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Group Membership Influences More Social Identification Than Social Learning or Overimitation in Children

Thibaud Gruber
University of Geneva and University of Oxford

Amélie Deschenaux
University of Neuchâtel

Aurélien Frick
University of Edinburgh and Suor Orsola Benincasa University of Naples

Fabrice Clément
University of Neuchâtel

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Group membership is a strong driver of everyday life in humans, influencing similarity judgments, trust choices, and learning processes. However, its ontogenetic development remains to be understood. This study investigated how group membership, age, sex, and identification with a team influenced 39- to 60-month-old children (N = 94) in a series of similarity, trust, and learning tasks. Group membership had the most influence on similarity and trust tasks, strongly biasing choices toward in-groups. In contrast, prior experience and identification with the team were the most important factors in the learning tasks. Finally, overimitation occurred most when the children's team, but not the opposite, displayed meaningless actions. Future work must investigate how these cognitive abilities combine during development to facilitate cultural processes.

From a very young age, children are sensitive to social group membership and make use of this information when engaged in experimental tasks (Chen, Corriveau, & Harris, 2013; Degner & Wentura, 2010). For example, by 6 years of age, but possibly earlier (Mahajan & Wynn, 2012; Sheskin, Bloom, & Wynn, 2014; Taylor, 2013; Terrier, Bernard, Mercier, & Clément, 2016), they understand that individuals can be divided into in- and outgroups, assimilating various identity cues such as gender or ethnicity into their treatment of others, which leads them to prefer individuals belonging to the same group (Bennett & Sani, 2008). In doing so, children are preferentially interested in the group they belong to, but also show that they know the groups to which others belong to, an information that will influence their judgment (Aboud & Amato, 2001). For instance, children will express a more positive opinion of in-group peers than of out-group peers (Arthur, Bigler, Liben, Gelman, & Ruble, 2008; Nesdale, Maass, Griffiths, & Durkin, 2003). They are also more enclined to choose individuals of their racial or ethnic group (Abrams, Rutland, & Cameron, 2003; Banaji, Baron, Dunham, & Olson, 2008; Baron & Banaji, 2006; Dunham, Chen, & Banaji, 2013; but see Hirschfeld, 1995) and to choose members of their native language group over speakers of a foreign language (Kinzler, Dupoux, & Spelke, 2007; Kinzler, Shutts, DeJesus, & Spelke, 2009). This preference is not necessarily bounded to language in itself and may extend to nonlanguage-based information provided by cultural peers over noncultural peers (Kinzler, Corriveau, & Harris, 2011).

Motivational factors also play an important role for group membership during early childhood, particularly with respect to belonging and acceptance aspects (Baumeister & Leary, 1995). Indeed, these

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Correspondence concerning this article should be addressed to Thibaud Gruber, Swiss Center for Affective Sciences, CISA–University of Geneva, Campus Biotech, Chemin des Mines 9, 1202 Geneva, Switzerland. Electronic mail may be sent to thibaud.gruber@unige.ch or thibaud.gruber@gmail.com.

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factors may underpin the search for, and importance of similarity and in-group identification (e.g., social identity development theory, Nesdale & Flesser, 2001; self-categorization theory, Haslam, Oakes, Turner, & McGarty, 1996; Turner & Oakes, 1986). In particular, the topic of in-group identification has received a large treatment in the literature, especially in studies dealing with prejudice, attitudes, exclusion, and more generally, social identity (Bigler, Spears Brown, & Markell, 2001; Killen, 2007; Killen & Stangor, 2001; Nesdale & Flesser, 2001; Nesdale et al., 2003; Rutland, Killen, & Abrams, 2010; Sherif, 1937). Interestingly, some of these studies have shown that with age, children will behave differently while witnessing the behavior of in- or out-group members, with a shift of interest, and source of judgment, from self to group and later to individuals, where their judgment is then not solely based on group membership anymore (Aboud, 1988; Abrams et al., 2003).

The fact that children rely on those that they consider "their" peers may also be explained in part by the fact that human children rely heavily on information given by others to learn about the world through social learning (Csibra & Gergely, 2009; Harris, 2012; Tomasello, 2008). As a consequence, they need to acquire reliable information, and children will tend to acquire this information from specific informers that they consider they can trust (Harris et al., 2012). For instance, children as young as 3 years old seek information from caregivers they are familiar with as compared to nonfamiliar caregivers (Corriveau & Harris, 2009). Nevertheless, this is not "blind trust" as they are also more likely to seek information from informants that they have witnessed being correct or accurate in the past (Clément, Koenig, & Harris, 2004; Jaswal & Neely, 2006; Koenig, Clément, & Harris, 2004; Sabbagh, Wdowiak, & Ottaway, 2003). Children also make moral or cognitive judgments about their sources of information, favoring benevolent over malevolent informants (Mascaro & Sperber, 2009), or honest over dishonest informants (Lane, Wellman, & Gelman, 2013). Preference for an informant facilitates effective learning processes in children: for example, they prefer to learn from more familiar models (Corriveau & Harris, 2009; Kinzler et al., 2011), models they judge to be nicer (Landrum, Mills, & Johnston, 2013), models they deem more trustworthy because they show more certainty in their statements (Brosseau-Liard & Poulin-Dubois, 2014; Sabbagh & Baldwin, 2001), or models whose statements sound more logical (Bernard, Mercier, & Clément, 2012; Doebel & Koenig, in press).

One important remaining question is to understand how the effects of group membership develop in children through the succession of challenges tackling different aspects of the social world, which they are confronted to daily. In practice, much of everyday human life is spent making choices in a variety of contexts, which often requires trusting individuals that one barely knows, for example, in social and political institutions (Yuki, Maddux, Brewer, & Takemura, 2005). Here, one must develop a "depersonalized trust" (Brewer, 2008) based on little to no history of interpersonal relationship with others (Cook, 2001; Kramer, 1999; Yamagishi & Yamagishi, 1994). One important factor here appears to be self-similarity judgments (Haun & Over, 2013). For instance, Fawcett and Markson (2010) showed that children as young as 3 years old preferred to play with puppets that expressed the same food preference as them. Nevertheless, this preference may also arise from perceptual similarity only; in the same study, children preferred puppets that looked similar to them rather than puppets that were different. Infants also appear to learn preferentially from others who are similar to them (Buttelmann, Zmyj, Daum, & Carpenter, 2013). Interestingly, the self-similarity effect may be connected to the general, and arguably unique, propensity of humans to engage in high-fidelity imitation (Haun & Over, 2013; but see Whiten, McGuigan, Marshall-Pescini, & Hopper, 2009), particularly because of the increased level of perceived similarity with the model resulting from imitation (Chartrand & Bargh, 1999). In learning tasks, 5- to 6-year-old children prefer to adopt the preferences displayed and labels proposed by informants who had been imitating their choices in previous interactions (Over, Carpenter, Spears, & Gattis, 2013). Conversely, from about 5 or 6 of age (and possibly earlier) children treat out-group peers negatively, even compared to neutral individuals (Aboud, 2003; Buttelmann & Bohm, 2014; Hamlin, Mahajan, Liberman, & Wynn, 2013; Oostenbroek & Over, 2015). Haun and Over (2013) have stressed the importance of social processes, and in particular, of homophily—the preference for others who are perceived as similar to oneself (see also Mahajan & Wynn, 2012)—to unite within the same framework the fields of group membership, social behavior, and social learning.

A particular case of social learning in which the evaluation of a model may be crucial for the learner is the learning of techniques and, possibly, tool use. In this context, the evaluation of others' efficiency is of great importance, and may have constituted a strong evolutionary force (Boyd & Richerson, 1985; Laland, 2004). In general, children appear to favor observing a model, as opposed to a "ghost condition" where the action is performed mechanically, particularly for complex tasks (Hopper, Lambeth, Schapiro, & Whiten, 2008). They will also notice whether a model succeeds or fails and will take this information into account in their own approach to a problem (Nielsen, 2006). Additionally, children can evaluate the inherent difficulty of a technique as compared to another technique displayed by two different models and opt for the technique they perceive as easier to achieve their goal (Williamson & Meltzoff, 2011). Children are also known for their attention to details when engaging in imitation (Tomasello, 2009). Two particular phenomena are of interest in studies involving object manipulation. First, children have been repeatedly shown to imitate meaningless actions when engaging with an apparatus, even when they have a direct experience that such action is pointless to reach the desired outcome (Horner & Whiten, 2005). This effect has been named "overimitation" in the literature (Lyons, Young, & Keil, 2007). Overimitation emerges in the 2nd year of life (Nielsen, 2006) and develops through the preschool period until adulthood (McGuigan, Makinson, & Whiten, 2010). While overimitation may not bring any benefits in terms of efficiency, it may instead serve a social role, increasing the degree of similarity between a model and a learner (Haun & Over, 2013). Second, overimitation may also be one of several manifestations of a well-described phenomenon in humans: conformity (Asch, 1956). Conformity is pervasive in human behavior and has been shown to influence how adults, as well as children, engage with various apparatus (Claidière & Whiten, 2012). Most interestingly, while prior experience with an apparatus can lead children to develop a technique preference (Flynn & Whiten, 2010; Gardiner, Bjorklund, Greif, & Gray, 2012; Wood, Kendal, & Flynn, 2013), children can discard the preference they formed originally when moving to a social context, as opposed to situations where they were alone, in order to favor collaborative exploration of the apparatus or observational learning (Flynn & Whiten, 2010). This difference in behavior induced by social context underlines that an important characteristic of children's social learning is their tendency to conform to their peers (Claidière & Whiten, 2012; Haun & Tomasello, 2011).

In order to understand how the formation of in-groups can influence children in a succession of judgments and learning choices, in the current study we exposed children between 4 and 6 years of age to a combination of successive tasks testing social identification, in the form of a similarity task (ST; who is like me?) and a trust task (TT; who do I trust?), and two social learning tasks either with previous individual experience (should I rely on my personal experience or on the group's knowledge?) or without direct experience (should I replicate all actions demonstrated by the model?). We aimed to determine whether the creation of a group (presented as a "team"—*équipe* in French—to the children and referred as such in this article when describing the effects of the group) as identified by a common piece of clothing could influence inner preferences or trust as well as learning processes when children were exposed to two models belonging to their team or not. This grouping, based on perceptual similarity, can indeed elicit the transfer of a child's preference to the in-group in children as young as 3–4 years of age (Richter, Over, & Dunham, 2016). In particular, we aimed to examine whether observing that they were behaving differently (incongruent condition) or similarly (congruent condition) to their team would influence children's subsequent choices, possibly altering their identification with their "team" as opposed to children who were not assigned to a team beforehand. Here, our prediction was that children in the three conditions would behave differently depending on how much they would identify with the models they would watch in the videos played to them by the experimenters. More specifically, we predicted that identification with the team would be maximal for children in the congruent condition. In contrast, we predicted that identification with the team would differ in the incongruent condition compared to the congruent condition, although we did not have clear expectations about how this difference would be expressed. For instance, in a reversed paradigm, it has been shown that children will judge more negatively in-group members that are deviant from the group, an effect called the *black sheep effect* (Marques, Yzerbyt, & Leyens, 1988). Therefore, in the present study, we could hypothesize that the children would consider themselves the blacksheeps of the team and modify their behavior accordingly. In this respect, children observing that "their" team behaved differently from them could either be predicted to overcompensate affiliation with their team if they thought they were "doing it wrong," or to the contrary, decrease their level of identification because they would feel less connections with "their" team, thus leaning toward the behavior of the control group, whose children were not allocated to a team.

As most children tested completed the same successive tasks, we could also evaluate whether their relationship with their team changed across tasks, and directly tested whether this influenced their decisions. To do so, we introduced a novel *index of team identification*, $I(x)$, calculated initially from the results of a given child in the first task and subsequently modified according to the variations in the child's choices in the consecutive tasks. In this analysis, the index was dynamic rather than static and changed according to the choices of the child in the $n - 1$ task. It was then subsequently used to predict the child's behavior in the n task. With this index, we aimed to provide a way to investigate directly the variation in the degree of identification of children to their team and evaluate whether behavior in preceding tasks would influence children's behavior in the subsequent tasks. In our analyses, we also tested the predictions of the changing index against the use of the children's initial index only to assess its usefulness. Finally, our experiment also exposed children to various social learning tasks, allowing us to study both whether children would be more likely to discard their individually formed knowledge in favor of the group's knowledge, and whether they would follow their team in the learning of new techniques even when this included meaningless actions. In particular, our prediction was that children who would watch members of their team engaging in meaningless actions would be more likely to engage in overimitation than children who witnessed a model from the other team displaying the meaningless action, while the model from their own team did not display this action.

Method

Participants

We tested 95 children between 35 and 69 months (M = 52.54, median = 53; 53 males) at six nursery schools located in medium-size cities (~20,000–100,000 inhabitants) in Switzerland and France, which we contacted individually and asked for participation in the experiments. Data acquisition occurred between October 2014 and September 2015. The research project and protocols were approved by the Ethics Committee at the University of Neuchâtel as well as all participating schools. Parents were contacted by the head teacher and asked to sign a written consent giving their agreement to the participation of their child in the experiment. All children belonged to middle-class families with little socioeconomic differences between them. Ethnicities were representative of the populations in France and Switzerland. Children only participated in the experiment if they were willing to come in the experimental booth, which was setup in a room adjacent to the common areas where children were playing. Reversely, we only accepted children for whom the consent form had been signed by the parents. Upon arriving in the experimental booth, the children were given a choice by the experimenter of two cloaks (a yellow and a blue one). If they chose a cloak, they were allocated to the congruent (N = 34, M_{age} = 52.59 months, SD = 8.60; 20 males) or incongruent conditions (N = 31, M_{age} = 52.32 months, SD = 9.71; 17 males). If they did not want to choose a cloak, they were allocated to the control condition to be able to proceed with data acquisition (five children). Twenty-five additional children were not proposed a cloak upon entering the experimental booth, resulting in a combined control group of N = 30 individuals (M_{age} = 52.53 months, SD = 8.19; 17 males). The behavior of the five children refusing the cloak did not differ from the 25 other control children (see Data S2b–S6b). All children participated in the four tasks, except: one child who did not complete any task and was removed from all analyses, one child who only completed the first two tasks, one child who did not pass the second learning task, and one additional child who did not complete the final task. Their data are only analyzed for the tasks they completed.

Equipment and Materials

Children were first exposed to a 40 × 30 × 19 cm Plexiglas box (Box 1, Figure 1A). They were subsequently shown videos and still images on a portable laptop (either a MacBook Air or Sony Vaio depending on the location of the experiment). Children were then exposed to a second Plexiglas box, Box 2, of similar dimension (40 × 30 × 19 cm) as Box 1 (Figure 1C). All interactions with the boxes and the children's behavior while watching the laptops were recorded on camcorders (GoPro3) located (~2 m) behind the children and out of their sight.

Procedures and Tasks

The participants were exposed to a sequence of four tasks as described next, the entire experiment lasting about 30 min per child. The tested children watched videos of models of similar age as the

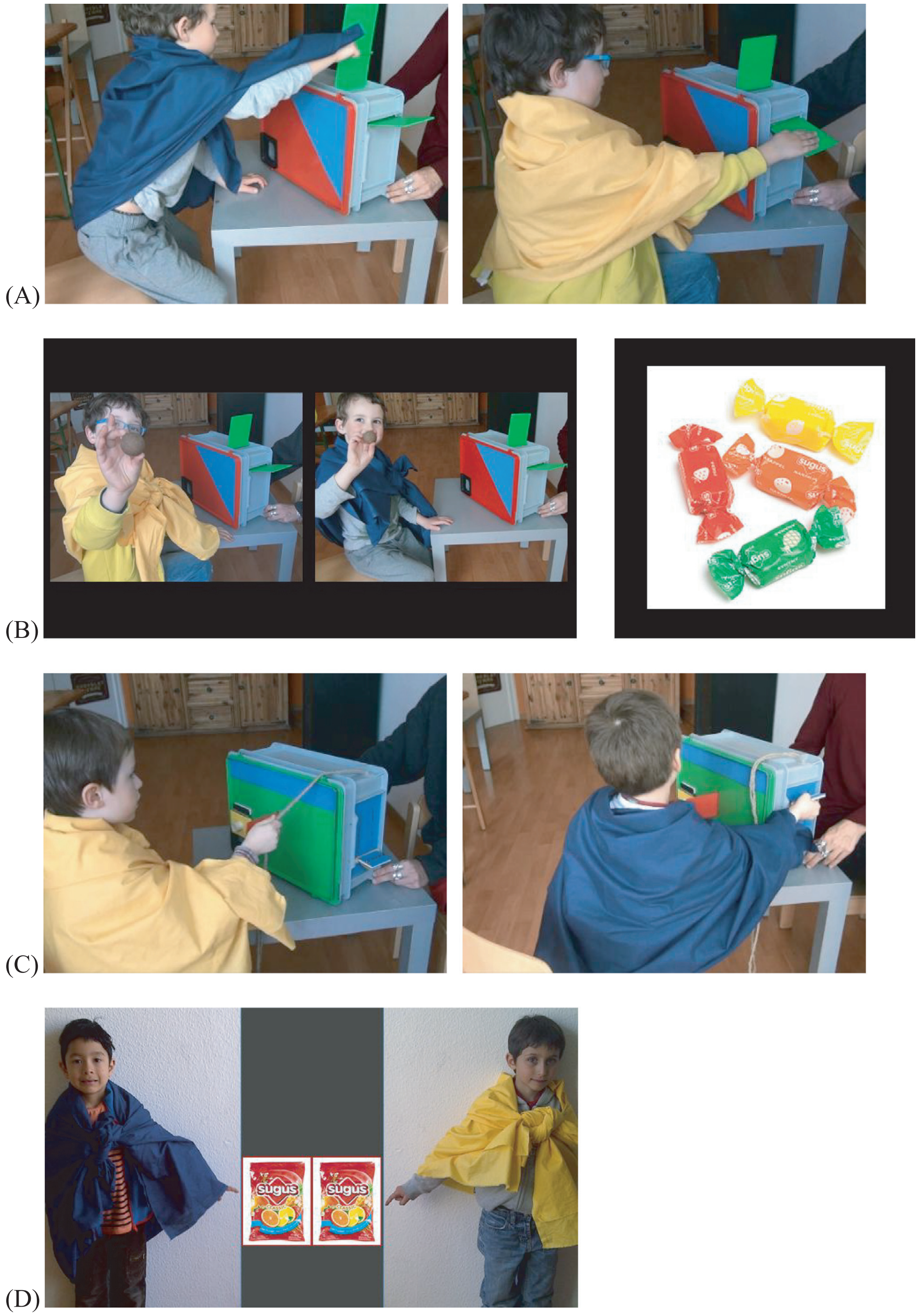

Figure 1. Experimental setup for each task (see text for description).

participants (Figure 1), who were trained by the experimenters (TG, AD) before recording the videos. All models were males and unknown to the participants. AD tested the children in the Swiss nurseries, while AF tested the children in the French nurseries. The location of the "correct" choice (i.e., the team member) appeared either as the first or the second video during the social learning tasks, or on the right or the left of the screen during the social identification tasks, counterbalanced within and between subjects. In between the tasks, the experimenters asked the participants in the congruent and incongruent conditions to name the team they belonged to (*Quel est l'enfant qui est* *dans ton équipe?* translation: "Which child is in your team?"), in order to check that the children continuously identified with one of the teams. We alternated two social learning tasks and two social identification tasks. The first task aimed to seed a preference in the child, with the video presentation introducing the two teams subsequently. The second task was a ST assessing preference toward the models appearing in the videos watched during the first task. The third task was an additional learning task aimed specifically at assessing social learning, particularly overimitation, from other models and without previous experience with the box. Finally, the fourth task, testing trust toward other team members and considered to require a more empathetic relationship than similarity judgments, provided a final task testing social identification with the group.

Possible Social Learning Task

In this task, the experimenter introduced a wooden ball in a hole drilled in the back of Box 1 invisible to the participant and asked the child to engage with the box to retrieve the ball. To do so, the child could either lift a green piece of wood located on the top of the box, or alternatively push on an equal-sized green piece of wood located on the side of the box (Figure 1A). Both techniques allowed the ball to fall on an inclined ramp inside the box that led the ball down to an opening on the left of the box, where the child could recover the ball. In the first part of the task, children were given 2 min to engage on their own with the box. Once the participant recovered the ball, she was asked by the experimenter to give back the ball, so that it could be placed again in the initial position. The children were given seven trials to determine a potential preference (preference was defined as more [4–7] displays of a given technique out of seven trials). If the participant was not able or willing to engage with the apparatus, the experimenter encouraged the children with neutral sentences such as *Peut-être que tu peux essayer de toucher les éléments verts que tu vois devant toi* (translation: "Maybe you can try to touch the green bits that you see in front of you"). The experimenter never gave the precise solution to the participant.

After seven trials were achieved, or alternatively after 2 min spent engaging with the box if they did not achieve seven trials, all participants were exposed to successive short videos displaying two model children from the blue and yellow teams displaying either of two possible techniques and counterbalanced in order across trials. In the congruent condition, the model wearing the same cloak as the participant displayed the same technique that the participant had displayed preferentially, whereas the model wearing the different cloak demonstrated the other technique. In the incongruent condition, the model wearing the same cloak as the participant displayed the opposite technique, whereas the model wearing the different cloak demonstrated the same technique that the participant had displayed preferentially. In the control condition, including in the cases where the participants had not developed a preference (four, all in the control condition), children were exposed to the two videos showing the two alternative techniques displayed by one member of each team. The videos were broadcast one after the other, in a counterbalanced setting. Once they were done watching the clips, the participants were once again asked to engage with the box for seven trials and the experimenter noted their preference. Because of their previous experience with the device, the participant's behavior could possibly be influenced by watching the videos or not. This is why we termed this task the possible social learning (PSL) task, as opposed to the later mandatory social learning (MSL) task, where children were required to watch videos before engaging with a novel box.

Similarity Task

During the ST, children were exposed to a still picture of each child they had previously seen engaging with Box 1 (Figure 1B). The experimenter then stated that every child liked Sugus (sweets commonly sold in Switzerland and France, which have different flavors according to their color), and then asked the participant what was her favorite flavor. The experimenter then asked the participant which child on the picture had the same taste as her.

Mandatory Social Learning Task

Before they could engage with Box 2, participants were required to watch two videos where one model child of each team displayed a technique to recover the wooden ball. This box included three steps to recover the ball. In each video, the two models began by pulling the same red lever toward them, before either using an elevator located on the right side of the box or pulling a string at the top of the box to recover the ball. Both mechanisms brought the ball on an inclined ramp that led the ball to a similar opening as in the first task. A final move was displayed by only one of the model children under the form of a useless action (lifting a yellow shutter located above the opening) before recovering the ball. As such, the tested child saw only one model of the two performing the useless action, either from her team or from the other team. Participants were then given the opportunity to engage with the apparatus and were given seven trials to recover the ball, with a trial defined as the succession of actions leading to the recovery of the ball. Similarly, if the participants were not willing to engage with the box, the experimenter encouraged them to do so. The task ended after the completion of the trials or after 2 min if the participant did not complete the trials. Compared to the PSL task, which aimed to compare whether children would rely on their individual knowledge built by direct experience or on the group knowledge, the MSL task aimed to test how much information they would extract from watching the models before engaging with the task, particularly with respect to necessary and meaningless actions.

Trust Task

Finally, the participants were exposed to a TT under the form of a forced-choice between two pictures displaying a model child from each team. Models in this task were different from the models displayed in the PSL and MSL tasks. Each child on the pictures pointed toward the picture of a gift (Figure 1D), which were placed at the center of the frame and equidistant to the children. The experimenter stated that the participant could only choose one child whom she thought was indicating the correct location of their favorite sugus, as a reward for the whole experiment. Irrelevantly of the choice made by the child, they received a sugus of their choice from the experimenter.

Coding

The data were first coded by two of the authors (AD and AF) and double checked by another author (TG) who then selected a set of videos representing about 30% of the total data set for recoding to check for interrater reliability. The raw data and the double coding for the interrater reliability assessment were also checked by an independent researcher blind to the hypotheses of the study. Kappa values obtained for the four tasks were as follows: Box 1: κ = .93, ST: κ = .86, TT: κ = .90, Box 2: κ = .78.

Data Analysis

To analyze our data, we ran generalized linear models (GLMs) using different full models taking into account interactions between factors, tested against the null model. These models took into account all possible interactions between factors. The factors we took into account for the analyses were: age (continuous), sex (male or female), condition (congruent vs. noncongruent, control), and $I(x)$. $I(x)$ was defined as the *index of identification* to the team, which fluctuated across time and tasks (see below). This parameter was different from condition in that condition tested the effect of group membership (with group members acting either similarly to the child or not), while $I(x)$ tested whether the children's choices matched their chosen or assigned team's identity or behavior. Because it was possible that some of the factors interacted with each other, we first tested models that included all possible interactions with each other (i.e., three-way interactions and two-way interactions between each factor). Following Hector, Von Felten, and Schmid (2010) and Mundry (2011), if the models were significantly different from the null model but no interaction was significant, we removed the interactions stepwise (one at a time) from the model and ran it again. As such we could precisely isolate interactions that would explain the variation. Following Schielzeth (2010), we centered 8
the age and $I(x)$ values around the means for the analyses and calculated them as C values, such as C values = value − mean(values). 9

$I(x)$ was a factor that was revaluated after each task, starting from $I(0)$, defined as the initial rate of preference (*Rp* in Supporting Information) for a given technique in the first part of the PSL task. In effect, $I(0)$ provided the base for the calculation of the index of identification of subsequent tasks, taking into account individual differences resulting from differential explorations of Box 1 by the participants.

$I(1)$, the first index of identification, was calculated in the PSL task as the effect of watching the videos on the participant's behavior in the subsequent interaction with the box and defined as: $I(1) = I(0) \pm$ *rate preference for the participant team's technique after watching the PSL video*. When the participant was acting according to her team preference (in the congruent and incongruent conditions), the rate was added in absolute value to the initial $I(0)$; if not, it was subtracted from $I(0)$. For participants in the control condition, the preference for a technique after watching the Box 1 video was considered as a team choice. This artificial team membership was then subsequently used to calculate later $I(x)$ values. For instance, a child in the yellow team in the congruent condition developed a lift preference in her initial engagement with the box, with an $I(0)$ of 0.86 (six lifts of seven trials). After watching the two videos, she once again lifted (the technique displayed by the yellow team in the congruent condition), with a rate of 0.86 (again, six lifts of seven trials). She ended up with a $I(1)$ of $0.86 + 0.86 = 1.72$. To the contrary, a child in the control condition initially preferred the pushing technique with an $I(0)$ of 1 (seven of seven pushes). After the video, he produced four lifts of seven trials, similar to the blue team. His $I(1)$ is thus of $1 - 0.57 = 0.43$. Additionally, because he went with the solution proposed by the blue team, he was considered to have opted for the blue team as a starting point in the rest of the analyses.

$I(2)$ was defined as the identification index following the choice in the ST and was thus defined as $I(2) = I(1) \pm 0.5$ depending on the choice of the child for a given team. Again, if the child chose her associated team (either from her own choice in the congruent and incongruent conditions, or from her automatically attributed team in the control condition), the 0.5 value (probability to choose a team) was added to her $I(1)$, or subtracted if she chose the opposite team.

$I(3)$ was defined as the identification index following the choice of the child in the MSL task and influenced by the technique chosen by the participant following watching the two videos. Again, if the child followed her team's choice, her preference rate for the technique was added to $I(2)$, or subtracted if she chose the technique displayed by the alternate team.

$I(4)$ was defined as the identification index after the choice made in the TT and was thus defined as $I(4) = I(3) \pm 0.5$ depending on the choice of the child for a given team. If the child chose to trust her associated team (either from her own choice in the congruent and incongruent conditions, or from her automatically attributed team in the control condition), the 0.5 value (probability to choose a team) was added to her $I(3)$, and subtracted if she chose the opposite team.

The following GLM models were tested for the following tasks:

PSL—Factors: Age, sex, condition, $I(0)$, interactions. Variable: Technique change (Y or N)
ST—Factors: Age, sex, condition, $I(1)$, interactions. Variable: Same as team (Y or N)
MSL—Factors: Age, sex, condition, $I(2)$, interactions. Variable: Same as team (Y or N)
TT: Factors: Age, sex, condition, $I(3)$, interactions. Variable: Same as team (Y or N)

For the PSL analysis, we also ran a related samples Wilcoxon signed-rank test to compare $I(0)$ and $I(1)$, which were not normally distributed (Kolmogorov–Smirnov tests, $p < .001$), to evaluate the effect of early team identification. For the MSL analysis, we additionally investigated whether children would be more likely to display overimitation if their team had displayed a meaningless action. To test whether our factors influenced the presence of overimitation, we thus ran an additional set of models, testing the number of times children touched the yellow shutter. These models also included whether the team of the participant had performed a useless action or not (team overimitation) as a factor, as follows:

MSL–Overimitation—Factors: Age, sex, condition, $I(2)$, team overimitation, interactions. Variable: Number of overimitation actions (shutter touch).

Finally, to assess the value of our newly introduced $I(x)$ index, we ran several additional analyses. First, we ran additional GLMs for the MSL, MSL–overimitation, and TT tasks using the first index of identification $I(1)$ to test whether the use of a static index would have the same effects as the ones found in the analyses run with the dynamic indexes. Second, we compared $I(x)$ values across 10
tasks and conditions with independent samples Kruskal–Wallis tests to study the evolution of the index across conditions and time.

All statistical tests were run using SPSS 21.0. 11

Results

PSL Task

The models with three-way interactions, and respective two-way interactions (see Data S2a), were significantly different from the intercept models, but as no interaction was significant in any of these models, we removed all interactions from the model. The final model was significantly different from the intercept model only, likelihood ratio test (LRT), $\chi^2(5,\ N = 90) = 24.33$, $p < .001$. We found main effects of both age, $\chi^2(1,\ N = 90) = 6.03$, $p = .01$ (Figure 2A), and $I(0)$, $\chi^2(1,\ N = 90) = 10.66$, $p = .001$ (Figure 2B). The younger the children were, the less likely they were to change their technique following the videos. Similarly, the higher their original engagement with one technique, the

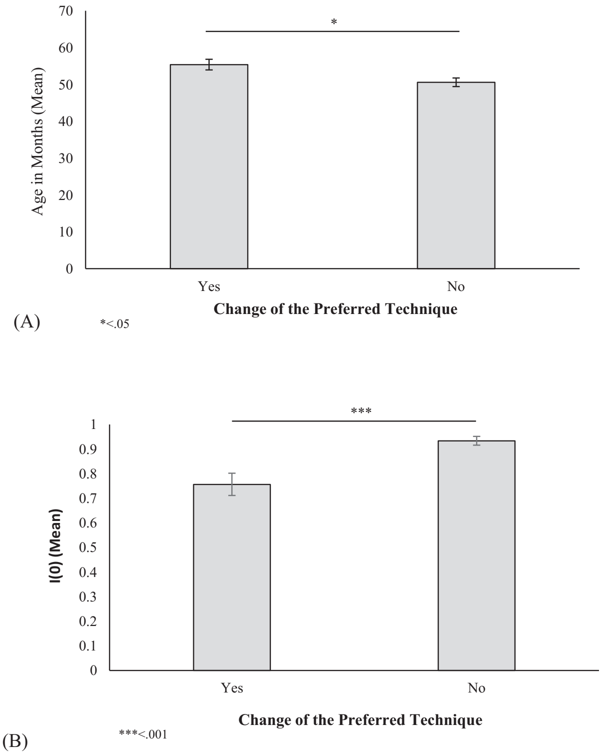

Figure 2. Change of the preferred technique as a function of (A) age and (B) initial rate of preference $I(0)$ in the possible social learning task, with standard error of the mean (*SEM*).

less they were likely to change their technique to the alternative technique. In contrast, we did not find effects for sex, $\chi^2(1, N = 90) = 0.31$, $p = .58$, or condition, $\chi^2(2, N = 90) = 0.95$, $p = .62$.

Finally, we found that $I(1)$ scores were on average higher than $I(0)$ scores (related samples Wilcoxon signed-rank test, $N = 94$, $W = 2785$, $p = .03$).

Similarity Task

The model including all three-way interactions but Sex × Condition × $I(1)$ was significantly different from the intercept, LRT, $\chi^2(19, N = 94) = 44.93$, $p = .001$ (see Data S3a), with a significant interaction between sex, age, and $I(1)$, $\chi^2(1, N = 94) = 6.14$, $p = .01$. When the nonsignificant three-way interactions were removed, the model including a three-way interaction between sex, age, and $I(1)$ was still significantly different from the intercept, LRT, $\chi^2(15, N = 94) = 36.11$, $p = .002$, with a significant three-way interaction between these three factors, $\chi^2(1, N = 94) = 4.34$, $p = .04$. In effect, male children that were younger and with a lower $I(1)$ following the PSL task were more likely to choose their team in the ST. We also found a main effect of condition, $\chi^2(2, N = 94) = 11.96$, $p = .003$. This main effect resulted mainly from the fact that children in the control condition chose a different team from the team they had been assigned to, compared to children wearing cloaks, who significantly chose more often this team (Figure 3). Children in the congruent and incongruent conditions, however, did not differ, $\chi^2(1, N = 94) = 0.61$, $p = .44$, calculated in the model without interactions.

MSL Task

Only the model including two-way interactions between condition and sex, and condition and age differed significantly from the intercept model, LRT, $\chi^2(9, N = 92) = 17.86$, $p = .04$, Table 1. Although none of the interactions were significant, we found a main effect of $I(2)$, $\chi^2(1, N = 92) = 8.15$, $p = .004$, but no effect of age, sex, or condition (see Data S4a). That is, the higher their $I(2)$, the more likely children were to learn from their team (Figure 4).

MSL–Overimitation

The model with all three-way interactions was significantly different from the intercept models, LRT, $\chi^2(36, N = 92) = 76.45$, $p < .001$. When we removed the nonsignificant three-way interactions, the final model was still significantly different from the intercept, LRT, $\chi^2(26, N = 92) = 65.54$, $p < .001$ (Table 2), with significant three-way interactions between sex, condition, and team overimitation, $\chi^2(2, N = 92) = 17.07$, $p < .001$, condition, team overimitation, and Age, $\chi^2(2, N = 92) = 19.38$, $p < .001$, and team overimitation, $I(2)$, and condition, $\chi^2(2, N = 92) = 7.23$, $p = .03$.

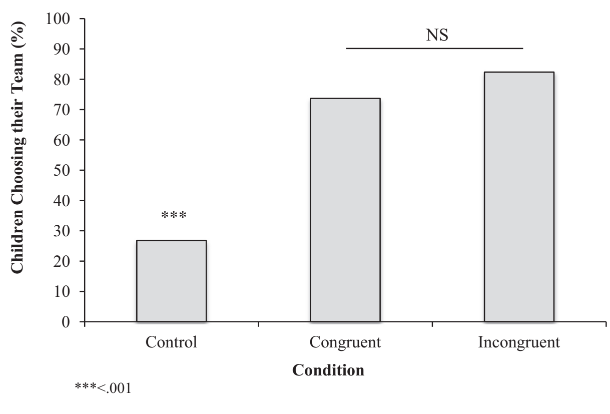

Figure 3. Percentage of children choosing their team as a function of condition in the similarity task.

Table 1
Comparison of the Effects of the Main Factors When Using I(1) *or* I(2) *as Predictors for the Results in the Mandatory Social Learning Task*

	Model with $I(2)$ only			Model with $I(1)$ only			Model with $I(1)$ and $I(2)$		
	Wald χ^2	*df*	*p*	Wald χ^2	*df*	*p*	Wald χ^2	*df*	*p*
Condition × Age	4.69	2	.10	4.89	2	.09	3.95	2	.14
Sex × Condition	3.54	2	.17	3.78	2	.15	3.30	2	.19
Age	2.04	1	.15	2.09	1	.15	1.93	1	.17
Sex	0.72	1	.40	0.79	1	.37	0.72	1	.40
Condition	2.21	2	.33	3.04	2	.22	1.29	2	.53
$I(1)$	n.a.	n.a.	n.a.	5.50	1	.02	0.40	1	.53
$I(2)$	8.15	1	**.004**	n.a.	n.a.	n.a.	3.49	1	*.06*
Likelihood ratio χ^2	17.86	9	**.04**	14.66	9	.10	18.26	10	*.051*
AICc	125.24			128.44			127.42		

Note. Bold indicates significant *p* value. AICc = corrected Akaike's information criterion.

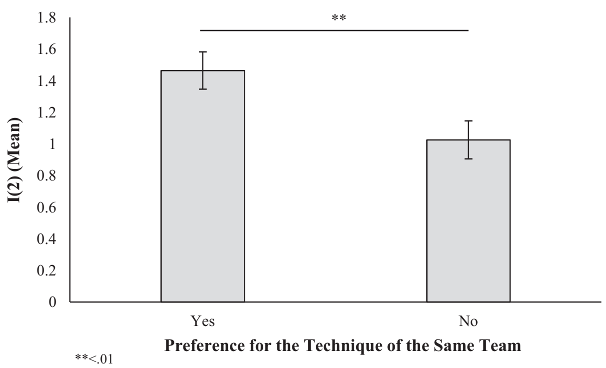

Figure 4. Preference for the technique of the same team as a function of $I(2)$ in the mandatory social learning task, with standard error of the mean (*SEM*).

The first three-way interaction suggested that females in all conditions were more likely to overimitate if their team displayed a useless action: control condition, $\chi^2(1, N = 92) = 6.29$, $p = .01$; incongruent condition, $\chi^2(1, N = 92) = 4.43$, $p = .04$; and congruent condition, $\chi^2(1, N = 92) = 5.86$, $p = .02$. In contrast, there were less clear effects for male subjects, who only engaged more in overimitation if their assigned team displayed a meaningless action in the control condition, $\chi^2(1, N = 92) = 5.07$, $p = .02$, but also when the other team displayed a meaningless action in the congruent condition, $\chi^2(1, N = 92) = 6.65$, $p = .01$. The second three-way interaction suggested that subjects in the congruent condition were less likely to overimitate with age when the other team was displaying the meaningless action, $\chi^2(1, N = 92) = 15.59$, $p < .001$, with a trend toward more overimitation with age when their team was displaying the meaningless action, $\chi^2(1, N = 92) = 3.43$, $p = .06$. In the incongruent condition, subjects were less likely to overimitate with age when their team had displayed the meaningless action, $\chi^2(1, N = 92) = 6.64$, $p = .01$. Finally, the third three-way interaction reflected the fact that participants in the control condition were more likely to overimitate when their associated team was displaying a meaningless action and that their index of identification to the team was higher, $\chi^2(1, N = 92) = 14.62$, $p < .001$.

Trust Task

Some of the models with three-way interactions, and respectively, two-way interactions, were significantly different from the intercept models (see Data S6a), but as no interaction was significant in any of these models, we removed all interactions from the model. This final model was significantly different from the intercept model only, LRT, $\chi^2(5, N = 92) = 19.89$, $p = .001$ (Table 3). We found a main effect of condition, $\chi^2(2, N = 92) = 10.99$, $p = .004$ (Figure 5A), and a main effect of $I(3)$, $\chi^2(1, N = 92) = 4.96$, $p = .03$ (Figure 5B), but no effect of age, $\chi^2(1, N = 92) = 1.89$, $p = .17$, or sex, $\chi^2(1, N = 92) = 3.01$, $p = .08$. The more a child identified with her team, that is, the higher the $I(3)$, the more she was likely to trust her teammate. As in the ST, the main effect found for condition resulted mainly from the fact that children in the control condition chose a team at random, compared to children who had chosen a team, who significantly chose more often their team. However, as in the ST, children in the congruent and incongruent conditions did not differ, $\chi^2(1, N = 92) = 0.20$, $p = .66$.

Table 2
Comparison of the Effects of the Main Factors When Using I*(1) or* I*(2) as Predictors for Overimitation*

	Model with $I(2)$ only			Model with $I(1)$ only			Model with $I(1)$ and $I(2)$		
	Wald χ^2	*df*	*p*	Wald χ^2	*df*	*p*	Wald χ^2	*df*	*p*
Sex × Condition × Overimitation	17.07	2	**< .001**	12.31	2	**.002**	39.64	2	n.a.
Condition × Overimitation × Age	19.38	2	**< .001**	17.28	2	**< .001**	14.34	2	n.a.
Condition × Overimitation × $I(1)$	n.a.	n.a.	n.a.	1.73	2	.42	15.78	1	n.a.
Condition × Overimitation × $I(2)$	7.23	2	**.03**	n.a.	n.a.	n.a.	19.35	1	n.a.
Sex × Age × $I(1)$ × $I(2)$	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	4.02	1	**< .05**
Likelihood ratio χ^2	65.54	26	**< .001**	60.47	26	**< .001**	139.03	56	**< .001**
AICc	421.65			426.72			589.78		

Note. Bold indicates significant *p* value. AICc = corrected Akaike's information criterion.

Table 3
Comparison of the Effects of the Main Factors When Using I*(1) or* I*(3) as Predictors for the Results in the Trust Task*

	Model with $I(3)$ only			Model with $I(1)$ only			Model with $I(1)$ and $I(3)$		
	Wald χ^2	*df*	*p*	Wald χ^2	*df*	*p*	Wald χ^2	*df*	*p*
Sex	3.01	1	.08	2.54	1	.11	2.27	1	.13
Age	1.89	1	.17	2.29	1	.13	1.85	1	.17
Condition	10.99	2	**.004**	11.88	2	**.003**	10.32	2	**.006**
$I(1)$	n.a.	n.a.	n.a.	2.97	1	.09	0.06	1	.81
$I(3)$	4.96	1	**.03**	n.a.	n.a.	n.a.	2.93	1	.09
Sex × $I(1)$	n.a.	n.a.	n.a.	n.a.	n.a.	n.a.	4.39	1	**.04**
Likelihood ratio χ^2	19.89	5	**.001**	17.50	5	**.004**	24.59	7	**.001**
AICc	110.67			113.07			110.72		

Note. Bold indicates significant *p* value. AICc = corrected Akaike's information criterion.

Relevancy of the $I(x)$ Index

In a final analysis, we tested the predicting power of a dynamic $I(x)$ compared to a static version of $I(x)$ by rerunning our models for each task, using both the dynamic $I(n - 1)$ value corresponding to the *n* task and a static value for $I(x)$ as determined in the first calculation of this index of identification. In other words, we reran the MSL task and overimitation models with both $I(1)$ and $I(2)$ (Tables 1 and 2), and the TT model with $I(1)$ and $I(3)$ (Table 3). We also ran our models replacing the dynamic $I(n - 1)$ value by the static $I(1)$ value to assess its predictive power (see Data S4c, S5c, and S6c).

When using both values, the MSL model was still marginally significantly different from the intercept model only ($p = .051$; Table 1), but no factor was significant with only a trend for $I(2)$—$p = .06$. In contrast, the model with $I(1)$ only was not significantly different from the intercept (Table 1).

Regarding overimitation, including $I(1)$ in the model led to a four-way interaction, which resulted mainly from a higher number of female participants having low $I(1)$ and $I(2)$ values engaging in more overimitation (Table 2) but could not help decipher between the contributions of $I(1)$ and $I(2)$. Nevertheless, similar to the MSL results, using $I(1)$ instead of $I(2)$ led to the loss of predictive power of the $I(x)$ index (Table 2).

Finally, for the TT, an interaction between $I(1)$ and sex appeared ($p = .04$), which hindered the predictive power of $I(3)$. This interaction, replicating the sex effect previously found in the ST, resulted from the significant differences observed for $I(1)$ values across conditions (independent samples Kruskal–Wallis test, $N = 94$, $H = 13.88$, $p = .001$), compared to nonsignificant differences between $I(2)$, $I(3)$, and $I(4)$ values across conditions, $I(2)$: $N = 94$, $H = 2.29$, $p = .32$; $I(3)$: $N = 94$, $H = 0.48$, $p = .79$; and $I(4)$: $N = 94$, $H = 0.02$, $p = .99$ (Figure 6). However, there was no significant effect of $I(x)$ when $I(1)$ replaced $I(3)$ (Table 3).

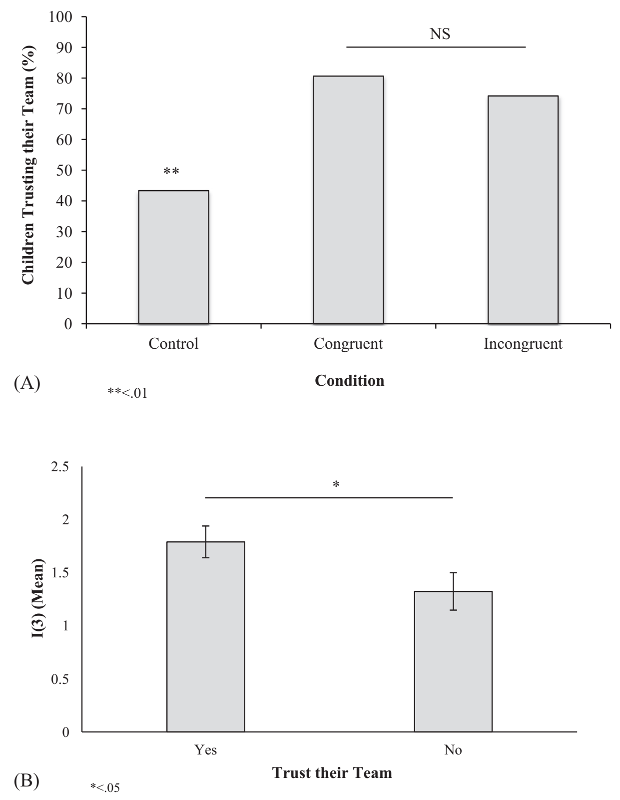

Figure 5. (A) Percentage of children trusting their own team as a function of condition in the trust task. (B) Trust toward one's own team as a function of *I*(3) in the trust task, with standard error of the mean (*SEM*).

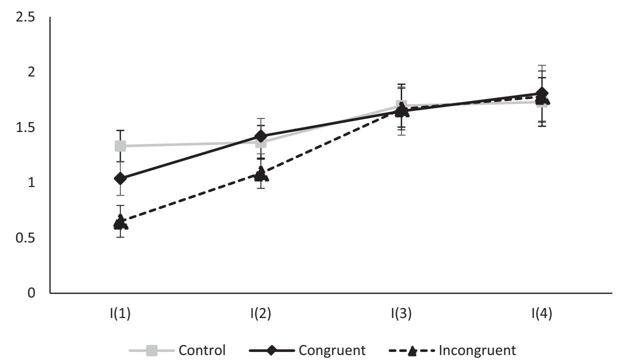

Figure 6. Variations in the *I*(*x*) values across the experimental tasks and conditions, with standard error of the mean (*SEM*).

Discussion

Our results show that social identification and social learning are influenced differently by various factors in consecutive tasks aimed at testing these abilities in developing children. Belonging to a group leads children to automatically consider themselves more similar to and trust more members of their group from a young age. Indeed, this feature was particularly influential in the similarity and TTs, as compared to control individuals without a group, confirming that simple perceptual conformity can induce the attribution of similar tastes and trust to other members of the group. When considering the effects of group membership in social learning processes our results were more mixed, particularly when the task was simple and the children had already engaged with the apparatus. Nevertheless, identification with the group was influential in both learning tasks. In addition, we found that various factors could influence whether a child would engage in overimitation or not, confirming recent evidence that children are not blind overimitators (Keupp, Behne, Zachow, Kasbohm, & Rakoczy, 2015). Finally, we showed that a dynamic index of identification introduced to take into account the succession of the tasks faced by the children predicted better their behavior in subsequent tasks than a static index. We discuss the main influences in our results in separate sections below before integrating them in our conclusion.

Group Membership

In the social identification tasks, we found a strong effect of group membership: In both the ST and the TT, children who chose a team at the beginning of the experiment felt more similar and trusted more children of their team compared to control children who did not show any preference for any of the teams. These results confirm that group membership may appear quite readily in young children and requires limited reinforcement (Dunham, Baron, & Carey, 2011; Oostenbroek & Over, 2015). This is in line with the idea that humans must continuously build novel associations in their life with little information and interaction with these individuals (Brewer, 2008; Cook, 2001; Kramer, 1999; Yamagishi & Yamagishi, 1994; Yuki et al., 2005).

Interestingly, we did not find major differences between the congruent and incongruent conditions in any of our tasks, particularly in the similarity and TTs. We did not formulate predictions at the beginning of the study on how children seeing their team acting similarly or differently from them would impact their behavior because it was unclear how children would react in the first place. For instance, in the case of the incongruent condition, we could have expected that (a) seeing their team behave differently from them would diminish children's similarity or trust judgments toward their team and possibly bias their learning strategies in favor of the other team, which could have appeared more similar to them after watching the first videos. But, in contrast, (b) children in this condition may also have attempted to modify their behavior toward their team in order to compensate for their initial "mistake" as compared with children in the congruent condition. In fact, neither of these two possible outcomes occurred, as the condition factor was only significant in our tasks when control was compared to the two team conditions. Generally, we did not find any effect of congruence in the similarity and TTs, and it did not appear either as a major factor in the learning tasks. This may be because either children in the incongruent setting failed to realize that they were not acting like their team, or because realizing this did not induce enough change in the PSL task, where children mostly relied on their own knowledge, to induce change in the subsequent tasks. One additional possibility is that the two factors occurred concurrently, either within or between children, both cases leading to a nonsignificant result overall. The $I(1)$ values recorded for all participants may be informative to decipher between these possibilities (Figure 6). While most children in the control condition tended to stick with their original choice after watching the first videos in the PSL tasks, resulting in a high artificial mean $I(1)$, most children in the incongruent condition changed their behavior, resulting in a low mean $I(1)$. In contrast, the two strategies were chosen equally by children from the congruent condition, possibly because of the novelty effect, resulting in an overall average mean $I(1)$. This particular variation in behavior within and between conditions may thus explain the overall lack of effect of condition in the PSL task.

Group Identification

In contrast to the two social identification tasks, the learning tasks appeared less influenced by group membership. We found no effect of group membership in the PSL and the MSL tasks, which means that children in the control condition did not significantly differ from the children belonging to a team. We found that, when equipped with previous experience on a simple task (PSL), children mostly relied on their own knowledge when asked to reengage with the same task. After watching videos of children belonging to the two teams, younger children were more likely to stick with their own knowledge, while older children were more likely to explore the second alternative. However, there was no effect of group membership in this task. Instead, older children switching their preference appear to be a possible effect of novelty, once they realized that there was a second, equally efficient solution to reach the ball. In contrast, the less flexible behavior of younger children may be more similar to the limitations seen in great apes in recognizing that there may be other options from the one they are used to (Gruber, 2016; Gruber, Zuberbühler, Clément, & van Schaik, 2015).

Nevertheless, the effect of the group may not solely be analyzed in our experiment through group membership, but also through identification to the team, a factor described by the introduction of the $I(x)$ parameter. Identification to the team is indeed different from group membership. One can imagine a child selecting a team at the beginning of the experiment, but not following any of her team's choice, resulting in a low group identification; or, to the contrary, a child in the control group who after watching the videos decides to identify with one particular team and following all of its choices. Therefore, the effects isolated for $I(1)$ in the PSL task and $I(2)$ in the MSL task can also result from a group effect that we would thus define as *group identification* rather than *group membership*. As group membership can have an effect on task completion (e.g., Chen et al., 2013), it is likely that group identification can do so too. It is thus possible that the tested children followed what they considered to be "their" team in the MSL task (the original team for participants in the congruent and incongruent conditions, the attributed team for the control condition).

Interestingly, group identification already had an impact in the PSL task, as $I(1)$ values were on average higher than $I(0)$, suggesting that children tended to perform more the technique displayed by their team. This effect was even more pronounced in the strict social learning task (MSL), where the strength of identification to the team was the most important factor. The more the participants had identified with their team in previous tasks, the more they learned the technique displayed by this team. In both social learning tasks, this effect was present for both children who had chosen a team at the beginning of the experiment, and for children who were automatically given a team following their technique choice after watching the videos in the first task. This result is in line with the idea that group identification can develop throughout the tasks, particularly in the case of the control group (for which the technique preference after watching the video determined the team), but also for the incongruent group, whose $I(x)$ significantly rose across tasks to reach the level of the congruent and control groups (Figure 6). Illustrating this, we found that our index of team identification changed throughout the tasks and that higher team identification indexes had significant effects on the later tasks both in the identification and learning domains (MSL and TT), as well as on overimitation. In sum, our results show that group identification changed throughout the experiment and may have strengthened ties with the team. They also suggest that group identification can be improved by multiple tasks.

Finally, it is worth nothing that the group identification effect appeared in both the PSL and MSL tasks despite the fact that the two tasks aimed to test different aspects of learning. In the PSL task, we were interested in the effect of prior knowledge, while in the MSL task, we were interested in observational learning only. As a consequence, the two tasks were noticeably different. In the PSL task, children were allowed and encouraged to develop their own preference before watching what their team was doing. Additionally, the problem was possibly easier to solve in the PSL task than in the subsequent MSL task, requiring only two steps to be completed compared to three actions in the MSL task. Children are known to adopt different learning strategies depending on the difficulty of the task they are faced with (Bauer & Kleinknecht, 2002). However, we did not specifically test for this parameter in the experimental design as the children did not have the opportunity to engage with Box 2 prior to watching the videos as in the PSL task. Future work should thus investigate in parallel whether task difficulty and group identification have a joint effect on learning solutions in complex tasks.

Overimitation

Results in the overimitation analysis support the idea that children paid attention to the actions of the models but were influenced by a variety of factors, leading to several significant three-way interactions. Regarding group membership, the control, congruent, and incongruent conditions had noticeably variable effects on the propensity of children to overimitate in the MSL task. While our results were mixed with respect to sex (with most significant effects in females), they suggest that girls were more likely to overimitate in all conditions if their team had displayed a useless behavior, suggesting a possible readjustment as compared with the first task to appear more similar to their team. Why this effect only applies to girls is unclear, although girls have been shown to conform more to their peers than boys (Haun & Tomasello, 2011). Nevertheless, this result suggests that using boys as models in our demonstration videos did not put girl participants at disadvantage compared to boys. Boys showed a similar effect as girls in the control condition, and were more likely to overimitate their assigned team if this team displayed a meaningless action. Additionally, in the ST, we found that boys were more likely to choose their team when displaying a lower $I(1)$. This lower $I(1)$ resulted from the fact that boys in the congruent and incongruent conditions acted differently from their team in the PSL task. Thus, these results could also be interpreted as a compensation mechanism that may be present in both sexes. Age also had an influence on overimitation (Nielsen & Tomaselli, 2010), with older children in the congruent condition less likely to overimitate if the other team displayed a meaningless action, with a trend to overimitate if their own team did so. However, in the incongruent condition, older subjects were less likely to overimitate when their team displayed the meaningless action. This result may thus support explanation (1) outlined above, with children less inclined to 13
learn from their team. Finally, overimitation was also influenced by the identification that occurred for children with their team in the control condition, thus illustrating the possible interaction between group membership and group identification: The more children associated with the team they had sided with during the first task, the more they were likely to overimitate if this team displayed the meaningless action. In sum, our results support not only a connection between overimitation and group membership (Haun & Over, 2013), but also the idea that children take contextual cues into account when overimitating, and thus do not overimitate blindly (e.g., Keupp et al., 2015). In addition, aside from boys in the congruent condition, the lack of overimitation of out-group members' meaningless action supports the view that children may distrust out-group members (Aboud, 2003; Buttelmann & Bohm, 2014; Oostenbroek & Over, 2015). Nevertheless, because our results on overimitation were influenced by a large number of factors, there is a need for a more direct assessment of the effect of group membership, group identification, sex, and age on overimitation to precisely decipher the contributions of each factor to the phenomenon.

Conclusion

Our findings show that belonging to a group has a differential impact on social identification and social learning tasks, suggesting that different tasks may trigger different cognitive mechanisms. Similarity and trust judgments appear directly influenced by group membership. In contrast, social learning processes as well as overimitation, while influenced by group identification and group membership, appear influenced by other factors such as age, individual experience, or the difficulty of the task. Interestingly, a major endeavor of group membership and group identification is to transmit knowledge, the basis of cultural behavior. As such it will be interesting to elucidate in the future how group membership and identification, beyond trust and similarity, can have an influence on learning processes. It is possible that a longer reinforcement of the two mechanisms, underlined by the constant strengthening of our index of team identification during the experiment, may be necessary for learning to rely on the group and to eventually lead to the spread of cultural knowledge. To track group identification, we have introduced a novel index of identification labeled $I(x)$, which takes into account the fact that children are constantly confronted to new tasks and problems in their environment. This index thus models that decisions taken by children with respect to their group in previous interactions may have consequences on their subsequent choices. Future work should focus on how to integrate the history that a child builds within her own group to better understand her subsequent choices in the social world.

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