279
dpdlab@crdh.concordia.ca

Participant:______

Chercheur/euse:__________________

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Parental Consent Form

This is to state that I agree to allow my child to participate in a research project being conducted by Dr. Diane Poulin-Dubois, in collaboration with PhD student Kimberly Burnside.

A. PURPOSE

I have been informed that the purpose of the research is to examine infants' theory of mind understanding.

B. PROCEDURES

The present study involves one visit to the Concordia Cognitive and Language Development Laboratory. First, you will be invited to complete a brief demographic questionnaire about your family (e.g., siblings, education). Then, your child will participate in a series of short games with three female researchers. Your child will watch experimenters act out scenes inside of a puppet theatre. Another experimenter will record live the eye movement of your child. Other tasks will involve finding hidden toys with an experimenter. During these tasks, your child will be sitting in a seat or on the floor with the experimenter.

We will videotape your child's responses and all tapes will be treated in the strictest of confidentiality. That means that the researcher will not reveal your child's identity in any written or oral reports about the study. You and your child will be assigned a coded number, and that code will be used on all materials collected in this study. All materials and data will be stored in secure facilities in the Department of Psychology at Concordia University. Only members of the research team will have access to these facilities. Questionnaires and electronic data files will be identified by coded identification numbers, unique to each family. Information collected on paper (questionnaires) or videotapes (observed behaviours) will be entered into computer databases. Raw data will be kept for a minimum of 5 years. When it is time for disposal, papers will be shredded, hard-drives will be purged, and videotapes and computer disks will be magnetically erased.

As well, because we are only interested in comparing children's group performance, no individual scores will be provided following participation. The whole session should last approximately 45 minutes.

C. RISKS AND BENEFITS

Your child will be given a certificate of merit at the end of the session as a thank-you for his/her participation. You will also be offered 20$ for your participation.

There is one condition that may result in the researchers being required to break the confidentiality of your child's participation. There are no procedures in this investigation that inquire about child maltreatment directly. However, by the laws of Québec and Canada, if the researchers discover information that indicates the possibility of child maltreatment, or that your child is at risk for imminent harm, they are required to disclose this information to the appropriate agencies. If this concern emerges, the lead researcher, Dr. Diane Poulin-Dubois, will discuss the reasons for this concern with you and will advise you of what steps will have to be taken.

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D. CONDITIONS OF PARTICIPATION

- I understand that I am free to withdraw my consent and discontinue my participation at any time without negative consequences, and that the experimenter will gladly answer any questions that might arise during the course of the research.
- I understand that my participation in this study is confidential (i.e. the researchers will know, but will not disclose my identity).
- I understand that the data from this study may be published, though no individual scores will be reported.

I would be interested in participating in other studies within the Centre for Research in Human Development (CRDH) with my child in the future (YES/NO): ______

I HAVE CAREFULLY STUDIED THE ABOVE AND UNDERSTAND THIS AGREEMENT. I FREELY CONSENT AND VOUNTARILY AGREE TO HAVE MY CHILD PARTICIPATE IN THIS STUDY.

MY CHILD'S NAME (please print) ______________________________

MY NAME (please print) ______________________________

SIGNATURE ______________________ DATE ________________

WITNESSED BY ______________________ DATE ________________

If at any time you have questions about your rights as a research participant, you are free to contact the Research Ethics and Compliance Officer of Concordia University, at (514) 848-2424 ext 7481 or by email at ethics@alcor.concordia.ca.

Diane Poulin-Dubois, Ph.D.
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Kimberly Burnside, M.A.
Ph.D. Student
Department of Psychology
514-848-2424 ext.2279
dpdlab@crdh.concordia.ca

Participant # ____________ Researcher: ____________________

UNIVERSITÉ Concordia UNIVERSITY

Formulaire de Consentement Parental

J'autorise par la présente mon enfant à participer à un projet de recherche dirigé par la professeure Diane Poulin-Dubois, avec la collaboration de Kimberly Burnside de l'Université Concordia.

A. BUT

On m'a informé(e) que le but de cette étude est d'étudier la théorie de l'esprit chez les nourrissons.

B. PROCÉDURE

La présente étude comprend une visite au Laboratoire de Recherche sur le Développement de la Cognition et du Langage. Vous serez d'abord invité à compléter de courts questionnaires sur le vocabulaire de votre enfant et des informations démographiques (fratrie, éducation). La visite comprendra la participation de votre enfant à quelques courtes activités avec trois expérimentatrices. Votre enfant observera les expérimentatrices jouer un rôle dans des scènes qui seront présentées dans un théâtre de marionnettes. Une autre expérience enregistrera en direct le mouvement des yeux de votre enfant. Pour les autres tâches, votre enfant va jouer à trouver des objets cachés avec une expérimentatrice. Au cours de toutes ces tâches, votre enfant sera assis dans un siège pour enfant ou sur le sol avec l'expérimentatrice.

Les réactions de votre enfant seront filmées et les vidéos, ainsi que toutes les informations recueillies, seront traitées de façon strictement confidentielle. Cela signifie que le chercheur/euse ne révélera pas votre identité ou celle de votre enfant dans tous les rapports écrits ou oraux au sujet de cette étude. Nous attribuerons un code numérique à votre enfant, et celui-ci sera utilisé dans tous les matériaux recueillis. Tous les matériaux et données seront conservés dans des lieux sécuritaires au département de psychologie de l'université. Seuls les membres de l'équipe de recherche auront accès à ces lieux. Les questionnaires et les données électroniques seront identifiés par des numéros d'identification propre à chaque famille. Les informations recueillies sur papier (questionnaires) ou sur vidéo (comportements observés en laboratoire) seront entrées dans notre système informatique. Les données brutes seront conservées pendant une durée minimum de 5 ans. Lorsqu'il sera temps de les éliminer, les papiers seront déchiquetés, et les disques durs et les vidéos seront effacés.

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UNIVERSITÉ Concordia UNIVERSITY

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- Je comprends que ma participation dans cette étude est confidentielle (les chercheurs sauront, mais ne révéleront pas notre identité).
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Je serais intéressé(e) à être contacté(e) de nouveau pour participer avec mon enfant à de futures études menées par le Centre de Recherche en Développement Humain (OUI/ NON) : __________

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NOM DE MON ENFANT (imprimer s'il-vous-plait) ______________________________

MON NOM (imprimer s'il-vous-plait) ______________________________

SIGNATURE ______________________________ DATE ____________________

SIGNÉ EN PRESENCE DE ____________________ DATE ____________________

Si vous avez des questions à propos de vos droits comme participant à la recherche, veuillez contacter la Conseillère sur l'éthique en recherche de l'Université Concordia, au (514) 848-2424 ext. 7481 ou par courriel à l'adresse ethics@alcor.concordia.ca.

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Participant:______ Chercheur/euse:________________

Appendix C: Demographics Questionnaire

English Demographics Questionnaire – Study 1

French Demographics Questionnaire – Study 1

English Demographics Questionnaire – Study 2

French Demographics Questionnaire – Study 2

The Cognitive and Language Development Laboratory
Concordia University
Participant Information

Child's Name: ______________________ ______________________
First Last

Child's Date of Birth: ________________ Child's Gender: ☐ M ☐ F
MM / DD / YY

Basic Family Information

Parent A's Full Name: ________________ ________________ ☐ **M** ☐ **F**
First **Last**

Parent B's Full Name: ________________ ________________ ☐ **M** ☐ **F**
First **Last**

Address (including **postal code**):

____

____

Phone numbers	**Where?** (e.g. home, Mom work, Dad cell)
1.	
2.	
3.	
4.	
5.	

E-mail: ______________________________

Does your child have any siblings?

Name of Sibling	**Date of Birth** MM / DD / YY	**Gender**	**Can we contact you for future studies for this child?**
		M F	☐ **Yes** ☐ **No**
		M F	☐ **Yes** ☐ **No**
		M F	☐ **Yes** ☐ **No**

Languages Spoken in the Home, School, or Childcare Setting

Note. Total of all languages should add up to 100%.

What percent of the time does your child hear **English**? _________ **%**

What percent of the time does your child hear **French?** _________ **%**

What percent of the time does your child hear **another language**? _________ **%**
Please specify this language: ________________________

Has the child lived/vacationed in any country **where s/he would hear a language other than English or French**?
☐ **Yes** ☐ **No**
If yes, please detail (when, where, and for how long?) _________________________________

Health History

What was your child's birth weight? __ __ **lbs** __ __ **oz** OR __ __ __ __ **grams**

How many weeks was your pregnancy? ____________**weeks**

Were there any **complications** during the pregnancy? ☐ **Yes** ☐ **No**
If yes please detail ____

Has your child had any major **medical problems**?
If yes please detail____

Does your child have any **hearing or vision problems**?
If yes please detail____

Does your child **currently** have an ear infection? ☐ **Yes** ☐ **No**

Has your child had any ear infections **in the past**? ☐ **Yes** ☐ **No**
If yes at which ages____

Does your child have a **cold** today? ☐ **Yes** ☐ **No**

If yes, does he/she have pressure/pain in ears (if known)? ☐ **Yes** ☐ **No**

Is there any other relevant information we should know (health or language-related)?

___

Has another university contacted you to participate in one of their studies? ☐ **Yes** ☐ **No**
If yes, which university? _________________________________

Is your child exposed to, or does s/he play with remote-control toys in your home or in daycare? ☐ **Yes** ☐ **No**

Family and Child Background Information (optional)

Parent A's Marital Status:

- ☐ Married
- ☐ Separated
- ☐ Remarried
- ☐ Single
- ☐ Divorced
- ☐ Common Law
- ☐ Widow
- ☐ Other

Parent A's Current Level of Education
Check any/all that apply:

- ☐ Primary School
- ☐ Some High School
- ☐ High School
- ☐ Some College/University
- ☐ College Certificate/Diploma
- ☐ Trade School Diploma
- ☐ Bachelor's Degree
- ☐ Master's Degree
- ☐ Doctoral Degree
- ☐ Professional Degree
- ☐ Not Applicable/Unknown
- ☐ Other (please specify):

____

____

Parent A's Occupational Status (optional)
Check any/all that apply:

- ☐ Employed Full-Time
- ☐ Employed Part-Time
- ☐ Stay-at-Home-Parent
- ☐ Student
- ☐ Unemployed
- ☐ Not Applicable/Unknown
- ☐ On Temporary Leave (e.g., maternity, paternity, sick, etc.; **please also check status when *not* on leave**)
- ☐ Other (please specify):

____

____

- ☐ Occupation:

____

____

Parent B's Marital Status

- ☐ Married
- ☐ Separated
- ☐ Remarried
- ☐ Single
- ☐ Divorced
- ☐ Common Law
- ☐ Widow
- ☐ Other

Parent B's Current Level of Education
Check any/all that apply:

- ☐ Primary School
- ☐ Some High School
- ☐ High School
- ☐ Some College/University
- ☐ College Certificate/Diploma
- ☐ Trade School Diploma
- ☐ Bachelor's Degree
- ☐ Master's Degree
- ☐ Doctoral Degree
- ☐ Professional Degree
- ☐ Not Applicable/Unknown
- ☐ Other (please specify):

____

____

Parent B's Occupational Status (optional)
Check any/all that apply:

- ☐ Employed Full-Time
- ☐ Employed Part-Time
- ☐ Stay-at-Home-Parent
- ☐ Student
- ☐ Unemployed
- ☐ Not Applicable/Unknown
- ☐ On Temporary Leave (e.g., maternity, paternity, sick, etc.; **please also check status when *not* on leave**)
- ☐ Other (please specify):

____

____

- ☐ Occupation:

____

____

In which of the following ranges does your annual household income fall (per year/before taxes)?

- ☐ < $ 22 000
- ☐ Between $22,000 and $35 000
- ☐ Between $35 000 and $50 000
- ☐ Between $50 000 and $75 000
- ☐ Between $75 000 and $100 000
- ☐ Between $100 000 and $150 000
- ☐ > $150 000

What language(s) community do you (and your partner) identify with? Check any/all that apply:

- ☐ Anglophone
- ☐ Francophone
- ☐ Allophone
- ☐ Other (please specify): ____________________

What are your child's ethnic origins? Check any/all that apply:

- ☐ Aboriginal
- ☐ African
- ☐ Arab
- ☐ West Asian
- ☐ South Asian
- ☐ East and Southeast Asian
- ☐ Caribbean
- ☐ European
- ☐ Latin/Central/South American
- ☐ Pacific Islands
- ☐ Canadian
- ☐ Not Applicable/Unknown
- ☐ Other (please specify):

____

What culture(s) do you (and your partner) identify with? Check any/all that apply:

- ☐ Aboriginal
- ☐ African
- ☐ Arab
- ☐ West Asian
- ☐ South Asian
- ☐ East and Southeast Asian
- ☐ Caribbean
- ☐ European
- ☐ Latin/Central/South American
- ☐ Pacific Islands
- ☐ Canadian/American
- ☐ Not Applicable/Unknown
- ☐ Other (please specify):

____

Laboratoire de Recherche sur le Développement de la Cognition et du Langage
L'Université Concordia
Information sur le participant

Nom de l'enfant ______________________________ ______________________________
Prénom Nom de famille

Date de naissance de l'enfant : ____________________ Sexe de l'enfant : ☐ M ☐ F
MM / JJ / AA

Information générale sur la famille

Nom du Parent A : ______________________________ ____________________ ☐**M** ☐**F**
Prénom **Nom de famille**

Nom du Parent B : ______________________________ ____________________ ☐**M** ☐**F**
Prénom **Nom de famille**

Adresse (s'il vous plait, inclure le **code postal**) :

____

____

Numéros de téléphone	**Où?** (p. ex. maison, travail mère, cell père)
1.	
2.	
3.	
4.	
5.	

Courriel : ____

Est-ce que votre enfant a des frères et/ou des soeurs?

Nom du frère ou de la soeur	**Date de naissance**	**Sexe**	**Est-ce que nous pouvons vous contacter pour participer à une future étude avec cet enfant?**
		M F	☐ **Oui** ☐ **Non**
		M F	☐ **Oui** ☐ **Non**
		M F	☐ **Oui** ☐ **Non**

<u>Langue(s) parlée(s) à la maison et à la garderie</u>

Notez que le total de toutes les langues devrait équivaloir à 100%.

Pour quel pourcentage du temps votre enfant entend-il le **français**? _________ **%**

Pour quel pourcentage du temps votre enfant entend-il l'**anglais**? _________ **%**

Pour quel pourcentage du temps votre enfant entend-il une autre **langue**? _________ **%**
S'il vous plait, spécifiez cette langue:________________________

Est-ce que votre enfant a déjà habité/voyagé dans un autre pays **où il aurait pu entendre une autre langue que le français ou l'anglais**? ☐ **Oui** ☐ **Non**
Si oui, s'il vous plait veuillez préciser quand, où, et pour combien de temps :

____

<u>Information générale sur la santé de votre enfant</u>

Âge du Parent A : ____________ **Âge du Parent B :** ____________

Quel était le poids de votre enfant à la naissance? __ __ **lb** __ __ **oz** OU __ __ __ __ **g**

Combien de semaines a été la grossesse? ____________**semaines**

Y a-t-il eu des **complications** durant la grossesse? ☐ **Oui** ☐ **Non**
Si oui, s'il vous plait veuillez préciser ____

Votre enfant a-t-il déjà souffert de **problèmes médicaux majeurs**?
Si oui, s'il vous plait veuillez préciser ____

Votre enfant a-t-il des **problèmes auditifs ou visuels**?
Si oui, s'il vous plait veuillez préciser ____

Est-ce que votre enfant a **<u>présentement</u>** une infection aux oreilles? ☐ **Oui** ☐ **Non**

Est-ce que votre enfant a déjà eu une infection aux oreilles **<u>dans le passé</u>**? ☐ **Oui** ☐ **Non**
Si oui, s'il vous plait veuillez préciser à quel âge ____

Est-ce que votre enfant a un rhume aujourd'hui? ☐ **Oui** ☐ **Non**
Si oui, est-ce que votre enfant se plaint de douleur/pression dans ses oreilles? ☐ **Oui** ☐ **Non**

Y a-t-il d'autres informations que vous jugez importantes et que nous devrions connaitre concernant la santé et/ou le développement du langage de votre enfant?

____

Est-ce qu'une autre université vous a déjà contacté afin de participer à une de leurs études?
☐ **Oui** ☐ **Non** Si oui, s'il vous plait veuillez indiquer le nom de l'université? ______________________

Votre enfant est-il exposé ou joue-il avec des jouets téléguidés à la maison ou à la garderie? ☐ **Oui** ☐ **Non**

Informations sur les antécédents familiaux de votre enfant (facultatif)

Statut civil du Parent A

- ☐ Marié
- ☐ Séparé
- ☐ Remarié
- ☐ Célibataire
- ☐ Divorcé
- ☐ Conjoint de fait
- ☐ Veuf
- ☐ Autre

Éducation du Parent A
Veuillez indiquer tout ce qui s'applique à ce jour:

- ☐ École primaire
- ☐ Études secondaires (non complétées)
- ☐ Diplôme d'études secondaires (DES)
- ☐ Études collégiales/universitaires (non complétées)
- ☐ Certificat/diplôme collégial (DEC)
- ☐ Attestation d'études collégiales (AÉC)
- ☐ Baccalauréat
- ☐ Maitrise
- ☐ Doctorat
- ☐ Diplôme d'études professionnelles (DEP)
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Autre (s'il vous plait, veuillez spécifier) :

____

____

Statut d'emploi du Parent A (facultatif)
Veuillez indiquer tout ce qui s'applique :

- ☐ Emploi à temps plein
- ☐ Emploi à temps partiel
- ☐ Parent au foyer
- ☐ Étudiant
- ☐ Sans emploi
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Arrêt de travail temporaire (p. ex., congé de maternité, paternité, maladie, etc.; **s'il vous plait, veuillez également indiquer votre statut d'emploi lorsque vous n'êtes *pas* en arrêt de travail)**
- ☐ Autre (s'il vous plait, veuillez spécifier) :

____

- ☐ Emploi : ______________________

Statut civil du Parent B

- ☐ Marié
- ☐ Séparé
- ☐ Remarié
- ☐ Célibataire
- ☐ Divorcé
- ☐ Conjoint de fait
- ☐ Veuf
- ☐ Autre

Éducation du Parent B
Veuillez indiquer tout ce qui s'applique à ce jour:

- ☐ École primaire
- ☐ Études secondaires (non complétées)
- ☐ Diplôme d'études secondaires (DES)
- ☐ Études collégiales/universitaires (non complétées)
- ☐ Certificat/diplôme collégial (DEC)
- ☐ Attestation d'études collégiales (AÉC)
- ☐ Baccalauréat
- ☐ Maitrise
- ☐ Doctorat
- ☐ Diplôme d'études professionnelles (DEP)
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Autre (s'il vous plait, veuillez spécifier) :

____

____

Statut d'emploi du Parent B (facultatif)
Veuillez indiquer tout ce qui s'applique :

- ☐ Emploi à temps plein
- ☐ Emploi à temps partiel
- ☐ Parent au foyer
- ☐ Étudiant
- ☐ Sans emploi
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Arrêt de travail temporaire (p. ex., congé de maternité, paternité, maladie, etc.; **s'il vous plait, veuillez également indiquer votre statut d'emploi lorsque vous n'êtes *pas* en arrêt de travail)**
- ☐ Autre (s'il vous plait, veuillez spécifier) :

____

- ☐ Emploi : ______________________

Tranche de revenus pour l'ensemble du ménage (par an / HT) :

- ☐ < $22 000
- ☐ Entre $22 000 et $35 000
- ☐ Entre $35 000 et $50 000
- ☐ Entre $50 000 et $75 000
- ☐ Entre $75 000 et $100 000
- ☐ Entre $100 000 et $150 000
- ☐ > $150 000

Auprès de quelle(s) communauté(s) linguistique(s) identifiez-vous (et votre conjoint/conjointe)? Veuillez indiquer tout ce qui s'applique :

- ☐ Anglophone
- ☐ Francophone
- ☐ Allophone
- ☐ Autre (s'il vous plait, veuillez spécifier) :

____

Quelles sont les origines ethniques de votre enfant?
Veuillez indiquer tout ce qui s'applique :

- ☐ Origines aborigènes
- ☐ Origines africaines
- ☐ Origines arabes
- ☐ Origines d'Asie occidentale
- ☐ Origines sud-asiatiques
- ☐ Origines asiatiques de l'Est et du Sud-Est
- ☐ Origines des Caraïbes
- ☐ Origines européennes
- ☐ Origines de l'Amérique latine, centrale et du sud
- ☐ Origines des îles du Pacifique
- ☐ Origines canadiennes
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Autre (s'il vous plait, veuillez spécifier):

____

Auprès de quelle culture identifiez-vous (et votre conjoint/conjointe)?
Veuillez indiquer tout ce qui s'applique :

- ☐ Origines aborigines
- ☐ Origines africaines
- ☐ Origines arabes
- ☐ Origines d'Asie occidentale
- ☐ Origines sud-asiatiques
- ☐ Origines asiatiques de l'Est et du Sud-Est
- ☐ Origines des Caraïbes
- ☐ Origines européennes
- ☐ Origines de l'Amérique latine, centrale et du sud
- ☐ Origines des îles du Pacifique
- ☐ Origines canadiennes
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Autre (s'il vous plait, veuillez spécifier):

The Cognitive and Language Development Laboratory
Concordia University
Participant Information

Child's Name: ______________________ ______________________
First Last

Child's Date of Birth: ________________ Child's Gender: ☐ M ☐ F
MM / DD / YY

Basic Family Information

Parent A's Full Name: ________________ ________________ ☐ **M** ☐ **F**
First **Last**

Parent B's Full Name: ________________ ________________ ☐ **M** ☐ **F**
First **Last**

Address (including **postal code**):

____

____

Phone numbers	**Where?** (e.g. home, Mom work, Dad cell)
1.	
2.	
3.	
4.	
5.	

E-mail: ______________________________

Does your child have any siblings?

Name of Sibling	**Date of Birth** MM / DD / YY	**Gender**	**Can we contact you for future studies for this child?**
		M F	☐ **Yes** ☐ **No**
		M F	☐ **Yes** ☐ **No**
		M F	☐ **Yes** ☐ **No**

Languages Spoken in the Home, School, or Childcare Setting

Note. Total of all languages should add up to 100%.

What percent of the time does your child hear **English**? _________ **%**

What percent of the time does your child hear **French?** _________ **%**

What percent of the time does your child hear **another language**? _________ **%**
Please specify this language: ________________________

Has the child lived/vacationed in any country **where s/he would hear a language other than English or French**?

☐ **Yes** ☐ **No**

If yes, please detail (when, where, and for how long?) ________________________________

Health History

What was your child's birth weight? __ __ **lbs** __ __ **oz** OR __ __ __ __ **grams**

How many weeks was your pregnancy? ____________**weeks**

Were there any **complications** during the pregnancy? ☐ **Yes** ☐ **No**
If yes please detail ____

Has your child had any major **medical problems**?
If yes please detail____

Does your child have any **hearing or vision problems**?
If yes please detail____

Does your child **currently** have an ear infection? ☐ **Yes** ☐ **No**

Has your child had any ear infections **in the past**? ☐ **Yes** ☐ **No**
If yes at which ages____

Does your child have a **cold** today? ☐ **Yes** ☐ **No**

If yes, does he/she have pressure/pain in ears (if known)? ☐ **Yes** ☐ **No**

Is there any other relevant information we should know (health or language-related)?

____

Has another university contacted you to participate in one of their studies? ☐ **Yes** ☐ **No**
If yes, which university? ________________________________

Family and Child Background Information (optional)

Parent A's Marital Status:

- ☐ Married
- ☐ Separated
- ☐ Remarried
- ☐ Single
- ☐ Divorced
- ☐ Common Law
- ☐ Widow
- ☐ Other

Parent A's Current Level of Education
Check any/all that apply:

- ☐ Primary School
- ☐ Some High School
- ☐ High School
- ☐ Some College/University
- ☐ College Certificate/Diploma
- ☐ Trade School Diploma
- ☐ Bachelor's Degree
- ☐ Master's Degree
- ☐ Doctoral Degree
- ☐ Professional Degree
- ☐ Not Applicable/Unknown
- ☐ Other (please specify):

____
____

Parent A's Occupational Status (optional)
Check any/all that apply:

- ☐ Employed Full-Time
- ☐ Employed Part-Time
- ☐ Stay-at-Home-Parent
- ☐ Student
- ☐ Unemployed
- ☐ Not Applicable/Unknown
- ☐ On Temporary Leave (e.g., maternity, paternity, sick, etc.; **please also check status when *not* on leave**)
- ☐ Other (please specify):

____
____

- ☐ Occupation:

____
____

Parent B's Marital Status

- ☐ Married
- ☐ Separated
- ☐ Remarried
- ☐ Single
- ☐ Divorced
- ☐ Common Law
- ☐ Widow
- ☐ Other

Parent B's Current Level of Education
Check any/all that apply:

- ☐ Primary School
- ☐ Some High School
- ☐ High School
- ☐ Some College/University
- ☐ College Certificate/Diploma
- ☐ Trade School Diploma
- ☐ Bachelor's Degree
- ☐ Master's Degree
- ☐ Doctoral Degree
- ☐ Professional Degree
- ☐ Not Applicable/Unknown
- ☐ Other (please specify):

____
____

Parent B's Occupational Status (optional)
Check any/all that apply:

- ☐ Employed Full-Time
- ☐ Employed Part-Time
- ☐ Stay-at-Home-Parent
- ☐ Student
- ☐ Unemployed
- ☐ Not Applicable/Unknown
- ☐ On Temporary Leave (e.g., maternity, paternity, sick, etc.; **please also check status when *not* on leave**)
- ☐ Other (please specify):

____
____

- ☐ Occupation:

____
____

In which of the following ranges does your annual household income fall (per year/before taxes)?

- ☐ < $ 22 000
- ☐ Between $22,000 and $35 000
- ☐ Between $35 000 and $50 000
- ☐ Between $50 000 and $75 000
- ☐ Between $75 000 and $100 000
- ☐ Between $100 000 and $150 000
- ☐ > $150 000

What language(s) community do you (and your partner) identify with? Check any/all that apply:

- ☐ Anglophone
- ☐ Francophone
- ☐ Allophone
- ☐ Other (please specify): ______________________________

What are your child's ethnic origins? Check any/all that apply:

- ☐ Aboriginal
- ☐ African
- ☐ Arab
- ☐ West Asian
- ☐ South Asian
- ☐ East and Southeast Asian
- ☐ Caribbean
- ☐ European
- ☐ Latin/Central/South American
- ☐ Pacific Islands
- ☐ Canadian
- ☐ Not Applicable/Unknown
- ☐ Other (please specify):

____

What culture(s) do you (and your partner) identify with? Check any/all that apply:

- ☐ Aboriginal
- ☐ African
- ☐ Arab
- ☐ West Asian
- ☐ South Asian
- ☐ East and Southeast Asian
- ☐ Caribbean
- ☐ European
- ☐ Latin/Central/South American
- ☐ Pacific Islands
- ☐ Canadian/American
- ☐ Not Applicable/Unknown
- ☐ Other (please specify):

____

Laboratoire de Recherche sur le Développement de la Cognition et du Langage
L'Université Concordia
Information sur le participant

Nom de l'enfant ______________________________ ______________________________
Prénom Nom de famille

Date de naissance de l'enfant : ____________________ Sexe de l'enfant : ☐ M ☐ F
MM / JJ / AA

Information générale sur la famille

Nom du Parent A : ______________________________ ____________________ ☐ **M** ☐ **F**
Prénom **Nom de famille**

Nom du Parent B : ______________________________ ____________________ ☐ **M** ☐ **F**
Prénom **Nom de famille**

Adresse (s'il vous plait, inclure le **code postal**) :

____

____

Numéros de téléphone	**Où?** (p. ex. maison, travail mère, cell père)
1.	
2.	
3.	
4.	
5.	

Courriel : ____

Est-ce que votre enfant a des frères et/ou des soeurs?

Nom du frère ou de la soeur	**Date de naissance**	**Sexe**	**Est-ce que nous pouvons vous contacter pour participer à une future étude avec cet enfant?**
		M F	☐ **Oui** ☐ **Non**
		M F	☐ **Oui** ☐ **Non**
		M F	☐ **Oui** ☐ **Non**

1

Langue(s) parlée(s) à la maison et à la garderie

Notez que le total de toutes les langues devrait équivaloir à 100%.

Pour quel pourcentage du temps votre enfant entend-il le **français**? _________ **%**

Pour quel pourcentage du temps votre enfant entend-il l'**anglais**? _________ **%**

Pour quel pourcentage du temps votre enfant entend-il une autre **langue**? _________ **%**
S'il vous plait, spécifiez cette langue:________________________

Est-ce que votre enfant a déjà habité/voyagé dans un autre pays **où il aurait pu entendre une autre langue que le français ou l'anglais**? ☐ **Oui** ☐ **Non**

Si oui, s'il vous plait veuillez préciser quand, où, et pour combien de temps :

____

Information générale sur la santé de votre enfant

Âge du Parent A : ____________ **Âge du Parent B :** ____________

Quel était le poids de votre enfant à la naissance? __ __ **lb** __ __ **oz** OU __ __ __ __ **g**

Combien de semaines a été la grossesse? ____________**semaines**

Y a-t-il eu des **complications** durant la grossesse? ☐ **Oui** ☐ **Non**
Si oui, s'il vous plait veuillez préciser ________________________________

Votre enfant a-t-il déjà souffert de **problèmes médicaux majeurs**?
Si oui, s'il vous plait veuillez préciser ________________________________

Votre enfant a-t-il des **problèmes auditifs ou visuels**?
Si oui, s'il vous plait veuillez préciser ________________________________

Est-ce que votre enfant a **présentement** une infection aux oreilles? ☐ **Oui** ☐ **Non**

Est-ce que votre enfant a déjà eu une infection aux oreilles **dans le passé**? ☐ **Oui** ☐ **Non**
Si oui, s'il vous plait veuillez préciser à quel âge ____________________________

Est-ce que votre enfant a un rhume aujourd'hui? ☐ **Oui** ☐ **Non**
Si oui, est-ce que votre enfant se plaint de douleur/pression dans ses oreilles? ☐ **Oui** ☐ **Non**

Y a-t-il d'autres informations que vous jugez importantes et que nous devrions connaitre concernant la santé et/ou le développement du langage de votre enfant?

____

Est-ce qu'une autre université vous a déjà contacté afin de participer à une de leurs études?
☐ **Oui** ☐ **Non** Si oui, s'il vous plait veuillez indiquer le nom de l'université? ______________

Informations sur les antécédents familiaux de votre enfant (facultatif)

Statut civil du Parent A

- ☐ Marié
- ☐ Séparé
- ☐ Remarié
- ☐ Célibataire
- ☐ Divorcé
- ☐ Conjoint de fait
- ☐ Veuf
- ☐ Autre

Statut civil du Parent B

- ☐ Marié
- ☐ Séparé
- ☐ Remarié
- ☐ Célibataire
- ☐ Divorcé
- ☐ Conjoint de fait
- ☐ Veuf
- ☐ Autre

Éducation du Parent A
Veuillez indiquer tout ce qui s'applique à ce jour:

- ☐ École primaire
- ☐ Études secondaires (non complétées)
- ☐ Diplôme d'études secondaires (DES)
- ☐ Études collégiales/universitaires (non complétées)
- ☐ Certificat/diplôme collégial (DEC)
- ☐ Attestation d'études collégiales (AÉC)
- ☐ Baccalauréat
- ☐ Maitrise
- ☐ Doctorat
- ☐ Diplôme d'études professionnelles (DEP)
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Autre (s'il vous plait, veuillez spécifier) :

____

____

Éducation du Parent B
Veuillez indiquer tout ce qui s'applique à ce jour:

- ☐ École primaire
- ☐ Études secondaires (non complétées)
- ☐ Diplôme d'études secondaires (DES)
- ☐ Études collégiales/universitaires (non complétées)
- ☐ Certificat/diplôme collégial (DEC)
- ☐ Attestation d'études collégiales (AÉC)
- ☐ Baccalauréat
- ☐ Maitrise
- ☐ Doctorat
- ☐ Diplôme d'études professionnelles (DEP)
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Autre (s'il vous plait, veuillez spécifier) :

____

____

Statut d'emploi du Parent A (facultatif)
Veuillez indiquer tout ce qui s'applique :

- ☐ Emploi à temps plein
- ☐ Emploi à temps partiel
- ☐ Parent au foyer
- ☐ Étudiant
- ☐ Sans emploi
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Arrêt de travail temporaire (p. ex., congé de maternité, paternité, maladie, etc.; **s'il vous plait, veuillez également indiquer votre statut d'emploi lorsque vous n'êtes *pas* en arrêt de travail)**
- ☐ Autre (s'il vous plait, veuillez spécifier) :

____

- ☐ Emploi :____________________________

Statut d'emploi du Parent B (facultatif)
Veuillez indiquer tout ce qui s'applique :

- ☐ Emploi à temps plein
- ☐ Emploi à temps partiel
- ☐ Parent au foyer
- ☐ Étudiant
- ☐ Sans emploi
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Arrêt de travail temporaire (p. ex., congé de maternité, paternité, maladie, etc.; **s'il vous plait, veuillez également indiquer votre statut d'emploi lorsque vous n'êtes *pas* en arrêt de travail)**
- ☐ Autre (s'il vous plait, veuillez spécifier) :

____

- ☐ Emploi :____________________________

Tranche de revenus pour l'ensemble du ménage (par an / HT) :

- ☐ < $22 000
- ☐ Entre $22 000 et $35 000
- ☐ Entre $35 000 et $50 000
- ☐ Entre $50 000 et $75 000
- ☐ Entre $75 000 et $100 000
- ☐ Entre $100 000 et $150 000
- ☐ > $150 000

Auprès de quelle(s) communauté(s) linguistique(s) identifiez-vous (et votre conjoint/conjointe)? Veuillez indiquer tout ce qui s'applique :

- ☐ Anglophone
- ☐ Francophone
- ☐ Allophone
- ☐ Autre (s'il vous plait, veuillez spécifier) :

____

Quelles sont les origines ethniques de votre enfant?
Veuillez indiquer tout ce qui s'applique :

- ☐ Origines aborigènes
- ☐ Origines africaines
- ☐ Origines arabes
- ☐ Origines d'Asie occidentale
- ☐ Origines sud-asiatiques
- ☐ Origines asiatiques de l'Est et du Sud-Est
- ☐ Origines des Caraïbes
- ☐ Origines européennes
- ☐ Origines de l'Amérique latine, centrale et du sud
- ☐ Origines des îles du Pacifique
- ☐ Origines canadiennes
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Autre (s'il vous plait, veuillez spécifier):

____

Auprès de quelle culture identifiez-vous (et votre conjoint/conjointe)?
Veuillez indiquer tout ce qui s'applique :

- ☐ Origines aborigines
- ☐ Origines africaines
- ☐ Origines arabes
- ☐ Origines d'Asie occidentale
- ☐ Origines sud-asiatiques
- ☐ Origines asiatiques de l'Est et du Sud-Est
- ☐ Origines des Caraïbes
- ☐ Origines européennes
- ☐ Origines de l'Amérique latine, centrale et du sud
- ☐ Origines des îles du Pacifique
- ☐ Origines canadiennes
- ☐ Ne s'applique pas/je ne sais pas
- ☐ Autre (s'il vous plait, veuillez spécifier):