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Raisonnement et Argumentation : une approche interculturelle et développementale

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RAISONNEMENT ET ARGUMENTATION :

UNE APPROCHE INTERCULTURELLE ET DEVELOPPEMENTALE



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RAISONNEMENT ET ARGUMENTATION: UNE APPROCHE INTERCULTURELLE ET DEVELOPPEMENTALE

RESUME

Dans le domaine des sciences cognitives, la plupart des études sur la communication humaine se sont intéressées à la manière dont on comprend la communication et non pas à la manière dont on l'évalue. D'après le cadre théorique de la *vigilance épistémique* (Sperber et al., 2010) les êtres humains disposent d'un ensemble de mécanismes dédiés à l'évaluation des messages qui servent à se protéger d'informations potentiellement trompeuses et qui permettent de communiquer de manière fluide et relativement honnête. Selon cette perspective, le raisonnement aurait évolué pour permettre une discrimination plus fine des messages. La principale fonction du raisonnement serait *argumentative* : il s'agirait de trouver des arguments pour convaincre les autres et d'évaluer les arguments d'autrui afin d'acquérir des croyances plus solides (Mercier & Sperber, 2011).

Si le raisonnement est le résultat d'une adaptation, ces compétences devraient être relativement universelles et on ne devrait pas avoir à les enseigner. L'universalité et le développement précoce de ces compétences permettraient donc de montrer qu'elles ne reposent pas sur un apprentissage culturel spécifique. Cependant, la plupart des études sur le raisonnement et l'argumentation chez les adultes comme chez les enfants, et par conséquent les principaux résultats qui soutiennent la *théorie argumentative du raisonnement*, se limitent à un échantillon restreint des sociétés humaines : les cultures occidentales. Ainsi, on pourrait penser que ces caractéristiques du raisonnement sont davantage l'expression de facteurs culturels plutôt que des traits universaux. Ce travail de thèse s'intéresse à cette question en déployant une approche interculturelle (en comparant les sociétés occidentales, orientales et traditionnelles) et développementale. Les cultures traditionnelles et orientales diffèrent des cultures occidentales sur divers aspects - tels que la tradition philosophique, le style parental ou l'accès à l'éducation formelle - qui sont particulièrement pertinents pour tester ces prédictions adaptatives.

Le rôle de la discussion a souvent été sous-estimé dans le domaine du raisonnement, à l'exception de certaines études développementales très influentes (Doise & Mugny, 1984; Perret-Clermont, 1980). En coupant le raisonnement de son contexte argumentatif, les psychologues du raisonnement l'ont privé de l'une de ses forces : l'échange d'arguments avec les autres. Dans une première étude, nous avons montré que dans une population traditionnelle – les Mayas indigènes du Guatemala – la discussion en groupe amène à de meilleures performances que le raisonnement individuel. De tels résultats avaient déjà été rapportés pour des populations occidentales et orientales. Deux caractéristiques du raisonnement peuvent expliquer ces résultats : le *biais vers son côté*, qui empêche les individus d'améliorer leurs performances individuelles, et *l'habilité à évaluer* les arguments des autres, qui permettent aux individus de bénéficier des discussions de groupes (Article 1). Dans trois études

exploratoires, nous avons apporté des preuves que le bénéfice de l'argumentation peut aussi s'étendre au raisonnement moral. La première étude confirme que les arguments peuvent faire changer les individus d'avis même dans des jugements moraux impliquant une forte charge émotionnelle. En revanche, les seconde et troisième études n'ont pas permis de révéler des effets notables de la discussion sur les jugements moraux (Chapitre 2).

Avant l'âge de trois ans, les enfants échangent des arguments avec leurs parents et leurs frères et sœurs. Cependant, aucune expérience n'a montré que les enfants de cet âge sont sensibles à la qualité des arguments. Dans une première étude, nous fournissons des preuves expérimentales que les enfants de deux ans sont sensibles à la force des arguments (Article 3). Toutefois, le développement de ces compétences pourrait être favorisé par le contexte culturel particulier dans lequel ces enfants sont immergés : familles occidentales de classe moyenne et supérieure. Aucune étude expérimentale n'a été effectuée sur des populations provenant des sociétés traditionnelles et orientales. Dans une série d'expériences, nous avons tout d'abord mis en évidence que les enfants mayas (Article 4) et japonais (Article 7), tout comme les enfants occidentaux, sont capables de discriminer les arguments forts (perceptifs) des arguments faibles (circulaires). Nous avons également observé que les enfants mayas (Article 4) et occidentaux (Article 5) suivent le témoignage du personnage dominant plutôt que celui du subordonné alors que les participants japonais favorisent le témoignage du subordonné (Article 8). De plus, lorsque les indices de pouvoir et de raison entrent en contradiction –c'est-à-dire lorsque le dominant donne un argument faible alors que le subordonné donne un argument fort– la raison prend le dessus sur le pouvoir, tout du moins pour les enfants mayas (Article 4). De nouvelles recherches sont nécessaires pour mieux comprendre la manière dont ces deux indices interagissent (Résultats complémentaires 6).

Ces résultats, mis en perspectives avec ceux rassemblés dans le cadre de la théorie argumentative du raisonnement renforcent l'hypothèse selon laquelle les caractéristiques du raisonnement sont adaptatives et que la principale fonction du raisonnement est argumentative (Mercier & Sperber, 2011, in press; Mercier, 2016). Elles seraient adaptatives dans le sens où elles permettent au raisonnement de remplir sa fonction principale : l'argumentation ; qui en retour, améliore et facilite la communication humaine. Cette théorie est en adéquation avec tout un courant de recherche qui souligne l'importance de l'argumentation et de l'échange de raisons dans la cognition humaine (Tomasello, 2014) et soutient l'importance de la fonction sociale de la cognition de haut niveau dans l'évolution humaine (Dunbar & Shultz, 2003; Tomasello et al., 2005).

Mots-clés : Argumentation, Raisonnement, Interculturel, Développement précoce, Universaux, Sociétés traditionnelles, Cultures orientales.

REASONING AND ARGUMENTATION: A CROSS-CULTURAL AND DEVELOPMENTAL APPROACH

ABSTRACT

Within cognitive science, most studies of communication have focused on how we understand communication and not on how we evaluate it. According to the *epistemic vigilance* framework (Sperber et al., 2011) a set of mechanisms would be devoted to evaluating other people's messages to protect us from potentially misleading information, allowing communication to work smoothly and to remain mostly honest. In this framework, reasoning would have evolved to allow for a finer grained discrimination of messages. The main function of reasoning would be *argumentative*: to find reasons in order to convince others, and to evaluate others' reasons in order to adopt better supported beliefs (Mercier & Sperber, 2011).

If reasoning is an evolved adaptation, these skills should be relatively universal and they should not have to be taught. Universality and early development is suggestive of skills that do not rest on specific cultural learning. However, most of the studies on reasoning and argumentation, either with adults or children, and consequently the main results supporting the argumentative theory of reasoning, are limited to a small range of human societies: Western cultures. One can argue that the features of reasoning might be the expression of specific cultural factors rather than universals traits. The present thesis addresses this question by deploying a cross-cultural (comparing Western, Eastern, and traditional societies) and a developmental approach. Traditional and Eastern cultures differ from Western cultures in dimensions such as philosophical tradition, parenting styles, or access to formal education that are particularly relevant to test these adaptive predictions.

The role of discussion has been often underestimated in the field of reasoning, with the exception of some influential developmental research (Doise & Mugny, 1984; Perret-Clermont, 1980). Cutting reasoning from its argumentative contexts, psychologists of reasoning deprived it from one of its strength, the exchange of arguments with others. In a first study we showed that, as reported in Western and Eastern populations, group discussion yields better performance than individual reasoning in a traditional population – indigenous Maya from Guatemala. Two features of reasoning can account for this improvement: the *myside bias*, which precludes individuals from improving their performance on their own, and the *ability to soundly evaluate* others' arguments, which allows individuals to benefit from group discussions (Article 1). In three exploratory studies we brought some evidence that the benefit of argumentation could be extended to moral judgments. The first one confirms that arguments can make people change their mind even on some emotionally charged moral judgments. By contrast, the second and the third ones failed to reveal consistent effects of discussion on moral judgments (Chapter 2).

Before the age of three, children exchange arguments with their parents and siblings, but no experiment has demonstrated that they are sensitive to argument quality. In a first study we provide experimental evidence that 2-year-olds are sensitive to argument strength (Article 3). However, these skills might have been fostered by the particular cultural context of Western middle- and upper-class families, to which most children studied belong. No experimental data had been gathered in Eastern or traditional societies. A series of experiments first revealed that, as reported in Western culture, Mayan (Article 4) and Japanese (Article 7) children can discriminate between a strong (perceptual) argument and a weak (circular) argument. Second, Mayan (Article 4) and Western (Article 5) children are shown to follow the testimony of a dominant over that of a subordinate while Japanese participants favor the testimony of the subordinate (Article 8). Third, when the power and reasoning cues conflict – that is, when the dominant offers a weak argument and the subordinate a strong one – reasoning trumps power at least among Maya children (Article 4). Further research is needed to better understand how these two cues interact (Complementary results 6).

Together with previous evidence, the present findings strengthen the conclusion that the features of reasoning described by the argumentative theory of reasoning are adaptive and that the main function of reasoning is argumentative (Mercier & Sperber, 2011, in press; Mercier, 2016). They would be adaptive because they enable reasoning to fulfill its main function, argumentation, which in turns greatly facilitates human communication. This theory fits well with a trend to stress the importance of argumentation and the exchange of reasons in human cognition (Tomasello, 2014) and the social function of high order cognition in human evolution (Dunbar & Shultz, 2003; Tomasello et al., 2005).

Keywords: Argumentation, Reasoning, Cross-cultural, Early development, Universals, Traditional societies, Eastern cultures

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À Vernay, le 11 novembre 2016.

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Introduction

> *Nous sommes comme des nains juchés sur des épaules de géants, de telle sorte que nous puissions voir plus de choses et de plus éloignées que n'en voyaient ces derniers. Et cela, non point parce que notre vue serait puissante ou notre taille avantageuse, mais parce que nous sommes portés et exhaussés par la haute stature des géants.*
>
> *Citation attribuée à Bertrand de Chartres, livre III du Metalogicon de Jean de Salisbury.*

Selon l'interprétation la plus répandue de cette citation, rendue célèbre par Isaac Newton, il s'agissait pour Bertrand de Chartres de rendre hommage à ses prédécesseurs et de reconnaître la dimension cumulative du savoir. Au delà du clin d'œil à mes directeurs, mes collaborateurs et ceux qui ont inspiré cette recherche et sans en extraire l'essence, j'aimerais en proposer une interprétation plus personnelle qui me permettra d'introduire les fondements du travail dont traite cette dissertation.

C'est sur la dimension sociale et interactive de la construction des savoirs que je souhaiterais porter l'attention du lecteur. Cette dimension a parfois été reléguée au second plan, voir complètement omise, des théories psychologiques qui traitent du raisonnement (à l'exception des théories développementales) et de sa fonction dans l'évolution humaine.

Par ailleurs, à l'instar des nains juchés sur les épaules de géants, les enfants sont en quelque sorte juchés sur les épaules des adultes. C'est en partie au travers des échanges avec ces derniers qu'ils découvrent et appréhendent le monde physique et social dans lequel ils sont immergés. Bien que parfois considérés comme crédules, ils s'avèrent être vigilants face aux informations qui leurs sont transmises et à leur sources, y compris aux arguments qui soutiennent ces informations.

De même, la plupart des connaissances ou croyances que nous pouvons acquérir au cours de notre vie proviennent de sources extérieures et se construisent en interaction avec les autres. Souvent conceptualisé comme une activité solitaire, le raisonnement se comprend mieux lorsque l'on considère sa dimension sociale et argumentative. C'est au travers de l'échange d'arguments (ou de raisons) que se déploient ses caractéristiques

qui révèlent son caractère adaptatif. Mais ces échanges ne peuvent se comprendre qu'à la lumière de l'évolution de la communication humaine qui nous distingue des autres primates et constitue un élément clé de cette dimension sociale.

L'argumentation est au cœur de la communication humaine, qu'elle se déroule dans le tumulte de la vie tokyoïte, dans la forêt amazonienne, au cœur de la savane africaine. Nous sommes régulièrement engagés dans des activités argumentatives, en train de produire et d'évaluer des raisons, que ce soit pour décider dans quel restaurant aller dîner, décider dans quelle école inscrire les enfants ou encore prendre une décision pour faire face à la sécheresse qui risque de compromettre la récolte de maïs. Produire et évaluer des arguments implique de déployer ses facultés de raisonnement. Bien que les contextes culturels et sociaux et les situations (solitaire ou dialogue) dans lesquels le raisonnement se déploie puissent varier, les mécanismes qui le sous-tendent et qui révèlent sa *fonction argumentative* n'en restent pas moins identiques et c'est ce que je tenterai de discuter tout au long de ce manuscrit.

Dans la première partie de cette dissertation, je présenterai le cadre théorique dans lequel s'inscrit ce travail de recherche et qui permet de rendre compte du lien entre l'argumentation et le raisonnement. Porté par une approche évolutionniste, ce cadre théorique permet de redéfinir la fonction du raisonnement et de concilier les données souvent contradictoires issues de la psychologie du raisonnement. Sera défendue en particulier la thèse que la fonction du raisonnement est argumentative. La seconde partie sera consacrée à la présentation de l'approche qui sera déployée dans cette recherche. Il s'agira de montrer en quoi l'approche interculturelle et développementale se révèle adéquate pour tester les hypothèses adaptatives qui découlent du cadre théorique dans lequel s'inscrit cette thèse. Dans une troisième partie, je présenterai les travaux expérimentaux qui visent à tester ces hypothèses et qui ont été menés auprès d'adultes et d'enfants issus de trois réalités socioculturelles disctinctes (sociétés traditionnelles, culture occidentale et culture orientale). Enfin, la dernière partie de cette dissertation sera dédiée à la discussion des résultats obtenus, de leurs conséquences théoriques et des perspectives soulevées par cette recherche.

1 Raisonnement et argumentation

Si les psychologues du raisonnement ont parfois ignoré, dans leurs approches théoriques, la dimension sociale qui caractérise les activités humaines, ce n'est pas le cas des psychologues du développement qui sous l'influence de Jean Piaget et Lev Vigotsky ont mis l'accent très tôt sur l'importance de l'environnement social et culturel dans le développement et l'apprentissage des enfants.

La dimension sociale est déjà présente dans l'approche théorique développée par Piaget (1959, 1976), en particulier la capacité à prendre en compte la perspective de l'autre qui agirait comme un levier pour le développement des compétences de raisonnement formel (Piaget, 1977). Le conflit généré par des perspectives différentes (entre deux individus) favoriserait l'apprentissage et des changements cognitifs au niveau de l'individu.

C'est d'ailleurs l'importance de la discussion qui a occupé une partie significative des travaux réalisés par ses successeurs. Ces derniers soulignent que le conflit scocio-cognitif est bénéfique et favorise le développement cognitif (Ames & Murray, 1982; Doise & Mugny, 1984; Perret-Clermont, 1980). Une tâche classiquement utilisée pour mettre en évidence l'effet du conflit socio-cognitif est la tâche de conservation des liquides. Les résultats montrent qu'une majorité des participants non-conservants le deviennent après avoir résolu le problème avec un pair conservant (Murray, 1982) et cette amélioration ne semble pas reposer sur la simple imitation du partenaire conservant (Perret-Clermont, 1980).

Pour certains auteurs issus de la tradition piagetienne, le moteur du développement se trouve dans le conflit généré par des perspectives différentes (Ames & Murray, 1982; Murray, 1982) alors que d'autres insistent sur la coordination sociale des points de vues pour que le développement cognitif se fasse de manière satisfaisante (Doise & Mugny, 1984). D'autres postulent que la coopération mutuelle est plus efficace que le conflit en tant que tel (Bearison, 1986; Glachan & Light, 1982; Perret-Clermont, Carugati, & Oates, 2004). Enfin, certains chercheurs soulignent l'importance des compétences des partenaires (du modèle plus compétent) comme un aspect crucial des possibles changements cognitifs qui peuvent s'opérer au sein des individus (Ellis &

Rogoff, 1982). Bien que les raisons qui expliquent les améliorations des performances en groupes soient encore l'objet de débats théoriques, les travaux qui viennent d'être mentionnés montrent les bénéfices de la discussion dans la résolution de problèmes.

De manière complémentaire, l'approche développée par Vygotsky (1978) permet de rendre compte de l'influence des facteurs culturels sur le développement des enfants. Selon cette approche, les constructions sociales (institutions, technologies, outils) orientent la nature et les types des interactions interpersonnelles, qui en retour agissent comme des médiateurs des fonctions cognitives de haut niveau (Vygotsky, 1978). La signification des mots, les actions médiées par des objets et les actions dirigées vers des buts se développent dans des contextes sociaux particuliers et relient l'individu au monde social auquel il appartient (Tudge & Winterhoff, 1993).

Une partie des travaux issus de cette tradition s'est portée sur les situations d'interactions enfant-adulte en mettant l'accent sur leurs processus plutôt que sur leurs résultats (Wertsch, 1985). Par exemple certains chercheurs se sont penchés sur la manière dont les mères et les enfants parviennent à la solution de tâches conjointes et ont montré que celle-ci varie en fonction de facteurs socioculturels et de l'étendue de l'assistance directe ou indirecte que les mères déploient vis-à-vis de leurs enfants (Wertsch, Minick, & Arns, 1984; Wertsch & Sammarco, 1985; Fidalgo & Pereira, 2005).

D'autres recherches montrent que l'exposition au langage et son mode d'acquisition peuvent varier d'une culture à l'autre. Par exemple, les enfants américains dans leur première année de vie sont davantage sollicités verbalement que les enfants mayas qui reçoivent la majeure partie de leur exposition au langage de manière indirecte (en écoutant les adultes discuter entre eux) (Shneidman & Goldin-Meadow, 2012). Certaines différences culturelles et sociales sont donc susceptibles d'avoir un impact précoce sur le développement cognitif des enfants.

De ces travaux on peut tirer un premier constat concernant l'argumentation : la discussion peut être un moteur de l'apprentissage cognitif ; des différences culturelles sont susceptibles d'avoir un impact sur le développement ou l'expression des

compétences argumentatives. Bien que ces deux traditions théoriques soulignent l'importance des dimensions sociales et culturelles dans l'étude de la cognition humaine, elles ne nous éclairent pas directement sur la question de la fonction (au sens évolutionniste) du raisonnement, question que j'aborderai maintenant.

1.1 La fonction du raisonnement humain

Bien qu'elle soit au cœur de nos communications, de nos activités quotidiennes et de nos échanges sociaux, l'argumentation a été quelque peu oubliée par la psychologie cognitive, en particulier par la psychologie du raisonnement. Néanmoins, de nombreux auteurs soulignent le rôle central de l'argumentation dans la communication (Ducrot & Anscombre, 1983), la cognition humaine (Billig, 1996; Dessalles, 2007; Kuhn, 1992) et le raisonnement moral (Gibbard, 1990; Haidt & Bjorklund, 2007). Ce n'est que très récemment que des tentatives d'intégration et de rapprochement ont émergé entre les chercheurs du raisonnement et les spécialistes de l'argumentation (Hahn & Oaksford, 2007; Hornikx & Hahn, 2012).

L'explication de cette dissociation de l'étude du raisonnement d'une part et celle de l'argumentation d'autre part résulte d'une longue tradition qui remonte au moins à Descartes (1637) et de la définition même du raisonnement qui en découle. Sur la base d'une distinction fondamentale entre les intuitions et les raisons, certaines théories récentes du raisonnement se sont construites autour d'un modèle à deux systèmes distincts. Même si elles ne font pas l'unanimité (Keren & Schul, 2009; Kruglanski & Gigerenzer, 2011; Mercier & Sperber, 2011), ces théories « à processus duels » ont largement dominé la psychologie du raisonnement ces dernières années (pour les adultes, voir Evans, 2008; pour le développement, voir Gauffroy & Barrouillet, 2009; Klaczynski, 2009; Reyna & Brainerd, 1995). Bien que ces théories divergent, entre autres, sur l'articulation des ces deux systèmes (parallèle vs sériel) ou sur la nature des représentations, elles ont en commun le fait de s'inscrire dans une perspective *individualiste* de la fonction du raisonnement (Mercier & Sperber, 2011, in press).

Selon la perspective individualiste, le raisonnement serait une activité solitaire qui permettrait à l'individu d'accéder à des croyances plus solides, générer des connaissances, et prendre de meilleures décisions, principalement grâce à la mobilisation de processus qui visent à corriger les intuitions (Evans & Over, 1996; Kahneman, 2003; Stanovich, 2004). La majorité des psychologues et philosophes partagent cette idée que la fonction principale du raisonnement est d'aider le raisonneur solitaire. Cependant, de nombreux résultats provenant d'études sur le raisonnement ou la prise de décision semblent difficiles à concilier avec une telle approche.

Tout d'abord, les intuitions se révèlent être un outil puissant de la cognition qui, dans l'ensemble, guident de manière satisfaisante la plupart de nos inférences et décisions (Mercier & Sperber, 2009; Gigerenzer, Todd, & ABC Research Group, 1999). De plus, loin de corriger nos intuitions, le raisonnement solitaire est biaisé (Evans, 2002) et se révèle « défaillant » dans de nombreuses situations (Kunda, 1990; Shafir, Simonson, & Tversky, 1993).

Le raisonnement solitaire est marqué par un fort biais de confirmation (ou *biais vers mon côté*) qui correspond à une tendance à chercher et à produire des raisons qui soutiennent nos croyances (Mercier, Bonnier & Trouche, 2016; Nickerson, 1998). En effet, quand les individus raisonnent seuls, loin de corriger leurs croyances, ils ont tendance à se polariser (Tesser, 1976) et être surconfiants (Koriat, Lichtenstein, & Fischhoff, 1980). De plus, les individus violent les règles de la logique lorsqu'ils raisonnent et ces erreurs ne sont pas dues au hasard mais sont systématiques (Shafir & LeBoeuf, 2002 ; Samuels, Stich & Fauchner, 2004). Même des étudiants universitaires se retrouvent quelque peu déroutés face à des problèmes mathématiques triviaux ou des problèmes simples de logique (Evans, 2002).

Il semble donc que dans de nombreux cas, le raisonnement fait exactement le contraire de ce qu'il est censé faire selon la perspective individualiste. Si la fonction du raisonnement est de monitorer nos propres pensées, cela serait un fort handicap (Mercier *et al.*, 2016). Ainsi, comme le soulignent Mercier et Sperber (2009), si dans l'ensemble les intuitions s'avèrent efficaces et que le raisonnement peine à corriger nos intuitions erronées, il devient difficile de soutenir une approche théorique qui définit la

fonction même du raisonnement humain comme celle de corriger les intuitions et encore moins de rendre compte de son rôle dans l'évolution de la cognition humaine.

Bien que les intuitions des psychologues puissent s'avérer correctes, le recourt à une approche évolutionniste semble plus à même de générer des hypothèses quant à la fonction du raisonnement humain (Cosmides & Tooby, 1994; Tooby & Cosmides, 1992; Mercier, 2013). Dans cette perspective, Sperber (2000, 2001) a proposé un cadre théorique qui, sur la base de l'évolution de la communication, suggère que la fonction du raisonnement est argumentative.

En opposition à la conception du raisonnement comme un outil de la cognition individuelle, il aurait évolué à des fins sociales et argumentatives (Mercier & Sperber, 2011). Selon cette perspective *interactionniste*, le raisonnement constituerait une compétence sociale dont la fonction argumentative serait plus apte à permettre aux individus d'accéder à des croyances plus solides que le raisonnement solitaire (Mercier & Sperber, 2011, in press; Mercier, 2016). La *théorie argumentative du raisonnement* postule que la fonction du raisonnement serait de produire des arguments pour convaincre les autres et évaluer les arguments des autres pour être convaincu lorsque cela est approprié (Mercier & Sperber, 2011).

L'émergence du raisonnement serait donc plutôt à chercher dans le cadre de l'évolution de la communication humaine. Le haut degré de coopération qui caractérise notre espèce implique une communication efficace. Afin de maintenir la stabilité de la communication, les êtres humains disposeraient de mécanismes de *vigilance épistémique* (Sperber *et al.*, 2010) qui leurs permettraient de filtrer les informations qui leurs sont communiquées. L'échange d'arguments rendrait la communication plus fiable et avantageuse, dans le sens où il permettrait d'améliorer la quantité et la qualité épistémique des informations échangées (Mercier & Sperber, 2011).

De récents travaux soulignent d'ailleurs l'importance de l'environnement social dans l'évolution des êtres humains et la fonction sociale de la cognition de haut niveau (Byrne & Whiten, 1988; Dunbar & Shultz, 2003; Dunbar, 1996; Tomasello, Carpenter, Call, Behne, & Moll, 2005; Whiten, 1997). Cette approche s'accorde également avec les

travaux portant sur le rôle évolutionnaire de la coopération en petits groupes (Dubreuil, 2010; Sterelny, 2012) où la communication joue un rôle essentiel.

C'est dans ce cadre théorique que s'inscrit ce travail de recherche. La suite de cette section sera dédiée à la description des mécanismes de vigilance épistémique (Sperber *et al.*, 2010), la définition de la fonction argumentative du raisonnement (Mercier & Sperber, 2011) et la caractérisation des processus de production et d'évaluation des arguments (Mercier, 2016).

1.2 Vigilance épistémique

La plupart des croyances et des connaissances que nous acquérons au cours de notre vie se font au travers de la communication et plus particulièrement des témoignages des autres. D'un point de vue évolutionniste, pour que la communication soit stable, il est nécessaire qu'elle bénéficie à la fois à l'émetteur et au récepteur Cependant, certaines des informations communiquées bien qu'en contradiction avec nos croyances peuvent constituer néanmoins des informations potentiellement utiles (Ce fruit qui ressemble à une groseille est toxique). Par ailleurs, les locuteurs peuvent avoir des niveaux de compétence et d'expertise variables selon les domaines et ils ont rarement des intérêts identiques à ceux de leurs interlocuteurs (Mercier & Sperber, 2009). Certains individus peuvent par exemple tenter de communiquer des informations erronées (qui pourraient être plus ou moins dommageables) afin d'en tirer un certain profit, tout du moins à court terme.

Il ne semble donc pas très avantageux de s'en remettre aveuglément aux témoignages des autres. Pour que la communication reste un avantage adaptatif, la confiance doit donc être calibrée. Un mécanisme de vigilance a dû évoluer en parallèle au développement de la communication afin de préserver les informations et conserver les bénéfices apportés par une telle faculté (Sperber *et al.*, 2010).

Les humains seraient dotés d'un ensemble de mécanismes de vigilance épistémique qui leurs permettraient de filtrer l'information qui leur est communiquée,

de manière à ce que les informations bénéfiques soient, en général, acceptées, et que les informations préjudiciables soient, en général, rejetées (Sperber *et al.*, 2010). Deux grandes catégories de mécanismes seraient en charge de l'évaluation de la communication : ceux ayant trait à la source et ceux ayant trait au contenu du message.

Evaluation de la source

Un premier mécanisme permettrait l'évaluation de la confiance attribuée dans la source du message (Sperber *et al.*, 2010): Est-elle fiable ? Est-elle compétente ? Un certain nombre d'indices font varier la confiance que l'on peut attribuer à un interlocuteur. La familiarité avec l'individu constitue l'un de ces indices. En effet, il est probable qu'une plus grande confiance soit accordée à un membre de sa famille qu'à un étranger dans la rue. Le niveau de compétence en est un autre. Plus de crédibilité est accordée à un médecin plutôt qu'à un garagiste lorsque le sujet porte sur une condition médicale. Et inversement si le thème de la discussion concerne le carburateur d'un véhicule.

Ce mécanisme semble se développer relativement tôt. Ces dernières années, de nombreuses recherches ont été menées pour tenter de mieux comprendre comment les enfants décident qui croire. Les travaux de ces chercheurs révèlent que les enfants, très jeunes, prennent en compte une variété de paramètres lorsqu'ils doivent évaluer les témoignages de différents informateurs (par ce terme ils signifient toute information communiquée verbalement) (Harris & Lane, 2014). Par exemple, ils choisissent dès 3 ans les sources d'information en fonction de leur familiarité (Corriveau & Harris, 2009), de leur accent maternelle (Kinzler, Corriveau, & Harris, 2011), de leur bienveillance (Mascaro & Sperber, 2009), de leurs émotions (Clément, Bernard, Grandjean, & Sander, 2013), de leur fiabilité (Corriveau & Harris, 2009; Koenig & Harris, 2005) et de leur compétence (Clément, Koenig, & Harris, 2004). De plus, dès 4 ans, les enfants sont capables de moduler la confiance qu'ils accordent à un informateur en fonction de ses témoignages passés (Harris & Lane, 2014; Koenig & Harris, 2007; pour une revue de la littérature, voir Clément, 2010; Harris, 2012).

La confiance qui est accordée dans une source n'est pas figée mais modulée par les interactions passées avec un individu, voir ses interactions avec d'autres individus ; informations qui participeront à sa réputation (Sperber & Baumard 2012). Ces informations peuvent être à la disposition des individus avec lesquels nous sommes amenés à interagir et favoriseront ou non les interactions voir la coopération avec ces derniers. Essayer de tirer profit des autres pourrait être une stratégie avantageuse. Toutefois, la structure éminemment sociale des sociétés humaines et le rôle fondamental de la coopération créent des conditions où nous entretenons des relations fréquentes avec un groupe relativement restreint d'individus. Si l'on est amené à communiquer fréquemment avec les mêmes individus, tenter de les tromper pourrait représenter un certain avantage à court terme. Cependant, dans la perspective d'une relation à long terme, cela risquerait de nuire à notre réputation et pourrait avoir des conséquences plus dommageables, comme l'arrêt des interactions (Sperber *et al.*, 2010; voir aussi Sperber & Baumard 2012). De même, tenter d'être le plus honnête possible lors des interactions avec d'autres individus peut constituer un coût à court terme mais un avantage à long terme, dans le sens où de nouveau ce type de stratégie améliore la réputation de l'individu (Sperber *et al.*, 2010).

En complément des indices liés à la source du message, pour évaluer la crédibilité des informations qui leurs sont communiquées, les humains disposeraient de mécanismes qui leurs permettraient d'en évaluer le contenu.

Evaluation du contenu

Un second mécanisme porterait sur l'évaluation du contenu du message (Sperber *et al.*, 2010): Est-il cohérent avec mes croyances ? L'évaluation de la cohérence implique la confrontation de l'information communiquée avec les croyances de l'individu. Elle vise à essayer d'intégrer la nouvelle information avec celles déjà existantes (Mercier & Sperber, 2011). Si une incohérence ou un conflit est détecté, il est probable qu'elle soit rejetée (par exemple : « la fonction du raisonnement est argumentative »).

De nouveaux, les travaux issus de la psychologie du développement semblent indiquer que très tôt les enfants se révèlent sensibles au contenu des messages. Dès 16 mois, les enfants sont surpris lorsqu'un informateur nomme mal un objet : ils lui portent plus d'attention qu'à un informateur qui nomme l'objet correctement (Koenig & Echols, 2003). A partir de 18 mois, les enfants rejettent explicitement des informations qui sont en conflit avec leurs propres croyances (Pea, 1982).

Toutefois, si trop d'informations sont rejetées, soit parce qu'elles sont portées par des émetteurs dans lequel on accorde peu de confiance, soit parce qu'elles sont en conflit avec nos propres croyances, ces mécanismes privent les individus de la possibilité d'acquérir de nouvelles informations potentiellement importantes, ainsi que de corriger et de mettre à jour leurs croyances. Dans la suite de cette section, on décrira comment les limites de ces deux mécanismes peuvent être dépassées.

Dépasser les limites de la vigilance épistémique

L'articulation des deux mécanismes (évaluation de la source et évaluation du contenu) permettrait de dépasser cette limite et constituerait un premier pas vers une analyse plus fine dans le processus de révision des croyances (Mercier & Sperber, 2011). En particulier lorsque l'individu qui communique une information en conflit avec nos croyances dispose d'un haut niveau de confiance, s'amorce alors un processus de révision de la confiance accordée en l'individu ou des croyances de l'audience. Dans ce cas, et étant donné que les motivations de cet individu de confiance sont susceptibles d'être alignées avec celles de l'audience, l'alternative la moins coûteuse serait d'accepter l'information communiquée (Mercier & Sperber, 2011).

Mais comment un émetteur peut transmettre des informations qui ne seraient pas acceptées sur la simple base de la confiance ? Il peut tenter de convaincre son interlocuteur (Mercier & Sperber, 2011). Pour y parvenir, l'émetteur doit produire des raisons pour défendre son point de vue, raisons que l'interlocuteur peut alors examiner. L'enjeu pour l'émetteur est donc de produire des arguments (prémisses) que le récepteur pourrait accepter ou avec lesquels il est déjà d'accord et qui soutiennent son point de vue (conclusion). L'enjeu pour le récepteur est d'évaluer la qualité des

arguments présentés afin d'être convaincu lorsque cela est approprié – et uniquement dans ce cas (Mercier & Sperber, 2011). Ainsi, l'échange d'arguments permettrait d'accéder à une analyse plus fine des processus de révisions des croyances. L'argumentation représenterait donc un avantage évolutif dans le sens où :

> « Les individus qui produisent des arguments ont plus de chance de diffuser leurs messages que ceux qui s'en remettent uniquement sur la base de la confiance ou de l'autorité qu'ils peuvent représenter. Les individus qui reçoivent les arguments peuvent accepter des messages bénéfiques qu'ils auraient sinon rejetés. L'argumentation participerait ainsi à ce que les bonnes idées et que les croyances solides se diffusent. » (Mercier, 2016, p. 2)

Selon cette approche interactionniste, le raisonnement aurait évolué pour être utilisé dans un contexte de dialogue (Mercier, 2016; Mercier & Landemore, 2012) et est défini comme « un sous ensemble de mécanismes cognitifs dédiés au traitement des arguments » (Mercier, 2016, p. 2). L'argumentation serait donc au cœur des processus de raisonnement. Elle en constituerait même l'une des principales fonctions (Mercier & Sperber, 2009, 2011, in press). C'est ce que je développerai dans la section suivante.

1.3 Fonction argumentative du raisonnement

Selon l'approche developpée par Mercier et Sperber (2011), la fonction argumentative du raisonnement s'articulerait autour de deux mécanismes fondamentaux : (i) évaluer les arguments qui sont transmis, notamment lorsqu'il existe un conflit entre ces derniers et les croyances de l'individu (ii) produire des arguments, que ce soit dans le contexte d'une réflexion solitaire (par exemple, justifier une décision en anticipation de devoir la défendre) ou un contexte argumentatif (par exemple, défendre une idée lors d'une réunion) (Mercier, 2016; Mercier & Sperber, 2011, in press).

L'asymétrie entre production et évaluation d'arguments constitue la pierre angulaire de la théorie argumentative du raisonnement (Mercier, 2016). Elle permet d'expliquer comment ses caractéristiques se manifestent dans les divers contextes dans lesquels le raisonnement se déploie (individuel versus dialogue). Plus précisément, la

production d'arguments serait caractérisée par le fait d'être biaisée et « fainéante » alors que l'évaluation d'arguments se révèle plus exigeante et objective (Mercier, 2016), pour des raisons que j'exposerai maintenant.

Production des arguments

Si la production d'arguments a pour objectif de convaincre un interlocuteur, ceci implique d'une part que les individus soient dotés de mécanismes qui leur permettent d'y parvenir et d'autre part que l'émetteur soit capable de produire des arguments suffisamment forts pour être convaincant.

Ici, le *biais vers son côté* (biais de confirmation) qui correspond à la tendance à produire des arguments qui soutiennent le point de vue ou les intuitions de l'émetteur, largement rapporté dans la littérature du raisonnement (Nickerson, 1998) et présent également chez les enfants (Ross, Smith, Spielmacher, & Recchia, 2004), prend tout son sens (Mercier & Sperber, 2011). Souvent considéré comme une erreur du raisonnement (Evans, 1989; Evans & Over, 1996), il s'avère particulièrement adapté dans un contexte de dialogue, puisque l'enjeu est justement de produire des arguments qui soutiennent l'idée que l'émetteur veut faire accepter ou l'opinion qu'il souhaite diffuser.

Par ailleurs, s'il veut être convaincant, l'émetteur doit produire des arguments suffisamment forts. Une possibilité serait de passer en revue les nombreux arguments disponibles pour soutenir son point de vue, et d'anticiper de possibles contre-arguments. Cependant, cette opération représenterait un coût cognitif énorme pour l'individu et il est peu probable que l'évolution ait favorisé une telle stratégie (Mercier & Sperber, 2011). Dans le contexte pour lequel le raisonnement a évolué, la situation de dialogue, les individus peuvent compter sur les autres. Il est beaucoup moins coûteux de s'en remettre aux autres pour qu'ils évaluent la force des arguments proposés. Dans le cas où un argument est rejeté ou fait fasse à un contre-argument, il suffira alors de produire un nouvel argument sur la base de cette nouvelle information.

De récents travaux expérimentaux soutiennent la prédiction que les raisonneurs lorsqu'ils produisent des arguments, sont fainéants (Mercier, Bonnier, & Trouche, 2016;

Trouche, Johansson, Hall, & Mercier, 2015). Inspirés par les travaux portant sur le *choice blindness*, Trouche et ses collaborateurs (2015), ont créé une situation ingénieuse dans laquelle les participants devaient évaluer leurs propres arguments présentés comme étant ceux d'un autre participant.

Dans une première phase, les participants étaient confrontés à des problèmes pour lesquels, après les avoir résolus, ils devaient justifier leurs réponses. Dans une seconde phase, ils leurs étaient présentés les mêmes problèmes et le choix entre deux réponses, celle qu'ils avaient proposé initialement et celle d'un autre participant. Les participants étaient alors invités à reconsidérer leur réponse en fonction des arguments proposés. Mais c'est là qu'intervient la manipulation. Pour un problème, la réponse présentée comme « alternative » était en fait la propre réponse des participants, accompagnée des arguments qu'ils avaient eux-mêmes produits pour la justifier, alors que la réponse présentée comme la leur était en fait celle d'un autre participant. La moitié des participants ne s'est pas rendu compte de la manipulation. Les résultats montrent que les participants rejettent leurs propres arguments dans 50% des cas. Ils ne les trouvent pas suffisamment forts pour les faire changer d'avis.

En d'autres termes les individus semblent moins critiques concernant les arguments qu'ils produisent que lorsqu'ils doivent les évaluer comme provenant d'une autre personne (Trouche *et al.*, 2015).

Evaluation des arguments

L'évaluation d'arguments a pour objectif de déterminer si les arguments proposés sont suffisamment forts ou convaincants pour, le cas échéant, entraîner un changement dans les croyances de l'individu. Pour ce faire, les individus devraient être dotés de mécanismes qui leurs permettraient de faire preuve de discernement surtout lorsqu'ils sont confrontés à des informations qui vont à l'encontre de leurs croyances mais qui peuvent potentiellement leurs être utiles.

De nombreuses données issues de la psychologie sociale ou de l'étude de l'argumentation convergent et soutiennent l'idée que les individus sont exigeants et

objectifs lorsqu'ils évaluent les arguments (pour une revue de la littérature, voir Mercier, 2016; Mercier & Sperber, 2011).

De récentes études expérimentales révèlent, pour des tâches intellectives, que les individus sont relativement objectifs lorsqu'ils évaluent les arguments (Trouche, Sander & Mercier, 2014). Dans leurs expériences, les auteurs ont utilisé des problèmes pour lesquels les participants montrent systématiquement un faible taux de réponses correctes, comme c'est le cas pour le problème du timbre et de l'enveloppe (*Bat and Ball problem*, Frederick, 2005). Son énoncé est le suivant :

> Un timbre et une enveloppe coûtent 1,10 euros.
>
> L'enveloppe coûte 1 euro de plus que le timbre.
>
> Combien coûte le timbre ?

Bien que le problème soit mathématiquement trivial, une majorité de participants répond 10 cents (La réponse correcte est 5 cents).

Dans une première série d'expériences, il était demandé aux participants de résoudre la tâche individuellement et de fournir une justification pour leur réponse. Les participants étaient ensuite exposés aux réponses et aux arguments d'autres participants (qui pouvaient être correctes ou incorrects) et avaient la possibilité de changer d'avis. Les résultats indiquent que les participants qui ont donné la mauvaise réponse tendent à changer plus souvent d'avis lorsqu'ils sont exposés aux arguments qui soutiennent la bonne réponse qu'aux autres arguments (Trouche *et al.*, 2014). Et ce indépendamment de leur niveau de confiance dans leur réponse initiale.

Dans une autre série d'expérience, les auteurs se sont intéressés à l'effet de la discussion sur la résolution de tâches similaires au Bat and Ball. Pour ce faire, après avoir demandé à des participants de résoudre la tâche individuellement, ils ont formé des petits groupes qui avaient comme instruction d'arriver à un consensus quant à la réponse du problème. Que ce soit dans le cas des adultes ou celui des enfants, les résultats montrent une amélioration des performances en groupe par rapport à la résolution solitaire. Le taux de changement de réponse en faveur de la réponse correcte dans les groupes de discussions montre qu'ils sont convaincus par les meilleurs

arguments. De nouveau, ces changements d'avis sont indépendants du niveau de confiance des participants dans leur réponse (Trouche *et al.*, 2014).

Par ailleurs, de récents travaux développementaux montrent que les capacités d'évaluation des arguments semblent émerger relativement tôt. En effet, dès 3 ans les enfants sont capables de discriminer la qualité des arguments qui leurs sont proposés. Face à des témoignages contradictoires, les enfants suisses de 3 à 5 ans favorisent le témoignage soutenu par un argument fort (perceptuel) par rapport à un témoignage soutenu par un argument faible (circulaire) (Mercier, Bernard, & Clément, 2014). Nous reviendrons dans la suite du manuscrit sur le raisonnement en groupe et l'évaluation des arguments chez les enfants qui constitueront les deux axes des travaux expérimentaux menés dans cette recherche.

Mercier (2016) distingue deux facteurs qui peuvent déterminer à quel point les individus vont s'engager dans l'évaluation des arguments des autres : l'étendue du dialogue et l'étendue du conflit. C'est essentiellement dans une situation de dialogue que les individus sont exposés aux arguments de autres et que sont mobilisées leurs facultés à les évaluer. Le conflit avec les croyances de l'individu va opérer comme un déclencheur du processus d'évaluation. C'est dans le cas du dialogue et lorsqu'il existe un conflit entre les opinions des participants que l'évaluation produit ses meilleurs résultats. La discussion favorise l'échange d'arguments et de contre-arguments. Les arguments faibles sont rejetés alors que les arguments les plus forts finissent par convaincre les autres (Claidière, Trouche, & Mercier, soumis).

Bien que le dialogue soit la situation idéale pour l'expression des mécanismes de production et d'évaluation des arguments, il est nécessaire que ceux qui y participent aient certaines motivations communes (résoudre un problème, accéder à des croyances plus solides) afin de s'engager dans un dialogue contructif et échanger des arguments (Mercier, 2016).

Selon la théorie argumentative du raisonnement, les effets de la production et de l'évaluation d'arguments que je viens de décrire sont le reflet des caractéristiques du raisonnement humain, de sa fonction argumentative.

Les caractéristiques du raisonnement humain

Au delà du fait que cette théorie permet de rendre compte du lien étroit qui existe entre le raisonnement et l'argumentation, sa force réside également dans le fait qu'elle intègre et rend compte de résultats parfois contradictoires (Mercier & Sperber, 2011; Mercier, 2011a; Mercier, 2011b; Mercier, 2013).

Les caractéristiques de la production d'arguments (biais vers son côté et fénéantise) permettent d'expliquer pourquoi les raisonneurs solitaires tendent à échouer à corriger leurs intuitions (Trouche *et al.*, 2015) et leurs faibles performances à des problèmes relativement simples (Trouche *et al.*, 2014). Elle permet également de rendre compte des phénomènes de sur-confiance et de polarisation (Mercier, 2016).

Les caractéristiques de l'évaluation d'arguments (exigeante et objective) permettent de rendre compte des effets de la discussion sur la résolution de problèmes de raisonnement logique. Il suffit qu'un membre du groupe ait la réponse correcte pour que les arguments qui la soutiennent parviennent à convaincre les autres de l'adopter (Schulze & Newell, 2016; Maciejovsky *et al.*, 2013). L'effet de la discussion a d'ailleurs été démontré pour des problèmes de raisonnement logique (Moshman & Geil, 1998), des problèmes mathématiques (Laughlin & Ellis, 1986), des problèmes issus de la psychologie du développement (Doise & Mugny, 1984; Perret-Clermont, 1980) et une variété d'exercices scolaires (pour une revue de la littérature, voir Mercier, 2011b). Des résultats similaires ont été rapportés dans de nombreuses tâches allant des jeux économiques aux décisions de jurys (pour une revue de la littérature, voir Mercier, 2016).

Bien que la théorie argumentative du raisonnement ait fait l'objet de critiques (voir les commentaires sur Mercier & Sperber, 2011; voir aussi Darmstadter, 2013 ; Santibáñez Yánez, 2012; pour des réponses, voir Mercier & Sperber, 2011; Mercier, 2012, 2013) une quantité importante de données en sa faveur a été amassée ces dernières années, que ce soit en psychologie du raisonnement, en psychologie sociale et dans le domaine de la prise de décision (Mercier & Sperber, 2009, 2011; Trouche *et al.*, 2014), en psychologie développementale (Mercier, 2011b), en psychologie interculturelle (Mercier, 2011a), en psychologie morale (Mercier, 2011c), en sciences

politiques (Bicchieri & Mercier, 2014; Landemore & Mercier, 2012; Mercier & Landemore, 2012), et les études sur l'expertise (Mercier, 2011d) (pour une revue de la littérature, voir Mercier, 2013; Mercier & Sperber, in press).

C'est dans le cadre théorique de la vigilance épistémique (Sperber *et al.*, 2010) et de la théorie argumentative du raisonnement (Mercier & Sperber, 2011) que s'inscrit ce travail de recherche. En voici un bref résumé qui me permettra d'introduire la problématique de cette thèse. Les mécanismes de vigilance épistémique ont évolué pour permettre la discrimination des informations bénéfiques et préjudiciables, en s'appuyant sur des indices tels que la confiance dans la source ou la plausibilité du message. Dans cette perspective, le raisonnement aurait évolué afin de permettre une discrimination plus fine des messages. En particulier, une fonction du raisonnement serait de permettre aux émetteurs de transmettre des messages qui ne l'auraient pas été sur la simple base de la confiance. L'argumentation améliorerait ainsi la quantité et la qualité épistémique des messages transmis entre les individus. La fonction argumentative du raisonnement représente donc un avantage évolutif dans le sens où elle améliorerait la communication humaine (Mercier & Sperber, in press).

Ce cadre théorique soulève des questions importantes quant à la fonction du raisonnement dans la cognition humaine. Le postulat évolutionniste sur lequel il repose implique que les mécanismes qui servent cette fonction sont universaux, c'est-à-dire qu'ils sont partagés par l'ensemble des humains (ayant un développement typique). On devrait donc être en mesure d'observer leurs effets dans toutes les cultures (Norenzayan & Heine, 2005). La problèmatique de cette recherche découle directement de cette affirmation, et sera abordée dans la section qui suit.

2 Une approche interculturelle et développementale

La plupart des études en psychologie du raisonnement, et de ce fait, les principaux résultats expérimentaux qui soutiennent la théorie argumentative du raisonnement proviennent d'expériences réalisées auprès de participants occidentaux (principalement des Etats-Unis et d'Europe). Or, les sociétés occidentales constituent un échantillon limité du spectre composé par les populations humaines, parfois regroupées sous l'acronyme de *WEIRD* pour « Western Educated Industrialized Rich Democratic » (Henrich, Heine, & Norenzayan, 2010). Les sociétés WEIRD représentent 16% de la population mondiale mais constituent 96% des échantillons des recherches en psychologie (Wang, 2016). Il est donc envisageable que les caractéristiques du raisonnement proposées par ce cadre théorique soient l'expression de facteurs culturels plutôt que des traits universels.

Les constructions sociales et culturelles (croyances, symboles, artéfacts, pratiques) structurent la vie quotidienne des sociétés humaines. Même certains processus cognitifs de « bas niveau » comme les sensations, la reconnaissance des visages ou encore la perception des couleurs ne semblent pas imperméables à certains facteurs culturels (pour une revue de la littérature, voir Wang, 2016). Il serait prématuré d'assumer que tout processus psychologique même basique soit immunisé contre l'expérience et la culture (Wang, 2016), d'autant plus lorsque l'on s'intéresse à des processus de haut niveau tels que le langage et le raisonnement.

Toutefois, c'est bien la question de l'universalité des caractéristiques du raisonnement dont il est question dans cette recherche. S'intéresser aux potentiels universaux est théoriquement pertinent pour la théorie argumentative du raisonnement car cela permet de tester d'une manière plus concluante ses hypothèses adaptatives.

Ainsi, si l'on postule que les mécanismes du raisonnement (production et évaluation des arguments) sont des adaptations, certaines compétences de base devraient être relativement universelles et ne devraient pas avoir besoin d'être enseignées de manière formelle. L'universalité et le développement précoce suggèreraient que ces compétences ne reposent pas sur un apprentissage culturel

spécifique. Le but de cette recherche est de tester ces deux prédictions en déployant une approche interculturelle et développementale.

L'intérêt de déployer cette double approche, interculturelle et développementale, est qu'elle permet de disposer d'un faisceau de preuves complémentaires. L'approche développementale apporte des indices sur l'émergence des compétences étudiées et sur leur dépendance vis-à-vis des apprentissages culturels, tels que ceux liés à la scolarisation. Le recours à une approche interculturelle offre la possibilité de tester la généralisation des mécanismes dont il est question dans des contextes culturels qui se différencient selon des dimensions théoriquement pertinentes, telles que la tradition philosophique, les pratiques sociales, le niveau d'éducation ou encore les styles parentaux (Norenzayan & Heine, 2005).

La psychologie culturelle joue un rôle important dans la confirmation, la modification ou l'enrichissement des théories existantes. Au delà de permettre de rendre compte de la diversité des comportements humains, ses résultats peuvent êtres une source pour le développement théorique ou empirique.

Par exemple, observer des différences entre des groupes culturels peut suggérer que le processus cognitif en question ou son déploiement est perméable aux variations écologiques et culturelles. L'observation de similarités entre divers groupes culturels peut être un indice que le processus étudié est lié à des contraintes biologiques, cognitives ou des expériences culturelles partagées (Wang, 2016). En psychologie du développement, identifier des similarités ou des différences est particulièrement informatif pour comprendre les relations entre les contraintes biologiques et cognitives et la structure socioculturelle dans laquelle ces processus se développent (Wang, 2016).

La possibilité de pouvoir généraliser les résultats obtenus auprès de populations WEIRD à d'autres contextes culturels viendrait renforcer l'hypothèse de l'universalité de la fonction argumentative du raisonnement. Dans le cas où les résultats ne permettraient pas de mettre en évidence les caractéristiques du raisonnement auprès de populations non-WEIRD, le modèle évolutionniste du raisonnement avancé se verrait remis en cause. C'est tout l'enjeu de ce travail de recherche.

Il convient alors de définir les caractéristiques culturelles qui sont susceptibles d'avoir un impact sur l'expression ou le développement de l'argumentation chez les populations occidentales et déterminer dans quelle mesure ces spécificités culturelles varient par rapport à d'autres sociétés humaines. La caractérisation de ces dimensions culturelles permettra la formulation d'hypothèses testables expérimentalement et dont les résultats pourront être interprétés à la lumière des prédictions de la théorie argumentative du raisonnement.

Mais avant cela il est important de souligner que postuler qu'un mécanisme est une adaptation ne signifie pas qu'il n'y ait pas de place pour la variabilité interculturelle et le développement (Norenzayan & Heine, 2005). En effet, la nature des arguments échangés ou les types d'arguments acceptés ou rejetés varient en fonction du contexte social et culturel (Mercier, 2011a). De même que le langage, les compétences argumentatives subissent des transformations et se complexifient avant d'atteindre la compétence de l'adulte (Mercier, 2011b).

2.1 L'argumentation, une spécificité des « WEIRD people » ?

Lorsque l'on s'intéresse au raisonnement et à l'argumentation, les cultures occidentales ont certains traits qui, sans être uniquement propres à ces cultures, pourraient potentiellement expliquer les caractéristiques du raisonnement défendues par la théorie argumentative du raisonnement (Mercier, 2011a, 2011b).

En effet, les cultures occidentales reposent sur une tradition philosophique qui met l'accent sur le débat et l'argumentation. Ces derniers jouent un rôle central dans les institutions, que ce soit en ce qui concerne la science, la justice ou encore la politique (Lloyd, 1996; Peng & Nisbett, 1999). Par ailleurs, les sociétés WEIRD accordent moins d'importance au fait de « sauver les apparences » (Kim & Markus, 1999; Oetzel *et al.*, 2001) ou à l'harmonie sociale, ce qui peut favoriser des débats plus ouverts et directs (Mercier, Deguchi, Van der Henst, & Yama, 2015). Enfin, l'institutionnalisation de l'éducation offre aux membres des sociétés WEIRD, en théorie, l'entraînement formel nécessaire pour raisonner de manière abstraite (Luria, 1971; Braine, 1990).

Si les participants WEIRD des études en psychologie du raisonnement constituent un échantillon limité des populations humaines. Le même constat peut être tiré pour les participants des études développementales. Ils semblent même constituer un échantillon encore plus limité, dans le sens où la majorité d'entre eux (en tout cas dans le domaine de la psychologie cognitive) proviennent de classes moyennes ou supérieures. Or, les styles parentaux adoptés dans différents contextes culturels et sociaux sont susceptibles de créer un environnement dans lequel l'argumentation est plus ou moins valorisée et ainsi influencer l'émergence des compétences argumentatives (Gauvain, Munroe, & Beebe, 2013).

Les parents d'enfants de classes moyennes et supérieures des sociétés occidentales échangent de nombreux arguments avec leurs enfants, attendent qu'ils en proposent et leurs demandent des explications (Tizard, Hughes, Carmichael, & Pinkerton, 1983; Mercier, 2011b). L'échange d'arguments joue un rôle primordial dans les interactions des enfants avec les adultes (Gauvain et al., 2013) ou avec leur pairs (Zadunaisky, 2011; Zadunaisky & Blum-Kulka, 2010). Les parents des classes moyennes ou supérieures tendent également à favoriser l'échange de raisons plutôt que l'expression de l'autorité (Chouinard, Harris, & Maratsos, 2007) les enfants reçoivent plus d'explications et questionnent plus fréquemment leurs parents que les enfants issus de familles plus défavorisées (Gauvain, *et al.*, 2013).

Tous ces facteurs pourraient faire de l'argumentation une compétence cognitive particulièrement valorisée dans les cultures occidentales. Il est donc concevable que ce contexte culturel particulier crée des conditions qui favorisent le développement des compétences argumentatives et une motivation pour s'engager dans des activités argumentatives.

Etant donné la diversité des sociétés humaines (les 84% restants), de nombreuses populations ne partagent pas certains de ces traits caractéristiques des cultures WEIRD. Afin de mettre en évidence ces potentielles variations culturelles je m'appuierai sur deux populations : les sociétés mayas d'Amérique centrale (société traditionnelle) et la société japonaise (culture orientale) qui diffèrent des populations occidentales sur des dimensions théoriquement pertinentes que j'exposerai dans la section suivante.

2.2 Sociétés traditionnelles et cultures orientales

Les sociétés traditionnelles et les cultures orientales représentent deux points de comparaisons particulièrement intéressants pour l'étude de l'argumentation. En effet, certaines dimensions culturelles qui les différencient des WEIRD comme la tradition philosophique, les styles parentaux ou encore l'accès à l'éducation formelle sont susceptibles d'avoir des effets sur l'expression de l'argumentation, le développement des compétences argumentatives, voir le développement des habilités de raisonnement.

Sociétés traditionelles

L'accès à l'éducation formelle (scolarisation) constitue un premier facteur qui pourrait avoir des conséquences sur le développement des habilités de raisonnement. Les résultats obtenus par Luria (1976) auprès de populations illettrées dans des régions isolées d'Ouzbékistan montrent un niveau de performance très faible pour des tâches de raisonnement déductif relativement simples. Par contre, lorsque les mêmes problèmes sont présentés à des participants ayant reçu un minimum d'éducation formelle, ceux-ci montrent des performances acceptables (Luria, 1976). D'autres études rapportent des résultats similaires pour des populations illettrées d'Afrique et d'Amérique Centrale (Cole, Gay, Glick, & Sharp, 1971; Scribner, 1975, 1977; Sharp & Cole, 1975). Enfin, certains auteurs postulent des différences qualitatives de raisonnement entre les populations illétrées et les populations scolarisées. Les populations illétrées disposeraient d'un raisonnement plus pratique que théorique ou hypothétique (Luria, 1976; Medin & Atran, 2004).

Toutefois, des résultats issus de la psychologie du développement indiquent que l'éducation formelle, plutôt que de créer les habilités de raisonnement abstrait, fournit un contexte dans lequel les individus peuvent s'engager dans ce type de raisonnement (Leevers & Harris, 1999). Lorsque le contenu des problèmes est familier, la performance des participants illettrés s'avère tout à fait acceptable (Hamill, 1990). Il semblerait que le rejet de la part des participants d'accepter des prémisses aléatoires et non familières comme vraies rendrait mieux compte des faibles performances qui ont été rapportées. En effet, dès qu'ils les acceptent, leurs performances augmentent

(Scribner, 1977; Mercier, 2011a). Dias, Roazzi et Harris (2005) ont par exemple observé chez des adultes illettrés au Brésil que ces derniers étaient disposés à raisonner sur des prémisses non familières ou contraires à leur expérience s'il leur était spécifié que les informations présentées se déroulaient dans un contexte imaginaire. Ces résultats suggèrent que les participants non scolarisés peuvent également s'engager dans la résolution de problèmes de raisonnement abstraits.

Le style parental adopté dans les sociétés traditionnelles représente un second facteur qui pourrait avoir une incidence sur l'émergence des compétences argumentatives. D'une culture à l'autre, les styles parentaux varient fortement en ce qui concerne le recours aux arguments et à l'autorité (Maratsos, 2007; Gauvain *et al.*, 2013). Dans les classes moyennes et supérieures des pays européens les parents s'engagent souvent dans des discussions argumentées avec leurs enfants. Dans la classe ouvrière, les parents recourrent plus souvent à l'autorité (Tizard *et al.*, 1983). Le contraste est encore plus marqué avec les sociétés traditionnelles dans lesquelles les parents attendent que les enfants « obéissent sans trop poser de questions » (Maratsos, 2007, p. 124). Et ces différences de style parental ont un effet sur les réactions des enfants. Par exemple, dans les sociétés traditionnelles les enfants demandent très rarement des explications aux parents (Gauvain *et al.*, 2013).

Alors que dans les sociétés occidentales, les adultes initient souvent le dialogue en posant des questions aux enfants (Ferguson, 1978), chez les mayas K'iche' (Guatemala), seulement 10% des requêtes qui leurs sont adressés sont des questions (autour de 20% entre adultes) (Pye, 1986). A l'inverse, les K'iche' utilisent principalement des imperatifs pour s'adresser aux enfants (environ 50% des énoncés), même s'ils ne les utilisent presque jamais avec les adultes.

De plus, une étude chez les Yucatans (mayas du Mexique) montre que les enfants d'un an de ces communautés, contrairement aux enfants américains issus de familles nombreuses, sont moins exposés au langage d'une manière générale. Ils recoivent une quantité moindre d'information verbale, et une proportion encore plus réduite des propositions auxquels ils sont exposés leurs sont directement adressées (Shneidman & Goldin-Meadow, 2012). L'acquisition du langage chez les enfants mayas

semble se faire principalement de manière indirecte. Contrairement aux enfants américains pour qui la majorité de l'exposition au langage se fait de manière directe (propositions qui leurs sont adressées directement), une grande proportion de l'information linguistique à laquelle les enfants mayas sont exposés à lieu au dessus de leur tête (les interactions des adultes entre eux) (Shneidman & Goldin-Meadow, 2012).

Ces études suggèrent que les enfants mayas ont beaucoup moins d'opportunités d'échanger des raisons (explications ou arguments) avec les adultes que les enfants européens, en particulier ceux des classes moyennes et supérieures.

Enfin, les membres de sociétés traditionnelles partagent une proportion plus grande de croyances communes et sont moins soumis à la pression de constamment justifier leurs choix. Ils sont exposés à moins de choix : moins de choix de produits à acheter, de choix de métiers, de choix de lieu où vivre, de choix de religion, etc. (Lévi-Strauss, 1966) et sont potentiellement moins amenés à devoir les justifier que les occidentaux.

Les membres des sociétés traditionnelles, ici, les communautés mayas représentent donc un point de comparaison particulièrement pertinent avec les sociétés occidentales. Il est possible qu'ils n'accordent pas la même valeur au débat et à l'argumentation. Par ailleurs, ils n'ont reçu aucune éducation formelle et pourraient être moins enclins à s'engager dans le raisonnement hypothétique. Le style parental adopté dans ces communautés crée un contexte où l'échange d'arguments avec les adultes est relativement pauvre et où l'autorité semble prendre le pas sur l'échange de raisons.

Ainsi, pour les membres des sociétés traditionnelles, le raisonnement pourrait moins reposer sur l'argumentation, et de ce fait ils ne bénéficieraient pas autant des discussions en groupe que les WEIRD. Cependant, on peut douter que les membres des sociétés traditionnelles ne s'engagent pas dans des discussions et au quotidien échangent des arguments. C'est d'ailleurs ce que les anthropologues ont observé de manière répétée dans ces sociétés (Boehm *et al.*, 1996; Brown, 1991; Mercier, 2011a). Néanmoins, sur la base des disparités concernant l'exposition au langage et l'échange de raisons, les compétences argumentatives des enfants de ses communautés pourraient se développer plus tardivement que celles des enfants occidentaux.

Cultures orientales

En opposition avec les cultures occidentales, les sociétés orientales, comme celle du Japon, sont souvent définies comme appartenant à des cultures qui évitent les débats et l'échange d'arguments, car ils représentent une potentielle menace à l'harmonie sociale (Becker, 1986; Nakamura, 1964). Par ailleurs, de nombreux travaux issus de la psychologie interculturelle ont été consacrés aux potentielles différentes qualitatives de raisonnement qu'il peut exister entre les occidentaux et les orientaux (Nisbett, Peng, Choi, & Norenzayan, 2001). Il a en particulier été avancé que les membres des cultures orientales seraient moins enclins que les WEIRD à s'engager dans des débats et l'argumentation formelle (Peng & Nisbett, 1999). Ainsi, ils pourraient être moins à même de bénéficier du raisonnement en groupe (Nguyen, Terlouw, & Pilot, 2005).

Comme pour les sociétés traditionnelles et bien que la démonstration publique d'un désaccord ou d'un débat puisse être considérée de manière négative dans ce contexte culturel, on peut douter du fait que ses membres ne s'engagent pas dans des échanges argumentatifs dans leur vie quotidienne, au travail, avec des amis ou encore avec leurs enfants (Mercier, 2011a).

En contraste avec les hypothèses interculturelles, Mercier (2011a) soutient, sur la base d'une revue de la littérature en philosophie, anthropologie et linguistique, qu'il ne semble pas exister de différence fondamentale en ce qui concerne l'argumentation entre les cultures occidentales et orientales. Il propose également que les différences observées quant à la manière de gérer la contradiction sont superficielles et n'empêchent pas les orientaux de s'engager dans des activités argumentatives. Ces différences interculturelles seraient davantage liées à l'usage des arguments dans un contexte culturel particulier qu'aux habilités de raisonnement en tant que telles (Mercier, 2011a).

De récents travaux expérimentaux semblent soutenir cette interprétation. Mercier, Deguchi, Van der Henst et Yama (2015a) ont montré que des participants japonais bénéficient, tout comme les participants WEIRD, de la discussion en groupe. Ils ont observé, pour la tâche de sélection de Wason, une amélioration similaire entre la résolution individuelle et celle en groupe. Toutefois, leurs résultats suggèrent également

que les participants orientaux accordent plus d'importance à la préservation de l'harmonie sociale lorsqu'ils sont engagés dans des discussions en groupe que les occidentaux (Mercier *et al.*, 2015a).

En ce qui concerne les styles parentaux, il s'avère que les enfants japonais sont élevés d'une manière similaire à celle des enfants européens, en particulier des enfants de classes moyennes et supérieures (Sato, 2003). Les mères et enseignants japonais semblent avoir moins recours à l'autorité et plus à la patience, et fournissent de nombreuses explications aux enfants (Sato, 2003; Hess, Kashiwagi, Azuma, Price, & Dickson, 1980; Lewis, 1984).

Les membres des cultures orientales, ici le Japon, représentent un autre point de comparaison intéréssant avec les sociétés occidentales. Même si on peut considérer que les enfants japonais sont exposés à une quantité d'arguments similaire aux enfants occidentaux, le poids accordé au respect de l'harmonie sociale peut créer un contexte où l'argumentation est moins valorisée. Il est donc possible qu'il existe des différences dans l'expression des compétences argumentatives des enfants japonais par rapport aux enfants occidentaux.

Les sociétés traditionnelles et orientales, par les différences qu'elles manifestent par rapport aux cultures WEIRD, dans des dimensions telles que la tradition philosophique, le style parental, ou l'accès à l'éducation formelle, constituent un terrain propice pour tester certaines prédictions fondamentales de la théorie argumentative du raisonnement. La suite du manuscrit sera consacrée à la présentation des expériences qui ont été menées à cet effet.

2.3 Organisation de la thèse

Comme je l'ai exposé précédemment, le but de cette recherche est de tester l'hypothèse de la fonction argumentative du raisonnement (Mercier & Sperber, 2011) en déployant une approche interculturelle et développementale. En effet, il est nécessaire pour la théorie argumentative du raisonnement de passer l'épreuve de la confrontation interculturelle si elle a pour visée de rendre compte de la fonction du raisonnement dans la cognition humaine.

Afin de délimiter l'objet de notre travail, et de proposer des hypothèses qui peuvent être testées expérimentalement, il convient de revenir sur les principales prédictions de la théorie argumentative du raisonnement. Elles peuvent être résumées de la manière suivante : (i) les humains sont « naturellement » bons pour argumenter ; (ii) les individus raisonnent mieux dans un contexte argumentatif (dialogue) qu'en solitaire ; (iii) lorsqu'ils produisent des arguments, ils sont fainéants et biaisés ; (iv) lorsqu'ils évaluent des arguments, ils sont plus exigeants et objectifs ; (v) des arguments suffisamment forts peuvent prendre le pas sur des indices liés à la source.

Les travaux expérimentaux qui ont testé directement ces prédictions démontrent les bénéfices de l'argumentation dans la résolution de problèmes de raisonnement logique dans des cultures occidentales et orientales (Trouche *et al.*, 2014; Trouche *et al.*, 2015; Mercier *et al.*, 2015a). Ils indiquent également que l'évaluation des arguments semble se développer relativement tôt chez les enfants occidentaux (Mercier *et al.*, 2014). Cette recherche s'inspire des méthodologies et des situations expérimentales développées dans ces études pour les appliquer à des contextes culturels et sociaux différents.

Ainsi, la première partie de cette thèse « Bénéfices de l'argumentation » sera consacrée aux effets de la discussion sur le raisonnement en groupe. Plus précisément, il s'agira de déterminer si, de même que les membres des sociétés occidentales, les membres des communautés traditionnelles mayas K'iche' (Guatemala) bénéficient de l'échange d'arguments lorsqu'ils sont confrontés à la résolution de problèmes de raisonnement logique en groupe (Article 1). Il s'agira également de déterminer, si cette amélioration est constatée, si elle peut s'expliquer par le déploiement des

caractéristiques du raisonnement (biais vers son côté et habilité à évaluer les arguments). Puis, en s'appuyant sur des expériences réalisées auprès d'étudiants occidentaux et d'adultes mayas K'iche', on tentera de déterminer si les bénéfices de l'argumentation, observés principalement pour des tâches intellectives, peuvent également s'étendre au domaine du raisonnement moral (Chapitre 2).

La seconde partie intitulée « Sensibilité précoce aux arguments », sera dédiée à l'étude des capacités d'évaluation des arguments des jeunes enfants. Il s'agira tout d'abord de déterminer si, dès 2 ans, les enfants occidentaux sont sensibles à la force des arguments qui leurs sont proposés (Article 3). Puis, dans une série d'études menées au Guatemala (Article 4), en France (Article 5 et Résultats complémentaires 6) et au Japon (Article 7, Article 8) on tentera de déterminer si les enfants issus de sociétés traditionnelles et orientales montrent les mêmes capacités d'évaluation des arguments que les enfants occidentaux et si dans ces trois cultures des arguments suffisamment forts peuvent prendre le pas sur des indices liés à la source (hiérarchie sociale).

Partie 1 : Bénéfices de l'argumentation

Le raisonnement de la vie de tous les jours est largement influencé par les contextes argumentatifs, culturels et sociaux dans lesquels il se déroule. En effet, on peut défendre l'idée que la plupart des activités de raisonnement dans la vie quotidienne a lieu lors de discussions, lorsque les gens échanges des arguments (Butera, Legrenzi, Mugny, & Pérez, 1992). Malheureusement, les psychologues du raisonnement ont majoritairement porté leur attention sur le raisonneur solitaire qui doit résoudre des problèmes abstraits. En coupant le raisonnement de son contexte argumentatif, ils l'ont privé de l'une de ses forces, l'échange d'arguments. C'est l'hypothèse qui sera soutenue dans cette partie.

1. Raisonnement en groupe

Considérons la tâche la plus classique de la psychologie du raisonnement, la tâche de sélection de Wason (Wason, 1966) qui implique de vérifier une simple règle conditionnelle. Sous sa forme la plus abstraite, il a été systématiquement reporté que les performances en solitaire son faibles, de l'ordre de 10 à 15% de réponses correctes (Evans, Newstead, & Byrne, 1993). Cependant, lorsque l'on demande à des groupes de 4 ou 5 participants de résoudre la même tâche, les performances atteignent jusqu'à 80% de réponses correctes (Moshman & Geil, 1998; Augustinova, 2008; Maciejovsky & Budescu, 2007). L'augmentation des performances en groupes par rapport aux performances individuelles a également était observée pour des problèmes mathématiques (Laughlin & Ellis, 1986) et un ensemble de tâches qui proviennent de la littérature de l'apprentissage collaboratif (Johnson & Johnson, 1987; Slavin, 1995) et du conflit socio-cognitif (Buchs & Butera, 2004; Doise & Mugny, 1984; Perret-Clermont *et al.*, 2004; Perret-Clermont, 1980). Bien que l'amélioration des performances en groupe soit un effet robuste et qu'elle soit largement rapportée dans la littérature, un débat persiste quant aux processus qui peuvent l'expliquer. Même les experts semblent sous estimer le rôle de la discussion dans le raisonnement (Mercier *et al.*, 2015b).

L'explication souvent avancée par la littérature sur le conflit socio-cognitif et l'apprentissage collaboratif est que le contexte social influence le raisonnement principalement en créant une source de motivation pour développer des arguments plus complexes, envisager les points de vue des autres et questionner nos propres connaissances (Moshman & Geil, 1998). D'autres chercheurs, insistent sur le rôle des processus liés à la source de l'information. Les participants seraient capables de repérer le membre du groupe le plus intelligent (Oaksford, Chater, & Grainger, 1999) ou le plus confiant (Levin & Druyan, 1993; Opfer & Sloutsky, 2011) et se contenteraient de le suivre. Or, comme on l'a mentionné précédemment, une récente étude a montré que les participants changent d'avis lorsqu'ils sont exposés aux arguments qui soutiennent la réponse correcte, et ce, indépendemment de leur niveau de confiance (Trouche *et al.*, 2014).

La théorie argumentative du raisonnement semble être une alternative qui rend mieux compte des différences de performances entre les raisonneurs solitaires et les groupes de discussion. En postulant que le biais vers son côté est une caractéristique adaptative du raisonnement, elle permet d'expliquer les faibles performances lorsque les participants raisonnent seuls. Elle prédit également que la discussion devrait améliorer les performances, grâce à l'échange d'arguments et la mobilisation des capacités d'évaluation, et ce indépendemment des apprentissages formels (scolarisation). On devrait donc être en mesure d'observer les bénéfices de l'argumentation et les effets des caractéristiques de production et d'évaluation dans des populations traditionnelles non scolarisées. C'est l'objet du premier article de cette thèse : *The benefit of argumentation in a Mayan indigenous population*.

Article 1 : Evidence for benefits of argumentation in a Mayan indigenous population

Evidence for Benefits of Argumentation in a Mayan Indigenous Population

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Abstract

Group discussion improves on individual reasoning performance for a wide variety of tasks. This improvement, however, could be largely specific to members of modern, schooled, affluent Western cultures. In two studies, we observed the same improvement in the members of a traditional population—indigenous Maya from Guatemala. Two features of reasoning can account for this improvement: the myside bias, which precludes individuals from improving their performance on their own, and the ability to soundly evaluate others' arguments, which allows individuals to benefit from group discussions. These two features were observed in the traditional population studied: solitary reasoning performance was marked by the myside bias; individuals were more likely to be convinced by arguments for the correct answer rather than for a wrong answer. Together with previous evidence, the present results strengthen the conclusion that these features are adaptive features of reasoning.

Keywords: Reasoning, argumentation, myside bias, traditional populations.

At least since Descartes, reasoning has generally been understood as a tool of individual cognition: by carefully evaluating and weighing one's reasons, one should arrive at sounder beliefs and better decisions (Descartes, 1637; Kahneman, 2003; Stanovich, 2004). Opposed to this individualistic view, an alternative is that reasoning's main function is social: to find reasons in order to convince others, and to evaluate others' reasons in order to adopt better supported beliefs. The argumentative theory of reasoning (Mercier & Sperber, 2011) is a recent instantiation of this social view of reasoning (for other social views of reasoning, see Baumeister & Masicampo, 2010; Billig, 1996; Gibbard, 1990; Piaget, 1928).

An important result supporting the argumentative theory of reasoning is that, provided minimal conditions are met (e.g. the expression of disagreement, see Janis, 1982), argumentation in the course of group discussion produces sizeable improvements in reasoning performance on a variety of tasks, such as logical, mathematical, and inductive problems (Laughlin, 2011; Moshman & Geil, 1998; Trouche, Sander, & Mercier, 2014), work related tasks (Mercier, 2011c), forecasting (Mellers *et al.*, 2014; Rowe & Wright, 1999), and school tasks (Mercier, 2011b; Slavin, 1995; Smith *et al*., 2009). The argumentative theory suggests that the gap in performance between individual reasoning and reasoning in discussion stems from a combination of two features of reasoning. The first is the myside bias (or confirmation bias): individuals overwhelming produce reasons for their preferred opinions (Mercier, in pressa; Nickerson, 1998). As a result, reasoning rarely allows the lone reasoner to correct mistaken intuitions. Instead, the myside bias can lead to overconfidence (Koriat, Lichtenstein, & Fischhoff, 1980) and polarization (Tesser & Conlee, 1975). The second feature is reasoning's ability to soundly evaluate others' arguments, rejecting weak arguments and accepting strong enough ones (Hahn & Oaksford, 2007; Petty & Wegener, 1998). In a discussion group members only provide arguments for their side, but they also evaluate each other's arguments. They change their minds when the arguments are good enough, which usually means changing their mind for the best.

These features of reasoning, along with the gap in reasoning performance they seek to explain, could be a peculiarity of WEIRD (Western Educated Industrialized Rich Democratic) cultures. These cultures, in which the research mentioned above has been conducted, differ from other cultures on a number of traits (Henrich, Heine, & Norenzayan, 2010). In particular, participants from WEIRD cultures are sometimes at

the far end of the distribution—for instance in terms of individualism (Henrich *et al.*, 2010). Schooling, which is comprehensive in WEIRD cultures but absent from many other cultures, can exert a profound influence on cognition, for instance through the acquisition of literacy (Dehaene, 2009) and numeracy (Dehaene, 1999; Gordon, 2004).

Regarding reasoning and argumentation, WEIRD cultures have a series of traits that, while not necessarily specific to these cultures, might conspire to create the features mentioned above. Compared to many other cultures, members of Western cultures: 1) have long put a higher value on argumentation in their institutions, from science to law or politics (Lloyd, 1996; Peng & Nisbett, 1999; especially compared to Eastern cultures, see Becker, 1986; Nakamura, 1964); 2) put relatively less stress on face-saving and social harmony (Kim & Markus, 1999; Oetzel *et al.*, 2001), which might allow for more confrontational and open debates (Mercier, Deguchi, Van der Henst, & Yama, 2015); 3) adopt a different parenting style in which children tend to argue more with adults: they question more freely their decisions, and receive more explanations—although this difference seems to be restricted to the middle and upper classes (Chouinard, Harris, & Maratsos, 2007; indeed, they talk more with adults generally, Hart & Risley, 1995; Heath, 1983). All of these factors might make argumentation a cognitive skill particularly valued in participants from WEIRD cultures.

The myside bias might be a cognitive response to a specific cultural environment in which argumentation is highly valued and it is particularly important to be able to defend one's point of view. Two other traits might help explain the existence of a myside bias in WEIRD cultures. First, in WEIRD cultures, individuals are confronted with a variety of choices, values, and worldviews. In such cultures, it makes sense to anticipate having to defend one's choices, since it is likely that one will encounter people who have made different choices (Schwartz, 2004). Second, many of these choices mostly have a symbolic value, so that it arguably matters more to make a decision that is socially acceptable than an intrinsically good decision. For instance, reasoning has been shown to lead customers towards products they enjoy less, but which allow them to be perceived more positively by others (Thompson & Norton, 2008; for review, see Mercier & Sperber, 2011). Even socially consequential choices, such as voting, might mostly have a symbolic value (Sears, Lau, Tyler, & Allen, 1980). The symbolic value of voting, and of political opinions more generally, might help

explain why voters in WEIRD cultures have a consistent myside bias when reasoning about politics: it matters more that they have arguments to justify their opinions than that they make otherwise sound opinions (Kahan *et al.*, 2012; Taber & Lodge, 2006).

WEIRD cultures thus seem to have a number of traits that favor the development of argumentative skills, traits which in turn might favor the emergence of a myside bias. In order to test whether these cultural traits partly or entirely account for the relevant features of reasoning—the efficiency of argumentation and the deficiencies of solitary reasoning—it is necessary to study reasoning and argumentation in a population that does not share these cultural traits. We first argue that a broad type of cultures—which we will call, in an ad-hoc fashion, traditional cultures—differs in many relevant ways from WEIRD cultures. Then we will argue that the population to which the participants recruited here belong, the K'iche' Maya in Guatemala, share these traits.

Here we define traditional cultures as the human groups which are the broad opposite of WEIRD cultures: small-scale groups which are not Western, educated, industrialized, or rich (note that many human groups would thus fall between WEIRD and traditional cultures as so defined). The fact that these cultures are not Western means that they do not share the hypothetical Western values which cast argumentation in a positive light (although they might hold other values to the same effect, see, e.g. Gluckman, 1967). Regarding lack of education (in the sense of formal schooling), one of its most relevant consequences is a reluctance to engage in hypothetical thinking. Experiments conducted in several unschooled populations have revealed that most of their members fail to complete even very simple hypothetical reasoning tasks (Cole, Gay, Glick, & Sharp, 1971; Luria, 1976; Scribner, 1977). This reluctance to engage in hypothetical thinking could hinder argumentation, since argumentation often relies on hypotheticals. Besides the lack of schooling, education also differs in traditional societies in other ways. Of particular relevance here is that parenting in traditional populations conforms to the pattern observed outside of middle and upper middle class WEIRD populations: relatively little talk addressed to children, and in particular a very small number of exchanges requiring reasons and explanations (Gauvain, Munroe, & Beebe, 2013). Because members of traditional cultures, compared to members of WEIRD cultures, might value argumentation less, be more reluctant to engage in

hypothetical thinking, and are not trained to argue early on, they might be less likely to develop the argumentative skills evidenced in the members of WEIRD cultures.

We argued above that the members of WEIRD cultures—particularly in the middle and upper middle classes—are faced with a great variety of choices, and that many of these choices are in large part symbolic. The choices facing members of traditional cultures differ in both respects. As a rule, members of these cultures have far fewer choices: far fewer (if any) products to buy, far fewer (if any) choice of occupation, far fewer (if any) choice of places to live, far fewer (if any) choice of religion, far fewer (if any) choices of people to befriend, etc. (see, Lévi-Strauss, 1966). This relative lack of choice suggests a lighter burden of justification. Members of traditional cultures might thus have less use of a myside bias which would help them defend their choices. Moreover, it has been argued that members of traditional cultures make more life and death decisions than members of WEIRD cultures (Diamond, 2012). Contrary to the members of WEIRD cultures, members of traditional cultures do not live only in a human created environment in which many natural dangers are eliminated (e.g. predation) or drastically reduced (e.g. many pathogens). This is reflected in the lower life expectancy in traditional cultures compared to WEIRD cultures (e.g. Gurven & Kaplan, 2007). It is thus plausible that for most decisions, intrinsic value matters more than symbolic value for the members of traditional cultures relative to members of WEIRD cultures. As a result, the myside bias could be disadvantageous for the former, as it leads to intrinsically worse decisions, and advantageous for the latter, as it leads to easier to defend symbolic decisions.

On the whole, it is thus plausible that members of traditional cultures, relative to members of WEIRD cultures, reason in a way that is more practical (see Luria, 1976; Medin & Atran, 2004) and more in line with the predictions of the individualistic view of reasoning. Relative to members of WEIRD cultures, members of traditional cultures might suffer less from the myside bias, and thus be more efficient solitary reasoners, while benefitting less from argumentation.

In light of the evidence available, the relevant traits of traditional cultures mentioned above appear to be present in the K'iche' Maya who participated in the present experiments. The K'iche' are a preliterate Maya Amerindian group living in rural areas of Guatemala. Men are mainly subsistence farmers and women do household maintenance work. They are obviously not Western, and there is no evidence that their

culture puts a particular value on argumentation. The participants in our experiments had received no schooling as children and were in the process of receiving a very moderate amount of schooling as adults. The pattern of interactions with the children seems to follow the pattern typically found outside of middle and upper classes in WEIRD cultures. A study of the interactions between K'iche' adults and children revealed that most of the utterances adults address to children are imperative and very few are questions (Pye, 1986). There is thus little opportunity for argumentative exchanges between children and adults. Overall, the K'iche' do not seem to enjoy any of the cultural traits that might make WEIRD cultures particularly congenial to argumentation.

Like other small-scale societies relying on substance farming, the K'iche' face fewer choices than members of WEIRD cultures. Few products are available for purchase, and they have very little money to purchase them with (UNDP, 2010a, 2010b). The choice of occupation and place to live is extremely restricted (UNDP, 2010a, 2010b, 2012, 2014). Moreover, the environment is harsher than that faced by most members of WEIRD cultures (for instance 94% of the population in the relevant district—Sololá—lacks food security, see INE, 2011, p. 29; UNDP, 2010a; UNFPA, 2014). The risk of disease and early death is much higher (INE, 2011; UNDP, 2010a; UNFPA, 2014). A myside bias might thus be less adaptive in such an environment than in that of WEIRD cultures.

The improvement in performance yielded by argumentation, the myside bias which explains poor solitary performance, and the argumentative skills which explain good performance in group discussion are the main pieces of evidence in favor of the argumentative theory of reasoning. This theory posits that reasoning is an evolved adaptation, and that these features, which make it adaptive, should be relatively universal (Mercier & Sperber, 2011). However, these features have mostly been documented among WEIRD cultures. We have argued above that several traits of Western cultures might conspire to explain these features, and that reasoning might exhibit different features in traditional populations such as the K'iche' Maya recruited in the present study. Experiments carried out in such populations can thus provide crucial evidence to understand the function of human reasoning. Accordingly, the goal of the present experiments is twofold. First, to test whether, in this traditional population, discussion improves performance compared to solitary reasoning. Second, if

such an improvement was observed, to determine whether it could be explained by the two features of reasoning that explain the gap in reasoning performance in WEIRD populations: myside bias and sound ability to evaluate others' arguments.

Methods

Participants. One hundred and forty preliterate participants were involved in this research, 57 in study 1 (48 females, M_{age} = 35.12 years, *SD* = 12.16, range 18-62 years) and 83 in study 2 (78 females, M_{age} = 43.89 years, *SD* = 12.49, range 21-76 years). The participants were K'iche' from ten different villages around the city of Nahualá in the department of Sololá, Guatemala. The participants were recruited through an alphabetization program set up by the CONALFA (National Committee for Alphabetization) in which they take part. The program consisted of arithmetic and literacy classes dispensed in K'iche'. The participants were supposed to spend three hours per week to learn to read and write, first in their native language and later in Spanish, but few of them were able to attend the classes regularly. Nearly all participants (N = 127, 91%) were in their first year of alphabetization, the rest in their second year. Verbal informed consent was obtained from the participants. Each participant received a reward—seeds or sewing threads—that they had requested during the recruitment phase.

Design. Two studies were conducted and both had the same design (see Supplemental Material for details). The tasks used in this research—conservation tasks—are designed to assess the understanding of the invariance of physical quantities across physical transformations (Dasen, 1972; Piaget & Inhelder, 1974), and discussion has been shown to improve performance in WEIRD cultures (Doise & Mugny, 1984; Perret-Clermont, 1980). We used weight/volume conservation tasks, in which participants must indicate how the water level in two glasses changes when one object is introduced in each glass (Figure 1A). The objects differ in some irrelevant dimension(s), such as weight or shape, but not volume; hence the correct answer is that the water rises as much in the two glasses. All the participants first completed two familiarization trials (whose presentation order was counterbalanced): In both tasks, the experimenter provided participants with feedback (see Figure S1; no feedback was provided at any other point

of the experiment). The participants then completed a series of three (Study 1) or two (Study 2) volume conservation tasks on their own (pre-test). Groups of three (Study 1, N = 19, Study 2, N = 25) or four (Study 2, N = 2) individuals were then formed randomly. The groups were given the instruction to arrive at a consensual answer for each task (test). Finally, each participant had to solve the task on her own again (post-test) (see Supplemental Material, Figure S1). In Study 1, a fourth, new task was presented to the participants in the post-test, in order to test for transfer effects (Task 4).

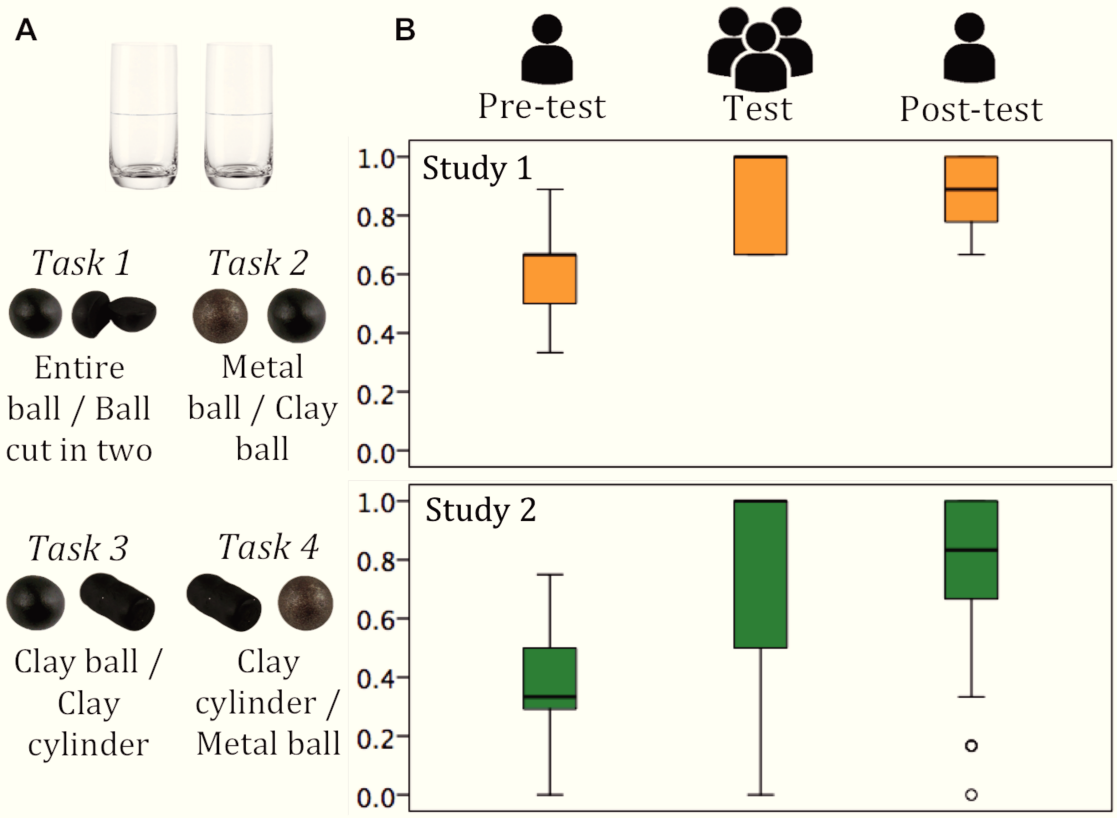

Figure 1. **(A)** Illustration of the four tasks. **(B)** Box plots representing the normalized scores for the groups in Study 1 (Tasks 1, 2, 3) and Study 2 (Tasks 2, 4). The groups are the real discussion groups in the test and the nominal groups comprising the same participants in the pre- and post-tests. The boxes represent the middle half of each sample.

The tasks used in Study 1 (Tasks 1, 2, and 3 at all phases, Task 4 as a transfer task) were chosen based on results obtained by one of the authors (F.J.) with another traditional population (in Papua New Guinea), in which participants only had to complete the tasks on their own. We chose tasks for which there were no ceiling or floor effects in this other traditional population. The tasks used in Study 2 were based

on the results of Study 1. We chose Task 2 because it elicited a lower rate of performance than Tasks 1 and 3 at the pre-test of Study 1. Task 4 provided a baseline to evaluate the performance in Study 1, in which it was used as a transfer task.

In each phase, the tasks were always presented in the same order. The positions of the objects (left and right) were the same during the pre and post-test, and were inverted in the test. During the pre- and the post-test, 114 participants were asked to justify their answers, while 26 were asked instead to think aloud. For all participants, the justifications and think aloud protocols in the pre- and post-test, as well as the discussion during test were recorded, transcribed, translated from K'iche' to Spanish, and coded by two individuals, one of whom was blind to the hypotheses (inter-coder reliability: Kappa = .79, $p < .001$).

Procedure. Two native female experimenters were trained by one of the authors (T.C.), and they conducted all the experiments. All the experiments were conducted in 2014. The experimenters interacted with the participants in their native language. The translations from Spanish to K'iche' were done by one of the experimenters, the back-translation by the other experimenter, with discrepancies resolved through discussion with one of the authors (T.C.). The experiments took place in the village of each community, in the rooms where the participants follow their alphabetization lessons. In order to ensure that the participants were not discussing the tasks outside of the experimental context, when they were not being tested they had to reintegrate their classroom and to continue to follow the lesson of the day. They were also instructed not to interact until the end of the experiment.

In the familiarization phase, the participants were presented with the material: two glasses and two pieces of clay (Play-Doh) (see Supplemental Material, Figure S1). We used the same materials in the following tasks, except for Tasks 2 and 4 in which we used one piece of clay and one piece of metal. The experimenter started the familiarization phase by pouring the two glasses with water and invited the participants to observe that their level was equal. Then she presented the first pair of objects in front of the two glasses. In Tasks 1 and 3, the transformations—cut the ball in two, turn it into a cylinder—were made in front of the participants, and the differences or similarities in weight or size were notified to them before each trial. The experimenter

then asked the participants: “If I put the balls in the two glasses, their level of water will rise, do you think that it will rise more in this glass [The experimenter pointed to one of the glasses]? Do you think it will rise more in this glass [The experimenter pointed to the other glass]? Or it will rise the same in the two glasses?” All the tasks followed the same instructions. During the test, participants were invited to discuss the tasks in groups and to arrive at a consensual answer: “You can discuss now and agree on an answer.” After the discussion, the experimenter asked: “Do you all agree? What is your answer?”

Results

At each stage of the studies, we computed the individual scores, assigning 1 to correct answers and 0 to incorrect answers, and the group scores (addition of individual scores), using real groups for the tests, and the equivalent nominal groups for the pre- and post-tests (Figure 1B, see Supplemental Material, Results for details). Comparing the individual scores, in both studies we observed a significant improvement in performance between the pre-test and the post-test (Study 1: $Mdn_{\text{Pre-test}} = 2$, $Mdn_{\text{Post-test}} = 3$, $Z = 4.79$, $p < .001$, $r = .44$; Study 2: $Mdn_{\text{Pre-test}} = 0$, $Mdn_{\text{Post-test}} = 2$, $Z = 5.33$, $p < .001$, $r = .43$). The pre-test / post-test improvement was also significant when we counted as correct only correct answers accompanied by a correct explanation, e.g. “because the objects have the same size” (Study 1: $Mdn_{\text{Pre-test}} = 2$, $Mdn_{\text{Post-test}} = 3$, $Z = 5.04$, $p < .001$, $r = .45$; Study 2: $Mdn_{\text{Pre-test}} = 0$, $Mdn_{\text{Post-test}} = 2$, $Z = 4.94$, $p < .001$, $r = .36$). Regarding group scores, in both studies we observed a significant improvement in performance between the pre-test and the test (Study 1: $Mdn_{\text{Pre-test}} = 6$, $Mdn_{\text{Test}} = 9$, $Z = 3.64$, $p < .001$, $r = .67$; Study 2: $Mdn_{\text{Pre-test}} = 2$, $Mdn_{\text{Test}} = 6$, $Z = 3.80$, $p < .001$, $r = .53$) but not between the test and the post-test (Study 1: $Mdn_{\text{Test}} = 9$ $Mdn_{\text{Post-test}} = 8$, $Z = 1.47$, $p = .14$; Study 2: $Mdn_{\text{Test}} = 6$, $Mdn_{\text{Post-test}} = 5$, $Z = .064$ $p = .95$). Thus, group discussion significantly improved the reasoning performance of preliterate individuals.

To test whether the myside bias could explain wrong answers at the pre-test, we analyzed the reasons participants provided. The myside bias should limit the number of reasons that go against the participants’ answers. Out of 141 explanations given by participants providing the wrong answer, 1 contained no reason, 134 contained only reasons supporting the participants’ answer, and 6 contained reasons against it. This

result could also reflect a task demand: participants were asked to explain their answers. Therefore, they might have failed to mention reasons that they had considered but dismissed. To test this possibility, a subset of participants had been asked not to explain their answers, but to think aloud while they were trying to solve the tasks. Out of the 32 explanations given by participants providing wrong answers in think aloud protocols, 3 mentioned reasons going against their final answer, 2 contained no reasons, while 27 contained only reasons supporting the participants' final answer (see Supplemental Material, Results for the detail of the coding).

To evaluate the soundness of argument evaluation, we contrasted the effects good and bad arguments had on the outcome of the discussion. An argument could convince other group members not because they think it is good, but because it is defended by the majority. To examine such majority effects, we first analyzed the 43 discussions in which a participant who had given the correct answer and the correct justification in the pre-test faced group members who all agreed on the same wrong answer. In 33 (77%) of these discussions, the group agreed on the correct answer. Moreover, in 8 out of the 10 remaining discussions, no argument for the correct answer was offered. We also analyzed the 23 discussions in which a participant who had given a wrong answer in the pre-test faced group members who all agreed on the correct answer. In these discussions, the participant with a wrong answer never convinced the group. Thus, a participant who defended an answer on her own was significantly more likely to convince the group if she defended the correct answer than a wrong answer ($p < .001$). As an illustration, Figure 2 represents the effects of correct and incorrect arguments on the outcome of group discussion for the Task 4 of Study 2.

If the participants who adopted the correct answer did so because they had understood the good argument, they might be able to use this new understanding to solve a transfer task. In Study 1, we used a novel conservation task (Task 4) after the post-test. In Study 2, Task 4 was used in the pre-test. In Study 1, participants solved this task correctly more often (63%) than in Study 2 (39%; $p = .006$).

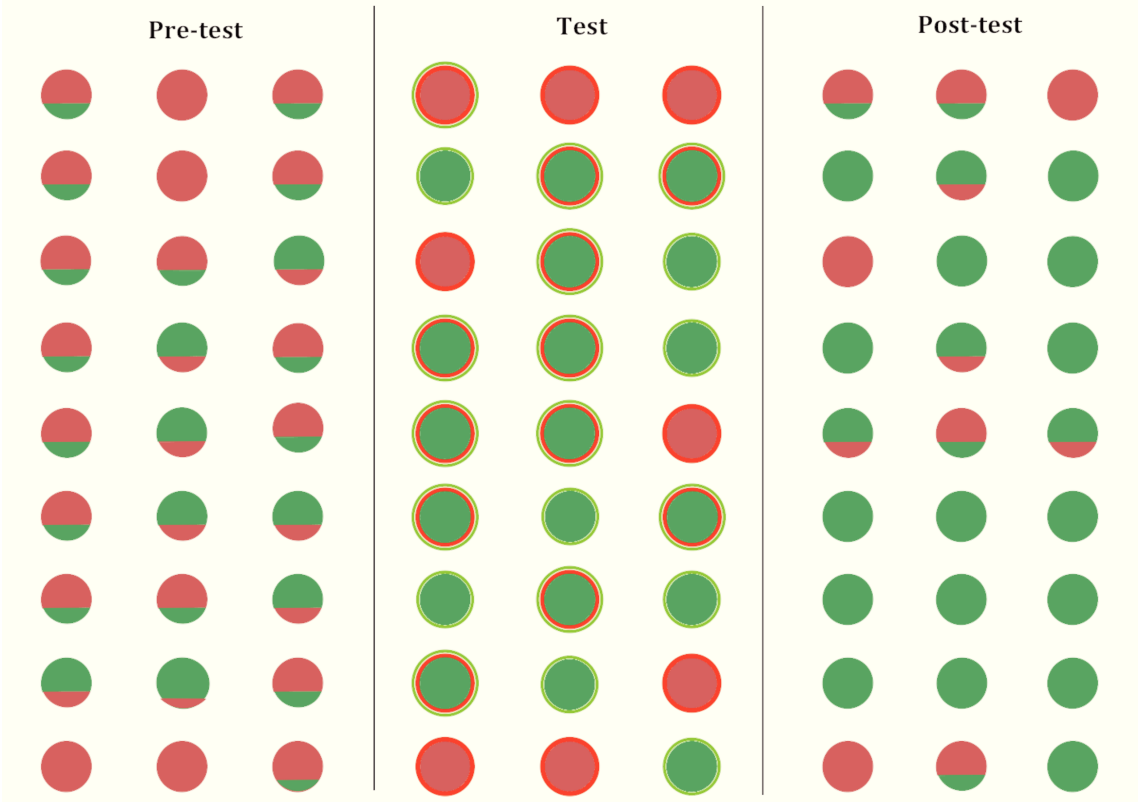

Figure 2. Details of the performance for Task 4 in Study 2. For the pre-test and the post-test, each disk represents a nominal group, and the proportion of red (resp. green) in the disks represents the proportion of incorrect (resp. correct) answers. For the test, each disk represents a group and the color represents the outcome of the discussion. A red (resp. green) surrounding circle indicates that an argument for the wrong answer (resp. the correct argument for the correct answer) was uttered at least once during the discussion.

Conclusion

The results of these studies show that preliterate individuals share some of the most important features of reasoning previously documented in WEIRD populations: reasoning performance significantly improves with discussion; argument production is marked by the myside bias; argument evaluation is efficient, enabling participants to discriminate between good and bad arguments and to be convinced by good arguments.

These results do not demonstrate that these features are universal. We might have considered the wrong traits of WEIRD cultures as being potentially relevant to the shaping of reasoning and argumentation. Other cultural traits, which are shared by WEIRD cultures and the Mayan indigenous group studied here but absent in other cultures, might in fact be determinant. Still, the K'iche' differ from WEIRD cultures in many of the traits that could have plausibly explained why the relevant features of

reasoning are observed in WEIRD cultures: the value placed on argumentation, the fact that children and adults exchange many arguments, the fact that people feel they have to justify many of their choices, and the relatively low costs of poor decisions. We thus suggest that the present investigation helps make the case that these features are not culturally acquired.

The potential universality of these features of reasoning is relevant to the debates about the function of reasoning. Individualist theories of reasoning do not necessarily predict poor argumentative performance, but it is not clear how they can explain the improvement in performance following group discussion. As for the myside bias, it runs directly against their predictions. By contrast, these features of reasoning support the argumentative theory of reasoning.

The argumentative theory of reasoning suggests that these features are adaptive features of reasoning. They would be adaptive because they enable reasoning to fulfill its main function, argumentation, which in turns greatly facilitates communication (the evolutionary rationale is exposed in Mercier & Sperber, 2011). As expected if these features are adaptive, not only are they extremely robust in adults from WEIRD populations (Mercier, in pressb; Mercier & Sperber, 2011), but they have now been observed in a culture that differs in many relevant ways from WEIRD cultures, and there is no strong evidence that they are absent from other cultures (Mercier, 2011a; Mercier *et al.*, 2015). Moreover these features seem to develop early (Castelain, Bernard, Van der Henst, & Mercier, in press; Mercier, 2011b).

Although research into cultural variation can yield precious insights about cognition, it is possible that cross-cultural psychology is overly geared towards differences rather than similarities. Focusing on potential universals is also of tremendous theoretical importance, in particular for testing adaptive hypotheses. We hope the present research can be another step in this direction (for another recent example using the same population, see Fontanari, Gonzalez, Vallortigara, & Girotto, 2014).

Data availability: All the data are available at this url: https://sites.google.com/site/hugomercier/Data%20Evidence%20for%20core%20features%20of%20reasoning.zip?attredirects=0

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Supplementary materials for "Evidence for benefits of argumentation in a Mayan indigenous population"

Material and Methods

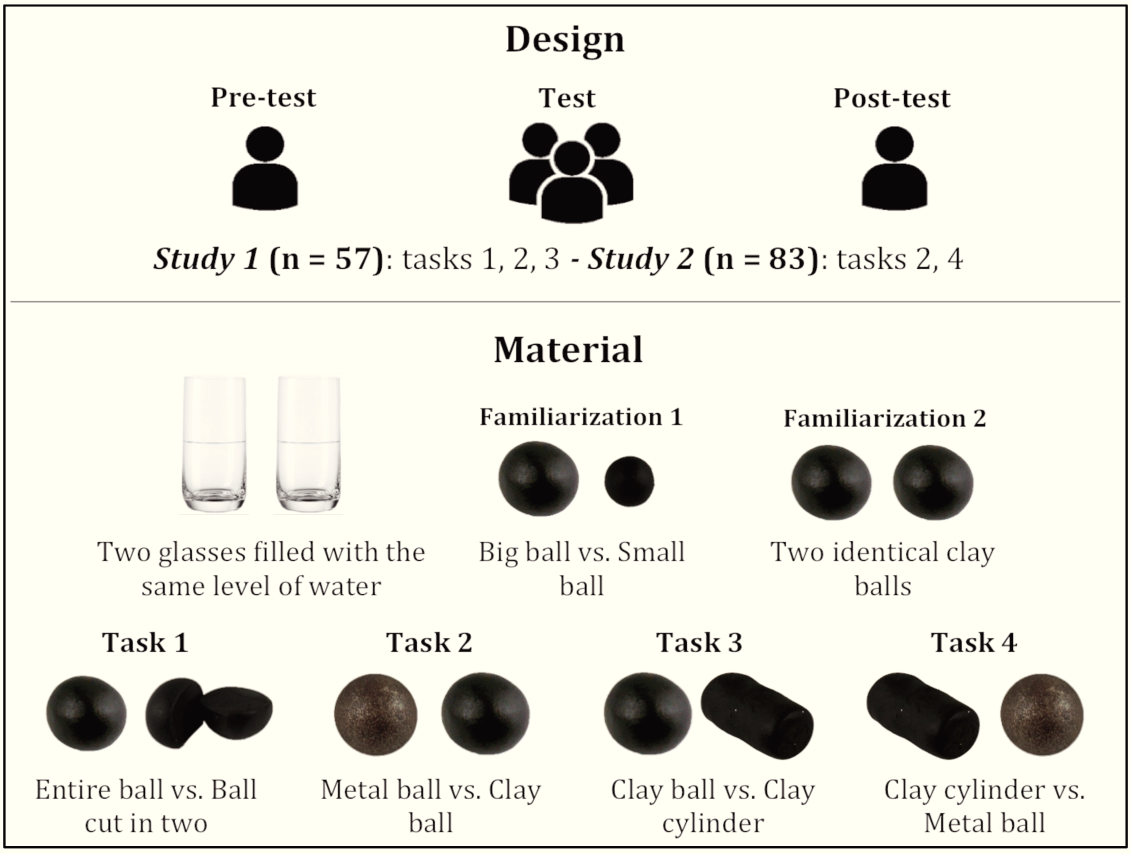

Figure S1. Illustration of the design and the material used in both studies.

Results

Performance. The most basic test consists in comparing performance during the three phases, using only the participants' answers, irrespective of their justifications. These results are reported in Tables S1 and S2 (broken down by correct / incorrect answer), and Tables S3 and S4 (broken down by specific answer).

Table S1. Percentages of correct answers in Study 1 (for each task, N = 57). In the test phase, the numbers in parentheses correspond to the percentage of groups (for each task, N = 19).

	Pre-test	**Test**	**Post-test**
Task 1	75	100(100)	93
Task 2	30	74(74)	68
Task 3	79	95(95)	95
Total	**61**	**90(90)**	**85**

Table S2. Percentages of correct answers in Study 2 (for each task, N = 83). In the test phase, the numbers in parentheses correspond to the percentage of groups (for each task, N = 27).

	Pre-test	**Test**	**Post-test**
Task 2	33	78(78)	75
Task 4	39	71(70)	76
Total	**35**	**75(74)**	**76**

Table S3. Number of specific answers in Study 1 (for each task, N = 57). In the test phase, the numbers in parentheses correspond to the number of groups (for each task, N = 19).

	Task 1			**Task 2**			**Task 3**			**Task 4**		
	Entire Ball	Ball cut in two	Same in both glasses	Metal ball	Clay ball	Same in both glasses	Ball	Cylinder	Same in both glasses	Cylinder	Metal ball	Same in both glasses
Pre-test	7	7	43	39	1	17	3	9	45	-	-	-
Test	0(0)	0(0)	57(19)	15(5)	0	42(14)	0	3(1)	54(18)	-	-	-
Post-test	2	2	53	18	0	39	0	3	54	6	15	36
Total	**9**	**9**	**153**	**72**	**1**	**98**	**3**	**15**	**153**	**6**	**15**	**36**

Table S4. Number of specific answers in Study 2 (for each task, N = 83). In the test phase, the numbers in parentheses correspond to the number of groups (for each task, N = 27).

	Task 2			**Task 4**		
	Metal ball	Clay ball	Same in both	Cylinder	Metal ball	Same in both
Pre-test	55	1	27	11	40	32
Test	18(6)	0(0)	65(21)	9(3)	15(5)	59(19)
Post-test	18	3	62	8	12	63
Total	**91**	**4**	**154**	**28**	**67**	**154**

Data analysis. The same data analysis procedure was used in studies 1 and 2. Analyses were performed using SPSS v21.0 (IBM Corp., Armonk, NY, USA). Preliminary analyses indicated that none of data collected (individual or group scores) followed a normal distribution. Thus, non-parametric statistics were performed, all of them two-tailed.

Individual and group scores. Answers were coded as follows: 1 for the correct answer, 0 for an incorrect answer. Individual scores were computed by summing the correct answers in the respective three (Study 1) or two (Study2) tasks. Real (test) and nominal (pre- and post-test) group scores were computed by summing individual scores. So, for each stage of the studies each participant could obtain a maximum score of 3 (Study 1) or 2 (Study 2) and each group could obtain a maximum score of 9 (Study 1) or 6 (Study 2).

Box plots. For ease of comparison between the two studies, individual and group scores were normalized to a scale from 0 to 1. The dark line represents the median value. The box represents the middle half of the sample, between the lower and the upper quartiles. The whiskers represent the largest values except for the outliers. The outliers (circles) are data points situated within one and a half and three box lengths lower than the lower quartile or higher than the upper quartile.

Coding scheme. The coding scheme used is laid out in Table S5, and the results in Tables S6 and S7. The justifications in the pre- and post-test, as well as the discussion of each task were analyzed by two coders, one of whom was blind to the hypotheses (inter-coder reliability: Kappa = .79, $p < .001$). For the discussions, the arguments exchanged by the group members (corresponding to one conversational turn) were coded one by one. These results can be found in the data files available online.

Table S5. Codification of the arguments given by the participants. Code 1: Argument types; Code 2: Arguments pro and con the participant's answer.

Code 1	**Explanation**	**Example**
0	There is no argument, the participant repeats the answer.	"The level rises in the two glasses."
1	The participant gives the correct argument for the correct answer.	"Because the two balls have the same size."
2	The participant gives one or more arguments for the correct answer, but none of the arguments are correct.	"Because they have the same weight."
3	The participant gives an argument for the incorrect answer.	"Because of the weight of the metal ball."

Code 2	**Explanation**	**Example**
0	There is no argument, the participant repeats the answer.	"The level rises in the two glasses."
1	The participant gives only arguments (one or more) that support her answer, whether her answer is right or wrong.	"Because the two balls have the same size." "Because of the weight of the metal ball."
2	The participant either only gives arguments against her answer, or arguments for more than one answer.	"The metal ball is heavier but they have the same size."

Table S6. Frequencies of the justifications in Study 1 (for each task, N = 57).

	Pre-test			**Post-test**		
Code	Task 1	Task 2	Task 3	Task 1	Task 2	Task 3
0	1	1	1	1	0	1
1	**36**	**15**	**38**	**48**	**36**	**50**
2	7	1	6	5	3	3
3	13	40	12	3	18	3

Note: 0 = Lack of clear explanation; 1 = Correct argument for the correct answer; 2 = One of more arguments for the correct answer, but none are correct; 3 = Argument for the incorrect answer.

Table S7. Frequencies of the justifications in Study 2 (for each task, N = 83).

	Pre-test		**Post-test**	
Code	Task 1	Task 2	Task 1	Task 2
0	1	2	1	2
1	**27**	**28**	**53**	**56**
2	0	3	6	7
3	55	50	23	18

Note: 0 = Lack of clear explanation; 1 = Correct argument for the correct answer; 2 = One of more arguments for the correct answer, but none are correct; 3 = Argument for the incorrect answer.

2. Raisonnement moral en groupe

Comme c'est le cas pour le raisonnement logique, il est probable que le rôle de l'argumentation dans les changements moraux ait été sous-estimé. Peu d'attention a été portée aux situations dans lesquelles le raisonnement est le plus susceptible d'influencer les jugements moraux : les discussions en groupe. En effet, la tendance actuelle en psychologie morale est de considérer le raisonnement comme un simple suiveur d'intuitions et d'émotions (Haidt, 2001, 2007, 2008) voir un mécanisme qui permette de justifier des comportements immoraux (Bandura, Barbaranelli, Caprara, & Pastorelli, 1996; Vohs & Schooler, 2008). Les théories qui postulent un rôle limité, voir négatif du raisonnement, peuvent être qualifiées d' « intuitives ».

Bien que des études aient montré que la discussion peut influencer certains jugements moraux (Berkowitz & Gibbs, 1985; Blatt & Kohlberg, 1975; Damon & Killen, 1982; Leman & Duveen, 1999), les chercheurs de la tradition intuitionniste ont été peu influencés par ces résultats, en partie car les jugements que les participants doivent donner dans ces expériences ne dépendent pas d'intuitions ou d'émotions fortes.

Haidt, Bjorklund et Murphy (2000) ont évalué la réaction des participants face à une situation d'inceste consenti entre un frère et une sœur. Bien qu'il est rendu explicite le fait que personne d'autre ne connaît cette situation, qu'aucun des deux n'a subi de dommage et que les deux sentent que cela les a plus unis, la majorité des participants jugent la situation de manière négative. De plus, de nombreux participants semblent conserver la même opinion même suite à la réfutation de toutes les raisons qu'ils peuvent avancer pour justifier leur jugement.

Sur la base des résultats d'études similaires à celle présentée, Haidt (2001) suggère que lorsque les individus justifient leur raisonnement moral, ils perdent souvent de vue ou occultent les prémisses basiques et les processus qui les ont réellement amenés à ces conclusions. Selon cette approche, le raisonnement se déploierait essentiellement pour produire des justifications post-hoc sur les opinions déjà formées sur la base des intuitions (Haidt & Bjorklund, 2008).

Evidemment, les théories intuitionnistes ne peuvent nier que des changements moraux ont lieu, que ce soit au niveau individuel ou historique, mais ils les attribuent principalement à l'influence sociale et la conformité (Haidt, 2001) ou à des moyens de persuasion qui n'impliquent pas de raisonnement ou d'arguments, mais qui font davantage appel aux émotions (Bloom, 2010).

Dans le domaine de la morale, les individus produisent des arguments sous la forme de rationalisations (Mercier, 2011c). Pour Mercier (2011c) ces rationalisations sont le produit naturel d'un mécanisme argumentatif doté d'un biais vers son côté robuste. Ce qui contredit la prédiction de Haidt & Bjorklund (2008), dans le sens où ces rationalisations non seulement rendent la personne vulnérable face à des contre-arguments mais peuvent aussi conduire à un changement d'opinion, dans les cas où aucune rationalisation n'est accessible.

Le raisonnement permet non seulement de produire des arguments mais aussi de les évaluer. De cette manière, les individus peuvent potentiellement accepter des conclusions bien fondées si celles-ci sont soutenues par des arguments forts. Ainsi, dans le contexte de groupe ou de débat, la capacité pour produire des arguments pour défendre son point de vue et la capacité à évaluer les arguments des autres peuvent se combiner pour conduire à de meilleures solutions (Mercier, 2011c). En lien avec les théories intuitionnistes, la théorie argumentative du raisonnement permet d'expliquer pourquoi le raisonnement solitaire résulte souvent en des justifications post-hoc plutôt que des changements moraux : sans personne pour évaluer de manière critique ses arguments, le raisonnement fourni naturellement au raisonneur solitaire des excuses pour ses inclinaisons (Mercier, 2011c). Mais elle se distingue de cette approche lorsqu'il s'agit du raisonnement dans un contexte de dialogue et prédit que même une opinion minoritaire peut changer les jugements moraux des groupes, et que ce changement est principalement dû aux arguments plutôt qu'à des formes de persuasions telles que le recours aux émotions. Les résultats limités dans ce domaine semblent compatibles avec cette prédiction (Mercier, 2011c). Le chapitre qui suit, *The power of moral arguments*, apportera de nouvelles données exploratoires qui visent à mieux comprendre le rôle des arguments et des discussions sur les jugements moraux.

Chapitre 2 : The power of moral arguments

The Power of Moral Arguments

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The question of the role of reasoning, by contrast with intuition and emotion, in moral judgment and decision has animated philosophy for centuries and psychology for the past few decades. Over the past years, an increasing number of experiments have revealed that reasoning often plays little active role in moral judgment (Haidt, 2001). In a famous study, participants cast a negative judgment on siblings who had sex even though it was stressed that no harm had come of it. Crucially, many participants still appeared to hold on to their negative judgment after all their reasons had been rebutted (Haidt, Bjorklund, & Murphy, 2000; although see, Royzman, Kim, Leeman, & others, 2015). In another experiment, the ethnicity of the protagonists in a story was manipulated. This manipulation affected participants' moral judgments of the protagonists—yet they never defended their judgments in ethnic terms, relying instead on impeccable but post-hoc moral principles (Uhlmann, Pizarro, Tannenbaum, & Ditto, 2009).

These experiments do not show that reasoning plays no role in moral judgments, but they suggest that it mostly plays a post-hoc role of finding justifications for a judgment that is arrived at intuitively. Reasoning mostly plays a causal role when it fails to find any decent moral justification, in which case people might feel compelled to change their mind (for an example with moral behavior, see Snyder, Kleck, Strenta, &

Mentzer, 1979). A few experiments have revealed a more active role for reasoning, so that making people reason more could alter their moral judgments. For instance, inducing a 'reflective mood' (by giving people logical problems that require reflection) made people more likely to give the utilitarian answer to 'sacrificial problems' (Paxton, Ungar, & Greene, 2012). (Sacrificial problems are moral dilemmas in which someone would need to sacrifice at least one life to save more lives—Sophie's choice being the archetypal example. The deontic answer is to refuse to sacrifice the life, the utilitarian one to sacrifice it.)

On the whole, these results fit well with Haidt's influential Social Intuitionist Model (Haidt, 2001). In this model, moral reasoning plays a limited role: it can influence intuitive moral judgments, but does so only rarely. However, the Social Intuitionist Model leaves open the possibility that reasoning might play a larger role when people exchange arguments with each other, instead of engaging in solitary ratiocination: "in conversation, where people can point out each other's flaws and give each other reasons, good reasoning often emerges from the dyad" (Haidt & Bjorklund, 2007, p. 241).

The role played by reasoning in moral judgment according to the Social Intuitionist Model is very similar to the role played by reasoning more broadly according to the argumentative theory of reasoning (Mercier & Sperber, 2011). This theory suggests that the main function of reasoning is to argue: to produce arguments in order to convince others, and to evaluate others' arguments in order to be convinced only when warranted. In this perspective, the limited effects of individual reasoning are readily explained by the function of reasoning. Solitary reasoning would mostly serve the function of preparing oneself to defend one's opinions or decisions, in anticipation of potential criticisms. Solitary reasoning should thus have a confirmation bias, or myside bias: it should mostly find arguments that support the reasoner's existing beliefs, and indeed it does (Mercier, in press).

By contrast, people should be able to evaluate others' arguments relatively well: they should reject fallacious arguments and be convinced by strong enough arguments. On the whole, the experimental evidence is consistent with this conclusion, at least when people care about the argument's conclusion (e.g. Hahn & Oaksford, 2007; Hoeken, Timmers, & Schellens, 2012; Petty & Wegener, 1998). In discussion, the ability to produce arguments to defend one's point of view, and to evaluate others'

arguments, should combine and yield good outcomes. People put forward arguments for their respective opinions, only the best arguments withstand the critical examination of the other group members, and these arguments end up carrying the day. In a discussion, group members have time to refine their arguments, to address each other's counter-arguments, and to combine bits of insight from the different members into a solution that can be better than that of the best members (Laughlin, 2011).

The efficacy of argumentation—and the apparent deficiencies of individual reasoning—are well illustrated by the following problem (which we will call the Paul and Linda problem):

> Paul is looking at Linda and Linda is looking at John.
> Paul is married but John is not married.
> Is a person who is married looking at a person who is not married?
>
> Yes / No / We cannot tell

The correct answer is 'Yes': Linda is either married or not married, and in both cases it is true that a person who is married is looking at a person who is not married (if Linda is married, the she's looking at John, who's not married; if Linda is not married, then Paul, who is married, is looking at her). Yet most participants (typically between 80 and 90%) answer 'We cannot tell,' a typical failure of individual reasoning (Trouche, Sander, & Mercier, 2014).

When participants who have found the correct answer on their own are given the standard argument for the wrong answer, they do not change their mind. By contrast, when those who have provided the intuitive but wrong answer are given the argument for the correct answer (written by another participant), approximately half of them accept the argument and adopt the correct answer (Trouche *et al.*, 2014; see also Stanovich & West, 1999). This shows that people find it easier to evaluate good arguments than to produce them on their own. The contrast becomes even starker in discussion. When participants discuss the problem in small groups, a single member who found the correct answer is nearly sure to convince the other members, even if they unanimously and confidently support the wrong answer (Laughlin, 2011; Moshman & Geil, 1998; Trouche *et al.*, 2014).

If argumentation works best for problems that have a demonstrably correct answer, it also substantially improves on reasoning performance in other domains: for inductive problems (Laughlin, Zander, Knievel, & Tan, 2003), for a variety of work-related problems (e.g. Blinder & Morgan, 2005; Mellers *et al.*, 2014), in schools (Mercier, 2011; Slavin, 1995), and in science (Dunbar, 1995; Mercier & Heintz, 2014). Most of these examples, however, are epistemic. What about morality?

In the case of moral judgments and decisions, it has been suggested that argumentation plays a limited role by contrast with other social processes such as trust or conformity (Bloom, 2010). People's moral convictions would blind them even to strong arguments that challenge their point of view (Edwards & Smith, 1996). While the bulk of the literature on moral reasoning bears on participants in isolation, there is still some data that speak to this issue.

Before looking at the data, we must lay out some predictions. In the epistemic domain, it is often possible to tell what the best—or at least a better—answer is. In the moral domain this is often difficult, but we must try nonetheless. If we assume that moral judgments aim chiefly at gauging whether people would make good cooperation partners (e.g. Baumard, André, & Sperber, 2013), then the judgments can be objectively more or less accurate. Sound moral judgments are those that accurately predict individuals' cooperative behaviors towards the individual doing the judging.

By symmetry, good moral decisions are decisions that make the relevant audience believe we would be good cooperation partners—decisions that play well for our reputation as moral individuals (e.g. Baumard, André, & Sperber, 2013). Evaluating moral decisions is much more difficult because any decision can carry a wide variety of costs and benefits for the individual on top of its effects on the individual's moral reputation. The best decision everything considered is rarely the most moral one.

The prediction of the argumentative theory of reasoning is that argumentation, on average, helps individuals who disagree but whose interests overlap reach better beliefs and better decisions. In the case of moral judgments, it means more accurate moral judgments. But in the case of decisions, it doesn't mean more moral decisions necessarily, but better decisions overall. This is a very rough prediction, however. We can get slightly more fine-grained predictions by looking at how argumentation works.

A useful way of thinking about the effects of argumentation is that, when argumentation works, it is by increasing the coherence between the beliefs of the audience (Sperber, 2001; Thagard, 2002). For instance, someone who provides the wrong answer to the Paul and Linda problem holds incoherent beliefs (i.e. the wrong answer is incoherent with the information provided in the problem). When she accepts the argument for the correct answer, her beliefs become more coherent. If we assume, trivially, that our beliefs are more likely to be accurate than not, then increased coherence should increase the accuracy of our beliefs (see, e.g., Thagard, 2002). In a few cases, increased coherence can lead to less accurate beliefs. This should happen when the subset of beliefs being recruited in argumentation is more likely to be inaccurate than accurate. This is plausibly the case for discussions of scientific topics that rely only on intuitive beliefs and not on scientific discoveries (discussions that would have had very little evolutionary relevance).

In the case of moral judgments and decisions, argumentation should play the same role. In particular, argumentation has the potential to increase the coherence between specific judgments and decisions and more general moral principles one is committed to. Still, coherence with moral principles should only be one of the factors being weighted in when making decisions.

The effect of arguments on moral matters—a brief literature review

Unidirectional arguments—arguments to which one cannot reply—are typically less effective at changing people's minds than an actual discussion and the exchange of arguments it enables. Yet even unidirectional arguments can influence people's moral judgments and decisions.

To show that arguments influence moral opinions, a standard methodology is to measure participant's opinions, expose them to an argument, and measure their new opinions. However, even if a change is observed, it could merely result from a task demand—participants understanding what is expected of them—or from mere conformity—exposition to someone else's opinions, whether it is well supported or not. To show that the argument matters, argument type or argument quality has to be manipulated. When this is the case, an alternative method is to compare the opinions of

participants who have received one argument to the opinions of participants who have received another argument, rather than to their prior opinions.

This is what Paxton and colleagues (2012) did. They asked participants to read the story of sibling incest mentioned at the beginning. They provided one of two arguments to the participants: a strong argument, which suggested that the feeling of disgust felt towards incest was not warranted, and a weak argument, which suggested that making love was a normal expression of love in any relationship. Participants were then asked to rate the morality of the siblings' behavior. Participants exposed to the strong argument were more accepting of the sibling's behavior than those exposed to the weak argument. This, however, was only true of participants who had time to reflect on the arguments. Participants who were asked to answer very quickly after reading the arguments were not influenced by the strength of the arguments, and their ratings fell in between the ratings of the participants who had reflected on the strong argument and those of the participants who had reflected on the weak argument. This suggests that both arguments had an effect, albeit an opposite one (the weak argument was indeed appallingly bad). That arguments can affect even a canonical example of an emotional moral judgment is an important result.

Studies in political science have also shown that arguments can affect views on policy that have a strong moral component. For instance, the debate, in the U.S., over the inheritance tax (or 'estate tax') has a strong moral dimension—Is it fair to tax people who want to transmit their wealth to their children? Would the repeal of the tax create immoral inequalities? (Graetz & Shapiro, 2005; Hochschild, 1980). It is also associated with political partisanship, with Republicans being more likely to favor its repeal (Krupnikov, Levine, Lupia, & Prior, 2006). It has been suggested that for such a topic, factual arguments would have little appeal compared to moral arguments (Graetz & Shapiro, 2005). To test the effect of arguments on support for the estate tax, Sides (2011; see also, Kuziemko, Norton, & Saez, 2015) asked voting-age Americans their opinion on the estate tax. Before giving their opinions, some respondents were provided with one of several arguments. One of the arguments was factual—pointing out who pays the estate tax—while the others were moral. One moral argument favored the estate tax—it avoids the creation of an "aristocracy of wealth"—others opposed it—e.g. it "infringes on the right of families to pass along inheritance to their children."

The factual and the moral arguments against the estate tax were effective. Moreover, they were equally effective, swaying approximately 10% of respondents each. By contrast, the arguments against the estate tax had no effect. This might be due to most respondents having already considered—on their own or through media exposure—these arguments while they might not have considered the arguments supporting the tax. These results show that even a single factual argument can have a significant effect on a morally and politically loaded issue. Similar results regarding the potency of factual arguments have been obtained for issues such as foreign aid (Gilens, 2001) and increases in teacher salaries (Howell, Peterson, & West, 2000).

Analogous results have been observed with children for purely moral behaviors. Primary school children could be made to share more of their prizes with poor children thanks to 'empathic' arguments (e.g., "they would be so happy and excited if they could buy food and toys…") than to 'normative' arguments ("we should give some money to others poorer than ourselves…") (Eisenberg-Berg & Geisheker, 1979; see also, Kuczynski, 1982).

By contrast, other studies have found that participants could be very critical of arguments that challenge their moral positions, suggesting that they might be so critical as to reject altogether any challenging argument, whatever its strength (Edwards & Smith, 1996; Taber & Lodge, 2006). For instance, Edwards and Smith (1996) gave the arguments such as the following to participants who either supported or opposed death penalty:

> Sentencing a person to death ensures that he/she will never commit another crime. Therefore, the death penalty should not be abolished. (Edwards & Smith, 1996, p. 9)

They found that participants who opposed the death penalty, compared to participants who supported the death penalty, rated such argument as being substantially weaker—indeed as being quite weak. However, the rejection of arguments that challenge our positions mostly stems from our ability to find counter-arguments (Edwards & Smith, 1996; Greenwald, 1968; Taber & Lodge, 2006). For instance, a participant who opposes the death penalty would have no trouble finding counter-

arguments against the argument above—for instance, that a life sentence has a similar outcome at a lower human cost. From the present point of view, the issue here isn't so much that people reject too easily arguments that challenge their positions, but instead that they accept too eagerly arguments that support their views. Moreover, when good rebuttals to the counter-argument exist, then they are likely to be found in the course of a discussion.

The best demonstration of the effectiveness of moral discussion comes from cases in which there is a clear moral benchmark. This often means studies with young children who haven't quite adopted what most adults see as a desirable moral stance. In one experiment, 9 year-olds were presented with this standard Piagetian moral problem, asking which of the two children is naughtier:

> Story 1
>
> Once there was a little boy called John. He was in his room and his mother called him to dinner. He opens the door to the dining room but behind the door there is a tray with six cups on it. John couldn't have known that the tray was behind the door. He opened the door, knocked the tray and all six cups smashed to the door.
>
> Story 2
>
> Once there was a little boy called David. One day when his mother was out he tried to get some sweets from the cupboard. He climbed on a chair and stretched out his arm. But the sweets were too high and he couldn't reach, and while he was trying to reach it he knocked over a cup and it fell and broke. (Leman & Duveen, 1999, p. 575)

After they had answered, pairs were formed comprising one child who favored each answer. Most of these pairs (49 out of 60) agreed on the correct answer that David was naughtier (see also, Blatt & Kohlberg, 1975).

Other experiments illustrate the tradeoffs between a moral decision and a good decision according to other criteria. These experiments have used economic games in

which moral and financial incentives conflict. For instance, in a dictator game, the dictator—who has just received some money and is asked if she wants to give some to another participant who has not received any money—can choose to share some of the money, or to keep it all for herself. In such games, decisions made by groups tend to favor financial incentives compared to decisions made by individuals—i.e. groups give less than individuals (Bornstein, Kugler, & Ziegelmeyer, 2004; Bornstein & Yaniv, 1998; Luhan, Kocher, & Sutter, 2009). To the extent that the dictators' reputations are not meaningfully at stake (the other participants do not know who the dictators are), this is arguably a more rational decision—and thus what we should expect discussions to yield.

Experiments from several other fields are also relevant, even if they provide less clear-cut results. Juries are supposed to adjudicate on matters of fact, not to solve moral dilemmas—yet there is often a moral dimension to their verdicts. Studies of mock juries suggest that deliberation often improves jury decisions (Ellsworth, 1989; Hastie, Penrod, & Pennington, 1983). Similarly, when citizens discuss policy together, in the context of deliberative polling for instance, they usually reach more enlightened opinions (Fishkin, 2009; Mercier & Landemore, 2012). In both the cases of juries and of citizen deliberation, most of the improvement likely stems from a better grasp of the relevant facts. As a rule, this should translate into more accurate moral judgments and better decisions.

The results reviewed here show that arguments and discussions can affect moral judgments and decisions. They also show that not all arguments are equally effective, which suggests that audiences do discriminate between arguments of various strengths. Discussions seem to influence judgments and decisions in a way that is broadly compatible with the argumentative theory of reasoning.

Still, this domain remains drastically underexplored. We now present three studies that aim to further investigate the role of arguments and discussions on moral judgments. In each case, we relied on dilemmas that have been well studied in moral psychology, even if mostly outside of any argumentative context. These studies are exploratory, and so we will only present an outline of the procedures and results.

Study 1: Effects of moral arguments on moral dilemmas

The goal of Study 1 was to replicate Paxton *et al*. (2012).[1] In particular, we wanted to establish more precisely the effects the arguments had on the participants. In Paxton *et al*. (2012), participants read the sibling incest story, were provided with an argument (weak or strong) supporting moral leniency towards the siblings, and then had to provide their moral judgments. As a result, it is impossible to tell whether people made more lenient moral judgments after seeing the strong argument, or more severe moral judgments after reading the weak argument. In the first experiment, we used a design similar to that of Paxton *et al*. (2012), except that we measured moral acceptability just after the participants read the story, and then after they had read the argument. Some of the other differences with the experiment of Paxton *et al*. (2012) are that we used a different strong argument (one we thought might be stronger), and that we asked other questions pertaining to moral judgments (regarding confidence for instance, which are not analyzed here).

241 participants were recruited through Amazon Mechanical Turk. Table 1 displays the acceptability ratings (on a scale from 1—completely acceptable—to 7—completely unacceptable) before and after presentation of the arguments. Given that we only provided participants with arguments for moral acceptability, we only present results for the participants whose initial moral judgments were challenged by this argument: the participants whose initial answer was on the 'unacceptable' end of the scale (5, 6, or 7, N = 156).

Table 1. Acceptability ratings (mean and SD) before and after receiving the argument for participants whose initial ratings were strictly superior to 4 (Study 1).

Argument strength	Initial judgment	Final judgment
Strong argument	6.49 (0.75)	6.06 (1.4)
Weak argument	6.35 (0.81)	6.15 (1.16)

Both arguments lowered the unacceptability ratings, but only the strong arguments did so significantly (shift in judgment for strong arguments: M = -0.43, SD = 0.87, Mdn = 0, one sample Wilcoxon: $p < .001$; for weak arguments: M = -0.19, SD = 0.78, Mdn = 0, p = .058). Moreover, strong arguments lowered the unacceptability ratings more than weak arguments (two samples Wilcoxon: $p < .05$). This result

[1] Materials and results for all experiments are available upon request to the first author.

suggests that strong arguments can affect moral judgments, even on emotionally salient issues. Moreover, the fact that strong arguments did so more than weak arguments suggests that this result is not an artifact (reflecting task demands of the experiment for instance).

Paxton *et al.* (2012) had observed similar results, but only when they had asked participants to reflect on the arguments for two minutes. When participants weren't asked to do so, there were no differences between strong and weak arguments. In the present experiment, the participants were not asked to reflect on the arguments. Several factors could explain the discrepancy between the results of Paxton *et al.* (2012) and ours: different arguments, different participants, different methodologies. In any case, our results suggest that specifically asking for a phase of reflection is not necessary for participants to consider moral arguments and weigh them as a function of their strength.

Study 2: Effects of group discussion on moral dilemmas

The experiments that demonstrate most convincingly the efficacy of arguments in group discussions are those that pit a minority with the correct answer with a majority with the wrong answer. In order to find an analogue to this set up with moral judgments, we relied on a specific type of sacrificial dilemmas: those in which the people who have to be sacrificed would die even if they weren't sacrificed. Sophie's choice is a good example: the child that is sacrificed if Sophie makes a choice also dies if she doesn't. In such cases, the utilitarian answer—i.e. saying that the sacrifice is morally acceptable—has sometimes been deemed superior to the deontic answer—i.e. saying that the sacrifice is not morally acceptable (e.g. Greene, 2008). Moreover, the utilitarian answer has been associated with System 2 processes in the same way that the correct answer to intellective problems has (Greene, Morelli, Lowenberg, Nystrom, & Cohen, 2008). One might therefore expect participants with the utilitarian answer to convince participants with the deontic answer even if they are in a minority position.

To test this prediction, we asked 110 participants (first year psychology students in France) to judge the actions in a sacrificial moral dilemma two times in a row. In the individual phase, they answered on their own. In the group phase, they were asked to discuss that same dilemma in small groups (26 groups of 4 or 5 participants) and to reach a consensual answer. Two sacrificial dilemmas were used, each for approximately

half of the participants, and the results do not differ across dilemmas, so they are analyzed together.

In order to compare the results of the two phases more easily, we computed a score for each discussion group and the equivalent nominal group for the individual phase (i.e. the statistical average of the participants that compose a given group during the group phase). Deontic answers were coded as 0 and utilitarian answers as 1, and the group averages were normalized to the [0, 1] range. Thus 0 means that every group member provided a deontic answer while 1 means that every group member provided a utilitarian answer. At the individual phase, the average group score was 0.25 (SD = 0.24, Mdn = 0.22). At the group phase, it was 0.24 (SD = 0.40, Mdn = 0). Discussion had no overall effects on moral judgments (Exact Wilcoxon-Signed-Rank Test, Z = 1.09, p = 0.27, r = 0.15). Analysis of the groups in which the utilitarian answer was defended by a minority of members confirms this pattern. There were nine such groups (typically one utilitarian participant against a majority of three deontic participants). In only one of these nine groups did the utilitarian answer convince the group.

Previous studies had shown that group discussion does not consistently lead to more utilitarian answers. In one study participants were asked to allocate the budget of a (hypothetical) hospital between patients requiring more or less expensive treatments. The participants had to make this decision after extensive discussion with peers. Less than 10% of the groups converged on the utilitarian answer which consists in allocating all the money to the patients which the cheapest treatments (holding everything else equal). Most groups agreed that this decision would be unfair (McKie, Shrimpton, Richardson, & Hurworth, 2011).

As we conducted the experiments, some concerns with the materials emerged. Although some participants were emotionally affected by the stories, many seemed to not take the scenarios very seriously. This is suggestive of a frame of mind quite different from the one involved in real life moral judgments—especially judgments on such dramatic issues. This is only an informal observation, but it converges with the results of Bauman *et al*. (2014), which suggested that many participants do not take some dilemmas seriously (in their case, trolley dilemmas).

Study 3: Effects of group discussion on moral dilemmas in a traditional population

All of the studies reviewed above have been conducted in so-called WEIRD (Western Educated Industrialized Rich Democratic) populations (Henrich, Heine, & Norenzayan, 2010). It has been suggested that, across several domains, members of these populations are outliers: not only are there cross-cultural differences, but WEIRD people are at an extreme of the spectrum. For instance, they seem to be the most individualistic population ever studied. Cross-cultural studies have evidenced differences relevant to moral psychology (e.g. Haidt, Koller, & Dias, 1993; Shweder, Mahapatra, & Miller, 1987). What is most relevant here, however, are the effects of arguments and discussions on moral judgments and decisions. Do we observe the same patterns in other cultures that we do in WEIRD cultures? To start answering this question, we conducted a preliminary study with members of a traditional population. The population studied were indigenous Maya from Guatemala who practice subsistence farming, are preliterate and, for the most part, do not speak Spanish (N = 54, all female, for more information about the population, see, Castelain, Girotto, Jamet, & Mercier, in press). Such traditional populations have been shown to differ in many respects from WEIRD populations, even for apparently basic cognitive mechanisms (Henrich *et al*., 2010).

The participants were asked to provide an answer to an adaptation of the standard Heintz dilemma (Kohlberg, 1981). In this dilemma, Miguel (in our version, Heintz in the original) steals some medicines that are required to save his wife's life. In the pre-test, participants had to tell, on their own, whether Miguel was right to have stolen the medicine or not. In the test phase, the participants were asked to discuss the dilemma in small groups (3 or 4 members) and try to reach a consensus. Finally, in the post-test they faced the dilemma on their own again. During the pre-test and the post-test, participants were asked to justify their answers. Their justifications were translated from K'iche' into Spanish and coded. The justifications were first coded simply as a function of the answer they supported. They were then coded using the assessment manual of Colby and Kohlberg (1987), which was designed to interpret the justifications from such Kolbergian dilemmas.

The simple coding of the justifications in terms of whether they supported a 'Yes' (i.e. Miguel should have stolen the drugs) or a 'No' answer (i.e. Miguel should not have stolen the drugs) revealed many mismatches between the justifications and the

answers provided by the participants. This issue did not arise when we asked the same participants to complete other tasks (reasoning tasks) (Castelain *et al.*, in press). We are not sure what the cause of this mismatch is. The participants might have misunderstood the question, so that they thought that answering 'Yes' meant that Miguel should not have stolen the drugs (e.g. 'Yes Miguel should be condemned'). In any case, we thought that the justifications would provide a more reliable guide to the participants' thinking. Indeed, all justifications could be understood as supporting a moral stance towards Miguel's actions, whether it was acceptation (e.g. "by stealing he saved his wife") or condemnation (e.g. "stealing is a crime"). These results are presented in Table 3.

Table 2. Number of justifications supporting the Yes and No answers at the Pre-test and Post-test of Study 3.

Answer supported by the justification	**Pre-test**	**Post-test**
Yes (he should have stolen the drugs)	36	41
No (he shouldn't have stolen the drugs)	18	15

Table 2 suggests that the discussion brought very few changes in the participants' answers. However, if it is true that there was little evolution in the aggregate answers, this stability was largely due to a balance between the number of participants who went from a 'Yes' answer to a 'No' answer (8) and those who went from a 'No' answer to a 'Yes' answer (13). Thirty-nine percent of participants thus changed their minds during the discussions. That these changes were not merely random noise is suggested by the fact that they all took place among participants who were exposed to different views in the course of the discussion. None of the 13 participants belonging to groups which unanimously supported an answer changed their mind, a significant difference with the 21 changes of minds occurring in groups in which the two answers were represented (Fischer exact test, $p < .001$).

Discussion might also have had an effect on the type of arguments put forward by the participants. Using the Kohlbergian scale from Colby and Kohlberg (1987), we compared the rankings of the justifications produced at the pre-test and at the post-test. For 15 participants the justifications ranked lower at the post-test, for 12 they ranked the same, and for 27 they ranked higher. A binomial test comparing the 15 participants whose performance decreased to the 27 for whom it increased reveals a trend towards an improvement ($p = .088$).

These results suggest that while discussions affected moral judgments, there were no consistent effect in the direction of greater leniency towards the protagonist who stole drugs for his dying wife. We should note that some of the arguments provided suggest the dilemma might have been too unrealistic for the participants, or that it was not well understood. In particular, many participants said that Miguel should have turned to his community to help him buy the drug instead of stealing it ("Miguel should ask his neighbors to borrow him some money"). This was the case even though it was specified in the dilemma that Miguel had unsuccessfully tried to borrow money from everyone he knew. This suggests that either the participants were not paying enough attention to the dilemma, or that they found this premise too unrealistic. We come back to the potential significance of this issue in the conclusion.

Conclusion

The impact of arguments and discussions on moral judgments and decisions remains an understudied domain. This is regrettable for at least three reasons. One is theoretical: more data is required to adjudicate between different theories of moral reasoning. Another is methodological: analyzing the arguments provided by participants and the way they discuss moral dilemmas provides telling cues regarding how participants think of the dilemmas. In particular, it can emerge in the course of the discussion that many participants have either missed or dismissed crucial elements of the dilemma (Study 3 above and Royzman *et al*., 2015), or that they do not take the dilemma very seriously (Study 2 above and Bauman *et al*., 2014).

The third reason is that it would make the experiments more ecological. In everyday life, we generally can discuss moral decisions and moral judgments with others. In particular, we can often discuss moral violations with the perpetrator. Indeed, research on explanations shows that people spontaneously justify their moral transgressions (Malle, 2004). However, we know very little about how these explanations are evaluated, and how they influence moral judgments. Taking the possibility of such feedback into account might change how we think about how moral judgments are made (on the relevance of the logic of interaction for thinking about cognitive mechanisms, see, Levinson, 2006; Mercier, Bonnier, & Trouche, in press).

For instance, people tend to be uncharitable in explaining others' bad behaviors—in particular, they attribute to their character actions that would often be better explained by situational factors (for review, see, Malle, 2006). This might seem surprising in light of the theories suggesting that we assess others' moral standing in order to select reliable cooperation partners. These theories should predict that we aim at forming accurate assessments of others' moral standing. Taking the possibility of feedback into account might explain this apparent discrepancy. People might start with an uncharitable interpretation, assuming that if a more charitable interpretation is correct, then the individual who behaved wrongly will spontaneously provide it. Unfortunately, we do not have much data—and even less experimental data—bearing on these issues.

We suggest that experimental research of everyday moral decisions and judgments, and the discussions that often accompany them, would be a very fruitful avenue for study. The moral problems most studied in the experimental literature—from incest to Sophie's choice—bear little resemblance to the matters that occupy our everyday moral discussions, such as: is it okay to take stationery from work, how much flirting can someone married engage in, what counts as an insulting joke, etc. (although people also discuss issues of personal relevance that happen to also be of broader political relevance, such as feminism, see, e.g., Mansbridge, 1999). Finding problems that participants care about would be especially important in the study of moral arguments, since participants are more likely to be swayed by strong arguments when they care about the issue (Petty & Cacioppo, 1979). This suggests that researchers should make more effort to find dilemmas whose answer is directly relevant to the participants. Our failure to do so in the present Studies 2 and 3 might explain why group discussion did not have any consistent effect.

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Partie 2 : Sensibilité précoce aux arguments

La plupart des croyances que nous acquérons sont acquises au travers du témoignage des autres. Les témoignages représentent une source importante d'informations pour les enfants et participent à la construction de la compréhension de l'environnement social dans lequel ils se développent.

Toutefois, certaines des informations qui sont communiquées aux enfants, que ce soit par leurs parents, leurs pairs ou encore d'autres adultes, peuvent être en contradiction avec leurs propres croyances ou en contradiction avec des informations qu'ils ont pu obtenir au travers d'autres témoignages. De nombreuses recherches ont été menées pour tenter de mieux comprendre comment les enfants décident qui croire dans de telles situations. Ces travaux ont mis en évidence que les enfants se basent sur des indices tels que la familiarité, la bienveillance ou encore la compétence des informateurs (Clément, 2010; Harris, 2012). Cependant, deux facteurs qui jouent un rôle important dans l'environnement social des enfants ont été jusque là peu étudiés : l'argumentation et la hiérarchie sociale.

L'étude de l'évaluation des arguments est directement liée à l'hypothèse selon laquelle les caractéristiques du raisonnement devraient se retrouver également chez de jeunes enfants, en particulier la capacité à discriminer la qualité des arguments, et ce indépendamment du contexte culturel et social dans lequel ils sont immergés. L'introduction de la hiérarchie sociale, outre son intérêt théorique, est plus indirecte et vise à déterminer si des arguments suffisamments forts peuvent prendre le pas sur des indices liés à la source.

La méthode classiquement utilisée dans ces recherches est la tâche de témoignage. Le plus souvent, il est demandé aux enfants de choisir entre leur propre croyance et le témoignage d'un informateur où entre les témoignages de deux informateurs. L'avantage de recourir aux tâches de témoignages est qu'elles permettent d'étudier à la fois les processus d'évaluation des indices liés au contenu du message (la qualité des arguments) et ceux liés à la source du témoignage (le statut hiérarchique)

chez de jeunes enfants. L'emploi de cette méthode permettra ainsi de mieux comprendre la manière dont ces derniers traitent ces indices de nature différente et le poids qu'ils leurs accordent lorsque ces indices sont mis en compétition. C'est ce que je développerai dans la suite de cette partie.

1. Argumentation et témoignage

Très jeunes (tout du moins dans les classes moyennes et supérieures des sociétés occidentales) les enfants sont exposés à de nombreux arguments, qu'ils viennent de leurs parents ou de leur pairs. Ils semblent d'ailleurs très tôt être sensibles au contenu des messages qui leurs sont transmis. A partir de 18 mois, les enfants rejettent des explications qui sont en conflit avec leurs propres croyances (Pea, 1982). Dès 1 ans, ils sont plus enclins à prendre en compte des informations communiquées lorsqu'elles n'entrent pas en conflit avec leurs croyances (Tamis-LeMonda *et al.*, 2008).

De récents travaux expérimentaux montrent que les enfants de 3 à 5 ans sont sensibles à la qualité épistémique des raisons données par les informateurs et utilisent cet indice pour évaluer la confiance qu'ils peuvent accorder dans la source. Ils préfèrent apprendre d'informateurs qui ont fourni ultérieurement de bonnes raisons (Koenig, 2012). D'autres travaux convergent vers des conclusions similaires et montrent que les enfants de 3 à 5 ans favorisent les explications non-circulaires aux explications circulaires, seulement si elles sont courtes, pour les enfants de 3 ans. Ils étendent également leur confiance aux informateurs qui fournissent de bonnes explications en comparaison à ceux qui fournissent des explications circulaires (Corriveau & Kurkul, 2014).

Dans la même veine, une autre étude a montré que les enfants en maternelle sont sensibles à la présence du connecteur « parce que » lorsqu'ils évaluent des arguments (Bernard, Mercier, & Clément, 2012). Dans cette expérience, les participants étaient confrontés à deux informateurs (deux Playmobils) qui donnaient des témoignages contradictoires sur la localisation d'un objet et justifaient leur position en donnant des arguments similaires. Toutefois, seul l'un des informateurs utilisait le connecteur

« parce que » pour lier le contenu de son témoignage avec l'argument. Les résultats révèlent que les enfants de 4 ans et 5 ans, mais pas de 3 ans, choisissent majoritairement l'informateur qui utilise le connecteur.

Dans la continuité de ces travaux, ces auteurs ont montré que les enfants sont capables de discriminer différents types d'arguments (Mercier *et al.*, 2014). Dans cette étude, les enfants étaient de nouveau exposés à l'histoire de trois personnages incarnés par des Playmobils. Ils devaient plus précisémment aider l'un d'entre eux à retrouver son chien égaré. Pour ce faire, ils pouvaient compter sur l'aide de deux informatrices. La tâche des enfants était de décider dans quelle direction était parti un chien, sur la base des deux témoignages contradictoires (les personnages pointent dans des directions différentes). Chacun des témoignages était soutenu par différents types d'arguments. L'un des informateurs fournissait un argument perceptif (fort) « Le chien est parti par là parce je l'ai vu partir dans cette direction. » alors que l'autre soutenait son témoignage par un argument circulaire (faible) « Le chien est parti par là parce qu'il est parti dans cette direction. » Les résultats montrent que les enfants des trois groupes d'âges suivent significativement plus le personnage dont le témoignage est soutenu par un argument fort et suggèrent que dès 3 ans les enfants sont capables de discriminer la qualité des arguments.

Toutefois, les nombreux arguments auxquels les enfants sont exposés ne sont pas transmis dans un « vide hérarchique » : les individus qui produisent les arguments ont une certaine position hiérarchique par rapport à l'enfant, quelle soit plus élevée (parents, frères et sœurs plus âgés, certains pairs) ou moins élevée (frères et sœurs plus jeunes, d'autres pairs). Il est possible, pour différentes raisons qui vont être détaillées, que les enfants utilisent aussi la hiérarchie sociale comme un indice (lié à la source) lorsqu'ils décident quel témoignage adopter.

2. Hiérarchie et témoignage

Les études éthologiques montrent qu'à partir de 2 ans les enfants forment des relations transitives stables hiérarchiques du type : si A domine B et B domine C, alors

A tend à dominer C) (McGrew, 1972; Strayer & Strayer, 1976). La capacité à reconnaître et utiliser les relations de dominance semble apparaitre tôt dans l'ontogénèse. Par exemple, dès 10 mois les nourissons utilisent la taille relative du corps des agents pour prédire le résultat d'un conflit (Thomsen, Frankenhuis, Ingold-Smith, & Carey, 2011). Dès 15 mois, les enfants s'attendent à ce qu'une relation asymétrique se maintienne dans le temps (Mascaro & Csibra, 2012). De plus, l'inférence de la hiérarchie sociale ne semble pas limitée à la suprématie physique. Dès 3 ans, ils l'infèrent également à partir de l'âge, de la quantité de ressources ou encore de l'habilité à imposer ses décisions aux autres (Charafeddine *et al.*, 2015).

Dans l'ensemble, les dominants peuvent s'avérer plus influents que les subordonnés pour au moins deux raisons. La première est informative ou épistémique. Des résultats chez l'adulte montrent que ces derniers accordent plus de compétences à un individu dominant, indépendemment de son réel niveau de compétences (Anderson & Kilduff, 2009). Des études chez les enfants montrent qu'ils prédisent qu'un dominant qui impose ses choix à un subordonné sera plus compétent dans un jeu ultérieur, et qu'il possèdera plus de ressources (Charafeddine, *et al.*, 2015 ; Charafeddine, *et al.*, 2016). De même, les enfants peuvent penser que le dominant possède des croyances en moyenne plus exactes, et accordent plus de crédit à son témoignage pour cette raison. Une deuxième raison pour laquelle les dominants peuvent avoir plus d'influence que les subordonnés est normative ou sociale. En général, il est plus important d'être vu de manière positive par les dominants que par les subordonnés, comme ils ont typiquement plus de ressources à partager et plus d'influence concernant diverses situations sociales.

Indépendamment de la nature de l'inférence que les enfants peuvent faire sur la base de la hiérarchie sociale, s'ils prennent en compte cet indice pour évaluer les témoignages auxquels ils sont confrontés, la hiérarchie est susceptible de rentrer en conflit avec la qualité des arguments, et ce d'autant plus que les enfants reçoivent la plupart des temoignages auxquels ils sont exposés d'individus d'un statut hiérarchique supérieur.

3. Hiérarchie et argumentation

Chez les adultes, de nombreux travaux se sont portés sur l'étude de l'interaction entre le contenu (par exemple la qualité des arguments) et la source du message (par exemple l'expertise ou la confiance). Peu de travaux expérimentaux ont porté sur la manipulation de la hiérarchie comme un indice de la source du message mais ceux qui l'ont fait ont retrouvé les mêmes résultats que pour d'autres variables sources (Clark, Evans, & Wegener, 2011). Lorsque les participants ont un intérêt limité dans la conclusion du message, ils sont principalement influencés par la source. Cependant, lorsque l'implication des participants est plus grande (pertinence de la tâche pour les sujets), la variable source est ignorée et la qualité des arguments du message détermine son acceptation.

Aucune étude jusqu'alors n'a manipulé l'argumentation et la hiérarchie pour étudier leurs effets sur l'évaluation des témoignages. Néanmoins, la littérature sur les styles parentaux fournit des indices indirects. Les travaux dans ce domaine suggèrent que donner des raisons aux enfants, pour leur expliquer par exemple pourquoi quelque chose est mal, se révèle être une « stratégie » plus efficace que le recours à l'expression de l'autorité ou la punition (Grusec & Goodnow, 1994). Toutefois, ces études impliquent l'usage direct de la dominance sous la forme de punitions physiques et les variables étudiées concernent entre autres, la résistance à la tentation, des concepts plus larges que ceux qui font l'objet de cette recherche.

Comme ces deux indices, épistémique et social, pointent dans la même direction, il est difficile de les départager. Cependant, si un dominant donne un argument faible alors que le subordonné donne un argument fort, la dimension épistémique devrait favoriser le subordonné, alors que la dimension sociale devrait favoriser le dominant. Ainsi, si les enfants croient le dominant plus que le subordonné dans cette situation, c'est un signe que l'influence du dominant se fait au travers du canal social. Dans ce cas, on devrait s'attendre à ce que l'indice épistémique prenne le pas sur l'indice social, c'est-à-dire que la qualité des arguments prenne le pas sur le statut hiérarchique des informateurs.

Les études observationnelles suggèrent que les enfants s'engagent dans des formes simples d'argumentation avant 3 ans. A 2 ans, ils produisent des arguments lorsqu'ils sont en désaccord avec leur parents ou leurs frères et sœurs (Kuczynski, Kochanska, Radke-Yarrow, & Girnius-Brown, 1987; Kuczynski & Kochanska, 1990; Perlman & Ross, 2005). On peut émettre l'hypothèse que les capacités d'évaluation des arguments émergent autour de cet âge où le langage occupe une place de plus en plus importante dans leurs interactions. Toutefois, il n'existe pas à l'heure actuelle de données expérimentales qui montrent que les enfants si jeunes sont sensibles à la force des arguments qu'on leur propose. C'est ce dont traite le premier article de cette partie : *Evidence that 2 years old are sensitive to argument strength*.

Les études interculturelles suggèrent que certains traits des sociétés traditionnelles et orientales sont susceptibles d'avoir un impact sur le développement des compétences argumentatives (Shneidman & Goldin-Meadow, 2012; Maratsos, 2007; Ferguson, 1978; Gauvain *et al.*, 2013; Pye, 1986). Cependant, on ne dispose pas de données expérimentales sur la capacité de discrimination des arguments d'enfants (du même âge que les enfants testés en occident) issus de sociétés traditionnelles et orientales. On ne dispose pas non plus d'informations sur la manière dont les enfants de ces trois cultures prennent en compte la hiérarchie sociale lorsqu'ils évaluent des témoignages et le poids relatif qu'ils accordent à la qualité des arguments et au statut social lorsque ces deux indices sont mis en compétition.

La série d'articles suivante sera consacrée à ces questions : *The influence of power and reason on young maya children's endorsement of testimony* ; *The boss is always right : preschoolers endorse the testimony of a dominant over that of a subordinate* ; *The influence of argument strength and decisional power in French children's endorsement of testimony* ; *Argument evaluation in japanese preschoolers* ; *Cross-cultural differences in the valuing of dominance in young children*.

Le tableau suivant permet de récapituler les hypothèses et les expériences qui seront présentées dans les articles qui suivent.

Expériences	**Argumentation**	**Hiérarchie**	**Argumentation vs. Hiérarchie**
Hypothèse testée	**Sensibilité à la qualité des arguments**	**Prise en compte la hiérarchie pour juger de la fiablité d'un témoignage**	**La qualité des arguments prend le pas sur la hiérarchie sociale**
Cultures Occidentales	Article 3 Castelain *et al.*, soumis	Article 5 Bernard *et al.*, 2016	Résultats complémentaires 6 Non publiés
Sociétés Traditionnelles	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2016
Cultures Orientales	Article 7 Sudo *et al.*, in prep.	Article 8 Charafeddine *et al.*, in prep.	*

* La confrontation argumentation versus hiérarchie n'a pas être réalisée au Japon compte tenu des résultats obtenus dans l'expérience sur la hiérarchie (voir Article 8).

Article 3 : Two-year-olds sensitivity to argument strength

Expériences	**Argumentation**	Hiérarchie	Argumentation vs. Hiérarchie
Hypothèse testée	**Sensibilité à la qualité des arguments**	Prise en compte la hiérarchie pour juger de la fiablité d'un témoignage	La qualité des arguments prend le pas sur la hiérarchie sociale
Cultures Occidentales	**Article 3 Castelain *et al.*, soumis**	Article 5 Bernard *et al.*, 2016	Résultats complémentaires 6 Non publiés
Sociétés Traditionnelles	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2016
Cultures Orientales	Article 7 Sudo *et al.*, in prep.	Article 8 Charafeddine *et al.*, in prep.	-

Evidence that 2 Years Old Children are Sensitive to Argument Strength

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Abstract

Two-year-olds exchange arguments with others, but no experiment has demonstrated that they are sensitive to argument strength. The present study aims at testing the ability of 2-year-olds to evaluate arguments as well as the informants who provide arguments. Children are asked to name ambiguous items, then an informant disagrees with them in one of three ways: either provides no argument, a weak (circular) argument, or a strong (perceptual) argument. On the whole, there was an effect of argument strength, so that children were more likely to endorse labels provided by the informant who had supported her answer with a perceptual argument. These results constitute the first experimental demonstration that 2-year-olds possess some argument discrimination skills.

Keywords: Argument evaluation, 2-year-olds, Early development.

We acquire a large number of our beliefs through communication. However, we cannot blindly rely on others' testimony. People have various levels of knowledge and expertise, and they rarely have perfectly aligned incentives. As a result, we can expect humans to be endowed with mechanisms of epistemic vigilance (Sperber *et al.*, 2010) that filter communicated information so that most beneficial information is accepted, and most harmful information is rejected. Some mechanisms of epistemic vigilance pay attention to the content of what is communicated—Is it plausible? Is it supported by good arguments?—others to the source of the communication—Is she trustworthy? Is she competent?

Although these mechanisms of epistemic vigilance become increasingly sophisticated with age, their roots can be found in young children. Preschoolers have been shown to rely on a wide variety of cues to weigh the testimony of different informants, such as past accuracy, benevolence, or degree of consensus (Clément, 2010; Harris, 2012). A few studies have shown that even younger children, 1- or 2-year-olds, can already perform some basic discrimination in this domain (Harris & Lane, 2014). For instance, they are more likely to take communicated information into account when it doesn't conflict with their prior beliefs (Tamis-LeMonda *et al.*, 2008), and when it comes from an expert informant (Kim & Kwak, 2011; Walden & Kim, 2005) or a confident informant (Brosseau-Liard & Poulin-Dubois, 2014).

A recent series of experiments have shown that preschoolers can use another mean of assessing communicated information: the relative quality of arguments and explanations (Castelain, Bernard, Van der Henst, & Mercier, 2015; Corriveau & Kurkul, 2014; Koenig, 2012; Mercier, Bernard, & Clément, 2014). For instance, in one experiment 3- to 5-year-olds were more likely to believe an informant who used a strong, perceptual argument ("the dog went this way because I've seen him go in this direction") over a circular one ("the dog went this way because he went in this direction") (Mercier *et al.*, 2014). Moreover, preschoolers seem to extend their trust in informants who have offered good, by contrast with circular, explanations. In one experiment, 3- and 5-year-olds were more likely to accept an explanation coming from an informant who had previously offered a good explanation than one coming from an informant who had previously offered a circular explanation (Corriveau & Kurkul, 2014). For 5-year-olds, this generalization of trust extended to word learning.

Observational data suggests that children engage in simple forms of argumentation before the age of three. Two-year-olds produce justifications and arguments when they disagree with their parents or siblings (Kuczynski & Kochanska, 1990; Kuczynski, Kochanska, Radke-Yarrow, & Girnius-Brown, 1987; Perlman & Ross, 2005). In the course of these disagreements, they are also exposed to arguments (although more so in some cultures, see, Maratsos, 2007; Tizard, Hughes, Carmichael, & Pinkerton, 1983). However, there is no data showing whether children this young are sensitive to the arguments offered to them. The goal of the present experiment is to offer some preliminary evidence regarding the ability of 2-year-olds to evaluate arguments as well as the informants who provide arguments.

The experiment has three phases, each designed to assess a different effect of argument evaluation in 2-year-olds. The goal of the first phase is to assess the impact of argument evaluation on the immediate acceptation of the argument's conclusion. The child is exposed to pictures of hybrid objects—for instance, an animal that is 75% bird and 25% fish (see, Bernard, Harris, Terrier, & Clément, 2015; Jaswal, 2004; Jaswal & Markman, 2007). The child is asked what he thinks the object is. An informant then tells the child what she thinks the object is, always disagreeing with him. In one condition, the informant offers no argument, in another she offers a poor, circular argument (e.g., "It's a fish, because I saw it's a fish"), and in another she offers a good, perceptual argument (e.g., "It's a fish because I saw it swimming in the water"). The child is asked again to tell what he thinks the object is, so we can measure the direct effect of argument evaluation: is he more likely to change his mind when presented with a strong argument? If 2-year-olds evaluate arguments in a way that is similar to 3-year-olds, they should be more likely to accept the new label when it is supported by a good argument. By contrast, if the 2-year-olds behave like the 3-year-olds (Mercier *et al.*, 2014), they should not favor the circular argument over the absence of argument.

The goal of the second phase is to test whether the child trusts more informants who have provided good arguments, by contrast with poor arguments or no argument. The child is shown new hybrids, asked what he thinks they are, and the informant again disagrees with him. However, in Phase 2 she never offers any argument, simply stating her disagreement before the child is asked again what he thinks the object is. If 2-year-olds generalize their trust towards informants who have provided good justifications in a way that is similar to 3-year-olds (Corriveau & Kurkul, 2014), they should be more

likely to accept the new label when comes from the informant who previously provided the good argument.

The goal of the third phase is to test the depth of the potential changes of mind obtained in the first two phases, in particular those of Phase 1. The informant leaves the room, and the child is introduced to a new picture book containing several pictures, and asked to name them. Some of these pictures depict the hybrid objects from the first two phases. This phase assesses how much the child had retained the opinion provided by the informant in the earlier phases. This has never, to the best of our knowledge, been tested in relation with variations in argument strength, even with preschoolers. Two-year-olds might have a tendency to accept what the informant says regardless of the support she provided for her labels (Jaswal & Kondrad, 2016; Mascaro & Morin, 2014). However, we might still observe a delayed effect of argument strength, so that labels supported by strong arguments are better retained than labels supported by no argument or by weak arguments.

Method

Participants. This experiment involved 50 2-year-olds children from seven French daycare centers in the city of Lyon, France (26 girls, M_{age} = 27.6, *SD* = 2.59, range 22-32 months). Most of the children came from middle or upper-middle class families. All of the children participated in the experiment individually in a quiet room located in the daycare center.

Materials and procedure. Hybrid pictures from Jaswal and Markman (2007) formed the main material of this experiment. These hybrid pictures were selected so that most children would form an opinion without being completely certain that it is correct. When the informant disagrees with the child, she does not state an opinion that blatantly contradicts his perception, making the disagreement more pragmatically felicitous. It is also possible for the child to accept the informant opinion's not through pure deference or politeness (Jaswal & Kondrad, 2016), but because he really thinks she is right.

Based on another study conducted in a French population (Bernard *et al.*, 2015), we selected four hybrids with a good level of identification by 3-year-olds children: two animals (a bird-fish and a rabbit-squirrel) and two objects (a spoon-key and a car-shoe).

Each hybrid was created with 75% of the features from one entity and 25% of the features from the other entity (see Figure 1).

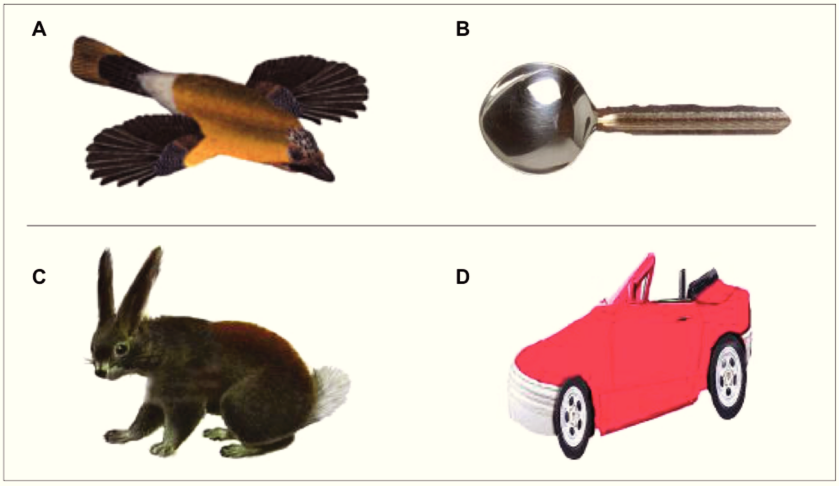

Figure 1. The four hybrids (Phase 1: A and B, Phase 2: C and D).

The procedure lasted between 5 to 10 minutes and involved four individuals: the child, his caretaker, the experimenter, and an informant. Before starting the experiment, the experimenter invited the child to sit on his caretaker's knees and invited the caretaker to wear headphones. Children were randomly assigned to one of the three experimental conditions: Perceptual Argument, Circular Argument, or Absence of Argument. The experiment is divided in three different phases (Figure 2) preceded by two familiarization trials.

Familiarization phase. The pictures used in this phase represented a house and a sun. The experimenter showed the pictures one at a time and asked the child "What is this?" If the child gave no answer, the question was repeated.

Phase 1. Two hybrids were used (see Figure 1). The experimenter showed the first hybrid to the child and asked, "What is this?" If the child gave no answer, the question was repeated. If the child gave no answer again, the experimenter asked him a forced-choice question, "Tell me, what is this, a bird or a fish?" (order counterbalanced). After the child answered, for example "bird," the experimenter turned towards the informant and asked, "According to you [informant's name], what is this?" The informant answered the experimenter, systematically giving an answer that contradicted the child's response. Then she looked at the child and added, depending on the condition: "It's a fish, because I saw it swimming in the water" (Perceptual

Argument condition), “It’s a fish, because I saw that is a fish” (Circular Argument condition), or “Hmm, it’s a fish” (Absence of Argument condition). Finally, the experimenter presented the hybrid again to the child and asked, “So, [child’s name], what is this?” If the child gave no answer the question was repeated, and if necessary, a forced-choice question was offered. This was repeated with the second hybrid, with adapted stimuli, the perceptual argument being: “It’s a key, because I saw someone open a door with it.” One point was assigned when children adopted the label of the hybrids provided by the informant. No points were assigned when they maintained their previous response. Each child could obtain a maximum score of 2 points.

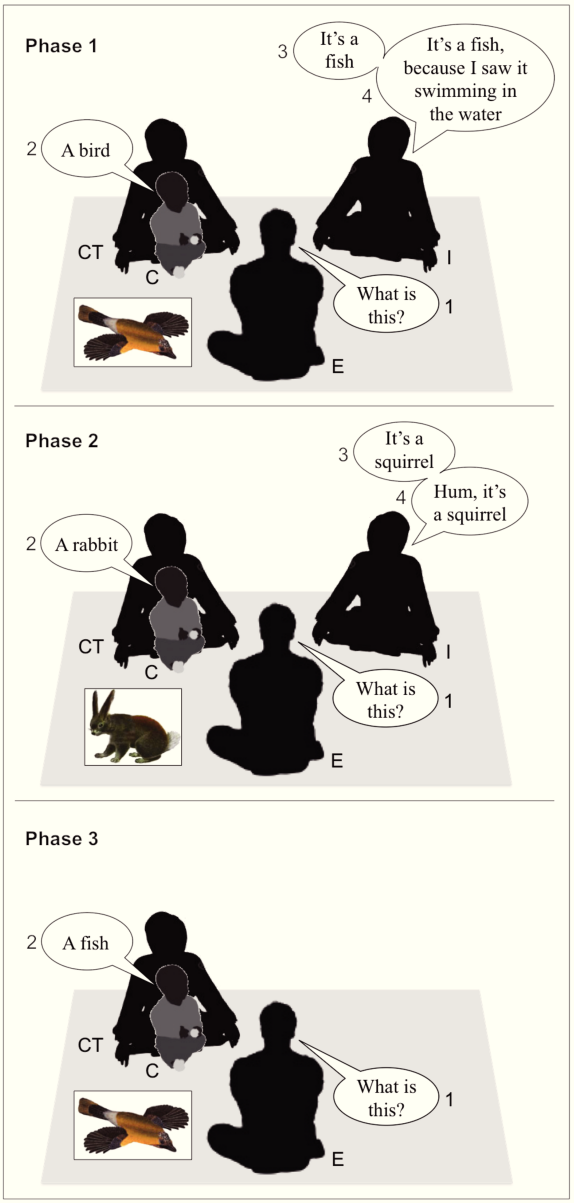

Figure 2. Illustration of the three phases of the experiment. The child (C) is seated on his caretaker’s (CT) knees. On his left is the informant (I). The experimenter (E) is seated in front of the child and the informant.

Phase 2. Two new hybrids were used (see Figure 1). The procedure was the same as in Phase 1, except that the informant always behaved as in the Absence of Argument condition. The coding was identical to that of Phase 1.

Phase 3. The informant faked a phone call and left the room. The experimenter told the child that they could continue and that they would look at a little book together. The experimenter presented a book composed of the 4 previous hybrids and 4 new non-ambiguous items (a ball, a cat, a doll, and a dog). The order of the items was counterbalanced. He opened the first page and asked the child, "What is this?" If the child gave no answer, the experimenter repeated the question two more times if necessary and then went to the next picture. For the hybrids items, as a third option, the experimenter offered a forced-choice question.

One point was assigned when children used the label of the hybrids provided during Phases 1 and 2 by the informant. No points were assigned when they maintained their first response in Phases 1 and 2. Thus, each child could obtain a maximum score of 4 points.

Results

Five participants were excluded: one participant because of a mistake made by the experimenter and the informant, a second because it was not possible to hear her clearly, and the three remaining because they gave no response to at least one of the four hybrids. Thus, the following analyses were conducted with the 45 remaining participants (22 girls, M_{age} = 27.7, *SD* = 2.68, range 22-32 months), 16 children in the Perceptual Argument condition, 14 children in the Circular Argument condition, and 15 children in the Absence of Argument condition. Children did not differ in age across the three experimental groups, $F(2,42) = .91$, $p = .41$, $\eta^2 = .04$.

Phase 1. There were no significant differences in the initial recognition of the 4 hybrids (fish-bird = 89% fish; spoon-key = 88% spoon; rabbit-squirrel = 91% rabbit; and car-shoe = 100% car), $F(3,123) = 1.75$, $p = .17$, $\eta^2 = .04$. Children adopted the label of the informant in 78,1% of the cases in the Perceptual Argument condition, 67,8% in the Circular Argument condition, and 63.3% in the Absence of Argument condition (Figure 3).

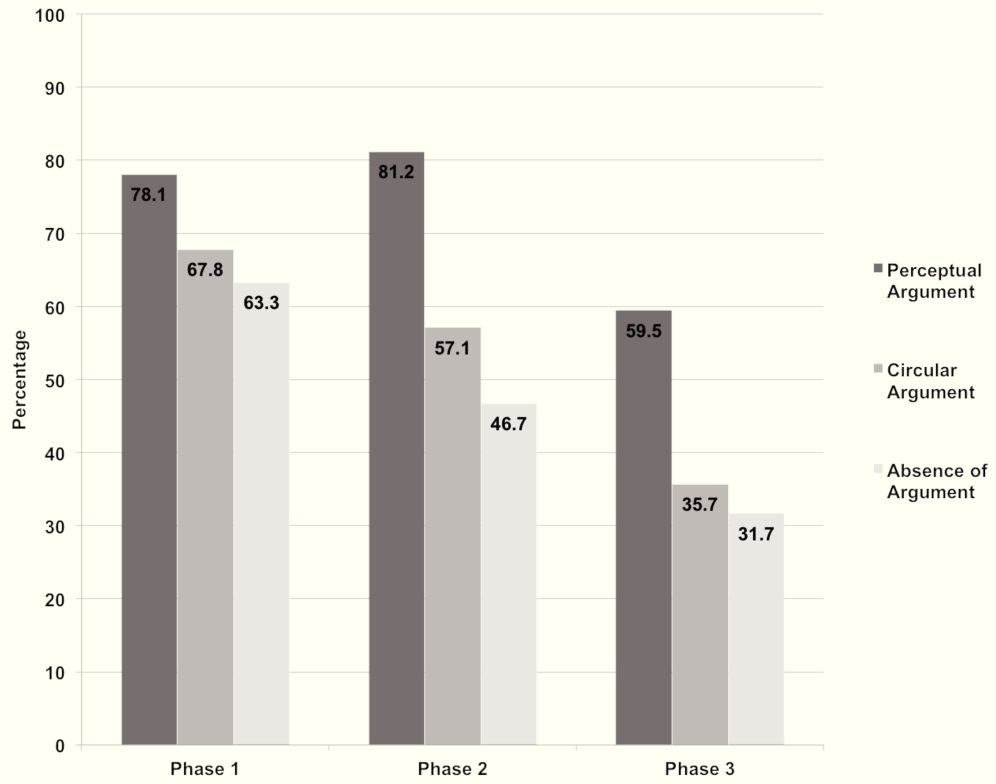

Figure 3. Percentage of the labels adopted by the children in Phases 1, 2, and 3 as a function of the experimental conditions.

To test our specific hypothesis regarding the three experimental conditions (i.e., rate of adoption of the informant's label in the Perceptual Argument condition > Circular Argument = Absence of Argument), a contrast analysis[1] was used (see, e.g., Wendorf, 2004). Two contrasts were tested in a regression analysis: a contrast of interest, corresponding to the previous hypothesis regarding the condition difference, and an orthogonal contrast, which tested the residual variance. The hypothesis can be accepted if the contrast of interest predicts the proportion of time (with an arcsine transformation) children adopted the labels provided by the informant in Phase 1 and if the orthogonal contrast does not. Neither contrast of interest, $F(1,42) = .89$, $p = .37$, nor orthogonal contrast, $F(1,42) = -.28$, $p = .78$, were significant, so the hypothesis involving condition difference must be rejected.

Phase 2. In this phase, no arguments were used—the names of the condition refer to the difference in the way the informant supported her claim in Phase 1. Children adopted the label of the informant in 81.2% of the cases in the Perceptual Argument

[1] This analysis is more powerful for testing specific hierarchical hypotheses (Brauer & McClelland, 2005).

condition, 57,1% in the Circular Argument condition, and 46.7% in the Absence of Argument condition (Figure 3). The contrast analysis with the same hypothesis tested in Phase 1 confirmed the hypothesis of a condition difference between the Perceptual Argument condition and the two other conditions, $F(1,42) = 2.14$, $p = .039$, for the contrast of interest, $F(1, 42) = -.49$, $p = .62$, for the orthogonal contrast.

Phase 3. For all four hybrids (presented in Phases 1 and 2), children provided the label previously supported by the informant in 59.5% of the cases in the Perceptual Argument condition, 35.7% in the Circular Argument condition, and 31.7% in the Absence of Argument condition (Figure 3).

The contrast analysis with the same hypothesis tested in Phases 1 and 2 confirmed the hypothesis of a condition difference between the Perceptual Argument condition and the two other conditions, $F(1,42) = 2.18$, $p = .035$, for the contrast of interest, $F(1,42) = -.02$, $p = .98$, for the orthogonal contrast.

We then examined the hypothesis that children selectively retain the labels directly supported by a strong argument, by contrast with those supported by a circular argument or no argument. Figure 4 presents the relevant data: the proportion of labels retained by the children in Phase 3, for the hybrids from Phase 1 (i.e., percentage of informant labels retained in Phase 3 divided by the percentage of informant labels accepted in Phase 1). To test whether the difference observed was significant, we looked at the interaction term in the following ANOVA. A mixed model ANOVA with Condition (Absence of Argument and Circular Argument together, Perceptual Argument) as between-subjects variables and Phase (Phase 1, Phase 3 with hybrids from Phase 1) as within-subjects variable was calculated for the proportion of times (with an arcsin transformation) children endorse the label given by the informant. This revealed a significant main effect of Phase, $F(1,43) = 10.91$, $p = .002$, $\eta^2 = .20$, and Condition, $F(1,43) = 4.13$, $p = .048$, $\eta^2 = .088$, and no interaction effect between these two factors, $F(1,43) = 1.67$, $p = .20$, $\eta^2 = .037$.

Finally, a mixed model ANOVA with Condition (Absence of Argument and Circular Argument together, Perceptual Argument) as between-subjects variables and Phase (Phase 1, Phase 2, Phase 3) as within-subjects variable was calculated for the proportion of times (with an arcsin transformation) children endorse the label given by the informant. This revealed a significant main effect of Phase, $F(2,86) = 14.01$, $p <$

.001, η^2 = .25, and Condition, $F(1,43) = 4.55$, p = .039, η^2 = .10, and no interaction effect between these two factors, $F(2,86) = 1.11$, p = .30, η^2 = .025. Grouping all conditions, children endorsed significantly less the informant's labels in Phase 3 than in Phases 1 ($p < .001$) and 2 ($p < .001$). There were no significant differences between Phases 1 and 2 ($p = 1$).

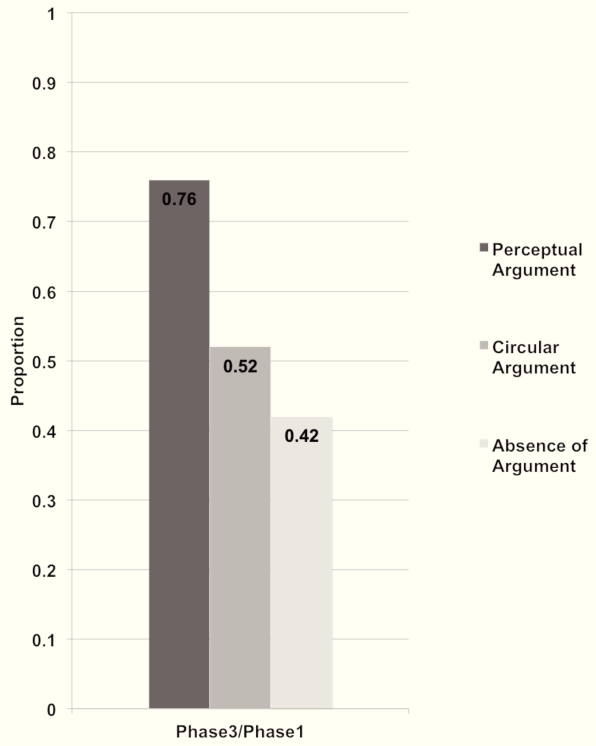

Figure 4. Proportion of labels retained by the children in Phase 3, for the hybrids from Phase 1 as a function of the experimental conditions.

Discussion

The goal of this experiment was to test whether 2-year-olds would be more influenced by a strong argument than by either a circular argument or an absence of argument. The children were shown pictures of hybrid animals, asked to name them, and then provided with a different label by an informant. For the two hybrids of the first phase, the informant supported her suggestion either with a strong, perceptual argument, with a weak, circular argument, or with no argument. For the two hybrids of the second phase, the informant did not support her suggestion with arguments. In the third phase, the four hybrids from Phases 1 and 2 were presented again, in the absence of the informant, to test how well the children retained the informant's suggestion.

An analysis of the overall results revealed that children were, on the whole, more likely to accept the informant's labels in the Perceptual Argument condition than in the Circular Argument and Absence of Argument conditions. This result supports the hypothesis that 2-year-olds are sensitive to argument strength.

In Phase 1, there was no significant advantage, in terms of children's acceptation of the informant's label, for the Perceptual Argument condition. Given the high rates of acceptation in the Circular Argument and the Absence of Argument condition, the lack of significant difference is likely due to a ceiling effect. The high rates of acceptation in the absence of a strong argument could be due to two main causes. First, given that the pictures were ambiguous, deference towards a plausibly better informed source (Jaswal & Markman, 2007). Second, politeness or ingratiation (see, Jaswal & Kondrad, 2016). Note that in the experiment showing that 3-year-olds tend to favor testimony supported by a perceptual over a circular argument, the two arguments were pitted against each other in a within participant design (Mercier *et al.*, 2014). In the present experiment, we chose a between participant design to avoid burdening the memory of the 2-year-olds, and this difference in design might explain the differing outcomes.

In Phase 2, there was a significant advantage, in terms of children's acceptation of the informant's label, for the Perceptual Argument condition. This was obtained even though the informant did not provide any argument in this phase, extending prior results showing that preschoolers generalize their trust in informants who have previously provided good explanations (Corriveau & Kurkul, 2014). Descriptively, the emergence of this difference seems due to a drop in the acceptation of the labels provided by the informant who had previously provided a weak or no argument (see Figure 3). This drop might be due either to children growing suspicion in the competence of an informant who keeps providing labels that contradict his impression, or to a waning motivation to be polite with the informant. The fact that the acceptation of the labels provided by the informant who had previously given a strong argument did not drop at all in Phase 2 suggests that the children might have accepted her labels in Phase 1 for reasons different from the reasons for which they accepted the labels supported by either a circular argument or an absence of argument.

In Phase 3, we observed an effect of condition, so that the labels which had been provided by the informant who used a perceptual argument in Phase 1 tended to be better retained than those provided by an informant who had used a circular argument or

no argument. However, there was an overall drop in the endorsement of the labels previously provided by the informant (Figure 3). Among the hybrids from Phase 1, those which had been supported by a perceptual argument were more likely to have been retained than those supported by a circular argument or no argument (Figure 4). However, maybe due to the small number of observations, this effect was not significant (absence of significant interaction in the repeated measure ANOVA).

The theoretical import of our results is that they constitute the first, to the best of our knowledge, experimental demonstration of argumentation skills in 2-year-olds. They thus support the view that argumentation skills start developing very early (Mercier, 2011), a view recently buttressed by a series of experiments in argument evaluation (Bernard, Mercier, & Clément, 2012; Castelain *et al.*, 2015; Koenig, 2012; Mercier *et al.*, 2014) and production (Köymen, Mammen, & Tomasello, 2015; Köymen, Rosenbaum, & Tomasello, 2014) in preschoolers. All of these results support the importance of argumentation, and the exchange of reasons more generally, in our species (Mercier & Sperber, in press, 2011; Tomasello, 2014).

Methodologically, the present study presents two significant innovations. First, it developed an experimental paradigm that allows testing argumentation skills in very young children. Second, it highlights the importance of testing how well information acquired through testimony is retained. The significant drop in the endorsement of labels provided by the informant observed in Phase 3 suggests that some of the apparent changes of mind observed in testimony experiments might be relatively short lived. More regular testing of the temporal robustness of the beliefs acquired through testimony (e.g., Corriveau & Harris, 2009), and of their robustness to the departure of the informant who provided the testimony (e.g., Haun, Rekers, & Tomasello, 2014), would bring valuable information, going beyond the question of whether children endorse testimony towards a better understanding of how they do so.

Acknowledgments

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Article 4 : The influence of power and reason on young Maya children's endorsement of testimony

Expériences	**Argumentation**	**Hiérarchie**	**Argumentation vs. Hiérarchie**
Hypothèse testée	**Sensibilité à la qualité des arguments**	**Prise en compte la hiérarchie pour juger de la fiablité d'un témoignage**	**La qualité des arguments prend le pas sur la hiérarchie sociale**
Cultures Occidentales	Article 3 Castelain *et al.*, soumis	Article 5 Bernard *et al.*, 2016	Résultats complémentaires 6 Non publiés
Sociétés Traditionnelles	**Article 4** **Castelain *et al.*, 2015**	**Article 4** **Castelain *et al.*, 2015**	**Article 4** **Castelain *et al.*, 2016**
Cultures Orientales	Article 7 Sudo *et al.*, in prep.	Article 8 Charafeddine *et al.*, in prep.	-

The Influence of Power and Reason on Young Maya Children's Endorsement of Testimony

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Abstract

Two important parenting strategies are to impose one's power and to use reasoning. The effect of these strategies on children's evaluation of testimony has received very little attention. Using the epistemic vigilance framework, we predict that when the reasoning cue is strong enough it should overcome the power cue. We test this prediction in a population for which anthropological data suggest that power is the prominent strategy while reasoning is rarely relied on in the interactions with children. In Experiment 1, 4- to 6-year-old children from a traditional Maya population are shown to endorse the testimony supported by a strong argument over that supported by a weak argument. In Experiment 2, the same participants are shown to follow the testimony of a dominant over that of a subordinate. The participants are then shown to endorse the testimony of a subordinate who provides a strong argument over that of a dominant who provides either a weak argument (Experiment 3) or no argument (Experiment 4). Thus, when the power and reasoning cues conflict, reasoning completely trumps power.

Keywords: Power, Reasoning, Testimony Selection, Trust, Epistemic Vigilance

Two of the main strategies parents use to influence their children are power and reason (Grusec & Goodnow, 1994; Hoffman, 1970). With *power* parents rely on their dominance to threaten or execute the withdrawal of privileges and corporal punishment. With *reasoning* parents provide their children reasons why they should behave in the desired manner. The frequency with which these strategies are used is related to many child outcomes: immediate compliance (Gershoff, 2002), but also resistance to temptation (Grusec & Goodnow, 1994), pro-social behavior (Eisenberg, Miller, Lewis, & Miller, 1990), and mental health (Gershoff, 2002). On the whole, parents' use of reasoning has been found to be related to positive child outcomes (see, e.g., Hoffman 1970). However, little is known about their impact in an essential domain: children's evaluation of testimony. Are children more likely to endorse the testimony of someone who imposes their power or that of someone who relies on reasoning?

Power, which refers to the ability to control what others do and the distribution of resources, can result from two main factors: dominance and authority. Dominance, which is shared with non-human primates and other social animals, largely relies on physical agonism (e.g., Lewis, 2002). For instance, two individuals compete for a scarce resource and the dominant monopolizes it through fighting, aggression or strength displays. Authority, by contrast, is a more human specific construct in which the powerful position results from leadership, status, respect, or prestige (e.g., Fiske, 1992). With authority, power is less coercive, more institutionalized, and is less likely to rely on physical strength. Although dominance and authority are related, they do not always correlate, for instance when an elderly individual exerts a strong authority. Dominance plays a very important role in children's lives (Boyce, 2004; Strayer & Strayer, 1976), and parents who use power can rely on dominance—their physical strength—to make children comply (Grusec & Goodnow, 1994).

Young children have been shown to identify dominance from several cues, and to make several inferences on the basis of dominance (Charafeddine *et al.*, in press; Mascaro & Csibra, 2012); in particular, 3- to 5-year-olds tend to endorse the testimony of a dominant individual over that of a subordinate (Bernard *et al.*, submitted). Preschoolers also tend to endorse the testimony of a physically stronger individual over that of a weaker one (Fusaro, Corriveau, & Harris, 2011). Given that children this age infer dominance from physical strength (Charafeddine *et al.*, in press), it is possible that

they endorsed the testimony of the stronger individual because they thought he was more likely to be a dominant.

In the present experiments we have operationalized power in the following way: two characters are seen play fighting, and then competing over an object. In both cases, the same character accomplishes her goal (i.e. winning the fight, getting the object) at the expense of the other. These two situations are archetypal examples of dominance that preschoolers encounter in the kindergarten (Russon & Waite, 1991; Sluckin & Smith, 1977; Strayer & Strayer, 1976) and that have been used in several experiments (Charafeddine *et al.*, in press; Mascaro & Csibra, 2012; Thomsen, Frankenhuis, Ingold-Smith, & Carey, 2011).

To operationalize reasoning, we have relied on a contrast between a character who provides a circular argument and one who provides a strong, non-circular argument. Preschoolers have been shown to favor the testimony supported by the strong, non-circular argument (Mercier, Bernard, & Clément, 2014; see also Corriveau & Kurkul, 2014)

In order to make predictions regarding which cue—power or reason—should provide stronger support for testimony, we rely on the framework of epistemic vigilance. Children's ability to evaluate testimony can be understood as being part of a set of mechanisms dedicated to epistemic vigilance (Mascaro & Sperber, 2009; Sperber *et al.*, 2010). These mechanisms have evolved to enable the discrimination of beneficial and harmful communicated information, using cues such as trust in the speaker and plausibility of the information. In this framework, reasoning would have evolved to allow for a finer grained discrimination of messages. In particular, a main function of reasoning would be to allow senders to transmit messages that would not be accepted on trust. When a receiver doesn't accept a message on trust, the sender can provide arguments. The receiver can evaluate these arguments and decide for herself if she should change her mind. Thus, strong enough arguments should be able to overcome a deficit of trust: a sender who is not trusted enough—for instance because she lacks power—but who provides strong arguments, should be believed (Mercier & Sperber, 2011). Evidence in adults suggests that strong arguments can take precedence over source-related cues such as confidence, competence, and honesty (Trouche, Sander, & Mercier, 2014; Trouche, Shao, & Mercier, submitted).

In order to test the prediction that strong enough arguments should take precedence over source related cues such as power, one can try to determine whether children endorse the testimony of a subordinate providing a strong argument over that of a dominant providing a weak argument, or no argument. However, conducting such a test in the populations standardly recruited in developmental psychology raises some issues. Most participants in psychology experiments belong to cultures described as WEIRD—Western Educated Industrialized Rich Democratic (Henrich, Heine, & Norenzayan, 2010). Cross-cultural research has demonstrated that the adults of WEIRD populations are outliers on a number of traits, some of which are relevant to the use of the power assertive and inductive reasoning strategies. Compared to many cultures, Western cultures tend to be individualist and relatively egalitarian, making the assertion of power more difficult (Singelis, Triandis, Bhawuk, & Gelfand, 1995; Triandis & Gelfand, 1998). Western cultures have also been described as putting a unique emphasis on the use of reason in argumentation and debate (for review, see, Mercier, 2011).

The specificity of WEIRD cultures is also reflected in parenting style (see, e.g., Little, Carver, & Legare, submitted). Anthropological and linguistic evidence suggests that traditional societies tend to rely more on power assertion relative to reasoning than Western cultures (especially than the middle- and upper-middle class children who usually take part in experiments, see, e.g., Tizard, Hughes, Carmichael, & Pinkerton, 1983). In traditional societies, children are not supposed to question their parents' decisions—they should be "seen and not heard" (Maratsos, 2007, p. 124; see also Nicolaisen, 1988). As a result, they very rarely require explanations by asking "why-questions" to adults (Gauvain, Munroe, & Beebe, 2013). This evidence suggests that in traditional cultures, relative to Western cultures, power assertion plays a stronger role and reasons a weaker role. Children from a traditional culture would thus provide a more robust test of the hypothesis that strong enough arguments take precedence over a source-related cue such as power.

To test this hypothesis, children from traditional Maya populations were asked to decide which of two informants' contradictory testimonies to endorse. In Experiment 1, one informant provided a strong (perceptual) argument and the other informant a weak (circular) argument. In Experiment 2, one informant was a dominant and the other a subordinate. In Experiment 3, one informant was a dominant who provided a weak argument and the other a subordinate who provided a strong argument. In Experiment 4,

one informant was a dominant who provided no argument and the other a subordinate who provided a strong argument.

Population tested

The participants were 4-, 5- and 6-year-old children from indigenous Kaqchikel families living in three villages in the department of Sololá, Guatemala. These are rural villages in which the majority of the population is illiterate (INE, 2002). Kaqchikel societies are not egalitarian. Although the hierarchical order does not perfectly track standard dominance, since the elders occupy a high hierarchical position, there is still a strong link between physical dominance and hierarchical position, with men having a higher position than women who have a higher position than children (UNDP, 2014). As is true in other traditional societies, there is comparatively little talk between children and their caregivers (Bunzel, 1959; Maratsos, 2007). In the closely related K'iche' communities, for which data are available, parents ask few questions to their children, relying primarily—over 50% of sentences—on imperatives when addressing them (Pye, 1986). This population thus fits well with the description provided earlier of traditional population.

At the age of four, children start pre-school, where they engage in educational activities for approximately four hours a day (PNUD, 2005). The experiments took place in the pre-schools of each village and were conducted in Kaqchikel, the children's native language. The experimenters were two women from the community recruited and trained by one of the authors. For each experiment, each child was seen individually in a quiet room by a single experimenter for about 10 minutes. Pictures were presented on a binder while the experimenter told the stories and asked the questions. The translations from Spanish to Kaqchikel were done by one of the experimenters, the back-translation by the other experimenter, with discrepancies resolved through discussion. Most children took part in the four experiments, and they were rewarded with school material, a bag, and a T-shirt after taking part in the experiment in which they last took part.

Experiment 1

Method

Participants. This experiment involved 99 children: 29 four-year-olds (16 girls, M_{age} = 54.3 months, *SD* = 3.23, range 50–60 months), 33 five-year-olds (14 girls, M_{age} = 67.4 months, *SD* = 3.07, range 61–72 months), and 37 six-year-olds (14 girls, M_{age} = 78.5 months, *SD* = 3.07, range 73–84 months).

Materials and procedure. The procedure was adapted from Mercier *et al.* (2014). In the first vignette, a young Playmobil girl, Maria, and her hen were presented to the children. The experimenter said: "In this game, you will try to help Maria find her hen" (see Supplementary Materials for a complete example of the pictures and instructions). A second vignette—which was repeated four times with different backgrounds and boy characters—showed Maria facing two Playmobil boy characters, each one pointing in a different direction. The experimenter said: "For instance, one day, Maria is looking for her hen in front of a house. These two kids tell her something. Actually, these two kids disagree. This one says: "The hen went this way because I saw it go this way" [Perceptual Argument]. And this one says: "The hen went this way because it went this way" [Circular Argument]" (Figure 1).

Finally, the experimenter asked the children, "According to you, where did Maria's hen go?" The characters' location (left/right) and the order of information presentation were counterbalanced. Each child could obtain a maximum score of 4 points: 1 point for each story in which the direction supported by the perceptual argument was chosen.

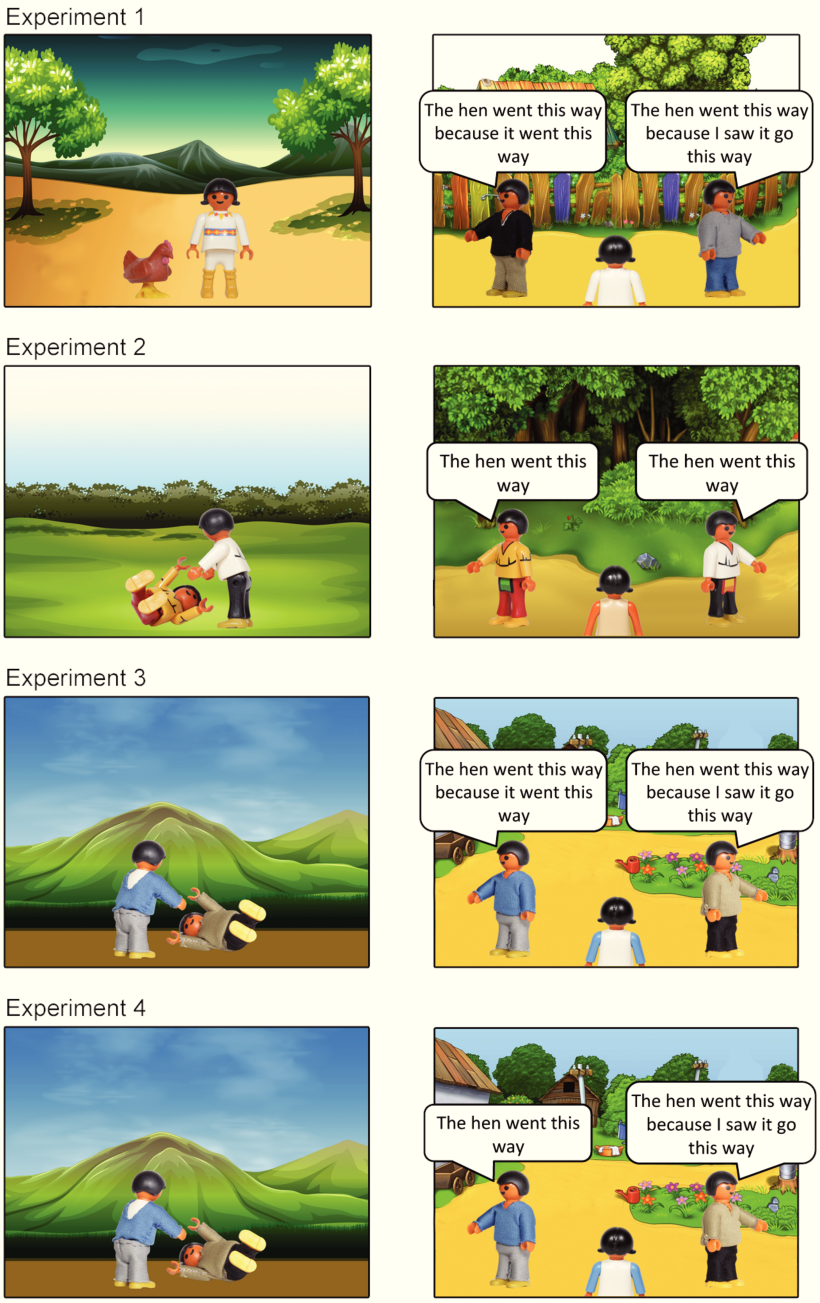

Figure 1. Summary of the experiments. Experiment 1. Introduction of the girl and her hen that will get lost (common to all the experiments); The characters respectively provide a perceptual and a circular argument. Experiment 2. The dominance relationship is established; The characters point in opposite directions without providing any argument. Experiment 3. The dominance relationship is established; The dominant provides a circular argument and the subordinate a perceptual argument. Experiment 4. The dominance relationship is established; The dominant provides no argument and the subordinate provides a perceptual argument.

Results and discussion

A Kruskal-Wallis one-way analysis of variance did not reveal any significant effect of age group, $\chi 2$ (2, N = 99) = 3.07, p = .216. One-sample Wilcoxon signed rank tests showed that the children were more likely than chance to select the testimony supported by the perceptual argument, both for the children as a whole (Mdn_{all} = 3, Z = 6.21, p < .001, r = .50, see Figure 2), and within each age group (Mdn_{4yo} = 3, Z = 4.13, p < .001, r = .66; Mdn_{5yo} = 3, Z = 4.17, p < .001, r = .61; Mdn_{6yo} = 3, Z = 2.71, p = .007, r = .32).

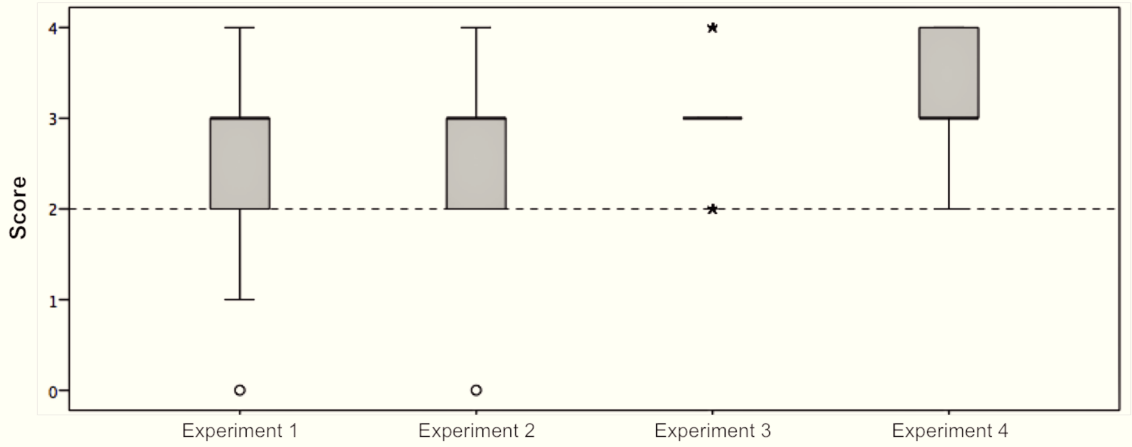

Figure 2. Box plots representing the scores of children following the testimony of: (Experiment 1) the character giving the perceptual argument (M_{all} = 2.78, SD = .94); (Experiment 2) the dominant character (M_{all} = 2.72, SD = .74); (Experiment 3) the subordinate character giving the perceptual argument while the dominant gave a circular argument (M_{all} = 3.02, SD = .63); (Experiment 4) the subordinate character giving the perceptual argument while the dominant gave no argument (M_{all} = 3.13, SD = .62). The dark lines represent the median value. The boxes represent the middle half of the sample, between the lower and the upper quartiles. The whiskers represent the largest values except for the outliers. Circles are outliers and asterisks far outliers[1].

This suggests that the children from all age groups were able to discriminate between a strong, perceptual argument, and a weak, circular argument. They favored the testimony supported by the strong argument, replicating the results obtained by Mercier *et al.* (2014) with Swiss participants. One could argue, however, that the present results do not decisively answer the question of whether children are able to recognize the strength of the strong argument, or only the weakness of the circular argument. Children

[1] Note: In experiment 3 we have asterisks because 60,4% of the participants get a score of 3 and the two others values (which are considered as extreme due to the non-normality of the distribution) are 2 (18,7%) and 4 (20,9%).

could think that the character providing the circular argument was in some way irrational, and thus favor the testimony of the other character without understanding that her argument was strong. Two sets of results weigh against this interpretation. Results from the study in Switzerland showed that 4- and 5-year-olds tended to endorse testimony supported by a circular argument over that supported by no argument (Mercier *et al.,* 2014). This suggests that children this age do not think that circular arguments are intrinsically irrational, only that they are weaker than other arguments. The results of the present Experiment 4 below also speak against this interpretation. Experiment 2 tests whether children from the same population of indigenous Maya take dominance into account when evaluating testimony.

Experiment 2

Method

Participants. This experiment involved 97 children: 31 four-year-olds (18 girls, M_{age} = 54.3 months, *SD* = 3.48, range 48–60 months), 34 five-year-olds (15 girls, M_{age} = 67.3 months, *SD* = 3.20, range 61–71 months), and 32 six-year-olds (11 girls, M_{age} = 78.8 months, *SD* = 2.99, range 73–84 months). Ninety of these children had taken part in Experiment 1 a minimum of one month before.

Materials and procedure. The design was adapted from Bernard *et al.* (submitted). The experiment was composed of two phases: a dominance induction phase and a test phase.

Dominance induction phase. In the induction phase, the children were told two stories involving two boy characters, José and Luis. One story presented the two characters play fighting (seven vignettes, see Supplementary Materials); the other story showed them contesting a ball (seven vignettes, see Supplementary Materials). The same character won in the two stories. The order of the stories, the dominant character and the position of the characters were counterbalanced.

Test phase. In the test phase the children were presented with a testimony task in which Luis and José gave conflicting testimonies in four consecutive trials. This task is similar to that of Experiment 1 except that: (a) the protagonists gave no arguments, merely pointing in one direction and saying: “The hen went this way” (Figure 1) (b) the four trials involved the same protagonists. Each child could obtain a maximum score of

4 points: 1 point for each story in which the direction supported by the dominant character was chosen.

Preference questions. After the fourth testimony trial, a picture displayed José and Luis in a neutral background and the experimenter asked the child: "Do you prefer José or Luis [order counterbalanced]?" Then she asked: "Would you prefer to play with Luis or José [order counterbalanced]?"

Control questions. The experimenter asked the children: "Do you think that one of the two characters is the boss?" If the answer was positive, the experimenter asked: "According to you, who is the boss?" If the answer was negative, the experimenter asked: "If you had to choose between the two characters, which one would be the boss?" To ascertain the children's grasp of power, the experimenter also asked: "Who is the boss in the classroom?"

Results and discussion

A Kruskal-Wallis one-way analysis of variance did not reveal any significant effect of age group, $\chi 2$ (2, N = 97) = 1.85, p = .397. One-sample Wilcoxon signed rank tests showed that children were more likely than chance to select the testimony of the dominant character, both for the children as a whole (Mdn_{all} = 3, Z = 6.65, p < .001, r = .47, see Figure 2), and within each age group (Mdn_{4yo} = 3, Z = 4.07, p < .001, r = .60; Mdn_{5yo} = 3, Z = 4.26, p < .001, r = .63; Mdn_{6yo} = 3, Z = 3.30, p = .001, r = .47). These results show that the children from all age groups favored the testimony of a dominant over that of a subordinate, replicating the results obtained by Bernard *et al.* (submitted) with French children.

Comparisons to chance level (binomial test) for the group as a whole revealed a preference for the dominant character (59 preferences for the dominant, 38 preferences for the subordinate, p = .042) and a preference to play with the dominant character (59 preferences for the dominant, 38 preferences for the subordinate, p = .042). Mann-Whitney tests revealed that the testimony scores of the group of children who preferred (or had a preference for playing with) the dominant did not differ significantly from the scores of those who preferred (or had a preference for playing with) the subordinate (respectively Z = .817, p = .414, and Z = 1.09, p = .277). Additionally, one-sample Wilcoxon signed rank tests showed that all groups of children were more likely than

chance to select the testimony of the dominant: children who expressed a preference for the subordinate (*Mdn* = 3, *Z* = 3.95, *p* < .001, *r* = .51); children who expressed a preference for the dominant (*Mdn* = 3, *Z* = 5.37, *p* < .001, *r* = .59); children who preferred to play with the subordinate (*Mdn* = 3, Z = 4.34, p < .001, r = .58); children who preferred to play with the dominant (*Mdn* = 3, *Z* = 5.12, *p* < .001, *r* = .56). Most children were able to correctly identify the dominant (73 out of 97, *p* < .001) and they all displayed a basic grasp of the concept of power (100% said that the boss in the classroom was their teacher).

The goal of Experiment 3 will be to test whether strong arguments can trump the source (i.e. dominance) cue. For Experiment 3 to be meaningful, the dominance cue, considered independently, should not be weaker than the argument cue, considered independently. Otherwise we would simply be dealing with a weak source cue, and it would not be surprising if it were trumped by argument quality. To ensure that this was not the case, analyses were conducted with the children in Experiment 3 who also took part in Experiments 1 and 2 (*N* = 81). A paired-sample Wilcoxon signed-rank test revealed that for those children the score linked to the perceptual argument in Experiment 1 did not differ significantly from the score linked to the dominant character in Experiment 2 (*Z* = .55, *p* = .583). Thus, if argument strength trumps dominance in Experiment 3, it cannot be simply because the source cue used was intrinsically weaker than the argument cue.

Experiment 3

Method

Participants. This experiment involved 91 children: 28 four-year-olds (16 girls, M_{age} = 53.9 months, *SD* = 3.40, range 48–60 months), 31 five-year-olds (12 girls, M_{age} = 67.5 months, *SD* = 2.88, range 62–71 months), and 32 six-year-olds (12 girls, M_{age} = 78.8 months, *SD* = 3.13, range 73–84 months). Eighty-one of these children had taken part in Experiments 1 and 2 a minimum of one month before.

Materials and procedure. The experiment was identical to Experiment 2 except that the arguments from Experiment 1 were introduced (and that the characters were different, as indicated by their new names). In each of the four testimony trials, the dominant used the circular argument and the subordinate the perceptual argument

(Figure 1). Each child could obtain a maximum score of 4 points: 1 point for each story in which the direction supported by the perceptual argument (given by the subordinate) was chosen.

Results and discussion

A Kruskal-Wallis one-way analysis of variance did not reveal any significant effect of age group, $\chi 2$ (2, N = 91) = 2.64, p = .267. One-sample Wilcoxon signed rank tests showed that children were more likely than chance to select the testimony of the subordinate giving the perceptual argument, both for the children as a whole (Mdn_{all} = 3, Z = 7.90, p < .001, r = .76, see Figure 2), and within each age group (Mdn_{4yo} = 3, Z = 4.46, p < .001, r = .76; Mdn_{5yo} = 3, Z = 4.77, p < .001, r = .76; Mdn_{6yo} = 3, Z = 4.60, p = .001, r = .75).

Comparisons to chance level (binomial test) revealed no preference between the characters (52 preferences for the dominant, 39 preferences for the subordinate, p = .208), or preference to play with one of the characters (45 preferences for the dominant, 46 preferences for the subordinate, p = 1). As in Experiment 2, Mann-Whitney tests revealed that the testimony scores of the children who preferred (or had a preference for playing with) the dominant and of those who preferred (or had a preference for playing with) the subordinate did not differ significantly (respectively Z = .294, p = .769, and Z = -.654, p = .513). Additionally, one-sample Wilcoxon signed rank tests showed that all groups of children were more likely than chance to select the testimony of the subordinate who gave a perceptual argument: children who expressed a preference for the subordinate (Mdn = 3, Z = 5.25, p < .001, r = .76); children who expressed a preference for the dominant (Mdn = 3, Z = 5.92, p < .001, r = .75); children who preferred to play with the subordinate (Mdn = 3, Z = 5.75, p < .001, r = .78); children who preferred to play with the dominant (Mdn = 3, Z = 5.44, p < .001, r = .72). Most children were able to correctly identify the dominant (74 out of 91, p < .001) and they all displayed a basic grasp of the concept of power (100% said that the boss in the classroom was their teacher).

The interpretation of these results, however, faces the same issue as that faced in Experiment 1: instead of recognizing the strength of the strong argument, children could simply avoid the speaker who provides an argument that could be construed as

being irrational and as violating conversational norms. Experiment 4 can rule out this interpretation, since it pits a subordinate who provides a strong argument against a dominant who provides no argument.

Experiment 4

Method

Participants. This experiment involved 60 children: 20 four-year-olds (12 girls, M_{age} = 53.9 months, *SD* = 3.59, range 48–60 months), 20 five-year-olds (9 girls, M_{age} = 66.3 months, *SD* = 3.28, range 61–72 months), and 20 six-year-olds (10 girls, M_{age} = 78.7 months, *SD* = 2.36, range 73–82 months). All of these children had taken part in two or three of the previous experiments, at least two weeks prior to taking part in Experiment 4.

Materials and procedure. The experiment was identical to Experiment 3 except that the circular argument was removed (and that the characters were different, as indicated by their new names). In each of the four testimony trials, the dominant did not provide any argument and the subordinate used the perceptual argument (Figure 1). Each child could obtain a maximum score of 4 points: 1 point for each story in which the direction supported by the perceptual argument (given by the subordinate) was chosen.

Results and discussion

A Kruskal-Wallis one-way analysis of variance did not reveal any significant effect of age group, $\chi 2$ (2, N = 60) = .419, p = .811. One-sample Wilcoxon signed rank tests showed that children were more likely than chance to select the testimony of the subordinate giving the perceptual argument, both for the children as a whole (Mdn_{all} = 3, Z = 6.57, p < .001, r = .79, see Figure 2), and within each age group (Mdn_{4yo} = 3, Z = 3.79, p < .001, r = .77; Mdn_{5yo} = 3, Z = 3.74, p < .001, r = .77; Mdn_{6yo} = 3, Z = 3.95, p = .001, r = .81).

Comparisons to chance level (binomial test) revealed a preference for the subordinate character (12 preferences for the dominant, 48 preferences for the subordinate, p < .001), and a preference to play with the subordinate character (13

preferences for the dominant, 47 preferences for the subordinate, $p < .001$). As in Experiments 2 and 3, Mann-Whitney tests revealed that the testimony scores of the children who preferred (or had a preference for playing with) the dominant and of those who preferred (or had a preference for playing with) the subordinate did not differ significantly (respectively $Z = -.296$, $p = .767$, and $Z = .698$, $p = .485$). Additionally, one-sample Wilcoxon signed rank tests showed that all groups of children were more likely than chance to select the testimony of the subordinate who gave a perceptual argument: children who expressed a preference for the subordinate ($Mdn = 3$, $Z = 5.91$, $p < .001$, $r = .79$); children who expressed a preference for the dominant ($Mdn = 3$, $Z = 2.92$, $p = .004$, $r = .75$); children who preferred to play with the subordinate ($Mdn = 3$, $Z = 5.88$, $p < .001$, $r = .79$); children who preferred to play with the dominant ($Mdn = 3$, $Z = 3.02$, $p = .003$, $r = .77$). Most children were able to correctly identify the dominant (55 out of 60, $p < .001$) and they all displayed a basic grasp of the concept of power (100% said that the boss in the classroom was their teacher).

These results show that, in Experiments 1 and 3, children were not merely rejecting the testimony that was supported by what could be construed as an irrational argument—i.e. the circular argument. Even in the absence of such an argument, children chose to endorse testimony supported by the strong argument.

Conclusion

Experiment 1 revealed that 4- to 6-year-old children from traditional Maya communities were able to recognize a perceptual argument as being stronger than a circular argument. Experiment 2 showed that they were more likely to endorse the testimony of a dominant over that of a subordinate. Both experiments thus replicate results previously obtained with populations in a WEIRD country (Bernard *et al.*, submitted; Mercier *et al.*, 2014).

When presented independently, both the reason cue (strong argument) and the power cue (dominance) generated equally strong endorsement. By contrast, when presented together, so that the subordinate gave a stronger argument than the dominant, the reason cue trumped the power cue for each age group. This result was robustly obtained both when the dominant gave a weak, circular argument (Experiment 3) and when he gave no argument (Experiment 4). In the type of community studied,

anthropological, sociological, and linguistic data suggest that dominance plays an important role, while argumentation, especially argumentation addressed to children, plays a more modest role. It is thus striking that, when very young children from these communities have to evaluate conflicting testimonies, strong arguments trump dominance. Argument evaluation thus plays the role predicted within the epistemic vigilance framework: that of overcoming source-based cues when good enough arguments are produced.

It should be noted that the contrast used in the current experiments between strong and weak arguments was particularly stark. The weak argument was perfectly circular, to the point that it could be considered anomalous (although circular replies to children's questions might be fairly common, see Robinson & Rackstraw, 1967). By contrast, the strong argument was perfectly appropriate given the task in hand: having seen where the hen had gone provides a very strong support for knowing where then hen is (although even this argument could be defeated, for instance by someone who has seen the hen more recently, by someone who points out that it was in fact another hen, by someone who points out that the character is extremely short sighted, etc.). If the contrast between the arguments had been weaker, the reason cue should not have trumped the power cue so clearly—a result that would not run against the epistemic vigilance framework, which does not predict that one type of cue should systematically trump another.

Children might also have been expected to act differently if they had been in a direct interaction with a dominant. In this case, the desire to ingratiate with the dominant, or even to avoid punishment, might have pushed the children to say they agreed with him. This might have been even more likely if the testimony had not borne on a factual matter, but on a matter of convention (such as object naming), or a practical matter (such as collective decision-making). Many more experiments will be necessary to better understand how reason and power cues interact in different contexts.

Data availability

All data are available at:

https://sites.google.com/site/hugomercier/Data_Base_ReasonPower.xlsx?attredirects=0

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Supplementary Materials for "The Influence of Power and Reason on Young Maya Children's Endorsement of Testimony"

Material. Complete example of the pictures and instructions used in experiments 1, 2 and 3.

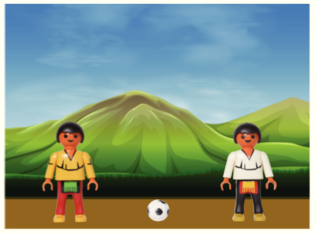
Experiment 1

María and her hen		I'm going to tell you the story of Maria [point] and her hen [point]. Actually, Maria's hen [point] often escapes, and she often has to go look for it. In the game, you will help Maria to find her hen. Let's begin…
Story 1		For example, one day, Maria looks for her hen in front of a house. These two boys tell her something. Actually, these two boys disagree. This one [point to the left] says "The hen went this way because I saw it go this way." [point to the left]. And this one [point to the right] says "The hen went this way because it went this way." [point to the right]. According to you, where did Maria's hen go?
Story 2		Another day, Maria looks for her hen in front of a school. These two new boys tell her something. They disagree. This one [point to the right] says "The hen went this way because I saw it go this way." [point to the right]. And this one [point to the left] says "The hen went this way because it went this way." [point to the left]. According to you, where did Maria's hen go?

Story 3		Another day, Maria looks for her hen in front of a church. These two new boys tell her something. They also disagree. This one [point to the left] says “The hen went this way because I saw it go this way.” [point to the left]. And this one [point to the right] says “The hen went this way because it went this way.” [point to the right]. According to you, where did Maria’s hen go?
Story 4		Finally, one day, Maria looks for her hen in front of a garden. These two last boys tell her something. They also disagree. This one [point to the left] says “The hen went this way because it went this way.” [point to the left]. And this one [point to the right] says “The hen went this way because I saw it go this way.” [point to the right]. According to you, where did Maria’s hen go? [after the child’s answer] Why?
Maria alone		Well, the game is over, we are going to see if, thanks to you, Maria found her hen, OK?
Maria and her hen		Yes, look! Thanks to you Maria found her hen. It’s great, you played the game very well!

Experiment 2

Induction phase 1		Here are José [point left] and Luis [point right]. Luis and José are two friends. They love playing fight. In the following images, we will see José and Luis playing fight. So we start…
		There, we see José [point] and Luis [point] getting closer to play fight.
		There, we see José [point] and Luis [point] catching each other.
		There, we see Luis [point] who starts to make José [point] fall down.

		There, José [point] nearly falls down, it is Luis [point] who knocks José down.
		José [point] is really on the ground now. Luis [point] managed to knock José down.
		Hey look, it is Luis [point] who won.
Induction phase 2		We see once again José [point left] and Luis [point right]. They just found a ball. They both want the ball. In the following images, we will see José and Luis trying to catch the ball. So we start…

		There, we see José [point] and Luis [point] who go towards the ball to catch it.
		There, we see José [point] and Luis [point] who both touch the ball.
		There, we see José [point] and Luis [point] who each pull the ball towards themselves.
		There, we see that Luis [point] started to take the ball from José [point].

		There, we see that Luis [point] pulled the ball harder than José [point].
		Hey look, it is Luis [point] who has the ball.
Ana and her hen		Now, I'm going to tell you the story of Ana [point] and her hen [point]. In this story, there will be Luis and José too. Actually, Ana's hen [point] often escapes, and she often has to go look for it. In the game, you will help Ana to find her hen. José and Luis will be on the pictures to help Ana to find her hen. Let's begin…
Story 1		For example, one day, Ana [point] looks for her hen in front of a wood. You see, José [point] and Luis [point] are both there too. José [point] says "The hen went this way." [point to the left]. And Luis [point] says "The hen went this way." [point to the right]. According to you, where did Ana's hen go?

Story 2		Another day, Ana [point] looks for her hen in front of a garden. Luis [point] says “The hen went this way.” [point to the left]. And José [point] says “The hen went this way.” [point to the right]. According to you, where did Ana’s hen go?
Story 3		Another day, Ana [point] looks for her hen in front of a house. José [point] says “The hen went this way.” [point to the left]. And Luis [point] says “The hen went this way.” [point to the right]. According to you, where did Ana’s hen go?
Story 4		Finally another day, Ana [point] looks for her hen in front of a school. Luis [point] says “The hen went this way.” [point to the left]. And José [point] says “The hen went this way.” [point to the right]. According to you, where did Ana’s hen go? [after the child’s answer] Why?
Final questions		Well, now we see again José [point] and Luis [point]. Tell me… - “Do you prefer José or Luis?” - “Would you prefer to play with Luis or José?” - “Do you think that one of the two characters is the boss?” Now, tell me, “Who is the boss in the classroom?”

Ana alone		Well, the game is over, we are going to see if, thanks to you, Ana found her hen, OK?
Ana and her hen		Yes, look! Thanks to you Ana found her hen. It's great, you played the game very well!

Experiment 3

Induction phase 1		Here are Andrés [point left] and Juan [point right]. Andrés and Juan are two friends. They just found a ball. They both want the ball. In the following images, we will see Andrés and Juan trying to catch the ball. So we start…

		There, we see Andrés [point] and Juan [point] going towards the ball to catch it.
		There, we see Andrés [point] and Juan [point] both touching the ball.
		There, we see Andrés [point] and Juan [point] each pulling the ball towards themselves.
		There, we see that Andrés [point] started to take the ball from Juan [point].

		There, we see that Andrés [point] pulled the ball harder than Juan [point].
		Hey look, it is Andrés [point] who has the ball.
Induction phase 2		We see once again Andrés [point left] and Juan [point right]. They love playing fight. In the following images, we will see Andrés and Juan playing fight. So we start…
		There, we see Andrés [point] and Juan [point] coming closer to play fight.

		There, we see Andrés [point] and Juan [point] catching each other.
		There, we see Andrés [point] who starts to make Juan [point] fall down.
		There, Juan [point] nearly falls down, it is Andrés [point] who knocks Juan down.
		Juan [point] is really on the ground now. Andrés [point] managed to knock Juan down.

		Hey look, it is Andrés [point] who won.
Manuela and her hen		Now, I'm going to tell you the story of Manuela [point] and her hen [point]. In this story, there will be Juan and Andrés too. Actually, Manuela's hen [point] often escapes, and she often has to go look for it. In the game, you will help Manuela to find her hen. Andrés and Juan will be on the pictures to help Manuela to find her hen. Let's begin…
Story 1		For example, one day, Manuela [point] looks for her hen in front of a garden. You see, Juan [point] and Andrés [point] are both there too. Juan [point] says "The hen went this way because I saw it go this way." [point to the right]. And Andrés [point] says "The hen went this way because it went this way." [point to the left]. According to you, where did Manuela's hen go?
Story 2		Another day, Manuela [point] looks for her hen in front of a house. Andrés and Juan disagree again. Andrés [point] says "The hen went this way because it went this way." [point to the left]. And Juan [point] says "The hen went this way because I saw it go this way." [point to the right]. According to you, where did Ana's hen go?

Story 3		Another day, Manuela [point] looks for her hen in front of a school. Juan and Andrés still disagree. Juan [point] says "The hen went this way because I saw it go this way." [point to the left]. And Andrés [point] says "The hen went this way because it went this way". According to you, where did Ana's hen go?
Story 4		Finally, another day, Manuela [point] looks for her hen in front of a wood. Andrés and Juan still disagree. Andrés [point] says "The hen went this way because it went this way." [point to the left]. And Juan [point] says "The hen went this way because I saw it go this way." [point to the right]. According to you, where did Ana's hen go? [after the child's answer] Why? [Final questions]
Preference and control questions		Well, now we see again Andrés [point] and Juan [point]. Tell me… - "Do you prefer Juan or Andrés?" - "Would you prefer to play with Andrés or Juan?" - "Do you think that one of the two characters is the boss?" Now, tell me, "Who is the boss in the classroom?"
Manuela alone		Well, the game is over, we are going to see if, thanks to you, Manuela found her hen, OK?

Manuela and her hen		Yes, look! Thanks to you Manuela found her hen. It's great, you played the game very well!

Article 5 : The boss is always right : preschoolers endorse the testimony of a dominant over that of a subordinate

Expériences	Argumentation	**Hiérarchie**	Argumentation vs. Hiérarchie
Hypothèse testée	Sensibilité à la qualité des arguments	**Prise en compte la hiérarchie pour juger de la fiablité d'un témoignage**	La qualité des arguments prend le pas sur la hiérarchie sociale
Cultures Occidentales	Article 3 Castelain *et al.*, soumis	**Article 5** **Bernard *et al.*, 2016**	Résultats complémentaires 6 Non publiés
Sociétés Traditionnelles	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2016
Cultures Orientales	Article 7 Sudo *et al.*, in prep.	Article 8 Charafeddine *et al.*, in prep.	-

The Boss is Always Right: Preschoolers Endorse the Testimony of a Dominant Over that of a Subordinate

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Abstract

Recent research has shown that young children rely on social cues to evaluate testimony. For instance, they prefer to endorse testimony provided by a consensual group than by a single dissenter. Given that dominance is pervasive in children's social environment, it can be hypothesized that children also use dominance relations in their selection of testimony. To test this hypothesis, a dominance asymmetry was induced between two characters either by having one repeatedly win in physical contests (physical power, Experiment 1) or by having one repeatedly impose her goals on the other (decisional power, Experiment 2). In two subsequent testimony tasks, 3- to 5-years-old children significantly tended to endorse the testimony of the dominant over that of the subordinate. These results suggest that preschoolers take dominance into account when evaluating testimony. In conclusion, we discuss two potential explanations for these findings.

Keywords: Dominance, Testimony Selection, Trust, Physical Power, Decisional Power, Preschoolers

Young children learn most of their factual knowledge through testimony. Using a paradigm in which children have to choose between two contradictory testimonies, studies have revealed that several cues such as reliability (e.g., Koenig, Clément, & Harris, 2004), emotions (Clément, Bernard, Grandjean, & Sander, 2013), and linguistic markers (Bernard, Mercier & Clément, 2012) influence the selection of testimony by children. Another set of studies has investigated the influence of social cues in young children's endorsement of testimony, such as accent (e.g., Kinzler, Corriveau, & Harris, 2011), and consensus (e.g., Bernard, Proust, & Clément, 2015; Corriveau, Fusaro, & Harris, 2009). This latter research has shown, for instance, that children endorse more strongly information provided by a consensual group than information provided by a single dissenter. The present study explores the influence of another important social cue that has received very little attention: the dominance of one informant over another.

Dominance is often characterized as the competitive ability to prevail in conflicting interactions between two individuals, which typically involve resource control (e.g., toys, locations) and decision-making (e.g., deciding which game to play, where to go). Dominance relations might be achieved through different conducts such as agonistic physical behavior, verbal command, or persuasion. Ethological studies have established that 2-year-olds form stable and transitive dominance hierarchies and that these hierarchies play an important role in their everyday interactions (e.g., Boyce, 2004; Russon & Waite, 1991). Recent experimental studies have demonstrated that young children (and in some cases even infants) can infer dominance from a variety of relational cues such as physical supremacy, holding resources, and decisional power (Charafeddine *et al.*, 2015; Mascaro & Csibra, 2012; Thomsen, Frankenhuis, Ingold-Smith, & Carey, 2011).

Of particular relevance here is a series of experiments that have shown that 3- to 5-year-olds take a variety of cues into account when inferring dominance. For instance, in one condition of the first experiment of Charafeddine *et al.* (2015), two puppets verbally expressed conflicting goals over which game to play together. The situation occurred twice and the same puppet successfully imposed its favorite game on both occasions. Children were then asked which puppet was the dominant (dominance inference). They responded significantly above chance that the puppet imposing its goal was the dominant. Other conditions and other experiments in Charafeddine *et al.* (2015)

have shown that 3- to 5-year-olds can also take physical supremacy, age, and amount of resources held as cues to infer dominance (see also Gulgoz & Gelman, accepted).

These experiments revealed a general increase in the ability to infer dominance with age, with no interaction between age and ability to infer dominance from specific cues (i.e., the ability to infer dominance from various cues increased equally with age). However, observational studies show clear developmental trends in the way dominance is expressed in young children. In particular, with age dominance moves away from physical agonism towards expressions of verbal and decisional power (Hawley, 1999; La Freniere & Charlesworth, 1983; Roseth, Pellegrini, Bohn, Van Ryzin, & Vance, 2007; Strayer & Trudel, 1984). It is therefore possible that some of the inferences drawn from dominance might display an age by type of dominance (e.g. physical supremacy vs. decisional power) interaction.

Several experiments have tested the inferences young children draw from dominance. For instance, 3- to 5-year-old children expect dominants to win competitive games, and to hold more resources, even if dominance was established in an unrelated way (Charafeddine *et al.,* 2015). These inferences seem to be robust within this age range. Given the observed developmental differences in the expression of dominance, it would not be surprising to observe some developmental differences in the inferences drawn from dominance. For instance, in a related task, Charafeddine *et al*. (in press) have shown that as children grow older—from 3 to 8 years of age—they become increasingly likely to be more generous towards a subordinate than a dominant.

The question raised here is whether young children infer that dominants should be more or less trusted than subordinates in testimony tasks. On the one hand, it is not clear that dominance status provides much ground for epistemic trust. On the other hand, we know that dominance plays a crucial role in young children's social lives, that they can infer dominance from various cues, and make various inferences from dominance. Moreover, young children have been shown to take other social cues into account when evaluating testimony, even when those cues do not have obvious epistemic value like gender (Terrier, Bernard, Mercier, & Clément, 2016) or minimal group membership (MacDonald, Schug, Chase, & Barth, 2013).

To our knowledge, only one study has investigated the role of dominance on the evaluation of testimony. In this study, two characters were introduced to 4-, 5-, and 6-

year-olds (Castelain, Bernard, Van der Henst, & Mercier, 2015). In two short stories, the physical dominance of one character over the other was established: the dominant won a play fight with the subordinate, and acquired a toy they both wanted. After this dominance induction phase, the children completed a testimony task in which a third character who had lost an animal was introduced. The dominant and the subordinate then gave contradictory information about the location of the lost animal, and the children had to say where they thought the animal was (localization task). Children from each of the three age groups tended to endorse the testimony of the dominant individual over that of the subordinate.

Although this study provides evidence that young children take dominance into account in evaluating testimony, the generality of this finding is debatable. The present research extends this finding in four directions.

The first and most important is that the present study is conducted in a population of Western middle and upper-middle class children. By contrast, Castelain *et al*. (2015)'s study was conducted in a preliterate, traditional population (indigenous Kaqchikel Maya from Guatemala). Compared to this type of traditional populations (i.e. subsistence farmers), Western populations tend to be relatively egalitarian (see, e.g., Morris, 2015). Moreover, parenting in traditional societies often relies on power assertion, significantly more so than parenting in Western cultures (especially in middle- and upper-middle class children see, e.g., Tizard, Hughes, Carmichael, & Pinkerton, 1983). In traditional cultures, parents tend to rely on imperatives to address their children, and the children are expected to comply without questioning their parents' decisions (Gauvain, Munroe, & Beebe, 2013; Maratsos, 2007; Nicolaisen, 1988). As a result, the Maya children investigated in Castelain *et al.* (2015) likely face a much more hierarchical social structure than the Western middle- and upper-middle class children usually tested in experimental developmental psychology. This might explain Maya children's tendency to endorse the testimony of the dominant, in which case we might expect different results in Western middle and upper-middle class children. In particular, the latter might take dominance into account less than the Maya children. The plausibility of cross-cultural differences in this respect is bolstered by findings of significant differences between adults of different cultures in the processing of dominance (e.g., Freeman, Rule, Adams, and Ambady, 2009; Liew, Ma, Han, & Aziz-Zadeh, 2011).

The second novelty of the present study is that it introduces different cues to dominance. In Experiment 1, dominance is induced in a way that is very similar to that of Castelain *et al*. (2015). By contrast, in Experiment 2, dominance takes the shape of an asymmetry in decisional power: two protagonists disagree over which decision to make, and one always gets her way. As mentioned above, we know that 3- to 5-year-olds are able to infer dominance both from physical supremacy and from decisional power (Charafeddine *et al.,* 2015). However, we do not know if those two ways of establishing dominance elicit selective inferences regarding the trustworthiness of either the dominant or the subordinate. In particular, given the developmental changes in the way dominance is expressed among young children—from physical towards verbal cues—we might expect developmental differences, so that for instance individuals whose dominance was established through physical supremacy become less trusted with age.

The third novelty of the current experiments is the inclusion of younger children: 3-year-olds. The inclusion of this age range is relevant for two reasons. First, as mentioned above, it is interesting to test for potential developmental differences in the importance of physical supremacy as an expression of dominance, since it is known to be more prevalent in early ages (e.g., Hawley, 1999). Second, because several experiments in the trust in testimony literature have revealed significant differences in the way 3- and 4-year-olds evaluate testimony (see for instance Clément, 2010). Moreover, many experiments have shown that 3-year-olds respond well to the type of paradigm used here (e.g., Clément, 2010; Harris, 2012).

Finally, the fourth novelty consists in the introduction of a new testimony task. Besides the localization task used in Castelain *et al*. (2015), our experiments also use a labeling task. In this task, children are presented with a novel object, and they have to name on the basis of the contradictory suggestions of two informants. This labeling task has been used in many previous experiments on the development of trust in testimony. Moreover, the use of both a localization task and a labeling task allows testing for the effects of dominance on trust in two different domains: episodic (localization task), and semantic (labeling task) (Koenig & Stephens, 2014).

Although the existing literature does not allow for very strong predictions regarding the effects of these novel features, there are grounds to expect they would have some effects. The present participants might be less likely to trust dominants than

the Maya participants, younger children might put more weight on dominance induced through physical supremacy, by contrast with older children, who might put more weight on dominance induced through decisional power.

Besides their theoretical import, these novel features have great practical import: they make it much easier for other researchers to build on the results of our experiments. Nearly all the experiments in the development of trust in testimony literature rely on Western middle and upper-middle class children, many test 3- to 5-year-olds, and many use a labeling task. The present results provide a crucial step forward before more refined hypotheses about the influence of dominance on testimony can be tested—as they likely will, given that trust in testimony, on the one hand, and dominance, on the other, are currently the focus of significant efforts in developmental research.

Experiment 1

Method

Participants. This experiment involved 74 children: 25 three-year-olds (13 girls, M_{age} = 43.9 months, *SD* = 2.36, range 40–47 months), 23 four-year-olds (14 girls, M_{age} = 53.6 months, *SD* = 3.87, range 48–59 months), and 26 five-year-olds (10 girls, M_{age} = 65.6 months, *SD* = 2.84, range 61–71 months) from two schools in Lyons (France). All the participants were French, and all the experiments were conducted in French. Most children came from middle and upper-middle class families. Each child was seen individually in a quiet room by a single experimenter for about 10 minutes.

Materials and procedure. Children were tested in two phases: an induction phase and a test phase. In the induction phase, one individual was established as dominant over another. In the test phase, two testimony tasks were presented to children in order to test whether they tend to endorse the testimony of the dominant over that of the subordinate.

Induction phase. In the induction phase, the children were told two stories involving two girl characters (Playmobils), Anna and Sophie. One story presented the two characters physically contesting a doll, as depicted in Figure 1. The second story was identical except that Anna and Sophie fought over a teddy bear. The same character

won in the two stories. The order of the stories, the dominant character and the position of the characters were counterbalanced.

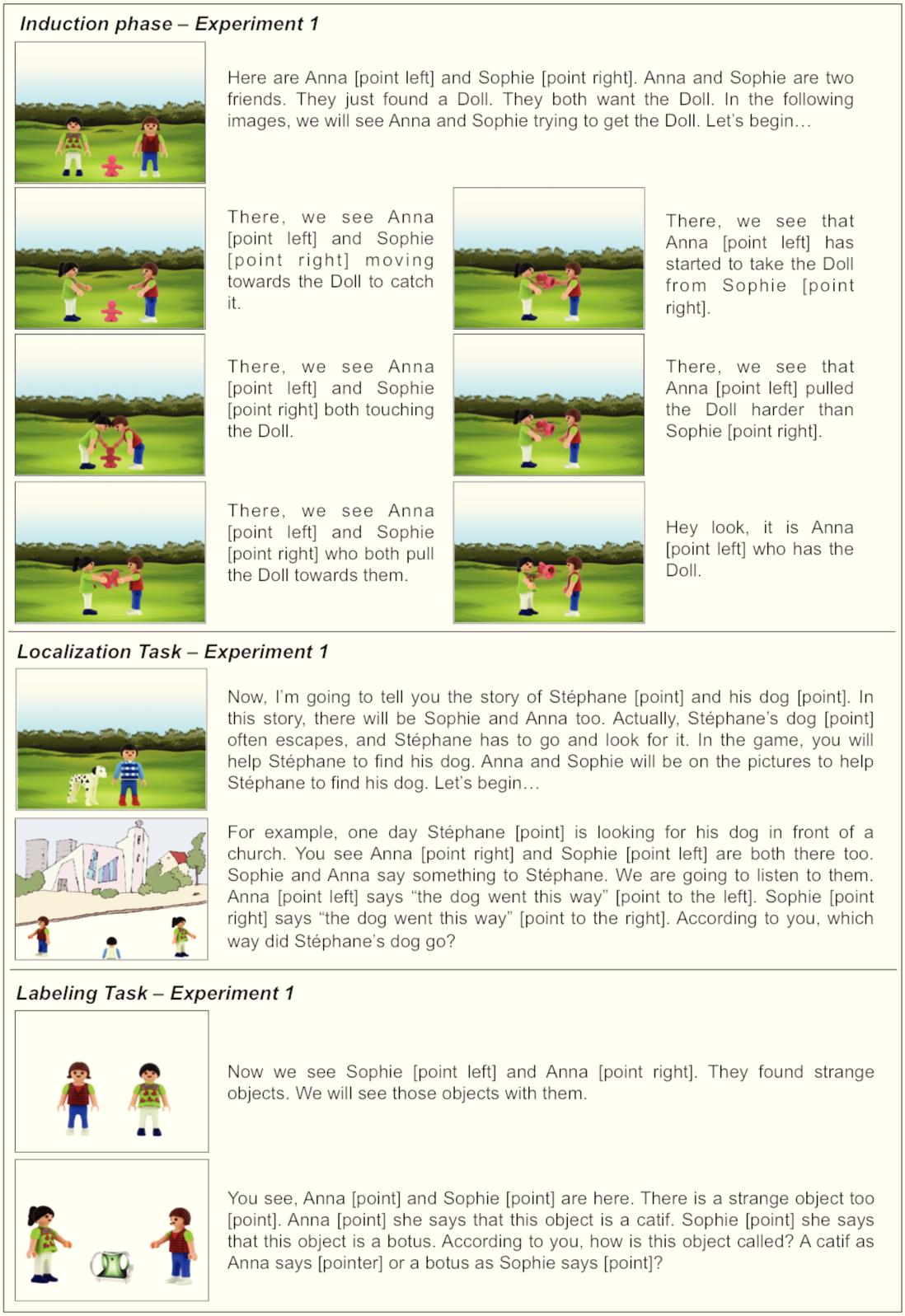

Figure 1. Excerpts from the induction phase (two characters contesting a doll), the localization task and the labeling task of Experiment 1.

Test phase. In the second phase all children were presented with two testimony tasks: a localization task and a labeling task (order counterbalanced). In each task, Anna and Sophie gave contradictory testimonies in three consecutive trials.

Localization task. In this task, Anna and Sophie provide contradictory information about the localization of a lost pet. Figure 1 provides details of some of the vignettes and script. Two vignettes similar to vignette 2 were then presented, with different backgrounds, for a total of 3 localization trials. The characters' location (left/right) and the order of information presentation were counterbalanced. Each child could obtain a maximum score of 3 points: 1 point for each story in which the direction supported by the dominant character was chosen.

Labeling task. In this task, Anna and Sophie provide contradictory information about the name of novel objects. Figure 1 provides details of some of the vignettes and script. Two vignettes similar to vignette 2 were then presented, with different objects and pseudo-words, for a total of 3 labeling trials. The character's place (left/right), the pseudo-word[1] provided by each character and the order of information presentation were counterbalanced. The child could obtain a maximum score of 3 points: in each story, 1 point was attributed to the child when she chose the label proposed by the dominant character.

Results[2]

In the localization task, the percentage of choices linked to the dominant was 62.7% for the 3-year-olds, 49.3% for the 4-year-olds, and 60.3% for the 5-year-olds. In the labeling task, the percentage of choices linked to the dominant was 62.7% for the 3-year-olds, 66.7% for the 4-year-olds, and 65.4% for the 5-year-olds.

A mixed model ANOVA with Age Group (3, 4, 5) as between-subjects variables and Task (Localization Task, Labeling Task) as within-subjects variable was calculated

[1] The pseudo-words, classically used in labeling tasks, were created thanks to the *LEXIQUE Toolbox* software (New & Pallier, 2001)

[2] Preliminary analyses revealed no significant effects of gender and order of task presentation (Localization Task/Labeling Task, Labeling Task/Localization Task) in Experiments 1 and 2. Thus, these two factors were not introduced into the following analyses. All children provided data during all experimental trials in Experiments 1 and 2.

for the proportion of times (with an arcsin transformation) children followed the dominant. This revealed no significant main effect (Age Group: $F(2,71) = .25$, $p = .78$, $\eta^2 = .01$; Task: $F(1,71) = 2.23$, $p = .13$, $\eta^2 = .03$) or interaction effect between these two factors ($F(2,71) = 1.85$, $p = .16$, $\eta^2 = .05$). Given that children's scores in the localization task did not differ significantly from those in the labeling task, these data were combined to create a choice of dominant's testimony score (maximum score: 6 points). The choice of dominant's testimony was significantly above chance, both for the children as a whole (61.3%, $M = 3.68$, $SD = 1.47$, $t(73) = 3.95$, $p < .001$, $d = .92$), and for the 3-year-olds (62.7%, $M = 3.76$, $SD = 1.42$, $t(24) = 2.67$, $p < .05$, $d = 1.09$) and the 5-year-olds (62.8%, $M = 3.77$, $SD = 1.53$, $t(25) = 2.56$, $p < .05$, $d = .61$). The 4-year-olds were more likely to endorse the dominant's testimony, but this effect only reached significance in the labeling task (both tasks: 58%, $M = 3.48$, $SD = 1.50$, $t(22) = 1.52$, $p = .14$, $d = .65$; labeling task: $M = 2$, $SD = .90$, $t(22) = 2.65$, $p < .05$, $d = 1.13$; localization task: $M = 1.48$, $SD = .99$, $t(22) = -.11$, $p = .92$, $d = -.05$). The choice of dominant's testimony was significantly above chance both for the labeling task (64.8%, $M = 1.95$, $SD = .79$, $t(73) = 4.84$, $p < .001$, $d = 1.13$) and the localization task (57.7%, $M = 1.73$, $SD = .98$, $t(73) = 2.01$, $p < .05$, $d = .47$).

Experiment 1 replicates and extends the results obtained by Castelain *et al.* (2015). Overall, the children—from a modern Western culture, by contrast with a traditional indigenous population—tended to endorse the testimony of the dominant individual. They did so not only in the localization task used by Castelain *et al.* (2015), but also in the new labeling task. Moreover, this was true also of 3-year-olds, an age group not tested by Castelain *et al.* (2015). The robustness of the overall results suggests that the 4-year-olds' lack of preference for the dominant's testimony in the localization task was a statistical abnormality. Experiment 2 extends these findings in two different ways: by relying on a different dominance induction phase, and by asking children whether they preferred the dominant or the subordinate. In Experiment 2, dominance is induced through decisional power. We might expect children, especially older children, to be more sensitive to this type of dominance induction. The question about preference aims at determining whether children's tendency to endorse the testimony of the dominant is related to a general preference for this character, or if it is a more specific phenomenon.

Experiment 2

Method

Participants. This experiment involved 67 children: Twenty-two 3-year-olds (15 girls, *M*age = 43.77 months, *SD* = 2.75, range 39–47 months), twenty-three 4-year-olds (9 girls, *M*age = 54.34 months, *SD* = 3.56, range 48–59 months), and twenty-two 5-year-olds (10 girls, *M*age = 66.50 months, *SD* = 4.23, range 60–73 months) from two schools in Lyons (France). The demographics were similar to those of Experiment 1. Most children came from middle and upper-middle class families. Each child was seen individually in a quiet room by a single experimenter for about 10 minutes.

Materials and procedure. As in Experiment 1, children were tested in two phases: an induction phase and a test phase. In the induction phase, one individual was established as dominant over another thanks to her decisional power. In the test phase, children were presented with the same testimony tasks as those used in Experiment 1.

Induction phase. As in Experiment 1, in the induction phase, the children were told stories involving two girl characters (Playmobils), Anna and Sophie, who are friends, but who end up competing. In this case, they compete over the placement of furniture in a new house they are moving in to. Figure 2 provides an example of the vignettes and script used in Experiment 2. For children who failed to answer the memory question at the third vignette, vignette 2 was repeated. There were two other induction stories (kitchen and living room stories), built on the model of the bedroom story.

Induction phase – Experiment 2



Here are Anna [point left] and Sophie [point right]. Anna and Sophie are two friends. They just bought a house together to live in. Look, we see their house behind them [point]. In fact, they just arrived in their house. In the following images, we will see Anna and Sophie placing their furniture in the different rooms of their house. Let's begin…



There, for example, we see Anna [point] and Sophie [point] in their bedroom. They have to decide where to put their wardrobe. Anna [point] wants to put the wardrobe next to the brown bed [point]. Sophie [point] wants to put the wardrobe next to the orange bed [point].



Finally, Anna and Sophie put their wardrobe next to the brown bed [point]. Tell me, in the previous image, where did Anna want to put the wardrobe? [If no response: "Anna wanted to put the wardrobe next to the brown bed or next to the orange bed?"]. And, in the previous image, where did Sophie want to put the wardrobe? [same procedure].

Figure 2. Excerpts from the induction phase (the bedroom story) of Experiment 2.

In each of these three stories, it was thus specified that 1) the two characters have to make a decision regarding where to put a piece of furniture, 2) the characters have conflicting goal over where to put the piece of furniture, and 3) a decision is made, resulting in the two characters putting the piece of furniture in one of the two locations. In each story, the same character—the one induced as dominant—imposes her goal. Which character was dominant, the character's location (left/right) and the order of information presentation were counterbalanced. The experimenter did not explicitly mention the dominance of one character over the other.

Test phase. In the second phase all children were presented with the same two testimony tasks used in Experiment 1, namely a localization task and a labeling task (order counterbalanced). Only the *Localization task* differed from the one used in Experiment 1 because it involved a young Playmobil girl instead of a boy in Experiment 1.

Preference question. After the last testimony task the experimenter asked the child: "Do you prefer Sophie or Anna [order counterbalanced]?" Children's preferences were evaluated to test whether their choices could be explained by a general preference for one of the characters.

Results

Regarding the success in the memory questions, all children correctly attributed the goals to the appropriate characters in either the first presentation or the second presentation of these questions.

In the localization task, the percentage of choices linked to the dominant was 66.6% for the 3-year-olds, 65.2% for the 4-year-olds, and 68.2% for the 5-year-olds. In the labeling task, the percentage of choices linked to the dominant was 65.2% for the 3-year-olds, 63.8% for the 4-year-olds, and 72.7% for the 5-year-olds.

A mixed model ANOVA with Age Group (3, 4, 5) as between-subjects variables and Task (Localization Task, Labeling Task) as within-subjects variable was performed for the proportion of times (with an arcsin transformation) children endorsed the testimony of the dominant character. This revealed no significant main effect (Age Group: $F(2,64) = .99$, $p = .37$, $\eta^2 = .03$; Task: $F(1,64) = .02$, $p = .88$, $\eta^2 = 0$) or interaction effect between these two factors ($F(2,64) = .47$, $p = .63$, $\eta^2 = .01$). Given that

children's scores in the localization task did not differ significantly from those in the labeling task, these data were combined to create a choice of dominant's testimony score (maximum score: 6 points). The choice of the dominant's testimony was significantly above chance, both for the children as a whole (66.9%, M = 4.01, SD = 1.25, $t(66) = 6.46$, $p < .001$, $d = 1.59$), and within each age group (3-year-olds: 65.8%, M = 3.95, SD = 1.09, $t(21) = 4.43$, $p < .001$, $d = 1.93$; 4-year-olds: 64.5%, M = 3.87, SD = 1.22, $t(22) = 3.22$, $p < .01$, $d = 1.37$; 5-year-olds: 70.5%, M = 4.23, SD = 1.44, $t(21)$ = 4.01, $p < .01$, $d = 1.75$). As in Experiment 1, the choice of dominant's testimony was significantly above chance both for the labeling task (67.2%, M = 2.01, SD = .76, $t(66)$ = 5.48, $p < .001$, $d = 1.35$) and the localization task (66.7%, M = 2, SD = .82, $t(66)$ = 5.01, $p < .001$, $d = 1.23$).

To investigate the possible effect of the type of induction phase on children's testimony choices, a mixed model ANOVA with Age Group (3, 4, 5) and Experiment (1, 2) as between-subjects variables, and Task (Localization Task, Labeling Task) as within-subjects variable was performed for the proportion of times (with an arcsin transformation) children endorsed the testimony of the dominant character. This revealed no significant main effect (Age Group: $F(2,135) = .96$, $p = .38$, $\eta^2 = .01$; Experiment: $F(1,135) = 1.43$, $p = .23$, $\eta^2 = .01$; Task: $F(1,135) = 1.19$, $p = .28$, $\eta^2 = .01$) or interaction effects (Age Group x Task: $F(2,135) = .80$, $p = .45$, $\eta^2 = .01$; Age Group x Experiment: $F(2,135) = .24$, $p = .79$, $\eta^2 = .003$; Task x Experiment: $F(1,135) = .765$, $p = .38$, $\eta^2 = .006$; Age Group x Task x Experiment: $F(2,135) = 1.40$, $p = .25$, $\eta^2 = .02$).

Finally, comparisons to chance level (binomial test) were made for each age group regarding the preference for the dominant character. These choices did not differ significantly from chance in any age group: 3-year-olds: 8 preferences for the dominant, 14 preferences for the subordinate, $p = .29$; 4-year-olds: 15, 8, $p = .21$; 5-year-olds: 14, 8, $p = .29$. Moreover, the contingency table showed no effect of the age group factor regarding the preference choices: χ^2 (2) = 4.72, $p = .094$. The lack of effects of the induction phase on the preference question might be due to the relatively lengthy test phase that separated the induction phase from the preference question.

Experiment 2 replicates and extends the results obtained in Experiment 1. As in Experiment 1, the children tended to endorse the testimony of the dominant. They did so even though the dominance was induced using different means, that is, using decisional power. Indeed, our results do not suggest that the children were more or less

sensitive to one way of inducing dominance over another. Finally, the fact that the 4-year-olds were more likely to endorse the testimony of the dominant in Experiment 2 suggests that their failure to do so in the localization task of Experiment 1 was indeed a statistical fluke.

Discussion

Like infants, who are shown to infer dominance from physical size (Thomsen *et al.*, 2011) and from the capacity to prevail in a situation where there is a conflict between agents' goals (Mascaro & Cisbra, 2012), preschoolers have been shown to infer dominance from a variety of relational cues such as physical competition and decisional power (Charafeddine *et al.*, 2015). Preschoolers have also been shown to draw a variety of inferences from attributions of dominance (Charafeddine *et al.*, 2015). A study suggested that 4- to 6-year-olds were more likely to endorse the testimony of a dominant than that of a subordinate (Castelain *et al.*, 2015). The goal of the present experiments was to extend this finding.

In two experiments, preschoolers were shown that one character was dominant over another character. The children then had to decide which character's testimony to endorse in two testimony tasks. The children were more likely to endorse the testimony of the dominant character. This was true whether dominance had been induced through physical power (Experiment 1) or decisional power (Experiment 2), whether the testimony task was a labeling task or a localization task (both experiments), and at all age groups (with a likely insignificant exception for one age group in one experiment).

These findings extend those of Castelain *et al.* (2015) in several ways: use of a new dominance induction phase, a new testimony task, a new age group, and a different population. This latter variable is particularly relevant. The children tested in Castelain *et al.* (2015) belonged to a traditional population and likely faced an environment in which hierarchy played a primordial role. By contrast, the middle- and upper-middle class French children tested in the current experiments live in a relatively more egalitarian society, and are in a more egalitarian relation with their parents. It is thus significant that even such children tend to favor the testimony of dominants over that of subordinates.

In the remainder of the conclusion, we would like to discuss two potential hypotheses for children's use of dominance to select testimony. The first hypothesis is *social*: children might seek to ingratiate with the dominant. In general, it is more important to be seen in a positive light by dominants than by subordinates. If agreeing with an individual makes her more inclined to like us, then we might have a greater propensity to agree with dominants than with subordinates. Recent data could support this interpretation. It has been shown indeed that children defer to the majority consensus, even when this consensus runs against their own accurate perception (e.g., Bernard, Harris, Terrier, & Clément, 2015; Corriveau & Harris, 2010; Haun & Tomasello, 2011). This deferential behavior might also be present with a dominant source.

Although this social interpretation could account for part of the results, the outcome of the preference question suggests that children do not only rely on a social heuristic. If the goal of the children was to ingratiate with the dominant, then they should also want to ingratiate with the dominant when they answer the preference question, and thus say that they prefer him or her, which they did not significantly do. Further research is thus needed to better evaluate the strength of the social heuristic leading children to endorse the testimony of the dominant and to translate this selective endorsement into social preference.

Besides the social interpretation mentioned above, recent results suggest a second interpretation, in this case linked to competence, to explain why preschoolers might take dominance into account when evaluating testimony. In their third experiment, Charafeddine *et al.* (2015) presented 3- to 5-year-olds with two characters marked as being a dominant and a subordinate by their bodily postures and by the actions of, respectively, giving orders and complying with orders. When asked which of these two characters would win in a nondescript game of skills, children were significantly more likely to select the dominant (Charafeddine *et al.*, 2015). These results suggest that preschoolers think dominants to be more competent than subordinates even in domains, such as a game of skills, which do not directly involve dominance.

Suggesting competence as a second inferential route leading to the selective endorsement of the dominant's testimony is consistent with research showing that adults tend to attribute more competence to individuals high in trait dominance (Anderson &

Kilduff, 2009). Interestingly, this research revealed that dominant individuals are perceived as competent even when they are not especially competent. For instance, in one of Anderson & Kilduff's experiments, participants had to solve mathematical problems in groups. Post-discussion ratings of competence by group members and outside observers were correlated with dominance. And yet, dominance did not correlate with actual competence as measured by the chances of suggesting the correct answer during the discussion. Admittedly, in the current experiment, the dominance induction phase did not provide any direct clue of competence relevant for the testimony tasks (location of pieces of furniture vs. labeling objects or finding a pet). But children might nevertheless use a heuristic similar to that used by adults and attribute, by default, competence to dominants irrespective of their actual competence.

In the present experiments, competence and dominance could interact in at least two ways. As described above, in the induction phase children could infer that a character is dominant, and then infer that she is also competent, assuming that dominants are more competent across the board. But the induction phase could also lead children to infer both that one character is dominant and that she is competent in one area—better at fighting or at knowing where to put furniture. Children would then generalize from this attribution of a specific competence to the attribution of a broader type of competence, explaining the results in the testimony questions. Whether and how children's dominance-based inferences are mediated by competence are interesting questions that need further research. But the question of whether dominance processing goes with competence attribution does not change the fact that young children did endorse the testimony of dominants over that of subordinates—confirming thereby previous experiments showing that children reliably infer dominance from this type of induction phases.

The two broad inferential paths leading to the selective endorsement of the dominant's testimony that we have suggested here, going either through deference or competence, are not incompatible. They might both work together, in a way that further developmental studies need to investigate. Such studies are all the more important as research on the inferential potential of dominance recognition remains, for the time being, relatively scarce.

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Complementary results 6 : The influence of argument strength and decisional power in French children's endorsement of testimony

Expériences	Argumentation	Hiérarchie	**Argumentation vs. Hiérarchie**
Hypothèse testée	Sensibilité à la qualité des arguments	Prise en compte la hiérarchie pour juger de la fiablité d'un témoignage	**La qualité des arguments prend le pas sur la hiérarchie sociale**
Cultures Occidentales	Article 3 Castelain *et al.*, soumis	Article 5 Bernard *et al.*, 2016	**Résultats complémentaires 6 Non publiés**
Sociétés Traditionnelles	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2016
Cultures Orientales	Article 7 Sudo *et al.*, in prep.	Article 8 Charafeddine *et al.*, in prep.	-

The Influence of Argument Strength and Decisional Power in French Children's Endorsement of Testimony

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Unpublished complementary results.

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Little is know about the impact of arguments strength and social dominance on children's evaluation of testimony. Recent experiments have tackled this issue showing that children from Europe, and Guatemala are able to discriminate arguments quality (Mercier, Bernard, & Clément, 2014; Castelain, Bernard, Van der Henst, & Mercier, 2015; Corriveau & Kurkul, 2014; Koenig, 2012) and that they use dominance when evaluating testimony (Bernard *et al.*, 2016 ; Castelain *et al.*, 2015). Following these results, and relying on the epistemic vigilance framework (Sperber *et al.*, 2010), we designed an experiment to test how French children balance reason and power cues when evaluating testimony.

To our knowledge, only one study has investigated the way children balance these two cues when evaluating testimony. The results obtained in a traditional population (Kaqchikel Mayan) provide evidences that when arguments quality and dominance are pitted against each other, reason trumps power (Castelain *et al.*, 2015). The present experiment extends this finding in three directions.

First, the present study is conducted in a new cultural context: Western middle and upper-middle class population. The second novelty is that it introduces a different cue to dominance. While in Castelain *et al.* (2015) it was induced by physical supremacy, in this study dominance is induced by decisional power. Previous experiments revealed that 3- to 5-year-olds French children are able to infer dominance from an asymmetry in decisional power (Charafeddine *et al.*, 2015) and tend to endorse the testimony of the dominant (Bernard *et al.*, 2016). Third novelty, the current

experiment included younger children: 3-year-olds. Indeed, it is interesting to test for potential developmental differences in the importance of these two cues. This period of life is characterized by great developmental changes in children. Particularly relevant for this study, as their argumentative skills are growing we can expect a shift in the way children balanced different cues in evaluating testimony, from easily accessible cues (source related cues) to more sophisticated ones (content cues).

Method

Participants. This experiment involved 115 children: 40 3-year-olds (19 girls, M_{age} = 41.7 months, *SD* = 3.14, range 36–47 months), 37 4-year-olds (18 girls, M_{age} = 54.6 months, *SD* = 3.31, range 48–60 months), 38 5-year-olds (15 girls, M_{age} = 65.6 months, *SD* = 3.33, range 60–71 months), from the same school in Lyon (France). Most children came from middle and upper-middle class families. Each child was seen individually in a quiet room by a single experimenter for about 10 minutes.

Materials and procedure. The design was adapted from Bernard et al. (2016) and Castelain et al. (2015). The experiment was composed of two phases: a dominance induction phase and a test phase. In the induction phase, one individual was established as dominant of another thanks to her decisional power. In the test phase, children were presented with a testimony task about the localization of a lost pet.

Dominance induction phase. In the induction phase, the children were told two stories involving two Playmobil girls, Anna and Sophie, who are friend, and have to decide the placement of furniture in a new house they are moving in to. In three different stories, they compete over the placement of several objects (see Figure 1). In each story, the same character imposes her goal (for detail, see Bernard et al., 2016, Experiment 2). The dominant character, the character's location, and the order of information presentation were counterbalanced.

Test phase. In the test phase all the children were presented with a testimony task in which Anna and Sophie gave conflicting testimony about the localization of a lost pet (see Figure 1). In a first vignette, a young Playmobil girl, Pauline, and her dog were presented to the children. The experimenter said: 'In this game, you will try to help Pauline find her dog'. A second vignette showed Pauline facing Sophie and Anna each one pointing in a different direction. In each of the three trials, the dominant

provided a circular argument and the subordinate offered a perceptual argument. The experimenter said: 'For instance, one day, Pauline is looking for her dog in front of a house. Anna and Sophie tell her something. Actually, they disagree. We are going to listen to them' At this point, a recording voice and an animation bubble were activated. The children heard for example, Anna [subordinate] saying: "The dog went this way because I saw it go this way" [Perceptual Argument]. Then a different recording voice for Sophie [dominant] saying: "The dog went this way because it went this way" [Circular Argument]. Children wore headphones to listen to the messages. Finally, the experimenter asked the children: 'According to you, where did Pauline's dog go?' The character's location (right/left), the order of information presentation, and the voice attribution for the character were counterbalanced. Each child could obtain a maximum score of 3 points: 1 point for each story in which the direction supported by the perceptual argument (given by the subordinate) was chosen.



Figure 1. (A) Excerpts from the induction phase (the bedroom story); (B) Excerpts from the test phase (localization task).

Preference questions. After the testimony task, a picture displayed Sophie and Anna against a neutral background and the experimenter asked the child: 'Do you prefer Sophie or Anna [order counterbalanced]?'

Control questions. Finally, the experimenter asked the children: 'Do you think that one of the two characters is the boss?' If the answer was positive, the experimenter

asked: ‘According to you, who is the boss?’ If the answer was negative, the experimenter asked: ‘If you have to choose between the two characters, which one would be the boss?’ To ascertain the children’s grasp of power, the experimenter also asked: ‘Who is the boss in the classroom?’

Results

Testimony task. The percentage of choices linked to the perceptual argument was 44.2% for the 3-year-olds, 55.3% for the 4-year-olds, and 57.9% for the 5-year-olds. One-sample Wilcoxon signed rank tests showed that children were not more likely than chance to select the testimony of the subordinate giving the perceptual argument, both for the children as a whole (Mdn_{all} = 1, Z = -.64, p = .52), and within each age group (Mdn_{3yo} = 2, Z = 1.35, p = .18; Mdn_{4yo} = 1, Z = -.66, p = .51, r = 0.76; Mdn_{5yo} = 1, Z = -1.60, p = .11).

However, a Jonckheere’s test revealed a significant trend in the data: as the age of the participant increased (from "3-year-olds", "4-year-olds ", to "5-year-olds "), the median of the endorsement of the testimony for the subordinate character (strong argument) increased, T_{JT} = 1801.5, z = -2.20, p < .05.

Post-hoc tests revealed that the testimony scores of the 3-year-olds are statistically lower than the testimony scores of the 5-year-olds (Z = -2.150, p < .05), but no significant difference for the other two comparisons (respectively, 5-year-olds vs 4-year-olds: Z = -.801, p = .63; 4-year-olds vs 3-year-olds: Z = -1.41, p = .24). This suggests that 3-year-olds, compared to 5-year-olds, rely more on the dominance cue relative to the argument strength cue.

Preference question. Comparisons to chance level (binomial test) revealed no preference between the characters (57 preferences for the dominant, 59 preferences for the subordinate, p = 1).

Control question. 63 out of 115 children were able to correctly identify the dominant (p = .35). Most children displayed a basic grasp of the concept of power (81% said that the boss in the classroom was their teacher).

Discussion

Contrary to the results with Maya participants (Castelain *et al.*, 2015), the French participants did not favor the testimony of the subordinate providing the perceptual argument. Comparisons of the proportions of endorsement of the subordinate character obtained by 5-year-olds children (for the same task) revealed no significant difference between French children and Maya children ($z = 1.3$, $p = .20$). One difference with the experiment in Guatemala is that hierarchy was not induced through physical dominance but decisional power.

While further research is needed to understand children's dominance-based inference, children might infer specific forms of competence from decision power that compete with the quality of the arguments provided. The difference observed between 3 and 5-year-olds suggests than changes in the weight conferred to the quality of the argument and to hierarchy occur during child development. Further research is needed to disentangle how children balance different type of cues and the weight attributed to them.

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Article 7 : Argument evaluation in Japanese preschoolers

Expériences	**Argumentation**	Hiérarchie	Argumentation vs. Hiérarchie
Hypothèse testée	**Sensibilité à la qualité des arguments**	Prise en compte la hiérarchie pour juger de la fiablité d'un témoignage	La qualité des arguments prend le pas sur la hiérarchie sociale
Cultures Occidentales	Article 3 Castelain *et al.*, soumis	Article 5 Bernard *et al.*, 2016	Résultats complémentaires 6 Non publiés
Sociétés Traditionnelles	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2016
Cultures Orientales	**Article 7** **Sudo *et al.*, in prep.**	Article 8 Charafeddine *et al.*, in prep.	-

Argument Evaluation in Japanese Preschoolers

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Preliminary report

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Abstract

Observational and experimental data have revealed that preschoolers possess some argumentation skills, both in the production and the evaluation of arguments. However, these skills might have been fostered by the particular cultural context of Western middle- and upper-classes families, to which most children studied belong. Some data suggests that children in other cultures possess at least some of these skills, but no experimental data had been gathered in Eastern cultures. These cultures are supposed to frown on argumentation, and might thus be less conducive to the early development of argumentation skills. We test the emergence of argument evaluation skills in Japanese 5-year-olds by presenting them with a choice between endorsing a strong, perceptual argument, and a weak, circular argument. A first experiment revealed a trend in the direction of the strong argument. A second experiment that addresses some methodological concerns of the first demonstrates a significant tendency to follow the strong argument. These results are similar to those previously gathered in two other cultures (Swiss and Maya), and suggest that some basic argumentation skills are early developing across cultures.

Keywords: Argumentation, preschoolers, argument evaluation, circular argument, Japan.

Children start arguing early on: at least some children start producing arguments around 2 years of age (e.g., Dunn & Munn, 1987; for review, see Mercier, 2011b). Observational data suggests that these argumentation skills play a useful role in children's interactions with parents, siblings, and peers (e.g. Ross, Ross, Stein, & Trabasso, 2006; Zadunaisky Ehrlich, 2011). Recent experimental studies have probed more precisely preschoolers' argumentation skills. Some studies have looked at argument production, and have shown that preschoolers modulate the justifications they offer as a function of common ground. For instance, preschoolers are more likely to offer justifications for actions perceived to be unconventional (Köymen, Rosenbaum, & Tomasello, 2014). Similarly, preschoolers adapt the content of their arguments to their audience by making some premises explicit when they are not known by the audience (Köymen, Mammen, & Tomasello, 2015).

Other studies have looked at how preschoolers evaluate arguments. Initial studies suggested that 6-year-olds were unable to discriminate circular from non-circular justifications (Baum, Danovitch, & Keil, 2008). However, more recent experiments, using simpler stimuli, have revealed that preschoolers can in fact discriminate circular and non-circular arguments. For instance, one experiment asked children to choose which way a pet had gone following the testimony of two informants (Mercier, Bernard, & Clément, 2014). One informant supported her testimony with a perceptual argument "because I saw it go this way," and the other with a circular argument "because it went this way." Three- to 5-year-olds were significantly more likely to select the direction supported by the strong, perceptual argument. Convergent results show that preschoolers can discriminate strong from weak arguments in different experimental situations (Castelain, Bernard, Van der Henst, & Mercier, 2015; Corriveau & Kurkul, 2014; Koenig, 2012).

Most of the experimental results obtained in this domain, however, were gathered among middle- and upper-middle class Western children. These children typically face an environment that might be particularly conducive to the early development of argumentation skills. Parents of middle- and upper-middle class Western children tend to talk to them a lot, using a rich vocabulary (e.g., Tizard, Hughes, Carmichael, & Pinkerton, 1983; for other specificities of this parenting style see, e.g., Little, Carver, & Legare, 2016). Of particular relevance is the relative prevalence of why-questions in the interactions between these children and their

parents, questions that typically elicit explanations, justifications, and arguments (Gauvain, Munroe, & Beebe, 2013).

One experiment on argument evaluation was conducted in a non-Western population. Castelain *et al.* (2015) replicated the experiment opposing perceptual and circular arguments described above, and which had been conducted with Swiss children, with 4- to 6-year-old children from a traditional Maya community in Guatemala. The results were similar to those obtained previously, showing a significant tendency to follow the perceptual over the circular argument. Given that children in traditional cultures tend to engage in much less argumentation with their parents than children of the Western middle- and upper-middle classes (Bunzel, 1959; Maratsos, 2007; Pye, 1986), these results suggest that some early developing argumentation skills do not depend on the specific cultural of the latter.

In order to draw the inference that these argument evaluation skills develop early universally, it would be preferable to add other points of comparison. Besides traditional cultures, a standard point of comparison with Western cultures has been Eastern cultures, of which Japan is a particularly relevant instance for the case in hand.

By contrast with most Western cultures, Eastern cultures—and Japanese culture in particular (Becker, 1983)—are supposed to value argumentation less (Becker, 1986; Nakamura, 1964). Texts that were influential in Eastern cultures devalue argumentation, such as this extract from the *Tao Te King*: "A good man does not argue; he who argues is not a good man" (Becker, 1986; Nakamura, 1964; but see Mercier, 2011a for an alternative view of the role of argumentation in Eastern cultures). This cultural distaste for argumentation might be related to the collectivistic nature of many Eastern cultures (e.g., Triandis, 1995). In collectivistic cultures, stress is put on the face saving and on the preservation of social harmony, which argumentation is seen as challenging (Triandis, 1995). Summarizing this research, Peng and Nisbett note that "there are social, historical, linguistic, and philosophical barriers to the acceptance of argumentation and debate as a method of intellectual discourse or as a strategy for the consideration of new proposals for social or political change" (Peng & Nisbett, 1999, p. 747).

The literature on reasoning in adults has revealed significant differences in the reasoning styles of members of Western and Eastern cultures (for reviews, see Buchtel

& Norenzayan, 2009; Nisbett, Peng, Choi, & Norenzayan, 2001). In particular, East Asians seem to be more tolerant of contradiction than Westerners. This might make the former less inclined to start exchanging arguments with each other (Peng & Nisbett, 1999; although see Mercier, Zhang, Qu, Lu, & Van der Henst, 2015). However, some experiments have also revealed common patterns in the reasoning of members of Western and Eastern cultures. Particularly relevant here is the demonstration that Japanese participants benefitted from discussing problems in groups (Mercier, Deguchi, Van der Henst, & Yama, 2015), as Western participants do (Laughlin, 2011; Mercier, Trouche, Yama, Heintz, & Girotto, 2015). Since it is through argumentation that group discussion improves performance on these tasks (Mercier & Sperber, 2011), these results suggest that some argumentation skills, as well as proclivity to engage in argumentation in some contexts, are shared between the members of Eastern and Western cultures.

Regarding children, there seem to be substantial similarities in the parenting of Western and Eastern middle- and upper-classes. Sato (2003), summarizing research on the behavior of Japanese mothers by Hess, Kashiwagi, Azuma, Price, and Dickson (1980) and Lewis (1984), notes that "Japanese mothers and nursery school teachers rely less on authority and more on patient, persistent explanations that will lead the child to eventual understanding" (p. 26). This is broadly similar to the 'reasoning' parenting style often deployed in Western middle- and upper-classes (Grusec & Goodnow, 1994).

In spite of these similarities, some relevant differences have been observed in the development of young children in Eastern cultures, including Japan, compared to other cultures—Western cultures in particular. Argument quality is only one of the many cues young children use to decide who they should believe. Preschoolers have also been shown to be sensitive to the past accuracy of informants, their expertise, their niceness, and many other cues (for review, see e.g., Harris, 2012; Mills, 2013). The sensitivity to some of these cues has been shown to be affected by culture. For instance, children learning languages with evidentials—such as Turkish—seem to perform better in some selective trust tasks (Lucas, Lewis, Pala, Wong, & Berridge, 2013). More relevant here, Japanese children seem more attuned to indications of confidence conveyed by tone of voice than French children (Matsui *et al.*, in prep.). Another domain related to argument evaluation is explicit mental states attribution. In this area, some results suggest that Japanese children have a significant delay in passing standard explicit false beliefs task,

with most children failing until the ages of 6 or 7 (Naito & Koyama, 2006; but see Matsui, Rakoczy, Miura, & Tomasello, 2009).

Although these differences do not bear on argument evaluation directly, they show that culture can significantly affect children's behavior in closely related domains. Given the suggested differences in the way adults relate to argumentation in Western and Eastern cultures, it is plausible that argumentation skills would develop at a different pace in both types of cultures.

The goal of the present experiments is to test whether Japanese preschoolers are able to discriminate a perceptual from a circular argument. Given the delays observed in related tasks in Japanese children (e.g., Naito & Koyama, 2006), and the fact that Western preschoolers sometimes fail to discriminate circular from non-circular explanations (Baum *et al.*, 2008; Corriveau & Kurkul, 2014), we choose to recruit not the youngest preschoolers, but 5-year-old children. To test their ability to discriminate a perceptual from a circular argument, we conducted two experiments. The first was a close replication of the Experiments 1 in (Mercier *et al.*, 2014) and (Castelain *et al.*, 2015). This experiment revealed some methodological difficulties with the adaptation of the original experimental set up for Japanese children. Experiment 2 addressed these difficulties.

Experiment 1

Method

Participants. This experiment involved 28 5-year-old children (16 girls, M_{age} = 65.1 months, *SD* = 2.92, range 60–69 months) from a school in Tokyo (Japan). Most children came from middle and upper-middle class families. Each child was seen individually in a quiet room by a single experimenter for about 5 minutes.

Materials and procedure. The design was adapted from Mercier *et al.* (2014). The stimuli were translated in Japanese from the English version that had been reported in the methods of Mercier *et al.* (2014) (and which had been translated from the French). In the first vignette, a young Playmobil boy, Yuta, and his dog were presented to the children (see Figure 1). The experimenter said: "In this game, you will try to help Yuta find is dog". A second vignette showed Yuta facing two girl characters, each one pointing in a different direction. The experimenter said: "For instance, one day, Yuta is

looking for his dog in front of a wood. These two girls tell him something. Actually they disagree. This one says: “The dog went this way because I’ve seen him go in this direction” (Perceptual Argument). And this one says: “The dog went this way because he went in this direction” (Circular Argument)[1]. Finally, the experimenter asked the children: “Which way do you think Yuta’s dog went?” Starting from the second vignette, the experiment was repeated 3 times, with different backgrounds, saying that Yuta is looking for his dog again. The character’s location (right/left) and the order of information presentation were counterbalanced. Each child could obtain a maximum score of 3 points: 1 point for each story in which the direction supported by the perceptual argument was chosen.

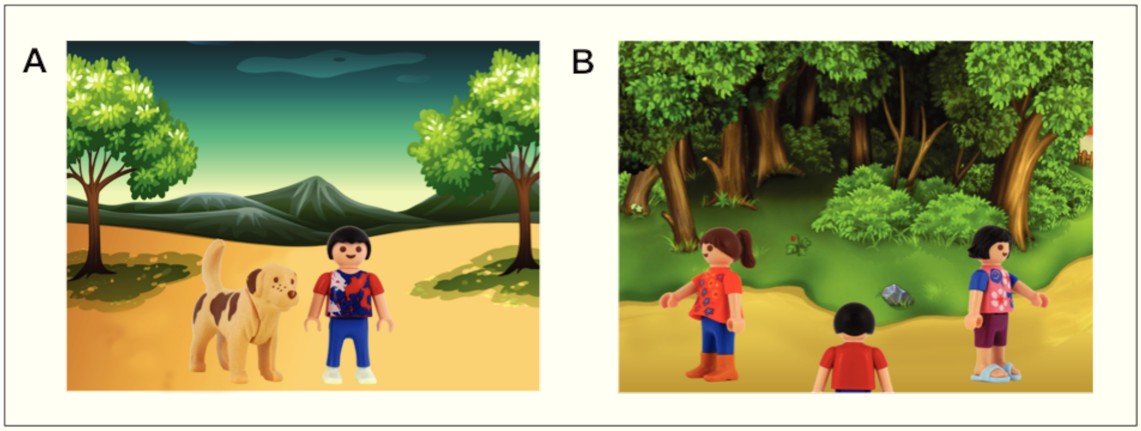

Figure 1. Excerpts of Experiment 1. A: Yuta and his dog are introduced to the child; B: The two characters are giving contradictory testimony about Yuta’s dog localization

Results

The percentage of choices linked to the perceptual argument was 61.9%. One-sample Wilcoxon signed rank test showed that children were only tendentially more likely than chance to select the testimony of the character providing the perceptual argument ($Mdn_{Japan} = 2$, $Z = 1.85$, $p = .063$). These results are in line with, albeit weaker than, the results obtained by Mercier *et al*. (2014) with Swiss participants and Castelain *et al*. (2015) with Maya participants. Mann-Whitney tests of the testimony scores obtained by 5-year-old children (for the same task), from the two populations, revealed

[1] The Japanese versions were, for the circular argument: 犬はこっちに行ったよ。だって、犬はこっちの方向に行ったから。; for the perceptual argument: 犬はこっちに行ったよ。だって、私は犬がこっちの方向に行くのを見たから。

no difference with the Swiss children (Mdn_{Swiss} = 3, Z = -1.07, p = .28) or the Maya children (Mdn_{Maya} = 3, Z = 1.03, p = .30).

Even though there was no stark difference with previous results, the relatively weaker tendency to follow the perceptual argument evinced by Japanese children prompted us to look in more details at their answers and at the stimuli. Regarding their answers, the experimenter had remarked that the children seemed somewhat baffled by the repetition of the trials. In line with this impression, the tendency to follow the perceptual argument dropped from the first trial (71%) to the third (46%). Regarding the stimuli, we considered the possibility that the translations of both the perceptual and the circular argument might have denoted a high level of confidence. More specifically, the use of *yo* at the end of the first clause ("The dog went this way") denotes confidence. This might have led them to consider the two statements as more similar than children in the other two cultures tested, especially since Japanese children seem to be particularly sensitive to confidence markers (Matsui, Yamamoto, Miura, & McCagg, 2016). Experiment 2 addressed these issues by a) having only one testimony task, and b), using more neutral statements.

Experiment 2

Method

Participants. This experiment involved 41 5-year-old children (23 girls, M_{age} = 65.6 months, SD = 3.33, range 60–71 months) from a school in Tokyo (Japan). Most children came from middle and upper-middle class families. Each child was seen individually in a quiet room by a single experimenter for about 5 minutes. None of the children had taken part in Experiment 1.

Materials and procedure. Experiment 2 was identical to experiment 1 with three exceptions. First, the story was not repeated, so that children only had to answer once to the question of were the dog went. Second, more neutral statements were used.[2] Third, for better control, instead of the experimenter telling the statements, they were prerecorded and activated at the appropriate time. More specifically, after the

[2] More specifically, for the circular argument: 犬が行ったのはこっち。だって、こっちなの。, and for the perceptual argument: 犬が行ったのはこっち。だって、私犬を見たの。

experimenter has said: “For instance, one day, Yuta is looking for his dog in front of a wood. These two girls tell him something. Actually they disagree,” he said “We are going to listen to them.” At this point, a recording voice was activated for one of the girls and children heard the new translation of one the two arguments. A different recording voice with the other argument was played for the second girl. The character’s location (right/left), the order of voice activation, and the voice attribution for the character were counterbalanced. The question was the same as in Experiment 1.

Results

The percentage of choices linked to the perceptual argument was 78%. Binomial test revealed that children were more likely than chance to select the testimony of the character providing the perceptual argument (32 out of 41 for the perceptual argument, $p < .01$). They favored the testimony supported by the strong argument, replicating the results obtained with Swiss participants (Mercier *et al.*, 2014) and with Maya participants (Castelain *et al.*, 2015). Comparisons of the proportions of endorsement of the perceptual argument obtained by 5-year-old children (for the first testimony trial) revealed no significantly difference between the Japanese children and the Swiss children (78% vs. 57,1%, $\chi^2(1, N = 69) = 3.43$, $p = .064$) or the Maya children (78% vs. 72.7%, $\chi^2(1, N = 74) = 0.28$, $p = .59$).

Discussion

In two experiments, Japanese 5-year-olds were faced with a situation in which they had to choose whether to believe a statement supported by a strong, perceptual argument, or a statement supported by a weak, circular argument. In both experiments the children were more likely to believe the statement supported by the strong, perceptual argument. In Experiment 1 this result did not reach statistical significance, but it did in Experiment 2 which addressed potential methodological issues with Experiment 1 and relied on a larger sample of participants.

These results thus show that in spite of cultural differences that might make of argumentation a less valued social practice in Japanese culture than in most Western cultures, Japanese 5-year-olds are capable of discriminating some strong and weak arguments in a way that is similar to Swiss and Maya children. This provides further

evidence that these early developing argument evaluations skills are universal (see Mercier, 2011b; Mercier & Sperber, 2011).

Western children have been shown to be sensitive to this distinction between strong and circular arguments earlier—at 3 years of age (Mercier *et al.*, 2014), and even 2 years of age (Castelain, Bernard, & Mercier, submitted). Future research should test whether Japanese 2- and 3-year-olds are also capable of drawing this distinction. More generally, this demonstration provides a basis for future tests of argumentation skills in Japanese children.

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Article 8 : Cross-cultural differences in the valuing of dominance by young children

Expériences	Argumentation	**Hiérarchie**	Argumentation vs. Hiérarchie
Hypothèse testée	Sensibilité à la qualité des arguments	**Prise en compte la hiérarchie pour juger de la fiablité d'un témoignage**	La qualité des arguments prend le pas sur la hiérarchie sociale
Cultures Occidentales	Article 3 Castelain *et al.*, soumis	Article 5 Bernard *et al.*, 2016	Résultats complémentaires 6 Non publiés
Sociétés Traditionnelles	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2015	Article 4 Castelain *et al.*, 2016
Cultures Orientales	Article 7 Sudo *et al.*, in prep.	**Article 8 Charafeddine *et al.*, in prep.**	-

Cross-cultural Differences in the Valuing of Dominance by Young Children

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Abstract

Developmental research suggests that young children tend to value dominant individuals over subordinates: 2-year-olds say they like dominants more, preschoolers tend to think they are more dominant than they actually are, and they tend to believe dominants over subordinates. This research, however, has nearly exclusively been carried out in Western cultures, and cross-cultural research among adults has revealed cultural differences in the valuing of dominance. In particular, it seems that Japanese culture, relative to many Western cultures, values dominance less. We conducted two experiments to test whether this difference would be observed in preschoolers. In Experiment 1, preschoolers in France and in Japan were asked to identify with either a dominant or a subordinate. Replicating past findings, French preschoolers identified with the dominant. By contrast, Japanese preschoolers were at chance, identifying significantly less with the dominant than French preschoolers, in spite of being equally able to identify the dominant. Experiment 2 revealed that Japanese preschoolers were more likely to believe a subordinate than a dominant individual, both compared to chance and compared to previous findings among French preschoolers. The convergent results from both experiments thus reveal an early emerging cross-cultural difference in the valuing of dominance.

Keywords: dominance, self-perception, cross-cultural comparison, testimony selection

The social life of primates, including humans, is characterized by ubiquitous dominance relationships, and children as young as two form stable and linear dominance hierarchies (Boyce, 2004; Strayer & Strayer, 1976). The importance of dominance in our species from an early age explains why young children can infer dominance status from a number of cues, such as size, wealth, winning physical conflicts, or imposing one's choices on others (Brey & Shutts, 2015; Charafeddine *et al.*, 2015; Gulgoz & Gelman, in press; Lourenco, Bonny, & Schwartz, 2016; Mascaro & Csibra, 2012).

Children can use inferred dominance status to guide their interactions towards more or less dominant individuals (see, e.g., Thomsen & Carey, 2013). On the one hand, it seems that young children should value dominants: they know that dominants tend to have more power and more resources (Charafeddine *et al.*, 2015), making them potentially valuable allies. On the other hand, because dominants impose their will on others and often act selfishly, they can also be negatively perceived.

Several results with young children show that a positive valuing of dominance seems to predominate. First, when 2-year-olds are introduced to a dominant and a subordinate agent, and asked which one they like, they overwhelmingly select the dominant (Thomas, Abramyan, Lukowski, Thomsen, & Sarnecka, 2016). Second, preschoolers strongly overestimate their own dominance status when they are asked to decide who, between themselves and each of their classmates, is "tougher" (Edelman & Omark, 1973; Sluckin & Smith, 1977; Strayer, Chapeskie, & Strayer, 1978). This result is in line with preschoolers' tendency to overestimate their rankings on other positive traits such as intelligence (e.g., Stipek, 1981), and suggests that preschoolers see being dominant as positive. Finally, preschoolers tend to believe dominants over subordinates. In a series of experiments, preschoolers were shown the interactions between two characters, revealing that one was dominant over the other. The two characters then provided contradictory testimony regarding the location of a lost animal. Preschoolers were more likely to select the location provided by the dominant individual (Bernard *et al.*, 2016; Castelain, Bernard, Van der Henst, & Mercier, 2015).

There is thus evidence that young children—from 2 to 5 years of age—value dominants over subordinates. Nearly all of this evidence, however, was gathered in a limited sample of Western cultures. The main exception is Castelain *et al.* (2015), which showed that 4- to 6-year-old children in a traditional Maya community in

Guatemala tend to believe dominants over subordinates. It is possible that young children's valuing of dominant individuals is a universal, potentially adaptive trait, in which case the results obtained so far should generalize to other cultures. However, because dominance can either be viewed from a positive or a negative perspective, the evaluation of dominance might partially depend on the weight placed by culture on each perspective.

For instance, it has been suggested that vertical individualist cultures (such as the U.S. and France) and vertical collectivist cultures (such as Japan) treat dominance differently (Triandis, 1995). In vertical individualist cultures "people often want to become distinguished and acquire status, and they do this in individual competitions with others." (Triandis & Gelfand, 1998, p. 119). By contrast, in vertical collectivist cultures, the conquest of power at the level of the individual is much less fostered, and communication often conveys explicit signs of subordination (e.g., bowing in Japan, Morsbach, 1988).

These differences have been confirmed by a study comparing American and Japanese participants' reactions to dominance. In an fMRI study, Freeman, Rule, Adams, and Ambady (2009) presented dominance and subordination body postures to American and Japanese participants. They found that brain reward structures were more activated by postures conveying dominance in American participants, while they were more activated by postures conveying subordination in Japanese participants. Moreover, personality questionnaires indicated that Americans scored higher on self-dominant statements (e.g., "I try to lead others") than Japanese, while the latter scored higher on self-subordinate statements (e.g., "I wait for others to lead the way").

These results suggest that Japan would be an interesting culture in which to study potential cross-cultural differences in the valuing of dominance. Japan is made even more relevant since the cross-cultural differences observed in relationships between adults are mirrored by differences in the way children are treated. In vertical individualist cultures, a number of cultural practices tend to individualize children, and to foster autonomy. By contrast, in Japan, the concept of *Hansei*, which is at the core of Japanese education at home and at school, promotes relational self-improvement and humility, and encourages children to focus their attention on their shortcomings and weaknesses (Lewis, 1995).

The question we address in this article is: How early do these differences in the valuing of dominance emerge? On the one hand, the dominance relationships between preschoolers across the world might be less shaped by culture than the dominance relationships between adults. This, combined with the plausibility of an adaptive explanation for the early valuing of dominants, suggests that Japanese preschoolers might also value dominants. On the other hand, it is also possible that the valuing of dominance by preschoolers is already influenced by local cultural norms.

More specifically, we are interested in two of the ways in which the valuing of dominance is expressed. The first is self-perception: whether children perceive themselves as dominants or subordinates. Cross-cultural effects in self-perception, whereby Easterners seemed to self-enhance less than Westerners (see Heine, Lehman, Markus, & Kitayama, 1999 for a review), have been controversial, with some researchers positing that the need for high self-regard itself is culturally determined (Heine *et al.*, 1999), and others suggesting that it is only the way it is expressed that is culturally modulated (Sedikides, Gaertner, & Toguchi, 2003). While developmental research shows evidence of cross-cultural differences in children's perception of self-competence (Henderson, Marx, & Kim, 1999; Jambunathan & Burts, 2003) there is a dearth of developmental data in the context of dominance.

The second expression of the valuing of dominants investigated here is the effect of dominance on belief in communicated messages. Experiments in the field of trust in testimony have demonstrated that preschoolers rely on a wide variety of cues when deciding whose messages to accept (for reviews, see Clément, 2010; Harris, 2012). In spite of the importance of dominance in children's social lives, it is only very recently that dominance has been shown to affect these decisions (Bernard *et al.*, 2016; Castelain *et al.*, 2015). If dominance had not been investigated earlier in this respect, it might be because it is not clear why dominance should affect trust in testimony—children might value dominants as potential allies without trusting them to be more knowledgeable. Yet the result that preschoolers tend to believe dominants more has been observed in several experiments (Bernard *et al.*, 2016; Castelain *et al.*, 2015). Studying the effects of dominance on trust in testimony in cultures that value dominants less than those previously investigated could help better understand the influence of dominance on trust in testimony.

Experiment 1 sought to measure the tendency to see oneself as a dominant rather than a subordinate. To do so, we developed a new paradigm in which children are asked to identify either with a clearly marked dominant or subordinate. This paradigm is easier to administer than those used in early research on the topic as it does not require the child to compare her own toughness with that of each of her classmates (Edelman & Omark, 1973; Sluckin & Smith, 1977). Given the novelty of the paradigm, we had to ensure that it would replicate past findings among Westerners showing that they tend to think of themselves as being dominant, and so we tested both Western (French) and Japanese preschoolers. Experiment 2 targeted the tendency to believe dominants over subordinates. In this case, we only introduced minor variations in the paradigm that was used previously (Bernard *et al.*, 2016; Castelain *et al.*, 2015), and so we only tested Japanese preschoolers.

Experiment 1

Method

Participants. In France 107 three- and 5-year-olds participated in this experiment (3-year-olds: 35 girls, 38 boys, M_{age} = 43.1 months, *SD* = 3.4 months; 5-year-olds: 18 girls, 16 boys, M_{age} = 64.5 months, *SD* = 3.2 months). They were recruited from a nursery school in Lyons. In Japan 94 three- and 5-year-olds participated in this experiment (3-year-olds: 32 girls, 32 boys, M_{age} = 42.5 months, *SD* = 1.93 months; 5-year-olds: 19 girls, 11 boys, M_{age} = 67.6 months, *SD* = 3.5 months). They were recruited from a kindergarten in west Tokyo.

Material and procedure. The experiment had a dominance identification phase and a self-identification phase. In the dominance identification phase, children were first presented with a picture of two imaginary characters with a dominance and subordination posture. One character displayed an erect posture with a raised head and pointed her/his finger at the other character with a direct gaze who bowed her/his head with an averted gaze (see Figure 1). These two types of body and head postures have been widely reported as conveying signals of dominance and subordination in western and non-western cultures (Bridge, Li, Tsao, & Chiao, 2007; Mignault & Chaudhuri, 2003; Rule, Adams, Ambady, & Freeman, 2012; Weisfeld & Beresford, 1982). The two characters were gender-neutral.

After presenting the picture, the experimenter explained that the two characters were children playing together and that one of the children was saying to the other *"You have to do everything I say! Do what I want!*" while the other was replying *"Ok! I will do what you want."* In the dominance identification phase, children's task was to indicate who was saying what by answering two questions: *"Who is saying 'do what I want?' Who is saying 'OK! I will do what you want?'"* The order of the two questions, as well as the position of the characters (left or right), were counterbalanced. Children were considered to have made a correct identification when they judged that the character displaying the dominance posture was the one who gave orders and that the character displaying the subordination posture was the one who accepted the order. These stimuli had previously elicited high identification rates in French preschoolers (Charafeddine *et al.*, 2015).

This identification phase was then followed by the self-identification phase. In this phase, the experimenter told each participant that she was in fact in the picture, and the child had to indicate to the experimenter who she was: "Now, you know what? You, you are in this picture; you are one of the two kids. Can you show me who you are?"

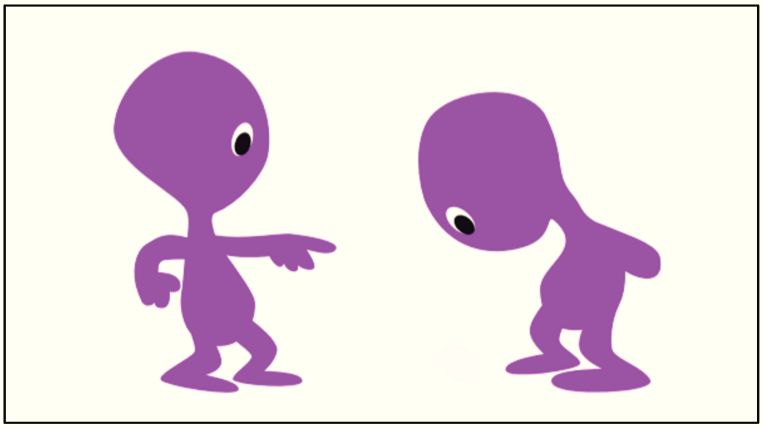

Figure 1. Two characters displaying postures of dominance and subordination.

Results[1]

Dominance identification. In the French group, identifications of dominant and subordinate were above chance for both 3- and 5-year-old children (3-year-olds: 79.5%,

[1] Preliminary analyses revealed no significant effects of gender in Experiment 1. Thus, this factor was not introduced into the analyses of Experiment 1.

two-tailed binomial test, $p < .001$; 5-year-olds: 100%, $p < .001$). The results also showed a developmental effect as the dominance identification rate in the 5-year-old group was higher than in the 3-year-old group (two-tailed Fischer's exact test ($N = 107$), $p = .003$, $\varphi = 0.28$). The results were similar for Japanese children: both 3- and 5-year-olds also identified dominant and subordinate above chance (3-year-olds: 70.3%, two-tailed binomial test, $p = .002$; 5-year-olds: 100%, $p < .001$); moreover, as in the French group, 5-year-olds showed a higher identification rate than the 3-year-olds ($\chi^2(1, N = 94) = 11.16$, $p < .001$, $\varphi = 0.34$). There were no significant differences between the French and Japanese groups (3-year-olds: 79.5% vs. 70.3%, $\chi^2(1, N = 137) = 1.53$, $p = .217$; 5-year-olds: 100% vs. 100%).

Self-identification. The analysis of self-identification was performed only on the children who had correctly identified dominant and subordinate. Moreover non-attributable answers (participants who did not respond or who responded "I don't know") were excluded from the analysis (2 in the French group and 4 in the Japanese group). The comparison included therefore 90 French and 71 Japanese participants.

In the French group, children were more likely than chance to identify with the dominant (68.8%, two-tailed binomial test, $p < .001$, see Figure 2). The tendency to identify oneself with the dominant rather than with the subordinate character was highly significant for the 5-year-olds (78.8%, $p < .001$, $N = 33$) and marginally significant for the 3-year-olds (63.2%, $p = .063$, $N = 57$). No significant difference between the two age groups was found (78.8% vs. 63.2%, $\chi^2(1, N = 90) = 2.38$, $p = .123$).

In the Japanese group, children were not more likely than chance to identify with the dominant (50.7%, two-tailed binomial test, $p = 1$, see Figure 2). This pattern was observed for both 3- and 5-year-old children (3-year-olds: 52.4%, $p = .878$, $N = 42$; 5-year-olds: 48.3%, $p = 1$, $N = 29$) and the two age groups did not differ from each other ($\chi^2(1, N = 71) = .12$, $p = .734$).

The comparison of the two groups indicated that overall the French children were significantly more likely than the Japanese children to identify themselves with the dominant character (68.9% vs. 50.7%, $\chi^2(1, N = 161) = 5.51$, $p = .019$, $\varphi = 0.19$). The comparison for each age group revealed that the difference between the two cultures was significant for the 5-year-olds (French: 78.8% vs. Japanese: 48.3%, $\chi^2(1, N = 62) = 5.51$, $p = .012$, $\varphi = 0.32$) but not for the 3-year-olds olds (French: 63.2% vs. Japanese: 52.4%, $\chi^2(1, N = 101) = 1.76$, $p = .18$).

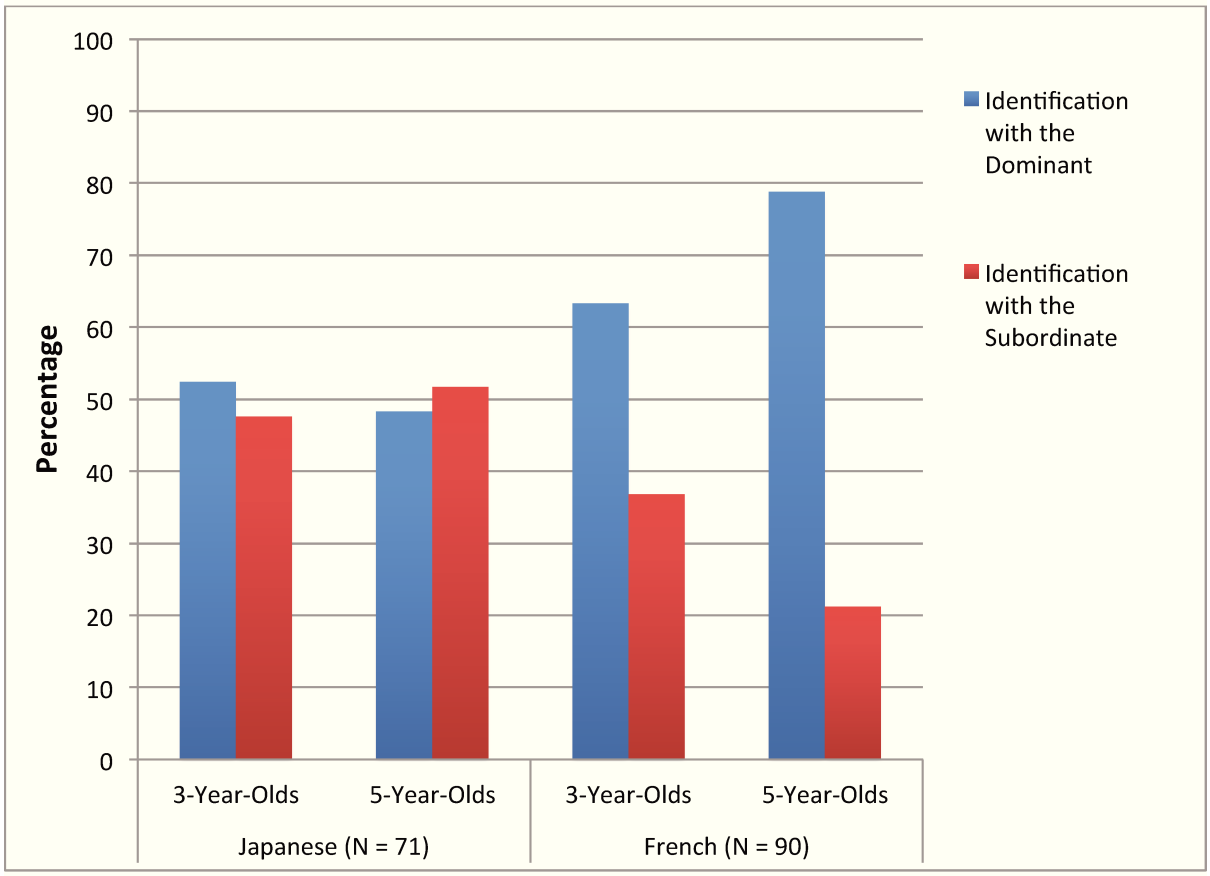

Figure 2. Percentages of Japanese and French children who identify with the dominant or subordinate posture as a function of age group.

Experiment 2

Method

We first conducted a small pilot study, to test whether the stimuli developed initially for children in other cultures would be appropriate for Japanese children (Bernard *et al.*, 2016; Castelain *et al.*, 2015). In this pilot, there were 3 test questions, and this revealed that the Japanese children seemed surprised by the repetition of the test question. As a result, for the actual experiment we only asked the children one test question—a format that was also more similar to that of the first experiment here. Given that the results of Experiment 1 revealed a clear cross-cultural difference with the 5-year-olds, we chose a sample of 5-year-olds for Experiment 2.

Participants. This experiment involved 44 five-year-olds children (24 girls, M_{age} = 65.7 months, *SD* = 3.25 months) from the same school in Tokyo (Japan). None of them had participated in Experiment 1.

Material and procedure. The design was adapted from Castelain *et al.* (2015) and Bernard *et al.* (2016). The experiment was composed of two phases: a dominance induction phase and a test phase (see Figure 3).

In the induction phase, the children were told two stories involving two Playmobil girls, Sayaka and Akari. The two stories showed them fighting over a doll or a teddy bear (for details, see Bernard *et al.*, 2016, Experiment 1). The same character won in both stories, so one character was established as dominant over the other. The order of the stories, the dominant character and the position of the characters were counterbalanced.

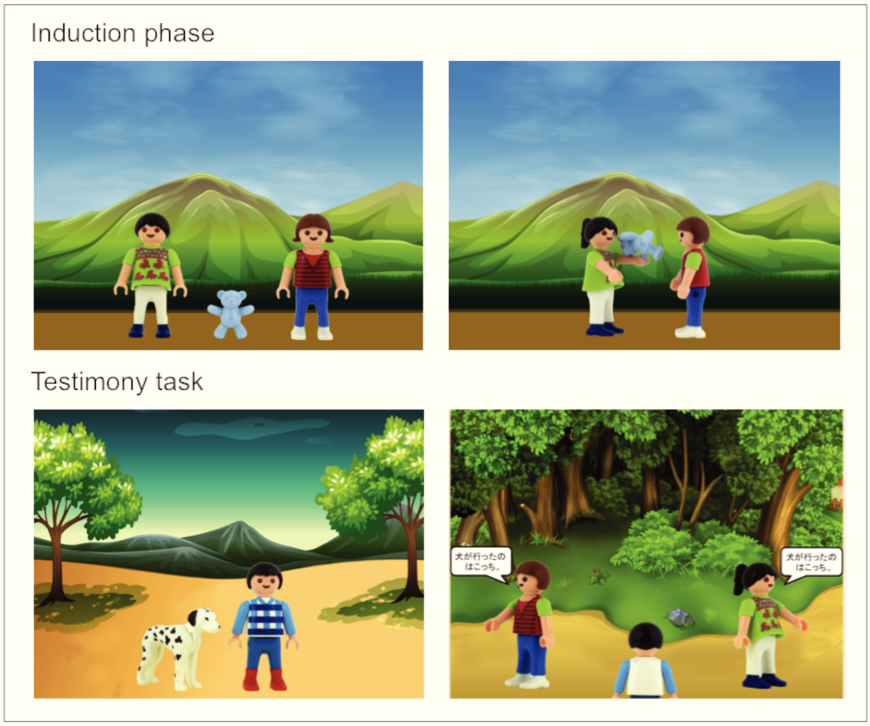

Figure 3. Excerpts from the induction phase (two characters contesting a teddy bear), and the testimony task (two characters give conflicting testimony about the localization of a dog) of Experiment 2.

In the test phase, the children were presented with a single-trial testimony task in which Akari and Sayaka gave conflicting testimony about the localization of a lost pet. In a first vignette, a young Playmobil boy, Takuya, and his dog were presented to the children (Figure 3). The experimenter said: “In this game, you will try to help Takuya find his dog”. A second vignette showed Takuya facing Akari and Sayaka each one pointing in a different direction. The experimenter said: “For instance, one day, Takuya is looking for his dog in front of a wood. Akari and Sayaka tell him something. We are going to listen to them.” At this point, a recording voice was activated for one of the

girls and children heard: “The dog went this way”. A different recording voice with the same statement was displayed for the second girl. The character’s location (right/left), the order of voice activation, and the voice attribution for the character were counterbalanced. Finally, the experimenter asked the children: “Which way do you think Takuy’s dog went?” One point was assigned to the child when she chose the direction supported by the dominant character.

Results

The percentage of choices linked to the dominant character was 34.1%. A two-tailed binomial test showed that children were more likely than chance to select the testimony of the subordinate character (29 out of 44 for the subordinate, $p = .049$). Contrary to the results obtained with 3- to 5-year-olds French participants (Bernard *et al.*, 2016), Japanese children did not favor the testimony of the dominant over that of the subordinate. To more directly examine a difference between a vertical individualist and a vertical collectivist culture, we compared the results of the Japanese participants to those obtained with the 26 five-year-old French children in the first testimony question of Bernard *et al.*’s study (Experiment 1; in that study, participants received three testimony questions). The analysis revealed that Japanese children endorsed significantly more the testimony of the subordinate than French children (65.9% vs. 38.5%, $\chi^2(1, N = 70) = 4.99$, $p = .026$, $\varphi = 0.27$; see Figure 4).

The above chance choice of the subordinate’s testimony was driven by the answers of female participants (19 out of 24, two-tailed binomial test, $p = .007$). By contrast, males answered at chance (10 out of 20, $p = 1$), and they were significantly less likely to favor the subordinate than females (50% vs. 79.2%, $\chi^2(1, N = 44) = 4.13$, $p = .042$, $\varphi = 0.31$). There were no significant gender differences in Bernard *et al.* (2016).

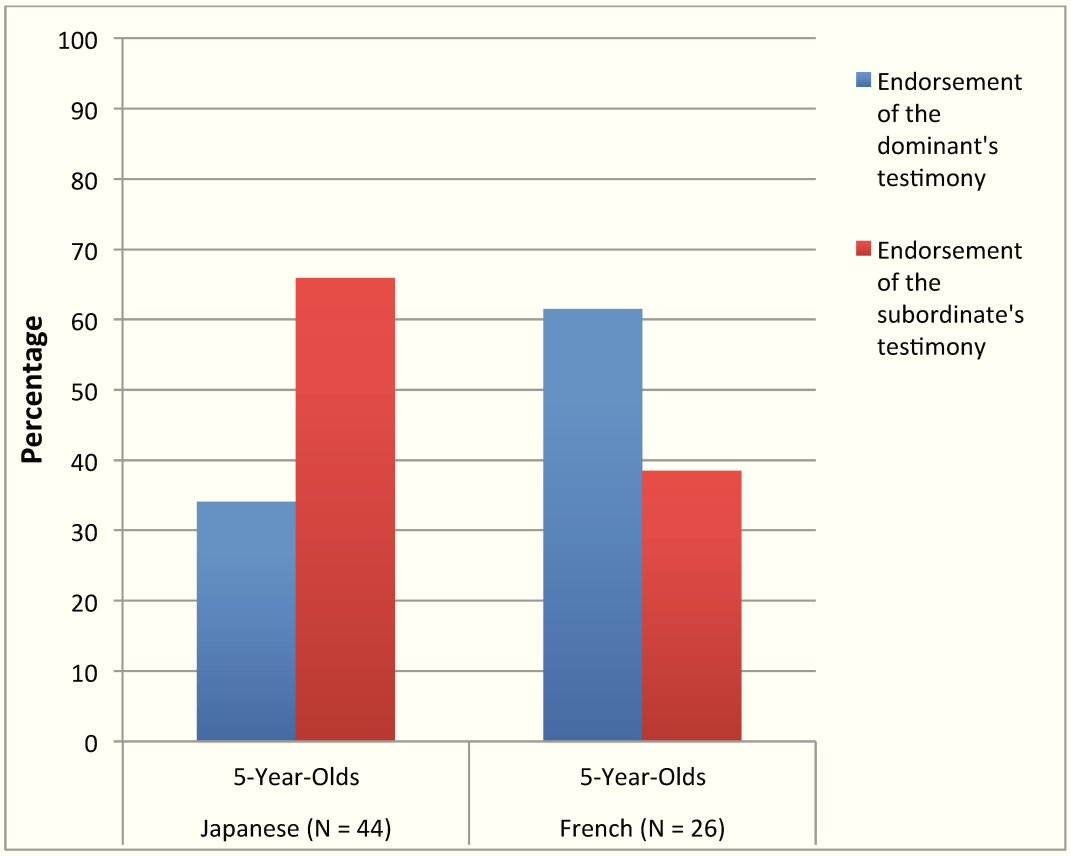

Figure 4. Rates of testimony endorsement by 5 year-old Japanese children and 5 year-old French children from Bernard *et al.* (2016).

Discussion

In the first experiment, French and Japanese children had to associate body postures with characters giving or accepting orders, and then had to identify themselves with one of the two characters. Three conclusions can be drawn. First, in both cultures children understood that the dominant posture was that of the individual who issued orders and that the subordinate posture was that of the individual who verbally complied with the orders. As a result, cross-cultural differences observed in the self-identification phase are unlikely to stem from a difference in identifying who was dominant and who was subordinate.

Second, in line with past studies indicating a positivity bias in the representation of one's own status in vertical individualist cultures, French preschoolers were more likely to identify with the dominant than the subordinate character. In contrast with earlier work, dominance was not based on the comparison of respective toughness: it was conveyed instead by an explicit relation in which one individual gave orders to another. This suggests that in vertical individualist cultures, children not only

overestimate their status in social comparison situations, but are also more likely to consider themselves as controlling others than being controlled by others.

Third, Japanese children identified less with the dominant character than French children. In line with previous cross-cultural comparisons on self-enhancement in adults (Heine *et al.*, 1999; Mezulis, Abramson, Hyde, & Hankin, 2004), Japanese participants did not show the opposite effect of that found with French participants: they were at chance rather than consistently identifying themselves with the subordinate.

This difference supports the hypothesis that culture modulates how children view themselves in a dominance interaction from an early age. According to the view that culture strongly influences self-perception (Heine *et al.*, 1999), these results could be interpreted as an absence of self-enhancement regarding status in the Japanese group. Alternatively, according to the view that self-enhancement is universal but is differentially achieved across cultures (Sedikides, Gaertner, & Toguchi, 2003), the results could be interpreted as indicating that the two groups value different attributes in the dominance interaction. In particular, as compared to French children, Japanese children may find it less rewarding to self-enhance through identifying with an individual who imposes his/her personal will on another, and may find it more appropriate to identify with the subordinate and compliant character. In other words Japanese children might be less likely to self-enhance on an individualistic form of dominance than French children.

In the second experiment, Japanese preschoolers were introduced to two characters, a dominant and a subordinate, who provided contradictory messages. The Japanese children were more likely than chance to believe the subordinate character. This contrasts with previous results obtained in France and in Maya communities in which the children tended to believe the dominant.

The difference observed in Experiment 1 can inform the results of Experiment 2, along with the results previously obtained with this paradigm. Research on trust in testimony has shown that children are more likely to believe sources who are more similar to them—whether they are similar in accent (Kinzler, Corriveau, & Harris, 2011), gender (Terrier, Bernard, Mercier, & Clément, 2016), or even hair color (Reyes-Jaquez & Echols, 2013)—and therefore who they can identify with more easily. Experiment 1 confirms that French preschoolers tend to identify with a dominant, but

also reveals that the Japanese do so significantly less. It is therefore possible that these differences in the tendency to identify with the dominant could help explain differences in the tendency to believe dominants.

Both experiments thus yielded convergent results: by comparison with members of vertical individualist countries—such as France and the U.S.—Japanese preschoolers value dominants less. These results stand in sharp contrast with previous experiments suggesting an early developing valuing of dominants, and they can be interpreted in at least two ways. First, it is still possible that there is a universal, adaptive, early developing tendency to value dominance—a tendency suggested for instance by the strong liking of dominants displayed by 2-year-olds for instance (Thomas *et al.*, 2016). This tendency, however, might be superseded by local cultural norms, such as the norms of Japanese cultures, or of vertical collectivist cultures more generally. A second interpretation is that the results obtained previously can be explained by the local cultural norms of vertical individualist cultures. In this case, there might be no universal tendency to value either dominants or subordinates (indeed, there might even be a universal tendency to value subordinates that is superseded by local norms but is unfettered in Japan).

A significant difference between the two experiments is that gender effects only emerged in one of the two experiments: Japanese girls were more likely than Japanese boys to believe a subordinate, but not to identify with him. Given that there was no consistent pattern, it is not clear what conclusions can be drawn from this difference, although it might be related to broader differences in the way gender and dominance interact in Japan (Rosenfeld, Van Buren, & Kalleberg, 1998). Moreover, this difference might also be an experimental artifact, since the characters were gender-less in Experiment 1, but were female in Experiment 2.

These two experiments offer strong evidence of cultural variability in the early valuing of dominance, suggesting that we should be cautious in generalizing the conclusions of studies on this topic conducted with Western children. A promising avenue for future research is to look at how early these differences emerge. For instance, it would be interesting to know whether the results showing that American 2-year-olds like dominants more replicate in Japan.

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Conclusion

Inscrit dans le cadre évolutionniste de la *vigilance épistémique* (Sperber *et al.*, 2010) et de la *théorie argumentative du raisonnement* (Mercier & Sperber, 2011) ce travail de recherche avait pour objectif de tester certaines des prédictions qui découlent du postulat de la *fonction argumentative du raisonnement*. Au délà de ces questions théoriques, cette thèse vise également à fournir une meilleure compréhension de l'influence que les contextes argumentatifs, culturels et sociaux peuvent avoir sur le raisonnement, et plus spécifiquement sur le déploiement de ses caractéristiques de production et d'évaluation d'arguments.

Selon l'approche développée par Mercier & Sperber (2011), les attributs du raisonnement (production biaisée et fainéante ; évaluation objective et exigeante) constitueraient des adaptations qui seraient le reflet du déploiement de sa fonction argumentative. Il en découle que les mécanismes qui servent cette fonction devraient être partagés par l'ensemble des populations humaines et ne devraient pas reposer sur des enseignements formels. On devrait donc être en mesure d'observer les effets des caractéristiques du raisonnement et l'émergence des compétences argumentatives dans différents contextes culturels et sociaux.

Toutefois, la plupart des résultats expérimentaux qui soutiennent cette perspective théorique proviennent d'expériences réalisées auprès de participants occidentaux (principalement des Etats-Unis et d'Europe). Cette recherche constitue l'opportunité de mettre à l'épreuve ces prédictions dans d'autres sociétés humaines.

La théorie argumentative du raisonnement (Mercier & Sperber, 2011) fournit un ensemble de prédictions claires, testables expérimentalement qui soutiennent le postulat de la fonction argumentative du raisonnement. Elles peuvent se résumer de la manière suivante : (i) les humains sont « naturellement » bons pour argumenter ; (ii) les individus raisonnent mieux dans un contexte argumentatif (dialogue) qu'en solitaire ; (iii) lorsqu'ils produisent des arguments, ils sont fainéants et biaisés ; (iv) lorsqu'ils évaluent des arguments, ils sont plus exigeants et objectifs ; (v) des arguments suffisamment forts peuvent prendre le pas sur des indices liés à la source.

La double approche, interculturelle et développementale, déployée ici s'avère particulièrement appropriée pour tester les hypothèses adaptatives avancées par ce cadre théorique. En effet, les dimensions sur lesquelles les sociétés occidentales, orientales et traditionnelles diffèrent fournissent un terrain propice pour tester l'universalité de la fonction argumentative du raisonnement et le développement des compétences argumentatives (voir Tableau 1). L'universalité et le développement précoce suggèreraient que les compétences argumentatives ne reposent pas sur un apprentissage culturel spécifique.

Tableau 1. Différences interculturelles entre les trois cultures étudiées.

Cultures	**Tradition philosophique**	**Style parental**	**Education formelle**
Cultures Occidentales	Valorise le débat et l'argumentation	Forte exposition aux arguments Recours à l'usage de raisons et moins à l'expression de l'autorité	Adultes Enfants
Cultures Orientales	Respect de l'harmonie sociale	Style parental similaire aux cultures occidentales	Adultes Enfants
Sociétés Traditionnelles	Ne valorise pas particulièrement l'argumentation	Faible exposition aux arguments Recours à l'expression de l'autorité et moins à l'usage de raisons	Adultes non Enfants très peu

Les études expérimentales qui ont été menées afin de tester ces prédictions se sont centrées sur les effets de l'argumentation sur le raisonnement en groupe et le développement des capacités d'évaluation des arguments. Les résultats complémentaires qui en découlent fournissent de nouvelles preuves du rôle déterminant de l'argumentation dans le raisonnement, invitent à reconsidérer les caractéristiques du raisonnement humain et plus largement sa fonction dans la cognition humaine.

1 Les caractéristiques du raisonnement humain

La question de l'universalité des caractéristiques du raisonnement est pertinente dans le débat concernant sa fonction dans la cognition humaine. Comme on l'a mis en évidence dans l'introduction, les psychologues du raisonnement sont confrontés à un paradoxe. Lorsque les individus raisonnement seuls, ils sont souvent biaisés et commettent des erreurs systématiques même pour des problèmes logiques triviaux. Par contre, lorsqu'ils résolvent les mêmes problèmes en petits groupes, leurs performances sont tout à fait acceptables. L'un des enjeux d'une théorie qui viserait à rendre compte de la fonction du raisonnement humain est d'être en mesure d'expliquer ce paradoxe.

Selon l'approche *individualiste*, le raisonnement serait une activité solitaire qui permettrait à l'individu d'accéder à des croyances plus solides, générer des connaissances, et prendre de meilleures décisions, principalement grâce à la mobilisation de processus qui visent à corriger les intuitions (Evans & Over, 1996; Kahneman, 2003; Stanovich, 2004).

Toutefois, le raisonnement solitaire marqué par un fort biais vers son côté (ou biais de confirmation) représente un premier obstacle pour cette approche et leurs prédictions quant aux raisons de l'amélioration en groupe manquent de clarté et ne font pas appel à des mécanismes directement liés au déploiement des compétences de raisonnement.

Certains auteurs avancent que les membres des groupes sont capables d'identifier l'individu le plus intelligent (Oaksford *et al.*, 1999) ou le plus confiant (Opfer & Sloutsky, 2011) et se contenteraient de le suivre. Toutefois, l'analyse des discussions en groupe montre que les participants sont disposés à changer d'avis seulement une fois qu'ils sont convaincus que leur réponse est erronée (Moshman & Geil, 1998) et la simple exposition à la réponse correcte semble avoir peu d'effet pour les faire changer d'avis (Trognon, 1993). En revanche, l'exposition aux arguments qui soutiennent la réponse correcte s'avère plus efficace (Trouche *et al.*, 2014; Trouche *et al.*, 2015).

D'autres chercheurs soutiennent l'hypothèse que le contexte du groupe constitue une source spécifique de motivation pour les individus, ce qui aurait comme conséquence d'accroître leur investissement dans la tâche (Oaksford *et al.*, 1999). Cet argument semble difficile à défendre étant donné que la performance en groupe est dans de nombreuses tâches en dessous des attentes, en grande partie car ses membres fournissent moins d'efforts que lorsqu'ils doivent la résoudre individuellement (Hill, 1982). De plus, d'autres formes de motivation ne semblent pas avoir d'effet sur les performances dans le domaine du raisonnement. Même des récompences monétaires échouent à améliorer les performances dans des tâches de raisonnement ou de prise de décision (Bonner, Hastie, Sprinkle, & Young, 2000; Johnson-Laird & Byrne, 2002).

Enfin, dans certaines situations, les groupes peuvent converger vers une bonne réponse, alors qu'aucun membre n'y avait accès avant la discussion. Dans ce cas, les performances du groupe dépassent celles du meilleur de ses membres (ou *assembly bonus effect* ; Laughlin, Bonner, & Miner, 2002; Moshman & Geil, 1998).

Les différences de performances entre le raisonnement solitaire et le raisonnement en groupe s'avèrent donc difficiles à conciler avec l'approche individualiste.

En opposition, l'approche *interactionniste* proposée par Mercier et Sperber (2011) offre un cadre théorique qui semble mieux rendre compte de ces résultats contradictoires. En postulant que le biais vers son côté est une caractéristique adaptative du raisonnement, elle permet d'expliquer les faibles performances lorsque les participants raisonnent seuls. Elle prédit également que la discussion devrait améliorer les performances, grâce à l'échange d'arguments qui mobilise les habilités d'évaluation des arguments. La théorie argumentative du raisonnement postule que l'asymétrie fondamentale entre production et évaluation est une caractéristique adaptative du raisonnement (Mercier, 2016).

Ainsi, si ces attributs constituent des adaptations, non seulement elles devraient s'oberver dans des populations occidentales (largement rapporté dans la littérature) mais également dans d'autres contextes culturels qui diffèrent sur des dimensions

théoriquement pertinentes par rapport à ces populations. C'est ce que Mercier et ses collaborateurs ont montré au Japon (Mercier *et al.*, 2015a; Boku, Yama, & Mercier, soumis) et ce qui a été démontré ici avec des participants non scolarisés au Guatemala.

L'étude menée auprès d'adultes mayas K'iche' (Article 1) montre que les participants non scolarisés issus de sociétés traditionnelles partagent ces caractéristiques du raisonnement. Leurs performances dans des tâches de raisonnement logique s'améliorent de manière significative grâce à l'échange d'arguments ; la production d'arguments est caractérisée par un biais vers son côté et l'évaluation d'arguments est efficace, ce qui permet aux participants de discriminer les mauvais des bons arguments et d'être convaincus par ces derniers ; il suffit qu'un membre du groupe ait la réponse correcte pour que les arguments qui la soutiennent parviennent à convaincre les autres membres du groupe.

De plus, les résultats des études exploratoires concernant le raisonnement moral (Chapitre 2) suggèrent que l'exposition à des arguments suffisamment forts peut provoquer un changement dans le jugement moral des participants (Etude 1). Les résultats des études portant sur la discussion en groupe (Etude 2 et Etude 3) sont moins probants mais suggèrent tout de même que des changements s'opèrent lorsque des réponses contradictoires sont portées par les menbres du groupe (Etude 3). Je reviendrai ultérieurement sur les raisons méthodologiques qui sont susceptibles d'avoir eu un impact sur la résolution de ces problèmes (voir section, recherches compémentaires).

Les résultats rassemblés ici, en complément de ceux des études qui ont testé directement ces prédictions, montrent l'effet bénéfique de la discussion sur le raisonnement et plus important encore, que cette amélioration des performances est le reflet des caractéristiques du raisonnement (voir Tableau 2). De plus, la généralisation de ces résultats dans les sociétés occidentales, orientales et traditionnelles suggère que les caractériques du raisonnement ne sont pas culturellement acquises.

Tableau 2. Résumé des travaux expérimentaux concernant l'effet de la discussion sur le raisonnement en groupe.

Cultures	**Effet de la discussion sur le raisonnement logique**	**Effet de la discussion sur le raisonnement moral en groupe**	**Caractéristiques du raisonnement : biais vers son côté et habilité à évaluer les arguments**
Cultures Occidentales	Largement rapporté dans la littérature	Mercier *et al.*, 2015c (Pas d'effet)	Trouche *et al.*, 2014 ; Trouche *et al.*, 2015
Cultures Orientales	Mercier *et al.*, 2015a	Absence de donnée	Mercier *et al.*, 2015a ; Boku *et al.*, soumis
Sociétés Traditionnelles non scolarisées	Castelain *et al.*, 2016	Mercier *et al.*, 2015c (Tendance)	Castelain *et al.*, 2016

Les études menées auprès d'enfants mayas, français et japonais fournissent des preuves complémentaires et nous éclairent sur le développement des compétences argumentatives dans différents contextes culturels et sociaux.

Tout d'abord, les expériences menées sur l'évaluation des arguments montrent que dès deux ans (Article 3), les enfants sont sensibles à la force des arguments qui leurs sont proposés. Dans l'ensemble, les résultats montrent que les enfants sont plus enclins à accepter le label fourni par un informateur lorsque celui-ci soutient sa réponse par un argument perceptuel que lorsqu'il la soutient par un argument circulaire ou l'absence d'argument.

De plus, les expériences réalisées dans des sociétés traditionnelles (Article 4) et orientales (Article 7) montrent que les enfants mayas et japonais lorsqu'ils sont confrontés à des témoignages contradictoires, l'un soutenu par un argument circulaire (faible), l'autre par un argument perceptif (fort), favorisent le témoignage soutenu par l'argument le plus fort.

Ces résultats montrent que malgré des différences culturelles et sociales entre ces trois populations (Tableau 1) qui pourraient potentiellement avoir un impact sur le développement des compétences argumentatives, les enfants européens, orientaux et

issus de sociétés traditionnelles montrent la même habilité à discriminer la qualité des arguments auxquels ils sont exposés (voir Tableau 3).

Tableau 3. Résumé des résultats obtenus pour l'évaluation des arguments en France, au Guatemala et au Japon.

Argumentation	**Référence**	**Age**	**Tâche de témoignage**	**Favorisent le témoignage soutenu par l'argument perceptuel**
Suisses (N = 84)	Mercier *et al.*, 2014	3 à 5 ans	Direction	OUI
Mayas (N = 99)	Castelain *et al.*, 2015	4 à 6 ans	Direction	OUI
Japonais (N = 41)	Sudo *et al.*, in prep	5 ans	Direction	OUI

L'objectif de la série d'études concernant la hiérarchie sociale, outre son intérêt théorique, était de déterminer si des enfants de sociétés WEIRD, traditionnelles et orientales prennent en compte cet indice (lié à la source) lorsqu'ils doivent évaluer des témoignages. Ceci afin d'être en mesure de tester la prédiction selon laquelle des arguments suffisamment forts peuvent prendre le pas sur un inidce lié à la source.

Les résultats de ces expériences montrent que les enfants mayas (Article 4), japonais (Article 8) et français (Article 5) infèrent la relation de dominance à partir d'une compétition physique mais également lorsqu'elle est induite sur la base du pouvoir décisionel (tout du moins en France). Plus important, ces études révèlent que les enfants de ces trois cultures utilisent la hiérarchie sociale comme un indice lorsqu'ils doivent évaluer la confiance qu'ils peuvent attribuer dans une source, que ce soit pour des questions factuelles (la localisation d'un chien) ou la labélisation d'objets (tout du moins en France).

La comparaison interculturelle se révèle particulièrement informative. Elle permet de mettre en évidence que les inférences faites sur la base de la hiérarchie sociale, contrairement à celles faites sur la base de la qualité des arguments, peuvent varier en fonction du contexte culturel. En effet, alors que les enfants mayas et français

favorisent le témoignage du personnage dominant, les enfants japonais au contraire favorisent le témoignage du subordonné (voir Tableau 4).

Deux hypothèses ont été avancées afin de tenter d'expliquer les infèrences faites par les enfants sur la base de la hiérarchie sociale: une hypothèse sociale lié à la déférence et une hypothèse épistémique liée à la compétence. Je reviendrai sur ces deux hypothèses ultérieurement (voir section, recherches compémentaires).

Indépendamment de la nature de ces inférences, le fait que les enfants mayas et français favorisent le témoignage du dominant a permis de réaliser la série d'expériences visant à confronter ces deux indices.

Tableau 4. Résumé des résultats obtenus pour l'évaluation de la hiérarchie en France, au Guatemala et au Japon.

Hiérarchie	**Référence**	**Age**	**Phase d'induction**	**Tâche de témoignage**	**Favorisent le témoignage du**
Mayas (N = 97)	Castelain *et al.*, 2015	4 à 6 ans	Dominance physique	Direction	Dominant
Français (N = 74)	Bernard *et al.*, 2016	3 à 5 ans	Dominance physique	Direction /Labélisation	Dominant
Français (N = 67)	Bernard *et al.*, 2016	3 à 5 ans	Dominance décisionnelle	Direction /Labélisation	Dominant
Japonais (N = 44)	Charafeddine *et al.*, soumis	5 ans	Dominance physique	Direction	Subordonné

Enfin, l'objectif des expériences qui mettent en compétition la qualité des arguments avec la hiérarchie sociale était de déterminer si des arguments suffisamment forts pouvaient prendre le pas sur un indice lié à la source, ici la hiérarchie sociale. Étant donné les résultats obtenus pour la hiérarchie au Japon (Article 8), ces expériences ont été menées uniquement au Guatemala et en France.

Pour les enfants mayas (Article 4), les résultats montrent que lorsqu'ils sont confrontés aux témoignages contradictoires d'un dominant qui fourni un argument circulaire et d'un subordonné qui fourni un argument perceptuel, ils tendent à favoriser le témoignage de ce dernier. Les résultats obtenus auprès d'enfants français (Résultats complémentaires 6) indiquent qu'ils ne favorisent pas le témoignage du subordonné qui

fourni un argument perceptuel (ni d'ailleurs celui du dominant qui fournit un argument circulaire) (voir Tableau 5).

Tableau 5. Résumé des résultats obtenus pour l'évaluation de l'argumentation et de la hiérarchie mis en compétition, au Guatemala et en France.

Argumentation vs. hiérarchie	**Référence**	**Age**	**Phase d'induction**	**Tâche de témoignage**	**Favorisent l'argument perceptuel**
Mayas (N = 91)	Castelain *et al.*, 2015	4 à 6 ans	Dominance physique	Direction	OUI
Français (N = 115)	Non publié	3 à 5 ans	Dominance décisionnelle	Direction	NON

Plus précisément, les résultats obtenus au Guatemala montrent que lorsque l'indice lié à la raison (argument fort) et l'indice lié au pouvoir (hiérarchie) sont présentés de manière indépendante, ils génèrent des taux d'acceptation similaires (voir Figure 1, pour un exemple avec les enfants de 5 ans). Cependant, lorsque ces deux indices sont mis en compétition, de manière à ce que le subordonné donne un argument plus fort que le dominant, l'indice lié à la raison prend le pas sur l'indice lié à la source.

Dans ces communautés, les données anthropologiques, sociologiques et linguisitiques suggèrent que la hiérarchie joue un plus grand rôle que l'argumentation en comparaison avec les WEIRD ; différence qui s'exprime notamment dans les styles parentaux de ces deux populations (Gauvain *et al.*, 2013; Maratsos, 2007). Il est donc étonnant de constater que chez des enfants relativement jeunes de ces communautés, les arguments prennent le pas sur la hiérarchie. L'évaluation des arguments semble donc jouer le rôle prédit par le cadre théorique de la vigilance épistémique : des arguments suffisamment forts sont capables de prendre le pas sur des indices liés à la source.

Cependant, les résultats obtenus auprès des enfants français n'ont pas permis de départager ces deux indices (voir Figure 1, pour les résultats chez les enfants de 5 ans). Une différence majeure avec l'expérience au Guatemala tient au fait que l'induction de la hiérarchie repose sur le pouvoir décisionel et non la dominance physique.

Bien que de nouveaux travaux soient nécessaires pour mieux comprendre les inférences faites sur la base de la hiérarchie sociale, les enfants pourraient inférer une

forme de compétence spécifique à partir du pouvoir de décision qui rentre en compétition avec la qualité des arguments. La différence observée entre les enfants de 3 ans et de 5 ans suggère que des changements dans le poids relatif conféré à la force des arguments et à la hiérarchie peut s'opérer au cours du développement. Ces questions restent à explorer.

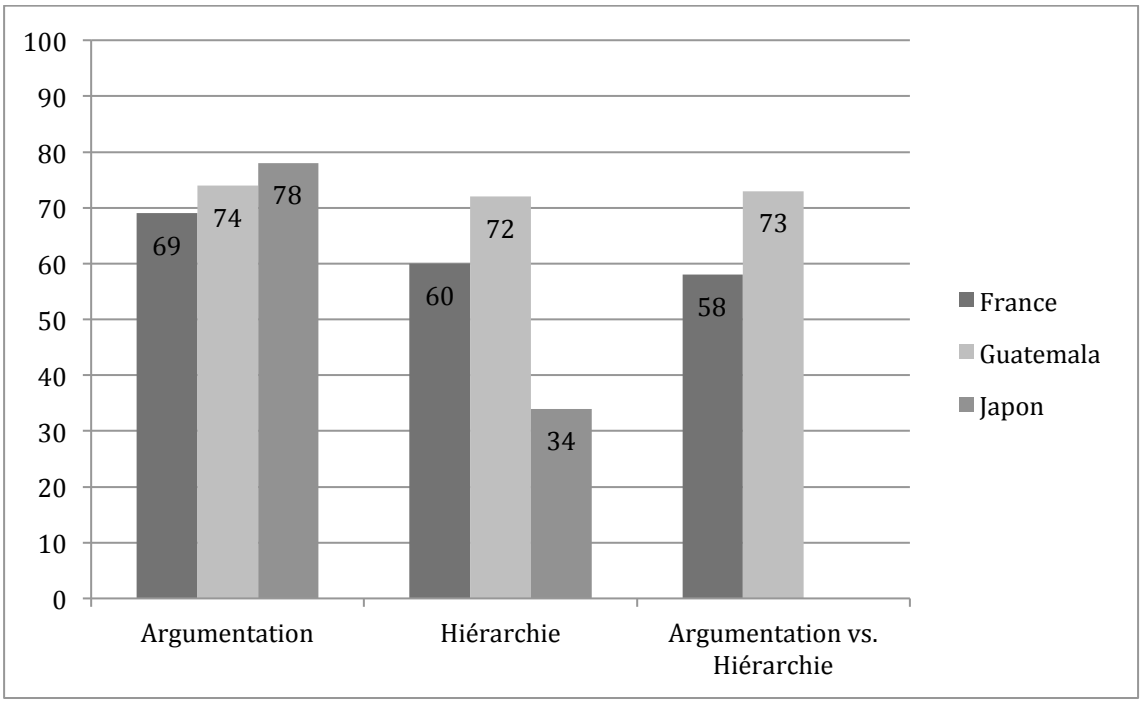

Figure 1. Comparaison du pourcentage de choix pour les enfants de 5 ans en France, au Guatemala, et au Japon pour les trois expériences. *Argumentation* : pourcentage de choix pour l'argument perceptuel ; *Hiérarchie* : pourcentage de choix pour le dominant ; *Argumentation vs. Hiérarchie* : pourcentage de choix pour le subordonné qui fournit un argument perceptuel.

L'ensemble des résultats des expériences réalisées en France, au Guatemala et au Japon suggère que les compétences argumentatives émergent relativement tôt, que l'évaluation des arguments montre des caractéristiques similaires à celles mises en évidence chez les adultes, et que cette sensibilité aux arguments est partagée par différentes sociétés humaines. Ces résultats étayent l'hypothèse que les caractéristiques du raisonnement (en tout cas l'évaluation des arguments) ne dépendent pas d'un apprentissage culturel spécifique.

Pour résumer, ce travail de thèse, riche de données collectées auprès d'adultes et d'enfants provenant de trois continents, constitue une avancée vers une meilleure compréhension de l'influence des contextes argumentatifs, culturels et sociaux sur le raisonnement humain, et plus précisement sur ses caractéristiques de production et d'évaluation d'arguments.

Les études qui ont été menées ont tout d'abord permis de mettre en évidence que les adultes issus de sociétés traditionnelles (non scolarisées) montrent les mêmes caractéristiques de production (biais vers son côté) et d'évaluation (objectivité) d'arguments observées dans les cultures occidentales et orientales. Ces résultats suggèrent que ces caractéristiques du raisonnement ne dépendent pas d'un apprentissage culturel spécifique. Les résultats développementaux appuyent cette interprétation. Dès l'âge de deux ans, les enfants se montrent sensibles à la force des arguments auxquels ils sont exposés. Enfin, les preuves rassemblées en France, au Guatemala et au Japon indiquent que cette habilité est partagée par les enfants de ces trois cultures et que des arguments suffisamment forts peuvent prendre le pas sur des indices liés à la source (hiérarchie sociale).

Ces résultats, mis en perspective avec ceux rassemblés dans le cadre de la théorie argumentative du raisonnement, soutiennent l'hypothèse que l'asymétrie fondamentale entre production et évaluation d'arguments serait une caractéristique adaptative de la fonction argumentative du raisonnement. Cette perspective permet de reconcilier de nombreux résultats contradictoires issus de la psychologie du raisonnement et de rendre compte de sa fonction dans la cognition humaine (Mercier, 2016). Le raisonnement aurait évolué à des fins sociales et sa fonction serait de produire des arguments pour convaincre les autres et évaluer les arguments des autres pour être convaincu lorsque cela est approprié (Mercier & Sperber, 2011). La fonction argumentative du raisonnement constituerait un avantage évolutif dans le sens où elle améliorerait la communication (Mercier & Sperber, in press). Cette approche du raisonnement trouve également un écho dans de récents développements théoriques qui soulignent l'importance de l'argumentation et de l'échange de raisons dans la cognition humaine (Tomasello, 2014) et la fonction sociale de la cognition de haut niveau (Dunbar & Shultz, 2003; Tomasello *et al.*, 2005).

Au delà de fournir de nouvelles preuves expérimentales qui soutiennent l'approche développée par la théorie argumentative du raisonnement, les expériences qui ont été menées au cours de cette thèse soulèvent de nouvelles questions et ouvrent des pistes de recherches que je présenterai dans la section suivante.

2 Recherches complémentaires

Une première piste de recherche concerne le raisonnement moral. Le chapitre 2 dédié au raisonnement moral en groupe souligne que l'impact des arguments et des discussions sur les décisions et les jugements moraux reste un domaine peu exploré. L'apport de nouvelles données expérimentales permettrait de trancher entre les théories concurrentes du raisonnement moral, en particulier entre l'approche défendue par les théories intuitionnistes (Haidt, 2001) et celle de la théorie argumentative du raisonnement (Mercier & Sperber, 2011). Ce que les études exploratoires présentées n'ont pas permis de faire, vraisemblablement pour des raisons méthodologiques telles que le type de problème choisi et l'implication des participants dans leur résolution.

L'analyse des arguments fournis par les participants représenterait une source d'informations qui permettrait de mieux discerner la manière dont les participants traitent les problèmes qui leurs sont proposés et leur investissement dans la tâche (Bauman *et al.*, 2014).

De plus, les décisions et jugements moraux auxquels nous pouvons faire face dans la vie quotidienne sont parfois très éloignés des problèmes classiquement utilisés dans cette littérature. Or, dans la vie de tous les jours, nous sommes parfois amenés à discuter de décisions morales ou de jugements moraux avec les autres. On sait d'ailleurs très peu des processus d'évaluation des explications fournies lors de justifications morales et comment cela influence les jugements moraux. Le design d'expériences plus écologiques permettrait de mieux comprendre les phénomènes en jeu et, en augmentant la pertinence de la situation pour les participants, permettrait également de s'assurer de l'engagement des participants dans la résolution des problèmes.

Argumentation

Une seconde piste de recherche concerne le développement des compétences argumentatives. Les travaux issus de la psychologie culturelle suggèrent que les différences les plus importantes quant à l'exposition au langage concernent les premières années de vie (de 0 à 2 ans) des enfants américains et mayas (Shneidman & Goldin-Meadow, 2012). Répliquer l'étude menée avec les enfants de 2 ans (Article 3) auprès d'enfants de sociétés traditionnelles permettrait de déterminer si les trajectoires développementales des compétences argumentatives diffèrent ou se superposent dans dans ces deux contextes culturels et sociaux.

De plus, les résultats obtenus avec les enfants de 2 ans soulignent l'importance de tester la manière dont les informations acquises au travers des témoignages sont retenues. Plus précisément, tester de manière plus régulière la robustesse temporelle des croyances acquises à travers des témoignages (Corriveau & Harris, 2009), et leur robustesse, une fois l'informateur parti (Haun, Rekers, & Tomasello, 2014), fournirait des informations importantes qui permettraient de déplacer la question de si les enfants suivent les témoignages à comprendre d'une manière plus précise comment ils le font.

Enfin, comme le souligne Mercier (2016), s'intéresser aux processus d'apprentissage de la production d'arguments permettrait de déterminer jusqu'à quel point ils sont spontanés ou influencés par les types d'arguments auxquels les enfants sont exposés. Réaliser de telles études dans divers contextes culturels et sociaux pourrait fournir des informations utiles pour répondre à ces questions.

Hiérarchie

Une dernière piste concerne les inférences faites sur la base de la hiérarchie sociale. Deux hypothèses ont été avancées : une hypothèse sociale lié à la déférence et une hypothèse épistémique liée à la compétence.

L'hypothèse sociale suggère que les enfants pourraient avoir envie d'être dans les bonnes grâces du dominant. En général, il est plus important d'être bien vu par les dominants plutôt que les subordonnés, étant donné qu'ils ont typiquement plus de

ressources à partager et plus d'influence concernant diverses situations sociales. Si être d'accord avec une personne a pour effet qu'elle soit plus susceptible de nous apprécier, on devrait avoir une plus grande propension à être d'accord avec les domiants plutôt que les subordonnés. De récents travaux expérimentaux semblent étayer cette interprétation. Il a été montré que les enfants défèrent à un consensus majoritaire, même lorsque le consensus va à l'encontre de leur propre perception (Bernard, Harris, Terrier, & Clément, 2015; Corriveau & Harris, 2010; Haun & Tomasello, 2011). Ce comportement de déférence peut être aussi présent face à une source dominante.

La deuxième interprétation, liée à la compétence, pourrait expliquer pourquoi les enfants prennent la hiérarchie en compte lorsqu'ils évaluent des témoignages. De récents travaux montrent que les enfants de maternelle jugent les dominants comme plus compétents que les subordonnés même dans des domaines sans lien direct avec la dominance (Charafeddine *et al.*, 2015). Cette interprétation est consistente avec les études chez l'adulte qui montrent qu'ils ont tendance à attribuer plus de compétences à des individus indépendamment de leur réel niveau de compétence (Anderson & Kilduff, 2009). Il est possible que les enfants utilisent cette même heuristique et attribuent aux dominants plus de compétences.

Ces deux hypothèses ne sont pas incompatibles et des expériences complémentaires pourraient permettre de mieux comprendre la nature des inférences qui sont faites à partir de la hiérarchie lorsque les enfants doivent juger d'un temoignage.

Les résultats obtenus au Japon apportent de nouveaux éléments de réponse qui tendraient à favoriser l'hypothèse sociale. En comparaison avec les membres de sociétés verticales individualistes, comme la France, les Etats-Unis ou le Guatemala, les enfants japonais valorisent moins la dominance. Ces résultats contrastent avec ceux des expériences qui suggèrent que la prise en compte de la hiérarchie se développe relativement tôt et son rôle évolutionnaire dans la régulation des interactions sociales de toutes les espèces sociales dont font partie les humains (Brown, 1991; Byrne & Whiten, 1988; Fiske, 1992).

On peut interpréter cette différence interculturelle de deux manières. Tout d'abord, il est envisageable qu'il y ait une tendance universelle à valoriser la dominance. Cette tendance est suggérée par la forte préférence pour les dominants chez les enfants de 2 ans (Thomas *et al.*, 2016). Elle peut cependant être supplantée part des normes culturelles locales, comme celle d'harmonie sociale qui caractérise la culture japonaise et les sociétés verticales collectivistes en général.

Une deuxième interprétation est que les résultats obtenus précédemment peuvent être expliqués par les normes culturelles locales des cultures verticales individualistes (WEIRD et sociétés traditionnelles). Dans ce cas, il n'y aurait pas de tendance universelle à valoriser les dominants ou les subordonnés. Pour tenter de départager ces deux prédictions il serait intéressant de déterminer à quel âge ces différences interculturelles émergent en s'intéressant au traitement de la hiérarchie sociale chez les enfants de 2 ans au Japon.

Dans une dernière partie, je souhaiterais souligner l'impact que les travaux menés dans le cadre de cette recherche et plus généralement de la théorie argumentative du raisonnement sont susceptibles d'avoir hors du laboratoire.

3 Perspectives

Au délà du fait d'offrir une explication adaptative des attributs du raisonnement, la théorie argumentative du raisonnement permet également de rendre compte des ses effets (Mercier, 2016). En effet, le contexte dans lequel le raisonnement se déploit joue un rôle majeur dans la dynamique des mécanismes de production et d'évaluation d'arguments. En absence de dialogue ou sans conflit entre des points de vues, c'est la production d'arguments (biaisée vers son côté) qui domine et peut avoir des conséquences délétères comme la polarisation ou la surconfiance. En revanche, dans une situation de dialogue ou lorsque des individus ont des opinions divergentes, qui favorisent l'échange d'arguments, l'évaluation d'arguments se déclenche, ce qui peut

permettre aux individus en groupe d'accéder à de meilleurs décisions et que les meilleurs idées (arguments) se diffusent.

Une meilleure compréhension de la dynamique entre les mécanismes de production et d'évaluation dans les différents contextes dans lesquels ils se déploient ouvre le champ à de potentielles applications hors du laboratoire.

Les petits groupes de discussions sont une composante importante des sociétés démocratiques et sont un outil commun dans les domaines de l'éducation, de la science, de la justice, des organisations ou encore des délibérations citoyennes (Landemore & Mercier, 2012). La prise en compte de la dynamique des mécanismes argumentatifs permettrait de dépasser certaines des limites du raisonnement en groupe (polarisation), favoriser l'échange des points de vues et ainsi, dans le meilleur des cas, les prises de décisions les mieux fondées (Mercier & Landemore, 2012).

Les éducateurs pourraient également tirer profit de ces recherches pour créer des conditions qui favorisent l'échange d'arguments dans les groupes de discussions et ainsi permettre aux étudiants de tirer le meilleur profit de leurs habilités argumentatives (Mercier, Boudry, Paglieri, & Trouche, 2016). Maximiser l'exposition des étudiants à des arguments qui vont à l'encontre de leur point de vue constitue une autre stratégie qui pourrait potentiellement permettre d'améliorer le raisonnement solitaire (Mercier *et al.*, 2016).

Enfin, pour conclure cette thèse et comme je l'ai défendu tout au long de cette dissertation, le raisonnement est une activité éminemment sociale. Et c'est grace à un petit groupe de chercheurs que j'ai pu affûter mes habilités et réaliser cette recherche. Sans eux, tout comme le raisonneur solitaire, j'aurai été privé de l'un de ses plus grands bénéfices, l'échange (d'arguments) avec les autres.

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