To copy or not to copy: Comparing selective social learning and overimitation in childhood

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Abstract

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Even young children use social learning, or the ability to learn from others' actions, to make sense of the world. Two social learning strategies that both develop rapidly during the preschool period are selective social learning and overimitation. Previous research suggests that different mechanisms might underlie these skills, namely theory of mind and social affiliation, respectively. To our knowledge, no study has compared performance on these two abilities. We hypothesized that these abilities would be associated, but that this association would decrease with age; that performance on the selective social learning task would be more strongly related to theory of mind; and that overimitation would be more strongly related to social affiliation. To test these predictions, we conducted two experiments. In Experiment 1, we administered a selective word learning task and an overimitation task with puppets via video-chat to a sample of 3.5- and 5-year-old children. Parents filled out questionnaires measuring cognitive and social abilities. Correlation and regression analyses revealed no association between the two tasks, nor between task performance and scores on the questionnaires. As the overimitation rate was very low, we conducted a second experiment using the same procedures, but with human agents, with a sample of 5-year-old children. Results showed an association between selective social learning and theory of mind, in line with our second hypothesis. Most children also copied the irrelevant actions, suggesting that overimitation might indeed be related to social affiliation, as our participants more frequently imitated a human agent compared to a puppet agent.

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Table of Contents

Table of Contents (Continued)

List of Tables

To copy or not to copy: Comparing selective social learning and overimitation in childhood

Humans have the ability to learn from others' actions through social learning, defined as knowledge acquisition creating a change in understanding in individuals and social groups through the observation of, or interaction with, another individual (Kendal et al., 2018; Reed et al., 2010). In contrast, asocial learning is learning individually, through experience and/or trial and error (Kendal et al., 2018). One of the key social learning mechanisms is imitation, and even young children use social learning and imitation to make sense of the world (Rawlings et al., 2019). A current focus of research in developmental science is to understand when and how children are so apt to assimilate new information from their social environment, as this perpetuates traditions and promotes a cumulative culture (Keupp et al., 2018; Legare & Nielsen, 2015; Nielsen, 2018). The present study aims to contribute to this line of research by examining two social learning strategies that both develop rapidly during the preschool period, selective social learning and overimitation. Our main goal is to shed light on the similarities and differences in the cognitive mechanisms underlying these critical skills.

Selective Social Learning

Selective social learning is the ability to choose who to learn new information from and it tends to develop between 3 and 5 years of age (Sobel & Finiasz, 2020), although a precocious form emerges in infancy (Poulin-Dubois & Brosseau-Liard, 2016). Selective social learning is often tested through a "conflicting sources paradigm" (Tong et al., 2020), or the selective word learning paradigm (Sobel & Finiasz, 2020), in which two informants show competence or incompetence about the names of familiar objects or facts (familiarization phase). The child then must use this information to decide which informant to trust when learning new information in the test phase (e.g., name of unfamiliar objects). In one of the first studies to use this paradigm,

Koenig et al. (2004) measured selective learning by asking 3- and 4-year-old children to name unfamiliar objects ("Endorse" questions) as well as to identify the competent or the incompetent informant, both after the familiarization and the test trials ("Explicit Judgment" questions). Participants were able to identify the accurate informant, with no significant difference between the two age groups. More importantly, preschoolers who correctly identified the competent (or incompetent) informant were also more likely to choose the label offered by the competent informant. Similarly, Koenig and Harris (2005a) found that preschoolers preferred to learn from a knowledgeable informant, especially older children (4-year-olds vs 3-year-olds). Another important element of the Koenig and Harris' (2005a) design is that they added "Ask" questions, for which participants had to choose the informant from whom they wanted to learn the name of the novel objects during the test phase. Similar results were found on these trials, in that performance on Ask and Explicit Judgment trials was correlated for 4-year-olds. Older children also tended to choose more often the accurate informant compared to younger children. Since these landmark studies, it has been reported that selective social learning increases with age, as shown by a recent meta-analysis on selective social learning, in which age moderated performance on Endorse questions, but not on Ask questions (Tong et al., 2020).

Over the past decade, much research has been conducted on selective social learning in preschoolers, with or without variations on the original paradigm (see Mills, 2013 and Sobel & Finiasz, 2020 for reviews). A number of studies have examined the impact of different variables related to the informants' characteristics on selective social learning, including expertise (e.g., Einav & Robinson, 2011; Luu et al., 2013; Pasquini et al, 2007), confidence (e.g., Bridgers et al., 2016; Brosseau-Liard & Poulin-Dubois, 2014; Tenney et al., 2011), benevolence (e.g., Johnston et al., 2015), conformity (e.g., Corriveau et al., 2009; Fusaro & Harris, 2008), age (e.g.,

VanderBorght & Jaswal, 2009), familiarity (e.g., Corriveau & Harris, 2009; Lucas et al., 2017; Schieler et al., 2018), physical strength (e.g., Hermes et al., 2015), racial identity (e.g., Gaither et al., 2014), and language (e.g., Kinzler et al., 2011; Marno et al., 2016). Selective social learning has also been studied cross-culturally (e.g., Lucas et al., 2013). Importantly for the current study, selective social learning has been linked to other cognitive abilities, including metacognition and theory of mind.

The bulk of the studies on theory of mind and selective social learning indicates that theory of mind plays an important role in selective social learning. Theory of mind can be defined as the ability to understand the mental states of others, such as thoughts, emotions, desires, and actions (ToM; Ruffman, 2014; Wellman, 2014). Numerous studies have reported that success on a selective social learning task based on an informant's accuracy is predicted by ToM skills (Brosseau-Liard et al., 2015; Crivello et al., 2018; 2021; DiYanni et al., 2012; Fusaro & Harris, 2008; Koenig & Harris, 2005b; Lucas et al., 2013; Mills & Elashi, 2014; Palmquist & Fierro, 2018; Poulin-Dubois & Brosseau-Liard, 2016; Sobel & Kushnir, 2013; Vanderbilt et al., 2011). Most of these studies used a battery of ToM tasks (e.g., Theory of Mind Scale; Wellman & Liu, 2004), but others have used the Children's Social Understanding Scale (CSUS), a parental questionnaire which measures various aspects of ToM (e.g., belief and knowledge; Tahiroglu et al., 2014). Interestingly, the few studies using the CSUS failed to find a link with performance on the classic selective learning task (Brosseau-Liard et al., 2018), or there was a link with only one of the subscales (i.e., belief; Resendes et al., 2021). Noteworthy, this absence of association has also sometimes been reported with direct measures of ToM tasks, including the Theory of Mind Scale (e.g., Brosseau-Liard et al., 2018; Cossette et al., 2020). Thus, it

remains unclear if ToM is reliably associated with selective learning, particularly when assessed through parental report.

The bulk of the research suggests that epistemic cues, which reflect competence or expertise, are crucial in selective social learning, especially in older children (Tong et al., 2020). In younger children, however, social characteristics of the informant (e.g., benevolence; Johnston et al., 2015) are also important, if not more so (Tong et al., 2020). Indeed, studies have found that while younger children preferred a familiar informant regardless of their accuracy, older children trusted familiar informants only if they also showed competence (Corriveau & Harris, 2009; Lucas et al., 2017). Similarly, in a study by Elashi & Mills (2014), although all children trusted the in-group informant compared to the out-group informant, only older children did not clearly prefer the in-group informant when he or she was inaccurate. Across most studies, this shift from favorizing social cues to epistemic cues tends to happen around 4 years of age (Tong et al., 2020). Such a shift is consistent with the two-stage theory of transmission of information (Henrich & Broesch, 2011) which proposes that young children first acquire new information from their parents and families, with whom they have a social connection, and later update this information with a model who is more knowledgeable. Thus, although related to ToM and epistemic cues, selective social learning is also influenced by social characteristics in young children. One of the goals of the present study will be to explore the socio-cognitive correlates of selective social learning.

Overimitation

In contrast to selective learning, overimitation is about faithful imitation (Keupp et al., 2018), and is the tendency to copy goal-irrelevant actions (Hoehl et al., 2019). Much like selective social learning, it tends to develop during the preschool years (Hoehl et al., 2019). One

of the first studies to have triggered the extensive research on overimitation, even if not the first one (e.g., Sibulkin & Uzgiris, 1978), was by Horner and Whiten (2005). In that study, they compared chimpanzees and preschoolers on the puzzle box apparatus, now a classic overimitation task. In this task, the model shows the child how to obtain a reward (e.g., a sticker) inside a complex-looking box, using a stick. Importantly, some actions performed by the demonstrator are causally irrelevant to the goal of getting the reward (e.g., pushing a bolt at the top of the box with the stick), while others are causally relevant (e.g., opening a door on the front of the box). The objective is to determine whether children and chimpanzees will imitate all actions performed by the model (i.e., overimitate) or just the relevant ones. Horner and Whiten (2005) found that both children and chimpanzees overimitated at a similar rate when the puzzle box was opaque, that is, when the inner structure of the box, which prevents getting the reward from the top of the box because of a barrier, is hidden. However, when using a transparent box in which the inner structure was apparent, children still overimitated, but chimpanzees did not. This suggests that humans might be more sensitive to the social influence of the demonstrator, while chimpanzees ignore that aspect of the task and directly reach for the reward.

Since then, several researchers have studied overimitation using the puzzle box (also called "glass-ceiling box"), or a variation of it (e.g., Berl & Hewlett, 2015; Flynn, 2008; Hoehl et al., 2019; Kenward et al., 2011; Lyons et al., 2007; 2011; McGuigan et al., 2007; 2011; 2012; McGuigan & Burgess, 2017; McGuigan & Whiten, 2009; Moraru et al., 2016; Nielsen et al., 2012; 2014; 2016; Simpson & Riggs, 2011; Whiten et al., 2016; Wood et al., 2013, Yu & Kushnir, 2015). A number of studies have also used different procedures. For example, Clegg & Legare (2016) designed a necklace-making task, in which the demonstrator put each bead on their forehead before putting them on the string. Some have used a toy-retrieval task, which is

similar to the puzzle box designed by Horner and Whiten (2005), but the boxes are usually less complex (e.g., Marsh et al., 2013; 2014; 2019; Vivanti et al., 2017). Some have even tested overimitation in pronunciation (Subiaul et al., 2015) or by using other designs such as preparing a sandwich (Freier et al., 2015), crushing cookies with a tool (DiYanni et al., 2015), cleaning marbles or jewels (Kenward, 2012; Keupp et al., 2015), retrieving objects from a toy (Hilbrink et al., 2013; Yu & Kushnir, 2011), and building objects (Marsh et al., 2014). Overimitation appears to be universal; for example in indigenous communities of southern Africa and Australia (Nielsen & Tomaselli, 2010; Nielsen et al., 2014), in Japan (Taniguchi & Sanefuji, 2017), and in Vanuatu (Clegg & Legare, 2016); although cross-cultural research is still limited (Hoehl et al., 2019). Regardless of the design, overimitation is a powerful learning strategy that is observed universally in typically developing preschoolers as well as adults (e.g., Berl & Hewlett, 2015; Flynn & Smith, 2012; McGuigan et al., 2011).

Several theoretical accounts have been proposed to explain overimitation (see Hoehl et al., 2019; Keupp et al., 2018; Rawlings et al., 2019 for reviews). Although hybrid theories have been developed in recent years (e.g., dual-process model of overimitation; Schleihauf & Hoehl, 2020), two major views seem to be opposed in the literature. The first one is the automatic causal encoding theory (Lyons et al., 2007; 2011), which states that children overimitate because they encode every action performed by the demonstrator as causally relevant; thus, they imitate all of them because they believe that all of the modeled actions are instrumental in reaching the goal. This strategy is usually helpful, but not when a model intentionally performs irrelevant actions (Lyons et al., 2011). This is supported by studies that found that children overimitated even after identifying the irrelevant actions (Lyons et al., 2007) or when doing so is costly (Lyons et al., 2011). Similar to this process is the "copy-all, refine/correct-later" perspective (Whiten et al.,

2005; Whiten et al., 2009) which posits that children copy irrelevant actions because they assume that these actions are fulfilling a non-obvious goal. Thus, it is safer to copy all of them than to miss an essential information. The second major theoretical account of overimitation suggests that social motivations drive children to overimitate. More specifically, this line of research encompasses two different accounts: the normative account, which states that one overimitates due to normative pressures (i.e., one ought to do so; Kenward, 2012; Kenward et al., 2011), and the social affiliation account, which maintains that preschoolers engage in overimitation to affiliate or "be like" the demonstrator (Nielsen, 2006; Nielsen & Blank, 2011; Over & Carpenter, 2012; Price et al., 2017). In an attempt to combine the two theoretical perspectives, Schleihauf and Hoehl (2020) proposed the dual-process theory of overimitation, which states that there are two different types of copying: blanket copying (type 1 processes) – or copying without questioning if the actions are relevant or not – and deliberate considerations whether or not to copy (type 2 processes), for example when a more efficient strategy is also shown. In the latter, the presence of overimitation depends on the individual goal of the situation (e.g., if there is a desire to affiliate with the demonstrator or not). Thus, it is mostly likely that overimitation can be explained by multiple motivations.

There is much support for the "social motivation" account of overimitation. For example, children overimitate more when the model is similar and familiar to them, which suggests a desire to affiliate (Price et al., 2017; Rawlings et al., 2019). Correspondingly, children with social deficits, including children with autism spectrum disorder, have been found to overimitate less than typically developing children (Marsh et al., 2013; Vivanti et al., 2017). However, contrary evidence has been reported (Nielsen and Hudry, 2010; Nielsen et al., 2013), in that children with autism spectrum disorder imitated at a similar rate as typically developing ones.

Still, this discrepancy suggests that some children might overimitate more than others, depending on their social skills. The fact that priming children with ostracism, by exposing them to video stimuli showing geometric shapes that interact with one another, increases overimitation also suggests that affiliation is heightened when group membership is at risk (Watson-Jones et al., 2014). Preschoolers also copy goal-irrelevant actions when the demonstrator is a humanoid robot, at a similar level (Schleihauf et al., 2021) or to a lesser extent compared to when the demonstrator is human (Sommer et al., 2020). Similarly, the rate of overimitation is lower when puppet models are used (McGuigan & Robertson, 2015). Having a communicative and pedagogical demonstrator also led 5-year-olds to adapt their imitative behavior after seeing a more efficient strategy compared to having a non-communicative and non-pedagogical demonstrator, which again supports the social affiliation account (Hoehl et al., 2014). Interestingly, recent findings suggest that perhaps overimitation is also influenced by the competence of the demonstrator, as 3- to 6-year-old children were more likely to overimitate a reliable model compared to an unreliable one (Allen et al., 2021). Thus, selective imitation and overimitation might operate similarly, at least at some level. Still, the bulk of research suggests that overimitation is likely more strongly related to social motivations in comparison to selective learning.

The Present Study

The goals of the present study were 1) to identify the common or unique mechanisms related to selective social learning and overimitation, 2) to compare performance on tasks measuring these skills, and 3) to determine how these relations may change with age. Although other researchers have compared related constructs (e.g., selective and faithful imitation –

Hilbrink et al., 2013; goal emulation and faithful imitation – Yu and Kushnir, 2020), to our knowledge, this is the first study to directly compare these two socio-cognitive abilities.

Because early selective social learning seems to first be mainly driven by social cues, and by epistemic cues later in childhood (Tong et al., 2020), and because overimitation seems largely driven by a desire for social affiliation (e.g., Over & Carpenter, 2012), we first predicted that performance on the two tasks would correlate, but that this correlation would decrease with age. Second, we anticipated that performance on the selective learning task would be more strongly related to ToM, as measured by the CSUS, than overimitation. Alternatively, we predicted that overimitation would be more strongly related to affiliation, compliance, and prosocial skills, as assessed by scores on the Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), compared to selective learning.

Another, more exploratory goal was to determine if children would overimitate a puppet demonstrator, which has, to our knowledge, only been tested twice (i.e., McGuigan & Robertson, 2015; Wood et al., 2013) with only one of these studies comparing a puppet model to a human model. Additionally, contrary to these previous studies, the puppet we used did not represent an animal, but a child. Thus, we investigated if the overimitation rate would be lower with a puppet, even if it was human-like.

Methods

Participants

Participants were recruited from a database of past participants, originally recruited through birth lists provided by a governmental health agency. A power analysis using G*Power 3.1.9.7 (5 total predictors and 3 tested predictors; $\alpha = .05$; power = .85) revealed that our sample had to have at least 74 participants, assuming an expected effect size of $f^2 = .18$ based on

previous research (Resendes et al., 2021). Out of the 94 children who were tested, 14 had to be excluded due to excessive fussiness (n = 1), technical difficulties (n = 1), using a cellphone (n = 2), excessive parental interference (n = 1), non completion of the study (n = 3), no data for the questionnaires (n = 1), or age (n = 5). Attentiveness was monitored by calculating engagement ratings for each task. How much children looked at the puppets or the experimenter, listened to instructions, cooperated with instructions, and answered without requiring several prompts was rated on a five-point scale going from 1 "Never" to 5 "Always" by a coder who was blind to the hypotheses. It was decided that average engagement ratings below 3/5 would be considered as excessively distracted and would be excluded from our final sample. One participant not already excluded had a low engagement score; however, they were kept in the analyses because their low score was due to shyness, and not to a lack of engagement in the tasks per se.

The final sample consisted of 80 participants (43 females) with a mean age of 51.92 months (*SD* = 9.44). The sample was equally divided into two age groups: 3.5-year-olds (24 females; mean age = 42.93 months; *SD* = 2.92) and 5-year-olds (19 females; mean age = 60.92 months; *SD* = 2.46). Responses from the demographic questionnaire indicate that most of participants were in the upper middle-class, with a median yearly income between 100 000$ and 150 000$ CAD. The majority of our sample were identified by their parents as White/Caucasian (57.5%). Other cultural identities reported include Middle Eastern (16.3%), Caribbean (11.3%), African (10%), Latin/Central/South American (8.8%), South Asian (5%), East and Southeast Asian (3.8%), European (1.3%), and Australian (1.3%). Parents could choose more than one cultural affiliation, resulting in 21.3% of our sample identifying with two or more cultures.

Materials and Procedures

All tasks were administered online over the video conference platform Zoom. Children were typically seated in front of, or beside their parent. Parents were asked to connect on a device with a large enough screen (i.e., computer or iPad), and to be seated in a room with as few distractions as possible. They were also asked to be seated in front of a table, so that the materials for the overimitation task could be seen on the screen. It was also required that parental intervention be kept to a minimum, except when the child was not responsive or too shy, as the experimenter could not always keep them focused on task or convince them to answer on their own.

Prior to the testing session, parents were asked to fill out an online consent form. Some elements of the consent form were repeated at the beginning of the online testing session, and parents gave an additional verbal consent. At the end of the session, children were mailed a certificate of merit for their participation and children's caregivers were given a $20 gift card from a local bookstore as compensation for their participation. The study was conducted in accordance with the standards of the Declaration of Helsinki. The research was also approved by the appropriate institutional review board.

Two tasks were administered during the testing session, which lasted approximately 30 minutes. The order of the tasks was counterbalanced to avoid carry-over or fatigue effects. Following the Zoom session, parents had two weeks to fill out three online questionnaires, which took 20-30 minutes to complete. The procedures were administered in the dominant language of the child (French or English), based on the parents' feedback. Out of our final sample of 80 participants, 34 were tested in French and 46 in English.

Selective Social Learning Task

This task was adapted from Koenig et al. (2004), except that the human speakers were replaced by puppets (Brosseau-Liard et al., 2015; Hermes et al., 2015; Resendes et al., 2021). Materials required for this study included two female puppets ("Sophie" and "Clara"), three familiar objects (a toy car, a ball, a cup), as well as three unfamiliar objects (a roll of blue string, the pump of a turkey baster, a rubber funnel). During the familiarization phase, the two puppets named familiar objects. One of the puppets named the objects accurately, while the other did not (e.g., calling a "ball" a "shoe"; see Table 1 for a complete list of the labels). The experimenter then asked the child if they knew which puppet had said something right or wrong ("Explicit Judgment" question). Whether the experimenter asked about the correct or the incorrect puppet was counterbalanced across participants. There were then three test trials, in which unfamiliar objects were presented to the children. Participants were first asked if they knew how each object was called. They were then asked to choose one of the puppets to ask for the name of the object ("Ask" question). Children received a point for choosing the competent puppet, resulting in a score out of three. Each puppet then labelled the object with nonsense words (e.g., "toma" or "mido"; see Table 1). Children were then asked to choose a label for the object ("Endorse" question) and received a point for endorsing the label of the reliable puppet (total score out of three). After the testing phase, the experimenter again asked the child which puppet they thought said something right/wrong (second Explicit Judgment question). Participants received a point for selecting the puppet corresponding to the question asked (e.g., the reliable puppet when asked "who said something right?"). The Explicit Judgment score was out of two, given that there was an Explicit Judgment question after both the familiarization and the testing phase. A "Combined"

score out of six was also generated to allow for more variability, by adding the scores of Ask and Endorse trials.

Table 1

Objects and Labels for the Selective Social Learning Task

Object	Correct Label	Incorrect Label
Familiarization phase		
Car	Car	Book
Ball	Ball	Shoe
Cup	Cup	Dog
Test phase		
Roll of blue string	Toma	Mido
Pump of a turkey baster	Fep	Dax
Rubber funnel	Bosa	Dawnoo

The puppet that was presented as the reliable one was counterbalanced across participants, to avoid any bias toward one puppet or the other. The order in which the puppets spoke alternated, meaning that the same puppet never spoke first twice in a row. The first puppet to speak at the beginning of the familiarization phase was counterbalanced across participants, as well as the side to which the first puppet to speak was on (i.e., left or right). The position of the puppets switched across trials to ensure that participants were relying on the identity of the puppet to endorse a label, and not on its position. Thus, there were 16 testing conditions for this task. Counterbalancing conditions were assigned across genders to ensure equal distribution as best as possible.

Overimitation Task

The overimitation task was adapted from Vivanti et al. (2017). Given that puppets were used in the selective learning task, a female puppet ("Anna") acted as the model. Three plastic containers and three toys (a tiger, a car, and a horse; see Table 2) were used during the

demonstration of the actions. To ensure that the participants had the exact same containers as the ones that the experimenter had, the set of containers were delivered to the home of each participant. Anna first introduced herself to the child. She then explained the task: "I will show you how to open different boxes to get a toy inside. I will now show you how to open the first box. Watch carefully!". Children then watched the puppet open a container following a distinct sequence of three actions. Two of the actions were instrumental to open the container (causally relevant actions), while the other one was unnecessary (causally irrelevant). Table 2 illustrates the objects, boxes, and sequences of actions that were used for each trial.

Table 2

Materials and Sequences of Actions for the Overimitation Task

Trial	Box	Toy	Causally relevant action 1	Causally irrelevant action	Causally relevant action 2
1		Tiger	Pull latches down	Tap box twice on the side	Remove lid
2		Car	Push button	Lift container twice	Remove lid
3		Horse	Pull latches up	Put head on the lid twice	Remove lid

After each demonstration, the parent was asked to give the child the same container. Children were then asked to open the container ("Now it's your turn! Your mom/dad will give you the same box as mine. Look, it's the same box! Can you open it like I did?"). There were three trials, and participants were asked to open the box after each demonstration. Children received one point for each irrelevant action performed, resulting in a total score out of three.

Questionnaires

Demographic questionnaire. Parents first had to fill out a short demographic questionnaire, with questions related to occupational status, ethnicity, family income, and health history of the child.

Children's Social Understanding Scale. The Children's Social Understanding Scale, or CSUS, was originally developed in English as a parental report measure of ToM (Tahiroglu et al., 2014). A French version was recently developed (Brosseau-Liard & Poulin-Dubois, 2019). It is a 42-item parent-report questionnaire on children's common behaviors and patterns of thinking, for children aged 2- to 7-year-old. The items are divided into six subscales (i.e., belief, knowledge, desire, emotion, perception, intention). Each statement is rated on a 4-point Likert scale ranging from 1 "Very untrue" to 4 "Very true". Total scores are calculated by adding the rating for each question and dividing it by the number of questions answered. Thus, all scores resulted in a mean score out of 4. The original scale has been shown to have excellent internal validity ($\alpha = .94$; Tahiroglu et al., 2014), as have its adaptations (e.g., Białecka-Pikul & Stępień-Nycz, 2019; Brosseau-Liard & Poulin-Dubois, 2019).

Strengths and Difficulties Questionnaire. The Strengths and Difficulties Questionnaire (SDQ; Goodman, 1997), is a behavioral screening questionnaire for children aged 3- to 16-year-old. It includes 25 items divided into five subscales (i.e., emotional symptoms, conduct

problems, hyperactivity/inattention, peer relationship problems, prosocial behavior), each containing five items. Items are rated on a 3-point scale, from "Not true" to "Certainly true". Given our two age groups, we either administered the preschool version of the questionnaire, which was developed for children aged 2- to 4-year-old, or the school version, appropriate for children 5 and older. Both versions are extremely similar; the wording on three items was modified for the preschool version so that they describe more age-appropriate behaviors. The SDQ has a self-report, parental, and teacher report form. For the purpose of our study, we only administered the parent version. Parents completed all 25 items, but we were particularly interested in the items from the prosocial and peer problems scales, as they inform us on the children's social relationships and affiliation tendencies. Thus, we only used scores from these two subscales for our analyses, which were both out of 10.

The SDQ has been translated in several languages, including French (Capron et al., 2007). In the original validation study, the SDQ showed satisfactory psychometric properties (Goodman, 2001). The mean Cronbach alpha indicated good internal consistency ($\alpha = .73$). With a mean of .34, cross-informant Pearson product-moment correlations were judged as adequate because they were almost all above the mean from other measures, as reported in a meta-analysis by Achenbach et al. (1987). Retest stability was measured 4 to 6 months later, with a mean of .62.

Scoring and Reliability

The Zoom sessions were recorded, so scoring was completed by the main experimenter after the testing sessions. A subset of the videos (i.e., 25%) was also coded by a second scorer. Kappa coefficients indicate excellent interrater reliability for both the selective social learning (Ask = 1.00; Endorse = .881; Explicit Judgment = 1.00), and the overimitation (1.00) tasks.

Results

Data Analysis

Data analyses were conducted using SPSS 27 (IBM, 2020). Following a visual inspection of the data and using a cut-off z-score of ± 3.0 (Raykov & Marcoulides, 2008), we identified two outliers for the overimitation score (4.23), one outlier for the total CSUS score (−3.44), one outlier for the Belief subscale (−3.07), one outlier for the Knowledge subscale (−3.80), one outlier for the Desire subscale (−3.29), and one outlier for the score on the peer problems scale of the SDQ (3.48). Given that most of these outliers were due to a lack of variability in the performance of our sample on the different tasks and questionnaires, we decided to keep them in the analyses. Additionally, removing these scores did not affect our conclusions. We also did not identify any multivariate outlier, as no Mahalanobis distance had a p-value below .001 when our variables were regressed on the participants' identification number (Tabachnick & Fidell, 2019). After the exclusion of some participants (see above), no data was missing from our analyses. None of our variables of interest followed normality according to the Kolmogorov-Smirnov test, but this distribution is expected given the nature of our variables. Normality for individual variables was however within recommended skewness (i.e., |3|) and kurtosis (i.e., |10|) values (Kline, 2011), and independence of data points could be assumed.

Selective Social Learning Task

Chance Analyses

One-sample t-tests were performed on the four variables of interests (i.e., Ask, Endorse, Combined, Explicit Judgment). Chance was operationalized as 50% of the raw score, as children had to choose between two options (e.g., competent vs incompetent puppet) for all types of questions. Children performed above chance on all variables when considering the full sample

(see Table 3). When dividing by age group, however, performance was not different from chance for Ask trials in 5-year-olds and for Explicit Judgment trials in 3.5-year-olds (see Table 3).

Overall, then, our sample performed well on the task. Surprisingly, however, independent samples t-tests did not reveal any difference between the two age groups on Ask trials ($t(78) = .480$, $p = .633$, 95% CI [−.315, .515], $d = .107$), Endorse trials ($t(78) = -.229$, $p = .819$, 95% CI [−.484, .384], $d = -.051$), and Explicit Judgment trials ($t(78) = -1.912$, $p = .060$, 95% CI [−.663, .013], $d = -.428$). This is different from what has been found in the literature, as older children typically perform better than younger ones (e.g., Koenig & Harris, 2005a). Additionally, although our mean and proportion scores are similar to a recent study conducted in our laboratory using the same task, they tend to be slightly lower than what has been previously reported in the literature (e.g., Brosseau-Liard et al., 2015; Koenig & Harris, 2005a; Koenig et al., 2004). For example, our mean proportion scores on Explicit Judgment trials are lower than in the study by Koenig et al. in 2004 (i.e., .76 vs .66 for the total sample; .69 vs .58 for the younger age group; .83 vs .74 for the older age group). It is important to note however that most of these studies were conducted with human agents rather than puppets, which could have contributed to our lower results.

Table 3

Descriptive Statistics and Chance Analyses for the Selective Social Learning Task

	Ask	Endorse	Combined	Explicit Judgment
		Full sample (N = 80)		
Mean	1.77	1.85	3.62	1.31
SD	.927	.969	1.554	.773
Proportion	.59	.62	.60	.66
t	2.652	3.230	3.598	3.617
df	79	79	79	79

Sig. (2-tailed)	.010	.002	.001	.001
95% CI	[.07; .48]	[.13; .57]	[.28; .97]	[.14; .48]
Cohen's d	.297	.361	.402	.404
		3.5-year-olds (N = 40)		
Mean	1.83	1.82	3.65	1.15
SD	.958	.903	1.406	.770
Proportion	.61	.61	.61	.58
t	2.146	2.277	2.924	1.233
df	39	39	39	39
Sig. (2-tailed)	.038	.028	.006	.225
95% CI	[.02; .63]	[.04; .61]	[.20; 1.10]	[−.10; .40]
Cohen's d	.339	.360	.462	.195
		5-year-olds (N = 40)		
Mean	1.72	1.87	3.60	1.48
SD	.905	1.042	1.707	.751
Proportion	.57	.62	.60	.74
t	1.572	2.275	2.223	4.002
df	39	39	39	39
Sig. (2-tailed)	.124	.028	.032	.000
95% CI	[−.06; .51]	[.04; .71]	[.05; 1.15]	[.23; .72]
Cohen's d	.248	.360	.352	.633

Note. 95% CI = 95% confidence interval of the difference.

Link between Ask, Endorse, and Explicit Judgment Trials

Previous research suggests that children who perform better on Explicit Judgment trials also tend to perform better on Ask and Endorse trials. To determine if we replicated this pattern, we conducted independent sample t-tests comparing children who obtained a perfect score on the Explicit Judgment trials (i.e., 2/2, n = 40) to those who did not (i.e., 0/2, n = 15; or 1/2, n = 25). Analyses revealed a significant difference in performance on Ask trials ($t(78) = -2.223$, $p = .029$, 95% CI [−.853, −.047], $d = -.497$), as well as on Endorse trials ($t(78) = -4.343$, $p = .000$, 95%

CI [−1.240, −.460], $d = -.971$). Thus, children who had a perfect score on Explicit Judgment questions overall performed better on the selective social learning task. Importantly, performance on Ask and Endorse trials was above chance only for those who had a perfect score on the Explicit Judgment trials.

Overimitation

Chance Analyses

A one-sample t-test was performed for the overimitation score. Chance was operationalized as 33% of the raw score, as children had three overimitation trials. Children performed below chance when considering the full sample (see Table 4), as well as when divided by age group, especially for the younger group (see Table 4).

Overall, then, our sample performed very poorly on this task, with only 11 children (14% of our sample) showing some form of overimitation. An independent sample t-test indicated a group difference between 3.5- and 5-year-olds: there was more overimitation in the older age group ($t(78) = -2.970$, $p = .004$, 95% CI [−.459, −.091], $d = -.664$). This is consistent with the existent literature, which suggests that overimitation increases with age (Hoehl et al., 2019). This difference is however probably significant because of the low performance in our sample, with only one child in the younger age group showing some overimitation, compared to 10 in the older group. Moreover, our mean scores are much lower than in previous studies, including the study from which we adapted our task, which had a mean raw score of .58 (37% of their typically developing sample overimitated at least once; Vivanti et al., 2017).

Table 4

Descriptive Statistics and Chance Analyses for the Overimitation Task

	Overimitation Score		
	Full sample	3.5-year-olds	5-year-olds
N	80	40	40
Mean	.16	.03	.30
SD	.434	.158	.564
t	−27.558	−39.000	−7.851
df	79	39	39
Sig. (2-tailed)	.000	.000	.000
95% CI	[−1.43; −1.24]	[−1.03; −.92]	[−.88; −.52]
Cohen's d	−3.081	−6.166	−1.241

Note. 95% CI = 95% confidence interval of the difference.

Children's Social Understanding Scale

Parents completed the CSUS in French or in English, based on their preferred language. All parents in our final sample of 80 participants completed the questionnaire. The mean total score was 3.23 (*SD* = .38), which is similar to Tahiroglu et al.'s original results (i.e., total mean of 3.14). Both age groups also performed well individually, with a mean total score of 3.06 (*SD* = .35) for 3.5-year-olds, and of 3.41 (*SD* = .33) for 5-year-olds.

Strengths and Difficulties Questionnaire

Parents completed the SDQ in French or in English, based on their preferred language. All parents in our final sample of 80 participants completed the questionnaire. As mentioned above, we were only interested in the scores for the peer problems and prosocial subscales. For the full sample, the mean score for the peer problems scale was 1.35 (*SD* = 1.623). The mean score for the prosocial scale was 8.15 (*SD* = 1.647). Similar scores were found when splitting the age groups, for both the peer problems scale (i.e., 1.28, *SD* = 1.552 for 3.5-year-olds; 1.43, *SD* =

1.708 for 5-year-olds) and the prosocial scale (i.e., 7.92, *SD* = 1.575 for 3.5-year-olds; 8.38, *SD* = 1.705 for 5-year-olds).

Correlational Analyses

The primary goal of our study was to examine the link between our different tasks and questionnaires. We thus ran bivariate correlations between our measures of selective social learning, overimitation, theory of mind, and social affiliation (see Appendix A). As expected, most scores in the selective social learning task were correlated with each other.

Our first hypothesis for this study was that performance on the two tasks would be associated, but that it would decrease with age. We found one significant correlation between Endorse trials and the overimitation score when looking at the whole sample ($r = .239$, $p = .033$). However, this association was no longer significant after performing the false discovery rate. There was no other significant association between the selective social learning and overimitation tasks in the full sample, at 3.5 years old, nor at 5 years old (see Appendix A). Thus, our first hypothesis was not supported.

For our second hypothesis, we predicted that selective social learning and theory of mind, as measured by the CSUS, would be associated. This was not supported, as no score on the selective social learning task was significantly correlated with the total score on the CSUS (Ask: $r = -.019$, $p = .865$; Endorse: $r = .021$, $p = .850$; Combined: $r = .002$, $p = .987$; Explicit Judgment: $r = .176$, $p = .118$). This was also the case when looking at the two age groups separately (see Appendix A). Similarly, no subscale of the CSUS significantly correlated with scores on the selective social learning task, except between the Intention scale and the Explicit Judgment Score ($r = .226$; $p = .044$). This link was however no longer significant after the false discovery rate.

Our third hypothesis maintained that overimitation would be linked to social affiliation, as measured by the peer problems and prosocial subscales of the SDQ. This hypothesis was again not supported, for both subscales (peer problems: $r = .008$, $p = .943$; prosocial: $r = .178$, $p = .114$). Similarly, no association was found when dividing the sample by age group (see Appendix A). Interestingly, there was a significant correlation between Ask trials and the peer problems subscale of the SDQ ($r = -.233$, $p = .038$), which suggests that children performing better on the Ask questions of the selective social learning task tend to have fewer problems with their peers. However, this association did not remain significant after the false discovery rate.

We also found some association between the two questionnaires: the CSUS was significantly correlated with the peer problems subscale ($r = -.311$, $p = .005$), as well as the prosocial subscale ($r = .341$, $p = .002$). This suggests that a better theory of mind is linked with less peer problems and with more prosocial attitudes. Other significant correlations were found when dividing the sample by age group (see Appendix A), but none stayed significant after performing the false discovery rate, apart from the ones linking the different selective social learning trials.

Finally, we correlated all our variables of interest with age and sex. Unsurprisingly, we found a significant association between overimitation and age ($r = .311$, $p = .005$), again indicating greater overimitation in the older age group. There was also a correlation between age and the CSUS score ($r = .490$, $p = .000$), which suggests that older children have better theory of mind. This is consistent with previous studies (e.g., Brosseau-Liard et al., 2018). Sex was only correlated with the prosocial scale of the SDQ ($r = .223$, $p = .047$), perhaps indicating that females have better prosocial tendencies. This was however no longer significant after the false discovery rate.

Regression Analyses

Because our analysis plan included regression analyses for our hypotheses 2 and 3, we decided to run linear regressions on all our variables despite not finding any significant associations. Model 1 included age and sex, and Model 2 included the scores on the questionnaires (i.e., CSUS, peer problems subscale of the SDQ, prosocial subscale of the SDQ). For each regression, the dependant variable was one of the scores for the selective social learning and overimitation tasks.

Overall, both models yielded nonsignificant results for the variables measured in the selective social learning task (i.e., Ask, Endorse, Combined, and Explicit Judgment), which is consistent with our findings from the correlations. In terms of coefficients, only the main effect of the peer problems scale in the SDQ was a significant predictor of the score on Ask trials (β = −.260, p = .039, 95% CI [−.289, −.008]). For the overimitation score, Model 1 yielded significant results and controlled for 10% of the variance in the outcome ($F(2, 77) = 4.287$, p = .017, R^2 = .100, $R^2_{adjusted}$ = .077). Model 2 was however not significant. Examination of the main effects in both models revealed that age was a significant unique contributor to overimitation scores, suggesting that the main effect of age significantly predicted overimitation (Model 1: β = .300, p = .008, 95% CI [.004, .024]; Model 2: β = .279, p = .036, 95% CI [.001, .025]). This is consistent with the results presented above, which indicated that the overimitation rate was greater in the older age group compared to the younger one. None of the other main effects were significant. To sum up, the regression analyses are consistent with our previous analyses, in that our hypotheses are not supported.

Discussion

The main objective of this study was to compare selective social learning and overimitation in preschool-aged children, as well as to identify the mechanisms underlying both abilities. Overall, we did not find any significant association between the two tasks, nor between the two parental questionnaires and performance on the tasks, thus not supporting any of our hypotheses.

Still, our sample performed well on the selective word learning task, with scores above chance for all types of trials. With slightly lower mean scores, our results replicate previous research (e.g., Brosseau-Liard et al., 2015; Koenig & Harris, 2005a; Koenig et al., 2004). Moreover, we found that children who received a perfect score on Explicit Judgment trials also performed better on Ask and Endorse trials, which is consistent with past studies (e.g., Koenig et al., 2004).

In contrast, our sample performed below chance on the overimitation task with only 2.5% of the 3.5-year-olds and 25% of the 5-year-olds showing at least one non-causal action. With such floor effect, it is not surprising that we did not find any link with scores on the questionnaires. This rate is also significantly lower than in past studies (see Hoehl et al., 2019), and could be explained by our methodological design. First, the online format imposed by the pandemic might have made the irrelevant actions performed by the puppet more challenging to detect. This is consistent with previous findings suggesting that there tends to be less imitation when stimuli are presented as videos (Rawlings et al., 2019). However, even past studies using video stimuli had higher overimitation rates than our sample (e.g., 37% for Vivanti et al., 2017), indicating that this might not be the sole explanation.

Second, we had to use simple containers due to the methodological difficulties imposed by the online format (e.g., having multiple sets of materials to deliver to the participants). Most children were familiar with at least one of them (i.e., 45% familiar with first container, 8.75% with the second, 72.5% with the third), and they could have overimitated less because they already knew well how to open them. However, the majority of the children, as reported by their parents, were not familiar with the second container, and the overimitation rate was still very low. Additionally, we used similar containers as Vivanti and colleagues (2017), and our rate was lower than theirs (14% of our full sample vs 37% of their typically developing sample).

Finally, and most relevant for our current research, it is possible that the low performance of our sample is due to reduced affiliation with a puppet demonstrator compared to a human demonstrator. McGuigan and Robertson (2015) found a lower rate of overimitation with animal puppets; our results suggest that this might also be true for a human puppet. We originally decided to use a puppet for the overimitation task to match the procedure of the selective social learning task. This was done to avoid any confounding variables that could have favorized our hypothesis that overimitation would be more related to social affiliation than selective learning by using a human in one task and a puppet in the other. This procedure was however also a good way for us to explore the effectiveness of a puppet as a demonstrator in an overimitation task. Thus, although we failed to detect a link between the overimitation performance and abilities measured by the parental questionnaire, our findings might still suggest that overimitation is driven by social affiliation, as we obtained lower rates than in previous studies, which used human demonstrators. In other words, perhaps children affiliate less with a puppet than with a human, and this is why our sample performed poorly on the task. We tested this hypothesis by conducting a second experiment.

Study 2

To address the limitations raised in Experiment 1, we replicated the exact same procedures, except that we substituted human agents to the puppets, with the prediction that an increase in the rate of overimitation would help us better identify the underlying mechanisms of selective social learning and overimitation. Our hypotheses 2 and 3 thus remained identical. We decided to focus on the older age group (i.e., 5-year-olds), which performed better on the task in Study 1, to maximize the chances at observing a higher rate of overimitation. In the first study, 5-year-olds also tended to understand the tasks better and to be less likely to be excluded due to extreme fussiness or lack of concentration. For these reasons, as well as for time constraints, the older age group was preferred for the second experiment. We therefore slightly changed our first hypothesis and predicted that the two tasks would be only weakly associated, given the theoretical background presented earlier and results from Study 1.

Methods

Participants

Participants were recruited from a database of past participants, originally recruited through birth lists provided by a governmental health agency. A power analysis using G*Power 3.1.9.7 (5 total predictors and 3 tested predictors; $\alpha = .05$; power = .80) revealed that our sample had to have at least 66 participants, assuming an expected effect size of $f^2 = .18$ based on previous research (Resendes et al., 2021). Out of the 85 children tested, 13 had to be excluded due to excessive fussiness (n = 1), technical difficulties (n = 2), using a cellphone (n = 2), excessive shyness (n = 3), excessive parental interference (n = 1), no data for the questionnaires (n = 2), or age (n = 2). Like in Study 1, attentiveness was monitored by calculating engagement ratings for each task. How much children looked at the videos or the experimenter, listened to

instructions, cooperated with instructions, and answered without requiring several prompts was rated on a five-point scale going from 1 "Never" to 5 "Always" by a coder who was blind to the hypotheses. It was decided that average engagement ratings below 3/5 would be considered as excessively distracted and would be excluded from our final sample. No participant had a low engagement score, so no additional participant had to be excluded.

The final sample consisted of 72 participants (31 females) with a mean age of 59.57 months (*SD* = 1.84). Responses from the demographic questionnaire indicated that most participants were in the upper middle-class, with a median yearly income between 100 000$ and 150 000$ CAD. The majority of our sample were identified by their parents as White/Caucasian (58.3%). Other cultural identities reported include Caribbean (13.9%), Middle Eastern (12.5%), Latin/Central/South American (12.5%), African (11.1%), East and Southeast Asian (6.9%), European (2.8%), and South Asian (1.4%). Parents could choose more than one cultural affiliation, resulting in 16.7% of our sample identifying with two or more cultures.

Materials and Procedures

Procedures were identical to Study 1, except that agents were humans instead of puppets. All tasks were again administered online over the video conference platform Zoom, in French (n = 30) or in English (n = 42). For the selective social learning task, all 16 conditions were created using pre-recorded videos of two female laboratory members. Videos were recorded on an Iphone, and each trial was filmed separately. The videos were put together in a PowerPoint to form the different conditions. For the purpose of this study, the models shown in the videos were called "Sophie" and "Clara", and, following Koenig et al.'s procedures (2004), they wore a blue and a red shirt, respectively. Like in Study 1, the reliable informant, the first informant to speak, and the side where the first informant to speak was on were counterbalanced across participants.

In the overimitation task, everything was the same as in Study 1, except that the experimenter herself was now doing the demonstration. The order of administration of the two tasks was again counterbalanced, and the same three questionnaires were filled out by parents after the Zoom session. A third task unrelated to the current study was also added at the end of the Zoom session, but it will not be discussed further here. Two female experimenters administered the tasks for Study 2. Testing conditions (e.g., shirt color, background) were matched as best as possible so that results could not be attributed to the experimenters themselves.

Scoring and Reliability

The Zoom sessions were recorded, so scoring was completed offline by two different scorers after the testing sessions. A subset of the videos (i.e., approximately 25%) was also coded by both. Kappa coefficients indicate very good interrater reliability for the selective social learning (Ask = .931; Endorse = .930; Explicit Judgment = .921), and for the overimitation (1.00) tasks.

Results

Data Analysis

Data analyses were conducted using SPSS 27 (IBM, 2020). Following a visual inspection of the data and using a cut-off z-score of ± 3.0 (Raykov & Marcoulides, 2008), we identified two outliers for the CSUS Belief score (−3.80 and −3.16), one outlier for the CSUS Knowledge score (−3.07), and one outlier for the score on the peer problems scale of the SDQ (3.44). We identified one multivariate outlier, as one participant's Mahalanobis distance had a p-value of .0006 when our variables of interest were regressed on the participants' identification number (Tabachnick & Fidell, 2019). Since this participant was also the one with a z-score of −3.80 on

the Belief subscale, we decided to remove that score. After running another regression on the participants' identification number and generating p-values for the new Mahalanobis distances, no other multivariate outlier was identified. For this reason and given that most of the other univariate outliers were due to a lack of variability in the performance of our sample on the different tasks and questionnaires, we decided to keep them in the analyses. After the exclusion of some participants (see above), no data was missing from our analyses, apart from the one outlier removed for the Belief subscale of the CSUS. Except for the Perception and Desire subscales of the CSUS, none of our variables of interest followed normality according to the Kolmogorov-Smirnov test, but this distribution is expected given the nature of our variables. Normality for individual variables was however within recommended skewness (i.e., |3|) and kurtosis (i.e., |10|) values (Kline, 2011), and independence of data points could be assumed.

Selective Social Learning Task

Chance Analyses

One-sample t-tests were performed on the four variables of interests (i.e., Ask, Endorse, Combined, Explicit Judgment). Chance was operationalized as 50% of the raw score, as children had to choose between two options (e.g., competent vs incompetent puppet) for all types of questions. Children performed above chance on all variables (see Table 5). Overall, then, our sample performed well on the task. Our mean and proportion scores are similar to Study 1, but still slightly lower than previous research done in person in other laboratories (e.g., Brosseau-Liard et al., 2015; Koenig & Harris, 2005a; Koenig et al., 2004), most probably due to the online format.

Table 5

Descriptive Statistics and Chance Analyses for the Selective Social Learning Task in Study 2

	Ask	Endorse	Combined	Explicit Judgment
Mean	2.06	1.81	3.86	1.44
SD	.748	1.030	1.513	.710
Proportion	.69	.60	.64	.72
T	6.298	2.518	4.828	5.313
Df	71	71	71	71
Sig. (2-tailed)	.000	.014	.000	.000
95% CI	[.38; .73]	[.06; .55]	[.51; 1.22]	[.28; .61]
Cohen's d	.742	.297	.569	.626

Note. N = 72. 95% CI = 95% confidence interval of the difference.

Link between Ask, Endorse, and Explicit Judgment Trials

To determine if children in our sample who performed better on Explicit judgment trials also tended to perform better on Ask and Endorse trials, we again conducted independent sample t-tests comparing children who obtained a perfect score on the Explicit Judgment trials (i.e., 2/2, n = 41) to those who did not (i.e., 0/2, n = 9; or 1/2, n = 22). Analyses revealed a significant difference in performance on Ask trials ($t(70) = -3.702$, $p = .000$, 95% CI [−.935, −.280], $d = -.881$), as well as on Endorse trials ($t(70) = -5.065$, $p = .000$, 95% CI [−1.495, −.654], $d = -1.214$). Thus, just like in Study 1, children who had a perfect score on Explicit Judgment questions overall performed better on the selective social learning task. Importantly, performance on Ask and Endorse trials was above chance only for those who had a perfect score on the Explicit Judgment trials.

Overimitation

Chance Analyses

A one-sample t-test was performed for the overimitation score. Chance was operationalized as 33% of the raw score, as children had three overimitation trials. Contrary to Study 1, children performed above chance ($t(71) = 3.425$, $p = .001$, 95% CI [.23, .86], $d = .404$; $M = 1.54$, $SD = 1.342$). Overall, then, our sample in Study 2 performed well on this task, with 46 children (64% of our sample) showing some form of overimitation. This score is similar, and even higher, than previous studies, including the one by Vivanti et al. (2017), in which 37% of their typically developing sample overimitated at least once.

Children's Social Understanding Scale

Parents completed the CSUS in French or in English, based on their preferred language. All parents in our final sample of 72 participants completed the questionnaire. The mean total score was 3.30 ($SD = .27$), which is similar to Tahiroglu et al.'s original results (i.e., total mean of 3.14), and to Study 1. Mean scores on the individual subscales ranged between 3.11 ($SD = .37$; Perception) and 3.41 ($SD = .40$; Knowledge).

Strengths and Difficulties Questionnaire

Parents completed the SDQ in French or in English, based on their preferred language. All parents in our final sample of 72 participants completed the questionnaire. The mean score for the peer problems scale was of 1.25 ($SD = 1.381$). The mean score for the prosocial scale was 7.72 ($SD = 1.778$). These scores are similar to Study 1.

Correlational Analyses

We again ran bivariate correlations between our measures of selective social learning, overimitation, theory of mind, and social affiliation (see Appendix B). Unsurprisingly, most

scores in the selective social learning task were correlated with each other. Much like in Study 1, we did not find any correlation between the two tasks. However, given that our second experiment only included older preschoolers, these null results could support our hypothesis that the correlation between the two tasks weakens with increasing age. This should however be interpreted with caution, and we would need to collect data with younger children to confirm this interpretation.

Our hypothesis that selective social learning and theory of mind, as measured by the CSUS, would be associated was supported in Study 2. All scores on the selective social learning task were significantly correlated with the total score on the CSUS (Ask: $r = .251$, $p = .033$; Endorse: $r = .296$, $p = .012$; Combined: $r = .326$, $p = .005$; Explicit Judgment: $r = .344$, $p = .003$), and all the correlations except the one between Ask trials and CSUS scores were still significant after the false discovery rate correction (see Appendix B).

On the contrary, our hypothesis suggesting that overimitation would be linked to social affiliation, as measured by the peer problems and prosocial subscales of the SDQ, was again not supported (peer problems: $r = -.112$, $p = .349$; prosocial: $r = .070$, $p = .560$). In fact, the overimitation task was not correlated with any other variable (see Appendix B).

We also found an association between the two subscales of the SDQ ($r = -.281$, $p = .017$), suggesting that better prosocial skills are associated with fewer peer problems; but none between the CSUS and the SDQ, contrary to our first experiment (see Appendix B).

Finally, we found significant associations between the total CSUS score and sex ($r = .242$, $p = .041$), as well as between sex and age ($r = -.249$, $p = .035$), but they were no longer significant after the false discovery rate. Given that our second study only had one age group

(i.e., 5-year-olds), it is not surprising that we did not find significant correlations with age when comparing with our first study.

Regression Analyses

We then ran linear regressions on all our variables. Like in the first experiment, Model 1 included age and sex, and Model 2 included the scores on the questionnaires (i.e., CSUS, peer problems subscale of the SDQ, prosocial subscale of the SDQ). For each regression, the dependant variable was one of the scores for the selective social learning and overimitation tasks.

For selective social learning scores, Model 2 was significant for Endorse ($F(3, 66) = 3.548$, $p = .019$, $R^2 = .165$, $R^2_{adjusted} = .101$), and Explicit Judgment ($F(3, 66) = 3.858$, $p = .013$, $R^2 = .167$, $R^2_{adjusted} = .104$) trials, but not for Ask trials ($F(3, 66) = 2.876$, $p = .093$, $R^2 = .130$, $R^2_{adjusted} = .065$; see Appendix B). Model 2 controlled for 13.5%, 14.6%, and 11.4% of the variance in the outcome, respectively. Examination of the main effects in Model 2 revealed that the CSUS total score was a significant unique contributor to Endorse ($\beta = .379$, $p = .002$, 95% CI [.540, 2.331]), Explicit Judgment ($\beta = .373$, $p = .002$, 95% CI [.357, 1.590]), and even Ask ($\beta = .318$, $p = .011$, 95% CI [.211, 1.539]) scores, suggesting that the main effect of CSUS significantly predicted selective social learning. This is consistent with the results presented above, which indicated that CSUS scores and performance on the selective social learning task were associated, except for Ask trials. Perhaps Ask trials do not require as much theory of mind as Endorse and Explicit Judgment trials. Indeed, choosing which unfamiliar word is the correct one or which agent was correct/incorrect may require a better understanding of other's mental states than choosing which agent to ask what the unfamiliar object is called. None of the other main effects in Model 2 were significant (see Appendix B).

For the overimitation score, both models yielded nonsignificant results, and no main effects were significant, which is consistent with our findings from the correlations. To sum up, the regression analyses are consistent with our previous analyses, in that our hypothesis predicting that selective social learning would be associated with theory of mind is supported.

Comparison between Studies 1 and 2

We compared the means of our two experiments for all tasks and questionnaires, to determine if performance was significantly different or not. For the selective social learning task, only scores on Ask trials were significantly different between the two studies ($t(150) = -2.038$, $p = .043$, 95% CI [−.553, −.009], $d = -.331$). A significant difference was also found for the overimitation task ($t(150) = -8.703$, $p = .000$, 95% CI [−1.692, −1.066], $d = -1.414$). This suggests that the use of puppets especially had an impact on the overimitation task, and not as much on the selective word learning task. Finally, significant differences were not found for the scores on the questionnaires.

Discussion

The main objective of this second experiment was to conduct a strict replication of Study 1, except with human agents instead of puppets. This was required in order to determine if the puppet was indeed the reason for the low overimitation rate in Study 1, as a way to confirm our hypothesis that overimitation is related to social affiliation. Overall, we found a significantly higher rate of overimitation, as well as a link between performance on the selective word learning task and the total score on the CSUS. However, we still did not find an association between the two tasks, nor between the overimitation task and the SDQ.

Although performance on the selective word learning task was similar to Study 1, the majority of the sample in Study 2 now also performed above chance on the overimitation task,

with 64% of preschoolers showing at least one non-causal action, compared to 14% in Study 1 (2.5% of 3.5-year-olds; 25% of 5-year-olds in Study 1). This rate is also similar to a previous study by Marsh et al. (2014), in which 62% of their sample completed at least one unnecessary action. Overimitation scores were again not related to scores on parental questionnaires, but the difference in performance compared to our first experiment may still suggest that this ability is indeed related to social affiliation, as only the agent was modified in our procedures.

These results also suggest that children's familiarity with the containers in the overimitation task was not likely the main reason to explain the low rate of overimitation in the first experiment. Indeed, most children in Study 2 were again familiar with at least one of them (i.e., 52.8% of the sample familiar with first container, 16.7% with the second, and 69.4% with the third), but they now performed irrelevant actions in a more consistent way. Similarly, the online format is unlikely to be the sole factor in the poor results in Study 1, as the second experiment was also conducted over Zoom. This suggests that the use of a puppet vs a human agent might be the key element.

General Discussion

The goal of this research was to compare two social learning abilities in preschool-aged children: selective social learning and overimitation. To do so, we conducted two experiments. In the first one, we hypothesized that 1) performance on the two tasks would be associated, but that this association would weaken with increasing age; 2) selective social learning would be more strongly related to scores on the Children's Social Understanding Scale, a parental questionnaire measuring theory of mind; and 3) overimitation would be more strongly related to social affiliation, as measured by the Strengths and Difficulties Questionnaire, another parental questionnaire. As an exploratory goal, we also examined if similar rates of overimitation would

be observed with a human-like puppet compared to a human demonstrator. Results from Study 1 led to a second experiment, in which we replicated the first experiment by substituting human agents for the puppets. Because we only tested one age group in Study 2, our first hypothesis was not fully relevant; however, hypotheses 2 and 3 were the same. In the first experiment, we failed to support any of our hypotheses, in part due to the fact that children performed poorly on the overimitation task. Our second hypothesis was supported in Study 2, and a significant increase in the overimitation rate also seem to support our third hypothesis.

In terms of individual tasks performance, the samples in both studies performed above chance in the selective word learning task (i.e., proportion mean scores ranging between .57 and .74 for the different trial types and age groups), which is in line with past research (proportion mean scores ranging between .40 and .83; e.g., Brosseau-Liard et al., 2015; Koenig & Harris, 2005a; Koenig et al., 2004). Additionally, we found in both experiments that children who were better on Explicit Judgment trials also had higher scores on Ask and Endorse trials, which replicates previous studies (e.g., Koenig et al., 2004). As performance on this task was similar in our two experiments, it seems that the use of a puppet or a human agent does not make a difference in measuring selective learning abilities (Rakoczy, 2022). Perhaps children are similarly able to attribute mental states to puppets and to humans because, as Rakoczy (2022) proposes, the "pretend activity" involved when interacting with puppets gives access to actual cognitive concepts and structures.

Next, although the sample in Study 1 did not show much overimitation (i.e., mean proportion score of .05 for the whole sample), performance was above chance in Study 2 (i.e., mean proportion score of .51 for the whole sample) and replicated previous findings using similar apparatus (mean proportion scores ranging between .19 to .69 in typically developing

samples; Marsh et al., 2013; 2014; 2019; Vivanti et al., 2017). Interestingly, these studies found lower rates when using video stimuli compared to live stimuli (i.e., .24 for Marsh et al., 2014 and .19 for Vivanti et al., 2017). However, although we also had a very low overimitation rate for Study 1, performance of the Study 2 sample is much similar to live demonstrations, suggesting that doing online experiments via video-chats might not have such a detrimental effect on overimitation performance. Relatedly, a recent study found that 4- to 6-year-old children imitated more in an online setting compared to a live one (Fong et al., 2021). Thus, contrary to selective social learning, it seems like the use of a puppet did make a difference in this task, with overimitation being a lot higher with a human model compared to a puppet one.

As discussed above, we found weak and indirect support for our first hypothesis, since we did not find a link between the two tasks in both studies. As these two abilities have never been compared in a study before, it is possible that they are too different and are simply not related, despite both being social learning constructs. However, firm conclusions regarding this hypothesis are premature given that overimitation performance was so low in the first study, and that we only had one age group in the second experiment. Still, one could argue in favor of our original hypothesis that the link between the two abilities weakens with age, since there was no association between the two tasks in Study 2, in which we only tested older preschoolers. In other words, a link could be found at younger ages when there is also a higher overimitation rate. Nevertheless, interpretations should be made with caution, and more research, both online and in person, should be done to confirm this claim.

With regards to our second hypothesis, although it was not supported in Study 1, we did find a link between selective social learning abilities and theory of mind, as measured by the CSUS. It is unclear why our results are inconsistent. As theory of mind continues to develop

throughout the preschool period, perhaps it is more stable in older age groups and not as fully fleshed-out in younger children (Ruffman, 2014; Wellman, 2014). As Study 1 had a mix of 3.5- and 5-year-olds, it is possible that theory of mind was overall not as well-developed in that sample compared to the one in Study 2, which was comprised of 5-year-olds only. It is also possible that the difference between the selective word learning task in our two studies (i.e., puppets vs human informants) may have impacted the link with theory of mind, as children might attribute fewer mental states to puppets when presented in an online format, where the animacy of the agents might be diminished. Additionally, inconsistent results are also found elsewhere in the literature, with most studies finding a link between selective learning and theory of mind (e.g., Brosseau-Liard et al., 2015; Poulin-Dubois & Brosseau-Liard, 2016; Vanderbilt et al., 2011), and others finding no link or a weak link, particularly when the CSUS is used to measure theory of mind abilities (e.g., Brosseau-Liard et al., 2018; Cossette et al., 2020; Resendes et al., 2021). This leads one to wonder if the CSUS is a reliable measure of theory of mind in every context.

As for our third hypothesis, findings from both studies did not support a link between performance on the overimitation task and responses on the peer problems and prosocial subscales of the SDQ. Although the low performance on the task in Study 1 might explain this result, it is probably not the case for our second experiment, in which most children performed some irrelevant actions. It is possible that these null results are due to the low variability in the scores on the questionnaire, as most parents indicated that their child had few peer problems (mean scores of 1.35 and 1.25 out of 10 in Studies 1 and 2, respectively) and good prosocial tendencies (mean scores of 8.15 and 7.72 out of 10). Alternatively, and perhaps most plausible, is the possibility that the SDQ does not accurately reflect social affiliation tendencies. This is a

limitation of our design, and future studies should test the hypothesis with a different questionnaire (e.g., Preschool and Kindergarten Behavior Scales (PKBS); Merrell, 1994; 1995), develop one that would better tap into social affiliation, or assess social affiliation through behavioral observations (e.g., Roseth et al., 2007; Waller et al., 2021). Still, the underlying idea behind our third hypothesis is supported by the fact that few children overimitated a puppet, while the majority of our sample did when the model was human. Indeed, it is probably the case that children affiliate more with a human – who is more similar to them – than with a puppet. As mentioned above, procedures were the same in the two experiments, so it is very unlikely that another factor, like the online format or familiarity with the containers, could explain the difference in performance. The age difference of our samples is also probably not a major influence, as 25% of 5-year-olds did at least one irrelevant action in Study 1, compared to 64% in Study 2.

Relatedly, we also had the exploratory goal of determining if preschoolers would overimitate a human-like puppet demonstrator. Much like McGuigan & Robertson's study (2015), our results suggest that children tend to perform irrelevant actions a lot less after seeing a puppet model compared to a human one, even when the puppet is human-like and not an animal.

Besides those already mentioned, our design has other limitations. One of them is that Study 2 only has one age group compared to Study 1, which slightly limits the comparisons that can be made between the two experiments. It would be important in the future to replicate Study 2 with a 3.5-year-old sample, to have a complete picture. Despite its necessity at the time of data collection, the online format of this research also has some limitations. For example, we had little control over the participants' environment, who were in their home. Children were sometimes easily distracted by elements in their surroundings (e.g., noises, pets, other family members

present, etc.), which could have impaired their performance on the tasks. Another disadvantage of online studies is that quite a few participants were extremely shy and wouldn't talk during the experiment, perhaps because seeing a stranger on a screen is quite intimidating for preschoolers, especially if they did not have as many interactions during the pandemic. Thus, it might be interesting to replicate these two studies in person to determine if the results would be different. For instance, do children overimitate more a human-like puppet if the demonstration is live in the lab? Children overimitate less an animal-like puppet, even in live experiments (McGuigan & Robertson, 2015), but, to our knowledge, nobody has used human-like puppets as the demonstrator in an overimitation task.

Future research should also explore more extensively the underlying mechanisms of social learning in childhood, especially of overimitation. For example, other characteristics of the demonstrator, like the language spoken, could be manipulated to determine if they have an impact on overimitation performance. In that case, and in line with the social affiliation account, perhaps children would prefer to imitate a model that speaks the same language as them compared to an unknown language, as the demonstrator would be more similar to them (Price et al., 2017; Rawlings et al., 2019). Conversely, as Lyons et al. (2007) propose, perhaps what underlies overimitation relates more to causal encoding rather than social motivations.

Additionally, it would be interesting to investigate what it is exactly about overimitation that makes children act differently when faced with a puppet compared to a human demonstrator. Is it affiliation, like our hypothesis and interpretation suggest, or could it also be that a human model has an "authority" role compared to a puppet? As discussed in the introduction of this paper, another prominent account maintains that one overimitates due to normative pressures (Kenward, 2012; Kenward et al., 2011). Relatedly, future studies could look at parenting style:

are children of authoritarian parents more likely to overimitate than those of authoritative or permissive parents? Whether affiliation, authority, or cognitive processes are examined in future research, these influences are not mutually exclusive, and probably all have a role in overimitation (Keupp et al., 2018).

In conclusion, this research aimed to compare two social learning abilities in preschoolers, namely selective social learning and overimitation. We conducted two online experiments: one with puppet agents, and one with human agents. In both studies, we did not find a link between the two abilities, nor between overimitation and social affiliation as measured by a parental questionnaire. However, we did find an association between selective social learning and theory of mind in the second experiment, and we observed a significant increase in the overimitation rate from the first to the second study, suggesting that preschoolers prefer to imitate a human demonstrator compared to a puppet one, possibly because they affiliate more with the human. Future research may want to explore in more depth these abilities, especially overimitation, which seems to have several influences. Clarifying how these abilities develop would deepen our understanding of social learning, which is a crucial way through which young children make sense of the world.

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Appendix A

Table A1

Zero-Order Correlations between Task Performance and Questionnaire Scores for the Full Sample in Study 1

	1. Ask	2. Endorse	3. Combined	4. Explicit Judgment	5. Overimitation	6. CSUS	7. SDQ peer	8. SDQ prosocial
1. *r*	1	**.342****	**.810****	.258*	−.002	−.019	−.233*	−.061
Sig. (2-tailed)		.002	.000	.021	.983	.865	.038	.594
2. *r*		1	**.828****	**.401****	.239*	.021	.098	−.184
Sig. (2-tailed)			.000	.000	.033	.850	.386	.102
3. *r*			1	**.404****	.148	.002	−.078	−.151
Sig. (2-tailed)				.000	.191	.987	.493	.182
4. *r*				1	.186	.176	−.068	−.087
Sig. (2-tailed)					.098	.118	.548	.443
5. *r*					1	.171	.008	.178
Sig. (2-tailed)						.128	.943	.114
6. *r*						1	**−.311****	**.341****
Sig. (2-tailed)							.005	.002
7. *r*							1	−.124
Sig. (2-tailed)								.273
8. *r*								1
Sig. (2-tailed)								

Note. N = 80. The correlations in bold remain significant after a false discovery rate correction of .05. ** p < .01; * p < .05

Table A2

Zero-Order Correlations between Task Performance and Questionnaire Scores for the 3.5-Year-Old Age Group in Study 1

	1. Ask	2. Endorse	3. Combined	4. Explicit Judgment	5. Overimitation	6. CSUS	7. SDQ peer	8. SDQ prosocial
1. *r*	1	.142	**.772****	.106	.030	.051	−.208	.144
Sig. (2-tailed)		.383	.000	.515	.856	.753	.197	.375
2. *r*		1	**.738****	.149	.211	.027	.017	−.316*
Sig. (2-tailed)			.000	.357	.191	.869	.917	.047
3. *r*			1	.168	.156	.052	−.131	−.105
Sig. (2-tailed)				.299	.337	.749	.420	.520
4. *r*				1	.179	.247	−.379*	.031
Sig. (2-tailed)					.269	.124	.016	.851
5. *r*					1	.180	−.029	.008
Sig. (2-tailed)						.265	.860	.962
6. *r*						1	−.349*	.338*
Sig. (2-tailed)							.027	.033
7. *r*							1	−.191
Sig. (2-tailed)								.239
8. *r*								1
Sig. (2-tailed)								

Note. N = 40. The correlations in bold remain significant after a false discovery rate correction of .05. ** p < .01; * p < .05

Table A3

Zero-Order Correlations between Task Performance and Questionnaire Scores for the 5-Year-Old Age Group in Study 1

	1. Ask	2. Endorse	3. Combined	4. Explicit Judgment	5. Overimitation	6. CSUS	7. SDQ peer	8. SDQ prosocial
1. *r*	1	**.533****	**.856****	**.461****	.015	−.044	−.254	−.247
Sig. (2-tailed)		.000	.000	.003	.926	.786	.114	.124
2. *r*		1	**.894****	**.635****	.284	−.004	.160	−.088
Sig. (2-tailed)			.000	.000	.076	.981	.323	.588
3. *r*			1	**.632****	.181	−.026	−.037	−.185
Sig. (2-tailed)				.000	.263	.874	.821	.253
4. *r*				1	.139	−.078	.198	−.263
Sig. (2-tailed)					.391	.633	.220	.101
5. *r*					1	−.008	−.003	.200
Sig. (2-tailed)						.960	.987	.216
6. *r*						1	−.401*	.296
Sig. (2-tailed)							.010	.064
7. *r*							1	−.083
Sig. (2-tailed)								.613
8. *r*								1
Sig. (2-tailed)								

Note. N = 40. The correlations in bold remain significant after a false discovery rate correction of .05. ** p < .01; * p < .05

Appendix B

Table B1

Zero-Order Correlations between Task Performance and Questionnaire Scores for the Full Sample in Study 2

	1. Ask	2. Endorse	3. Combined	4. Explicit Judgment	5. Overimitation	6. CSUS	7. SDQ peer	8. SDQ prosocial
1. *r*	1	**.435****	**.790****	**.377****	.208	.251*	.150	.001
Sig. (2-tailed)		.000	.000	.001	.080	.033	.209	.992
2. *r*		1	**.895****	**.505****	.087	**.296***	.094	−.015
Sig. (2-tailed)			.000	.000	.465	.012	.432	.904
3. *r*			1	**.530****	.162	**.326****	.138	−.009
Sig. (2-tailed)				.000	.173	.005	.247	.938
4. *r*				1	.128	**.344****	.115	−.024
Sig. (2-tailed)					.283	.003	.337	.844
5. *r*					1	.062	−.112	.070
Sig. (2-tailed)						.604	.349	.560
6. *r*						1	−.206	.170
Sig. (2-tailed)							.083	.153
7. *r*							1	**−.281***
Sig. (2-tailed)								.017
8. *r*								1
Sig. (2-tailed)								

Note. N = 72. The correlations in bold remain significant after a false discovery rate correction of .05. ** p < .01; * p < .05

Table B2

Linear Regression Results for the Selective Social Learning Task in Study 2

Variable		F	p	R^2	$R^2_{adjusted}$	ΔR^2	ΔF	β	β 95% CI [LL, UL]	p
					Ask					
Model 1		.586	.559	.017	−.012	.017	.586			.559
	Age							−.081	[−.133, .067]	.514
	Sex							−.123	[−.554, .185]	.322
Model 2		1.979	.093	.130	.065	.114	2.876			.043
	Age							−.068	[−.125, .070]	.572
	Sex							−.165	[−.615, .121]	.184
	CSUS							.318	[.211, 1.539]	.011
	SDQpeer							.201	[−.023, .241]	.104
	SDQprosocial							.024	[−.092, .112]	.843
					Endorse					
Model 1		1.061	.352	.030	.002	.030	1.061			.352
	Age							.138	[−.059, .215]	.262
	Sex							−.075	[−.658, .350]	.545

Model 2		2.600	.033	.165	.101	.135	3.548			.019
	Age							.162	[−.040, .222]	.171
	Sex							−.137	[−.779, .212]	.258
	CSUS							.379	[.540, 2.331]	.002
	SDQpeer							.126	[−.084, .272]	.297
	SDQprosocial							−.004	[−.139, .135]	.976
					Explicit Judgment					
Model 1		.742	.480	.021	−.007	.021	.742			.480
	Age							−.119	[−.141, .049]	.338
	Sex							.059	[−.265, .433]	.634
Model 2		2.649	.030	.167	.104	.146	3.858			.013
	Age							−.105	[−.131, .050]	.374
	Sex							.015	[−.320, .362]	.903
	CSUS							.373	[.357, 1.590]	.002
	SDQpeer							.195	[−.023, .223]	.108
	SDQprosocial							−.046	[−.113, .076]	.700

Note. N = 72.