FOUNDATIONS OF CULTURAL LEARNING

by

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Abstract

To acquire their local culture, infants must identify good cultural models to learn from. Doing so successfully requires learners to evaluate others’ qualities as potential knowledge sources. The following body of research examines how the youngest humans identify good sources of conventional behaviours—a domain of cultural knowledge that lacks inherent properties for evaluation.

Chapter 2 examines infants’ preferences for individuals who performed a consensus action vs. an oft-repeated action. Results revealed that preverbal infants are capable of making complex, context-dependent evaluations, favouring conformists when the targets’ prior knowledge cannot be assumed, and preferring mavericks when it can. Chapter 3 extends these results by showing that preschool aged children use some of these same cues to identify who may be good to learn from.

Chapter 4 investigates infants’ use of observed emotional communications to choose between social and asocial targets. Cultural and domain differences were found for 12 month old infants: target preferences were influenced by emotional reactions directed at social targets, but not by emotional reactions directed at asocial targets. A differential response to positive and negative emotional reaction only reliably affected European Canadian infants’ choices, but not East Asian infants, nor European and East Asian mixed infants.

Chapter 5 investigated how parents convey evaluative messages about objects during interactions with infants, and explored cultural differences in these pedagogical interactions. Results hint at cultural differences in the amount of valence congruent
utterances caregivers make, resulting in differential experience with emotional communications as a means of learning about the world.
Preface

The work and ideas presented in this thesis are those of the author, developed in collaboration with research supervisor Dr. J. Kiley Hamlin. The projects and associated methods were approved by the University of British Columbia’s Behavioural Research Ethics Board [certificate #H10-01808]. All chapters reflect original, unpublished work by the author, who had primary responsibility for all aspects of each study, including design, data collection, analysis, and manuscript composition. Chapter 3 was developed in discussion with Dr. Andrew Baron, who also provided input into study design and data collection.
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1. Introduction

1.1 General overview

Human cultural diversity is a defining characteristic of our species. Adapting to the wide range of ecologies that our species inhabit, from tropics to tundra to marshland, would be impossible without the capacity to acquire know-how, built up and refined over generations, for living in the local environment. From subsistence (how to hunt, tend to crops, or to shop for produce), and treating disease (which plant, or root, or medication to compound or use), to coexisting with social others (how to engage in courtship, conduct warfare, or implement values such as liberty and equality), and navigating terrain (reading the position of the sun and stars, use maps, or the GPS), “culture” encompasses all “information capable of affecting individuals’ behaviours that they acquire from other members of their species” (Richerson & Boyd, 2005). Human newborns do not possess knowledge of any particular culture, but rather, must learn these from other humans over the course of their lives. The youngest humans, then, must be equipped with a common set of tools that allows them to acquire cultural knowledge. What might this common toolkit contain? And how does the process of cultural learning unfold during the first years of life?

By the time they start school, children already possess a great deal of cultural knowledge. Most typically developing children have command of their native language, express culturally specific food preferences, and can label and use common objects. They also generally abide by their societies’ social norms, which prescribe how to speak and take turns, and proscribe certain kinds of aggression
against others. And yet, despite children clearly demonstrating many forms of cultural knowledge, relatively little is understood about how children become such accomplished cultural learners in such a brief time. Indeed, much more is known about what children know at different ages than about how they traverse from one kind of understanding to another (Needham & Woodward, 2009, p. xviii).

What do earlier forms of cultural learning look like? Are preverbal infants capable of cultural learning, and do they exhibit selectivity in doing so? What are some dimensions along which infants evaluate potential sources of cultural knowledge? This thesis focuses on social evaluative abilities during infancy and early childhood that help cultural novices identify and learn local culture, focusing in particular on evaluating and learning social conventional behaviours.

1.2 Two modes of learning

There are numerous possible ways to learn about the world. Humans, like other species, can discover objective facts about the world through first-person trial and error, aided by reasoning about cause and effect. For example, an individual can pick between several possible tools by trying each one and evaluating the efficacy of the outcomes. This initial trial-and-error will allow the individual to select the best tool for achieving his or her goal in the present, as well as to retain the conclusion for later use. While trial and error learning is certainly a beneficial mechanism for acquiring some forms of knowledge, there are plentiful situations in which learning by trial-and-error proves less beneficial than another common learning mode:
cultural learning\(^1\), whereby knowledge is acquired from others via observation or teaching. Indeed, cultural learning provides many advantages over trial-and-error learning. For instance, it may be dangerous or otherwise costly to learn by trial and error (e.g. touching a hot stove). It is often more expedient to learn from others in situations in which how things work is not obvious or immediately available (e.g. the relationship between being exposed to viruses and subsequently showing flu symptoms). In these situations, cultural learning can save individuals time and effort by observing others’ successes and mistakes.

According to recent estimates, humans’ adaptation to our diverse circumstances was primarily driven by cultural learning, while individual resourcefulness plays a lesser role (Mathew & Perreault, 2015). Humans’ proclivity for cultural learning has been documented extensively in many domains of life. Children and adults learn acts of aggression, prosocial giving, alcohol consumption and littering from others, especially in unfamiliar situations when the appropriate behaviour is unknown or ambiguous (Bandura & McDonald, 1963; Baron, Vandello, & Brunsman, 1996; Goldstein, Cialdini, & Griskevicius, 2008; Prentice & Miller, 1993). Knowledgeable adults facilitate the cultural learning process by demonstrating culturally desirable behaviours, and providing justifications for those behaviours at a level that is appropriate for the learner’s abilities. In turn, children’s reasoning and judgment resemble that of their cultural models (Holstein, 1972; 

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\(^1\) Rather than the common sense understanding of “culture”, in reference to “pop” or “high” culture, here cultural learning refers more broadly to any information learned from a conspecific; it is also commonly referred to as social learning in the literature.
Bandura, Grusec, & Menlove, 1967; Brody & Henderson, 1977), both in the types of arguments used to justify their judgments, and the content of judgments themselves.

Infants in their first year of life imitate a range of behaviours performed by adult models. Starting as early as an hour after birth, infants can imitate facial postures, including tongue protrusions, lip pursing, and finger movements (Meltzoff & Moore, 1983). By the end of the first year and into the second year, infants reliably imitate many novel actions (Buttelmann, Zmyj, Daum, & Carpenter, 2013; DiYanni & Kelemen, 2008; Herrmann, Call, Hernandez-Lloreda, Hare, & Tomasello, 2007; Nielsen, 2006; Zmyj & Daum, 2009; Zmyj et al, 2002); and are even able to successfully imitate failed, or incomplete actions (Meltzoff, 1995).

The clearest evidence that infants learn from others is in the language domain, since there is no way for infants to identify the meaning of words except by hearing others speak. By 9 months, infants already recognize many words referring to common household items and parts of the body, outperforming even their parents reports of their word knowledge (Bergelson & Swingley, 2012). By twelve months of age, infants are adept at discriminating phonemes (speech sounds) of their native language, but have lost the ability to discriminate foreign language phonemes that they were able to differentiate a few months earlier (Kuhl et al., 2006; Werker & Tees, 2005). These results suggest that twelve-month-old infants have learned to recognize the phonemes of their native language. Finally, the complexity and variation in caregivers’ speech predicts infants’ vocabulary and language processing (Fernald, Marchman, & Weisleder, 2012), further supporting the view that infants learn from their caregivers.
One aspect of the current discussion that stands out is the variability in solutions offered by cultures: there are over 6000 languages spoken worldwide, a plethora of possible actions for any given physical context, and competing religious systems that each purport to be the most authentic. Humans are clearly addicted to culture, but how is a learner to ensure that she is learning the “right stuff”?

1.3 Selective cultural learning

Our heavy dependence on knowledge learned from others requires humans to be somewhat credulous. To believe and to rely on culturally transmitted information, we must trust that what others tell us are in large part truthful (Jaswal, 2013; Koenig & Sabbagh, 2013). This tendency to trust is evident in adults and children, who readily learn and act on knowledge that is neither accessible by direct observation nor easily verifiable, such as the shape of the earth (Vosniadou & Brewer, 1994), the life cycle of animals (Giménez & Harris, 2002), the existence of microbial organisms, and how the brain works (Gottfried, Gelman, & Schultz, 1999). This tendency to trust is so strong that learners will sometimes trust another person’s claims even if they conflict with their own observations (Jaswal, 2010; Jaswal, Croft, Setia, & Cole, 2010).

However, learners are not entirely vulnerable to the whims and inconsistencies of potential informants. Even young learners are able to avoid the pitfalls of erroneous information and learn only some information from others. For example, extensive research has shown that given a choice between potential models from which to learn new information, young children are sensitive to a number of dimensions on which informants differ, and preferentially acquire
information from individuals who are likely to provide information that is more accurate, reliable, well-intentioned, and relevant (Koenig & Sabbagh, 2013; Mills, 2013). I will address each dimension below.

1.3.1 Accuracy and reliability.

A first challenge to successful cultural learning is to identify accurate and knowledgeable informants. Indeed, potential models may be unreliable for a number of reasons: 1) they may be poorly informed, overall (a sign that this may be the case is if the model was wrong in the past, or they may seem uncertain or show hesitation); 2) they may lack situationally-relevant information (if they are absent from, or lack visual access to an event); or 3) they may have intentions to deceive or withhold accurate information (they show signs of being uncooperative). Learners must safeguard against these bad models by being choosy about whom to trust and pay attention to.

Research suggests that far from blindly learning from any potential source of information, young children show sensitivity to differences in informants’ past reliability. Three-year-olds assess past reliability of models in word learning—they are more likely to learn novel words from informants who have previously named familiar objects correctly, compared to those who have named them incorrectly (Birch, Vauthier, & Bloom, 2008; Jaswal & Malone, 2007; Jaswal & Neely, 2006; Koenig & Harris, 2005; Koenig, Clément, & Harris, 2004; Pasquini, Corriveau, Koenig, & Harris, 2007; Scofield & Behrend, 2008). By their 4th year, children track the degree of informants’ past reliability in deciding whom to trust, trusting individuals who have been relatively more accurate over those who have been
relatively less accurate (Pasquini et al., 2007). Although 3-year-olds prefer to learn from those who are consistently accurate and reliable, unlike 4-year-olds they fail to differentiate between degrees of accuracy and error; for example, they are no more likely to trust someone who made one mistake and several accurate judgments than someone who made several mistakes.

Children's sensitivity to reliability reflects a direct judgment of the quality of an informant's information that is based on the child's own prior knowledge. Other cues help learners assess informant quality in a more indirect fashion, even if they possess no prior knowledge. One such cue is confidence, which portrays the informant's relative certainty of the quality of the information they are transmitting. Confidence is a useful cue, as it tends to be correlated with actual accuracy: confident informants tend to be more skillful and offer more accurate information than uncertain/hesitant informants (e.g., Sporer, Penrod, Read, & Cutler, 1995). Two-year-olds are sensitive to nonverbal cues of confidence; they prefer to learn from someone who confidently performs an action, compared to someone who performs it unconfidently (Birch, Akmal, & Frampton, 2010). They are also sensitive to verbal cues of confidence: they prefer to learn from a confident informant (who declares “This is a spoon”), to an informant who expresses uncertainty (who says “I think this is a spoon”) (Jaswal & Malone, 2007).

Another indirect cue to informant accuracy is prestige, or the amount of respect a given individual has been granted by others. This is often measured by how much attention is allocated to an individual: those with more respect are often attended to more. Prestige is likely an indirect cue to past accuracy: an informant
who has proven to be reliable in the past is likely to have more respect and be attended to more than someone who was proven unreliable. A learner can thus use the amount of attention directed at an informant as an indirect gauge of previous demonstrated accuracy or reliability. Indeed, 3- and 4-year-olds are more likely to learn from those who others attend to, particularly in the domain in which their prestige was originally observed (Chudek, Heller, Birch, & Henrich, 2012).

Related to prestige, another indirect cue to informant accuracy is informant age. As older individuals are likely to have more knowledge, it would benefit learners to generally learn from older individuals; indeed, children are more likely to learn from older informants, unless those informants have proven unreliable in the past (Jaswal & Neely, 2006; Rakoczy, Hamann, Warneken, & Tomasello, 2010). This tendency to learn from older informants is itself selective, however: children tend to choose similarly aged informants when learning about toys (VanderBorght & Jaswal, 2009).

1.3.2 Situational access.

In addition to being sensitive to who might be more knowledgeable in general, children are also sensitive to the fact that an individual may have knowledge of some situations and not others. Three-year-olds show selective trust for an informant who has demonstrated the source of their knowledge (by looking inside a container) over an informant who has indicated probable ignorance (by guessing or pretending that something is in a container; Koenig, 2012). Similarly, 4- and 5-year-old children are more likely to trust a speaker who has visual access to
an object over a speaker whose vision is limited when learning object labels (Brosseau-Liard & Birch, 2011).

1.3.3 Helpful intentions.

Even if one can determine whether or not a potential informant is knowledgeable, it would be inadvisable to learn from informants who intend to deceive. Research suggests that in the preschool years, young children come to recognize that all informants may not be equally well meaning. For example, 3- to 5-year olds preferentially trust benevolent informants (Mascaro & Sperber, 2009). This ability may not be robust in 3- and 4-year olds, but by 5 years of age children reliably take advice from a benevolent informant (Vanderbilt, Liu, & Heyman, 2011). When both accuracy and benevolence cues are available, 3- to 5-year-olds selectively learn from a person described as an expert vs. a non-expert only when they were also described as nice, rather than mean (Landrum, Mills, & Johnston, 2013). Finally, 5- and 6-year olds are able to discern differently valenced intentions by observing past behaviour; they put greater trust into informants who previously tried to help others more than informants who previously tried to deceive others, regardless of whether their help led to a good or bad outcome (Liu, Vanderbilt, & Heyman, 2013).

1.3.4 Relevance.

One type of challenge that learners face is discerning what information is applicable to their situation, including its relevance to their local sociocultural context. Social rules pertaining to how to use objects, how to behave, and which languages are spoken in a given culture apply to members of particular groups.
When presented with a choice of informants, young learners show sensitivity on dimensions that are indicative of geographical and cultural proximity (stable group membership). One such dimension is whether the learner already knows the individual; children prefer familiar individuals as informants over strangers (Corriveau & Harris, 2009; Harris & Corriveau, 2011). Beyond the immediate family, learners are sensitive to which individuals share their particular culture. For example, 4- and 5-year old children preferentially reproduce object functions demonstrated by native accented speakers of their own language (Corriveau, Kinzler, & Harris, 2013).

Thus, despite a degree of credulity necessary to learn from other people, by 4 years of age, children begin to demonstrate selectivity along dimensions of reliability, benevolence, and relevance in their decisions regarding whom to learn from. Three year olds, in comparison, are less reliable at evaluating along these dimensions, suggestive of developmental change taking place over the 3rd year. How does such selectivity develop? Do children achieve such competency in evaluating potential knowledge sources by toiling through repeated trials of success and failure? Or are they equipped with some evaluative tools from the outset? What do earlier forms of cultural learning mechanisms look like, and what are the relative roles of built-in constraints, and domain-general learning mechanisms in the development of learning abilities from their early manifestations to their mature forms? To answer these questions, populations with less experience in learning are particularly informative to study. In particular, infants in their first months of life have had less time to learn techniques for learning, and also do not have the benefit
of symbolically based learning strategies that are facilitated by language. Next, I turn to the foundations of such selectivity in learning during infancy.

1.4 Learning in preverbal infants.

How do preverbal infants solve the vastly complex problem of knowing what, how, and from whom to learn? To learn successfully, attention must be constrained, rendering some aspects of the world easier to attend to and remember. With few opportunities to learn what aspects of the environment are important to attend to, how might young infants constrain their attention and learning? Humans seem particularly likely to retain certain kinds of information—that is, they are biased in terms of what they learn.

1.4.1 Content biases in learning

Some have proposed that humans possess content biases regarding features of the ancestral environment that consistently posed a threat to survival. For example, snake, spider, and height phobias are all extremely common today, perhaps because although it is rare to die from spider bites today, individuals who feared these threats during human evolution were more likely to survive and reproduce. Indeed, these common phobias are often compared to modern threats like automobile travel, which kill many more people each year than snakes or spiders, and yet almost no one is afraid to get in a car.

Preverbal infants’ reasoning appears to be constrained by domain-specific rules and limits. Research with preverbal infants suggests that content biases may be present in infants’ learning from the first year of life. For example, content biases for learning about the edibility of plants have been shown in 6- and 18-month-old
infants (Wertz & Wynn, 2014). In this work, infants preferentially reached for food from a plant vs. from an artifact, but showed no such selectivity when choosing between things to use. Critically, this preference disappeared in the absence of a social model demonstrating that a plant is good to eat. This biased learning about edibility of plants may be due to the important risk posed by plant toxins over evolutionary history, such that infants will prefer only plants that others have demonstrated to be safe.

Similar content biases appear to exist for infants’ learning of fear of snakes (DeLoache & LoBue, 2009). In this study, infants looked longer toward a film of a snake in motion than a film of other animals in motion, but only when the films were accompanied by a fearful adult voice. In contrast, infants did not show preferential looking when the animals were presented without an accompanying fear voice. These results suggest that rather than possessing an innate fear of snakes, infants may be flexibly prepared to easily acquire fear of snakes; for instance, in the presence of another human who indicates that snakes are threatening. Critically, infants’ readiness to learn fear applies specifically to snakes, and not to various comparison animals. Together, the above examples support the existence of content biases in infant cultural learning, pointing to constraints in the relative ease with which certain types of content can be learned. In addition, they highlight the importance of humans as sources of information, as infants showed preferential learning only in the presence of a human informant.

In addition to having a bias for learning particular kinds of content, human learners are also biased in terms of who or what they learn from. A challenge all
learners face is to identify sources of cultural information, interpret others’ actions and infer the intent behind their communications. To do so effectively requires a number of basic cognitive capacities, including but not limited to an interest in people, the ability to infer goals (in order to identify the model’s intended target or outcome of their modeled actions), and to understand communicative gestures and evaluative states such as pointing, eye gaze, and emotions (Bruner, 1983, 1993).

1.4.2 Source biases in learning

From early on, young humans appear to categorize the world into agents who possess goals and desires, and non-agents that adhere to physical laws but lack psychological states such as goals and preferences. Newborn infants prefer to look at goal-directed actions (grasping a ball) over non-goal oriented movement just 2 days after birth (Craighero, Leo, Umiltà, & Simion, 2011). Six-month-old infants attribute preferences and goals to agents, but not to inanimate mechanical claws (Woodward, 1998). They also attribute valence to actions (good or bad), when interactions are between animate-like agents, but not to similar interactions between non-agentive shapes (Hamlin, Wynn, & Bloom, 2007). An additional expectation that human infants seem to possess is for other people to be sources of information. From shortly after birth, infants are very interested in other people. They are especially attentive to faces, human voices, and especially faces that engage them in eye contact (DeCasper & Fifer, 1980; Farroni, Csibra, Simion, & Johnson, 2002; Goren, Sarty, & Wu, 1975). These preferences serve infants’ learning by attending to expressive parts of the body that are likely to communicate information.
Faces. Within hours after birth, human neonates show a preference for human faces and face-like stimuli (Cassia, Turati, & Simion, 2004; Farroni et al., 2005; Valenza, Simion, Cassia, & Umiltà, 1996), as well as for faces they have been exposed to (Walton & Bower, 1993; Walton, Armstrong, & Bower, 1997). Furthermore, they appear to use this visual information; averaging across faces they have encountered to form a composite “prototype” (Langlois & Roggman, 1990).

Neonates are able to form prototypes very rapidly, capable of creating a composite after a single, one-minute exposure to each of several faces (Walton & Bower, 1993). Important to the task of being a discriminating learner, prototypes are used as a basis for preference; strangers’ faces that are similar to the prototypical average are preferred over those that deviate (Langlois & Roggman, 1990; Pascalis, de Schonen, Morton, Deruelle, & Fabre-Grenet, 1995; Walton, Bower, & Bower, 1992). While this preference for strangers with prototypical appearances seems puzzling, in real life it may serve to help neonates develop a preference for attending to individuals who spend the most time in close proximity to them, such as their primary caretaker, as well as those who look like him/her (kin). Indeed, neonates do show a preference for their mother’s face compared to a stranger’s by just 48 hours after birth (Bushnell, Sai, & Mullin, 1989; Pascalis et al., 1995; Walton et al., 1992). By three months, infants also exhibit a preference for faces of the same gender as their primary caregiver (Quinn, Yahr, Kuhn, Slater, & Pascalis, 2002) and the racial group in their social environment (Bar-Haim, Ziv, Lamy, & Hodes, 2006; Kelly et al., 2005), showing early generalization of experiences with individual faces to groups of
people who share similar traits. These preferences might allow infants to direct preferential attention to potential sources of relevant cultural information.

**Speech sounds.** Newborn infants also prefer speech sounds compared to non-speech sounds of similar pitch and amplitude (Vouloumanos & Werker, 2007). Infant-directed speech, characterized by higher and broader pitch, greater amplitude variation and slower speed than adult-oriented speech also increases infants’ attention and interest toward the speaker (Cooper & Aslin, 1990; Fernald, 1985; Pegg, Werker, & McLeod, 1992; Werker, Pegg, & McLeod, 1994).

**Eye gaze.** An assumption that infants appear to hold is that others are willing and able to share information with them. As early as 9-months, infants look at adults while simultaneously making communicative gestures such as pointing and reaching in bids for help; these efforts increase with age and with difficulty of tasks (Goubet, Rochat, Maire Leblond, & Poss, 2006). Infants appear to be especially attuned to cues indicating that something is being taught, including ostensive pedagogical cues and child-directed speech (Csibra & Gergely, 2006; Gergely & Csibra, 2005). Ostensive communication such as overt speech and eye contact set up “teaching moments” that prepare young learners for demonstrations intended to transfer knowledge. These attention biases for social sources of information may help learners learn both from and about other people.

### 1.4.3 Inferring content of actions

On top of having a desire to attend to cultural informants, learners must identify *what* is being taught. A fundamental aspect of social learning is to recognize that others’ actions are carried out in the service of underlying goals: Alice reached
out because she wanted to grab the cup. Learning to achieve desired outcomes (getting a cup) requires accurately identifying the relevant sequence of actions a model employed (reaching out at an appropriate angle, with a specific hand formation suitable for grasping) to accomplish their goal (a particular cup), and evaluating the outcome (did the model get the cup?). Since goals are invisible mental states, their content must be inferred from overt behaviours.

Numerous studies show that from early on, infants can infer goals from observable actions in a number of ways. Five-month-old infants are able to infer others’ goals from repeated reaching behaviour (Luo & Baillargeon, 2005; Woodward, 1998). By 12 months, they also use cues of equifinality—reaching the same destination via different paths (Gergely, Nádasdy, Csibra, & Bíró, 1995), engaging in contingent behaviour (Johnson, 2003; Johnson, Alpha Shimizu, & Ok, 2007; Shimizu & Johnson, 2004), and rationality—reaching a destination efficiently (Gergely et al., 1995; Gergely, Bekkering, & Király, 2002; Kamewari, Kato, Kanda, Ishiguro, & Hiraki, 2005) to infer the content of others’ goals.

The connection between an agent and their goal does not have to be physical for infants to infer their content. By their first birthday, infants are capable of inferring distal goals through visual attention (Johnson et al., 2007; Moll & Tomasello, 2004; Woodward, 2003), failed actions (Brandone & Wellman, 2009; Hamlin, Hallinan, & Woodward, 2008), and compound goals that require 2 or more contingent steps to complete (Sommerville & Woodward, 2005). They will even use pointing as a way to communicate about and draw others’ attention to their own distant goals (Tomasello, Carpenter, & Liszkowski, 2007; Liszkowski, Carpenter,
Henning, Striano, & Tomasello, 2004). Thus, preverbal infants are equipped to infer the content of other people’s proximal and distal goals via a variety of means by the end of their first year of life.

1.4.4 Using emotions

Before infants can understand or produce language, they are sensitive to affective communications and what they reveal about others’ mental states and their relationship to the external world. Newborns have been found to differentiate happy to sad voices in their own language (Mastropieri & Turkewitz, 1999). By 4 months after birth, infants reliably differentiate between and sometimes recognize facial expressions of anger, fear and happiness (Haviland & Lelwica, 1987; LaBarbera, Izard, Vietze, & Parisi, 1976; Montague & Walker-Andrews, 2001). Five-month-olds can discriminate among vocal expressions of emotion presented in infant-directed speech in their native or a foreign language (Fernald, 1993), or adult-directed speech accompanied by a facial expression (Walker-Andrews & Grolnick, 1983; Walker-Andrews & Lennon, 1991). Five-month-olds are also adept at discriminating between dynamically presented expressions of emotion (Caron, Caron, & MacLean, 1988).

By 5.5 months, infants have been shown to regulate their own behaviour toward objects that other individuals had previously emoted towards; infants are more likely to touch an object that had received a happy reaction compared to a fearful reaction, so long as there are redundant facial and vocal emotional expressions available (Vaillant-Molina & Bahrick, 2012). By the end of the first year, infants reliably regulate their behaviours in response to emotional communications
through a single modality (Klinnert, Emde, Butterfield, & Campos, 1986; Hornik, Risenhoover, & Gunnar, 1987; Mumme, Fernald, & Herrera, 1996; Sorce, Emde, Campos, & Klinnert, 1985). While a combination of vocal and facial expressions continues to be most potent for affecting infants’ behaviour, vocal cues alone appear to be more effective than facial cues alone (Mumme et al., 1996; Vaish & Striano, 2004).

Also toward the end of the first year, infants begin to actively seek out other people for emotional information regarding an ambiguous event (Striano & Rochat, 2000; Walden & Ogan, 1988). Around the same time, infants demonstrate an ability to use an emoter’s affective displays toward objects to predict her subsequent object choice; they fail to do so if the emoter was looking away from the object, suggesting that they understand emotions as referential communications about a target (Flom & Johnson, 2011; Phillips, Wellman, & Spelke, 2002; Repacholi, 1998).

The above discussion indicates that preverbal infants are demonstrably selective in knowledge content and source, preferentially learning adaptive-relevant content from social sources. Furthermore, they are able to perceive the intended outcomes of others’ actions and reactions, through direct instruction as well as through observation. These abilities set the stage for cultural learning in infancy, channeling young humans’ attention toward cultural conspecifics, and equipping them to understand conspecifics’ behaviours. With these abilities alone, infants may be capable of identifying causally effective actions for achieving a number of desired physical outcomes, such as reaching a toy, or opening a jar. However, by themselves, these abilities are insufficient for learning about conventional behaviours, for these
vary by culture, yet typically are not evaluable by physical causality. To learn about conventional behaviours, learners must rely on identifying knowledgeable sources, or by analyzing the conventionality of the behaviours themselves. Next, I turn to infants’ capacities for identifying good sources of cultural knowledge.

1.5 Evaluating sources of cultural knowledge

Successful cultural learning requires identifying appropriate models; something that, as reviewed above, young children are already adept at. Are preverbal infants also sensitive to cues that may be indicative of relevant and accurate information and sources? There is mounting evidence that even very young infants discriminate between potential sources on a number of dimensions, and moderate their behaviours based on these differential evaluations.

1.5.1 Evaluation by behavioural valence

Within one’s cultural group, individuals vary in the extent to which they are able and willing to share knowledge. As discussed above, preschool aged children are capable of determining whether someone is a competent and/or benevolent informant. This sensitivity appears to be ontogenetically precocious, as even preverbal infants form evaluations based on the degree to which an individual’s actions are cooperative or prosocial. As early as 3-months after birth, and robustly through the first year, infants appear sensitive to the valence of others’ actions, preferring those who behave prosocially vs. antisocially (Hamlin et al., 2007; Hamlin & Wynn, 2011). In addition to informing their evaluations, benevolence appears to also influence infants’ choice of cultural models: 16 month olds fail to match the
food preferences of a previously mean individual, but readily imitate the food preferences of nice and neutral individuals (Hamlin & Wynn, 2012).

Infants also prefer to learn from informants who were reliable in the past (see Harris & Lane, 2014 for a review). For example, 8-month-old infants selectively look in the direction cued by a previously reliable informant, but not a previously unreliable informant (Tummeltshammer, Wu, Sobel, & Kirkham, 2014b). Fourteen month olds are more likely to imitate individuals who reacted appropriately in the past, and discount individuals who displayed inappropriate emotional reactions to the contents of a container, in whether to follow their eye gaze (Chow, Poulin-Dubois, & Lewis, 2008), and to imitate their unusual method of turning on a light (Poulin-Dubois, Brooker, & Polonia, 2011). They also tend to imitate competent informants who use objects correctly compared to incompetent informants who use objects incorrectly (Zmyj, Buttelmann, Carpenter, & Daum, 2010).

The research reviewed above on infants’ social evaluations and learning suggest that infants distinguish potential informants based on their past reliability and helpfulness, both of which are relevant attributes of a good cultural informant. Next, I will focus on informant qualities that are important to learning about cultural conventional behaviours from individuals infants have no prior knowledge about: they neither displayed inaccurate or nonsensical behaviours, nor were their behaviours nice or mean. I will review suggestive evidence that even young, preverbal infants may be capable of learning about and evaluating inherently neutral actions, using existing skills such as their sensitivity to group membership, statistical regularity, and others’ emotional reactions.
1.5.2 Evaluation by group membership

One way in which preverbal infants’ sensitivity to differential informant quality has been studied is by looking at their attention and liking for a pair of individuals differing on a relevant dimension, such as familiarity, or gender. While these studies do not directly measure learning, selective attention and liking arguably create opportunities for learning, as learners pay more attention to positively evaluated targets, and in doing so foregoing exposure to alternative models. Using these preference methods, infants in their first six months of life evaluate others based on stable indicators of social group membership, preferring individuals of their same racial group, and those who speak their native language (Bar-Haim et al., 2006; Kinzler, Dupoux, & Spelke, 2007). By the end of their first year, infants are also more likely to accept toys and food offered by a speaker of infants’ own dialect, but not from someone of their own race (Kinzler et al., 2007; Shutts, Kinzler, McKee, & Spelke, 2009). Infants even form evaluations based on stable behavioural markers such as food preferences, namely, whether a puppet shares infants' own expressed food preference (Mahajan & Wynn, 2012). Like dialect and morphology, food preferences co-vary with social group, and are strongly influenced by prenatal exposure to maternal diet and postnatal observational learning (Addessi, Galloway, Visalberghi, & Birch, 2005; Baeyens, Vansteenwegen, De Houwer, & Crombez, 1996; Mennella, Jagnow, & Beauchamp, 2001). Infants' evaluations are not limited to those who share or differ from their food preferences; they also extend to 3rd parties who interact with those individuals, preferring individuals who help those who share their food preferences, as well as
individuals who harm those who do not (Hamlin, Mahajan, Liberman, & Wynn, 2013). Thus, preverbal infants seem quite capable of identifying individuals who may be in their social in-group and who will likely be good sources of culturally relevant information.

1.5.3 Evaluation by statistical information

Statistical regularity is an important component to infants’ early visual preferences. Three-month-old infants prefer the faces of the gender of their primary caregiver (Quinn et al., 2002). Six-month-old infants prefer faces that more closely resemble the statistical average of faces they have encountered (Rubenstein, Kalakanis, & Langlois, 1999). The influence of statistical regularity extends to preverbal infants’ evaluations of informants on the basis of their behaviours. Young infants preferentially attend to informants who act with a high degree of consistency (Tummeltshammer, Mareschal, & Kirkham, 2014a). Infants in their second year also evaluate reliability by the extent to which a model uses a conventional label or demonstrates the conventional usage for a familiar object (Poulin-Dubois et al., 2011; Zmyj et al., 2010). This result suggests that they are able to track how people typically behave in a given situation, and compare new behaviours against a prototype of past experiences that held similar relevant features. Could young preverbal infants apply their facility with tracking statistical regularities to evaluate and learn about intrinsically neutral targets? Given the highly consistent nature of conventional actions, infants may be able to use their sensitivity to statistical information to evaluate people who engage in different behaviours that are inherently neither good nor bad, but are nevertheless
differentially valued. This question will be examined in Chapters 2 and 3 of this dissertation.

1.5.4 Evaluation by emotional cues.

As reviewed above, infants’ early emerging understanding of emotions as communicative signals allow them to tap into other people's evaluations of an ambiguous situation to inform their own responses accordingly. Do they also use others’ emotional reactions as a tool for learning about unfamiliar people and their actions?

To date, three studies have examined relevant aspects of infants’ observational learning using emotional cues. Repacholi & Meltzoff (2007) found that 18-month-olds are able to learn evaluations of objects based on emotional reactions. In the study, infants watched an individual manipulate objects, while an observer expressed either angry or neutral affect toward these actions. When given the opportunity to play with the objects, infants who had observed the observer's anger avoided the objects, whereas those who had observed a neutral reaction were more likely to manipulate the objects. However, in this study, infants’ learning was specific to the individual who displayed their emotional reaction, and behaved in a manner consistent with the emoter’s emotional expression only when he or she was present. Infants did not regulate their behaviours across contexts when the original emoter was absent, suggesting they did not infer that positive and negative reactions were due to objective characteristics of the objects (i.e. Mom had a negative reaction to the object because it is bad, or dangerous).
While learning individual preferences is one desirable outcome of cultural learning, amassing shared, more generalizable knowledge about what objects are good to use and which individuals are safe to interact with can help infants navigate a broader range of situations. Eighteen-month-old infants do appear to infer object-specific evaluations when it was preceded by ostensive signals (i.e. the emoter first looked at the infant before evaluating the object; Egyed, Kiraly, & Gergely, 2013). When ostensive signals were lacking, they interpreted the evaluation to be a person-specific preference, and did not use the emotional reactions to regulate their own interactions with the object (i.e. they did not generalize the evaluations to pertain to their own interactions with the object).

A recent study by Vaish, Grossmann, & Woodward (2015) suggest that infants’ willingness to generalize evaluations may be moderated by their emotional valence. The study found that 2-year-olds were more likely to generalize an emoter’s negative evaluations of an object to new individuals, whereas they did not tend to do so for positive emotions. Thus, negative emotional reactions may be attributed to the object itself, whereas positive emotional reactions may be an attitude held by a specific individual.

Could younger infants as bystanders extract target-centered information from other people’s emotional reactions and use it to guide their own behaviours with regards to people, and to objects? This question will be examined in Chapter 4 of this dissertation.
1.6 Cultural differences in cultural learning?

The discussion thus far has focused heavily on universal aspects of early social cognition underlying humans’ impressive ability to learn culture. Conspicuously absent is a treatment of cultural variation itself. Indeed, cultural differences are plain by early childhood, and only grow thereafter. But when exactly do these differences begin to emerge? Do infants and toddlers across the world more or less resemble one another until they enter school age? Or do they exhibit differences much sooner? And more specifically, how similar or different are the ways in which infants growing up in different cultures engage in cultural learning? Do young humans engage in cultural learning using a universal set of mechanisms, applied in uniform ways, or does cultural learning set learners on divergent trajectories early on?

At the broadest level, the social and economic arrangements of the larger society in which development unfolds impacts infants’ earliest experiences. Infants born in traditional societies are typically surrounded by peers and by members of the extended family, many of who actively contribute to child rearing, and participate extensively in the infant’s life (Chen, French, Schneider, 2006; LeVine, 1988). In contrast, infants growing up in societies consisting predominantly of nuclear families are typically raised by one or 2 parents, along with any older siblings. Whether an infant is raised by a community, or in a nuclear family context has been shown to result in differences of attachment quality: infants who have many alloparents experience attachment with several individuals, but less intensely with each individual, than do infants growing up with a single caregiver. Attachment
relationships have implications for learning: infants raised by a community of caregivers are exposed to more potential cultural models than are those raised by parents in nuclear families, and also have more opportunities to exercise selectivity in model choice.

Infants develop in contexts structured by primary socialization agents (usually parents), who form the earliest sources of cultural transmission. Parenting behaviours are typically informed by valued developmental outcomes, and aimed to prepare children for the local cultural environment (Keller, 2007). Differential emphasis on aspects of the environment has been documented in several cross-cultural studies comparing parent and parent interactions. For instance, North American parents view autonomy and independence as valued outcomes of development, whereas relatively more interdependent Japanese parents value social relatedness as an ideal outcome. Consistent with these values, American mothers have been found to be more responsive when their children orient to physical objects in the environment, while Japanese mothers are more responsive when their infants oriented to them (Fernald & Morikawa, 1993; Fogel, Toda, & Kawai, 1988; Bornstein et al, 1992; Tamis-LeMonda, Bornstein, Cyphers, Toda, & Ogino, 1992). Implicit in these interactions are differential valuation of learning about objects in the environment, and social routines in these two cultures. Through these reinforcement events, infants in North American cultures may learn that accurately predicting the behaviour and functions of objects is important, whereas infants in East Asian cultures may learn that accurately interpreting the social cues and empathizing with one’s interaction partners is more important.
Indeed, even the extent to which members of a culture engage in active teaching is not universal. In Western cultures, adults often heavily scaffold infants’ exploration and learning about objects (Bornstein, 2002; Keller et al., 2009). However, in many non-Western societies, learning experiences are often more collaborative (Rogoff et al., 1993), and may occur in the absence of adult participation altogether (Bakeman, Adamson, Konner, & Barr, 1990). In lieu of active pedagogy by adults, early cultural learning in many societies takes the form of observational learning (Heyes, 2012; Lancy, Bock, & Gaskins, 2010; Odden & Rochat, 2004). For example, Mayan children tend to learn through overhearing conversation, whereas American children more often participate directly in language exchanges (Shneidman & Goldin-Meadow, 2012).

Caregivers also employ culturally variable methods for communicating information, particularly for fostering their children’s learning (Bornstein, Cote, Haynes, Suwalsky, & Bakeman, 2012; Herrmann, Legare, Harris, & Whitehouse, 2013; Legare & Nielsen, in press; Mathew & Perreault, 2015). One example of such cross-cultural difference is the extent to which parents rely on at-a-distance communication using facial and vocal utterances (in visual joint attention) versus physical manipulations of their child’s bodies (physical joint attention) to teach about objects (Little, Carver, & Legare, 2015). The former pattern of interaction is predominantly characteristic of Western urban settings (Duranti, 2009; Richman, Miller, & LeVine, 1992), whereas the latter is more common in traditional societies. These differences may be a manifestation of the broader socialization values described earlier: extensive bodily contact and direct physical manipulation tend to
foster reliance on the caregiver and facilitate bonds of closeness, while physical separation and at-a-distance communication fosters independence and autonomous judgment and decision-making (Keller, 2007).

We might expect early differences in social and emotional experiences to have cascading downstream effects on social cognition. Early pathways may influence developmental outcomes by canalizing and constraining subsequent attention, preferences, and learning. For example, preference for one's native language, though arrived at similarly for infants across cultures (through exposure and familiarity), channels their subsequent attention to native language speakers (Kinzler et al., 2007; Moon, Cooper, Fifer, 1993). Attentional biases earlier in development may influence which groups of people infants are more likely to accept a toy from by 10 months (Kinzler, 2007), learn from by 14 months (Buttelmann et al., 2013), and friendship choices by 5 years of age (Kinzler et al., 2007). Thus, differences in early cultural learning experiences may create diverging outcomes with lasting impact on development. This question of cultural differences in cultural learning will be explored in Chapter 5.

1.7 Thesis rationale and outline of subsequent chapters

The chapters within this dissertation examine how the youngest humans engage in cultural learning about conventional behaviours. In particular, they ask whether preverbal infants and preschool aged children have the means available to evaluate others using cues such as who performs common actions, how others react emotionally to actions and individuals, and via culturally specific pedagogical social interactions. In Chapter 2, infants' preference for individuals who perform a
consensus action vs. an oft-repeated action is examined, and evidence suggests that sensitivity to the distribution of actions emerges early. Chapter 3 extends on Chapter 2 by investigating the developmental trajectory of using consensus to inform subsequent learning of new information in pre-school aged children.

Chapter 4 examines the developmental trajectory of preverbal infants’ observational learning about people and objects via bystander reactions. It presents evidence that not only are interpretations of emotional cues constrained by domain (specifically, infants use bystander's emotional reactions differently when they refer to social vs. inanimate targets), but also that cultural differences in the use of emotional cues for social learning are present by 6 months of age.

Chapter 5 investigates how parents convey evaluative messages about targets during interactions with infants, and explore cultural differences in these pedagogical interactions. In particular, the study focuses on cultural differences in reliance on at-a-distance vocal communications and direct physical manipulation.
2. Preverbal infants’ context dependent preferences for conformists vs. innovators

2.1 Introduction

The capacity to evaluate potential social partners—to tell friend from foe, and expert from novice—is foundational to human social life. Friends confer numerous benefits, from sharing knowledge and resources to cooperatively completing large tasks that are impossible to tackle individually. Social others are also an efficient source of knowledge, as learning from others eliminates much of the costs of trial-and-error learning, and learning social conventions makes it possible to coordinate group activities. Humans evaluate others intuitively and effortlessly, along dimensions such as skill, ethnicity, gender, age, and appearance (Quinn et al., 2002; Rakoczy et al., 2010; Rubenstein et al., 1999). Just what qualities make a good social partner at any given moment, however, may vary depending on one’s interactional goals and situational needs. What are the ontogenetic origins of context dependent, flexible social evaluations?

Studies with children have demonstrated flexibility in learning early on in development, being sensitive to contextual factors and situationally salient motivations. In choosing how to learn, children use both imitation—learning faithfully from others, and innovation—recombining extant behaviours in one’s repertoire into novel forms. Children may favour imitation when learning social conventions that are particular to their social group (e.g. dancing the macarena), and which requires a high degree of fidelity to reproduce (Kenward, 2012; Legare & Nielsen, in press). In contrast, children may favour innovation when learning
instrumental behaviours targeted at effectively reaching a functional outcome (e.g. making the biggest sandcastle; (Legare, Wen, Herrmann, & Whitehouse, 2015).

Furthermore, the fidelity with which children imitate may differ with context. Children are at times rational imitators, effective at extracting causally relevant aspects of behaviours for achieving a particular goal (Carpenter, Akhtar, & Tomasello, 1998; Gergely et al., 2002; Meltzoff, 1995); at other times, children are over-imitators, copying actions that are causally irrelevant to their desired end goal (Gergely & Csibra, 2006; Horner & Whiten, 2005; Lyons, Young, & Keil, 2007). Children’s flexibility in switching between rational and over-imitation appear to be moderated by contextually salient goals: efficient learning motivation leads to rational learning, whereas affiliation with social others is more likely to lead to over-imitation (Nielsen, 2006; Over & Carpenter, 2012).

While there does not appear to be similarly strong evidence of context-dependent learning in the first year of life, results from a number of studies suggest that even preverbal infants may make flexible, context-dependent evaluations of others’ actions for the purpose of identifying good social partners. There appear to be 2 primary avenues for doing so: evaluating behaviours and assessing group membership. One aspect of behaviour that has important implications for social interaction is the degree to which a person is cooperative and trustworthy. Cooperative acts include working towards a common goal or resource (e.g. paying taxes, or not littering to keep the streets clean), not exploiting others when opportunities arise (e.g. stealing unattended laptops in a coffee shop), teaching useful skills and knowledge (e.g. helping a child to ride a bike), and not
deceiving/misleading others. From this perspective, good social partners are individuals who help rather than harm others (i.e. are prosocial).

A second avenue for evaluating social partners is by a person’s group membership. Behaviours do not take place in a vacuum, but instead, in the sociocultural context of a social group. Successful cooperation gave rise to humans living in cultural groups that share a language, customs, beliefs and attitudes (Henrich & Henrich, 2007). These shared behaviours facilitate social interaction through shared understanding, reducing the burden of having to negotiate the terms of engagement in each new interaction. Group membership is thus useful for identifying good social partners as individuals whose attitudes and behaviours we can understand and predict, and thereby interact with successfully.

Recent research on the development of social evaluation has found that humans do evaluate potential social partners on the basis of their behaviours from an early age. As early as five months, human infants prefer those who help over those who hinder others’ from achieving their goals (Hamlin & Wynn, 2011). Consistent support for such prosocial preferences has been found with 3-month-old infants, who look longer (interpreted as preference) at individuals who help others achieve their goals than individuals who hinder others from achieving their goals (Hamlin, Wynn, & Bloom, 2010).

However, these preferences are not absolute, as young infants’ evaluations are sensitive to the contexts in which behaviours take place. When the past history of the target is known, 5-month-old infants take the overall moral balance into account in their evaluations, preferring an agent who helps a previously helpful
target and an agent who hinders a previously anti-social target. Nine- and 14-month-old infants further take into account the target's similarities to oneself to help them evaluate their behaviours (Hamlin et al., 2013). Similarity to self may predict similarity along other dimensions that pave the way to friendship (people who listen to the same music are also likely to enjoy the same food). Underlying such similarities may be common cultural group membership from which we develop our palate and acquire our music preferences.

Evidence also exists for young infants' evaluations on the basis of group membership. In the first few months of life, infants appear capable of discriminating between individuals based on dialect (Kinzler, Corriveau, & Harris, 2007), ethnic appearance (Bar-Haim et al., 2006) and similarity of food preferences (Mahajan & Wynn, 2012). These preferences may help learners identify individuals who likely belong to the same cultural group, and who are therefore “good bets” to learn from; as infants who prefer speakers of their native dialect are also likely to correctly identify in-group members who possess knowledge of their culture. Furthermore, since those who live in physical proximity are also likely to possess locally relevant cultural knowledge, a preference for individuals with familiar appearances should tend to increase the likelihood that infants will easily identify and prefer to attend to members of their own culture. Finally, humans learn what is good to eat through observational learning, promoting a strong group-based food preference (Addessi et al., 2005; Baeyens et al., 1996; Shutts et al., 2009). Therefore, liking others who share similar food preferences can also help infants identify in-group members.
As with behaviours, evaluations of group membership are also context dependent. Children and adults flexibly assign temporary group membership to others in our language community when travelling abroad, yet at a moment’s notice, will reform group boundaries based on sex when locating the correct washroom. Even 19-month-old infants show such flexibility in making assessments of group membership in 3rd party contexts (Sloane, Baillargeon, & Premack, in prep). They expect individuals with dissimilar appearances to receive different treatment based on group membership, yet can flexibly reimage these dissimilar-looking individuals to be part of the same group, deserving of similar treatment, following a brief episode of coordinated play. This latter finding suggests that infants can make complex analyses of identifying members of a community through their behaviours, and further, evaluate the appropriateness of a 3rd party’s behaviours towards those individuals based on their group membership.

The ability to evaluate goal-oriented social behaviours and facets of group membership can serve a cultural novice quite well in identifying good social partners. However, a vast number of human social behaviour are not based on physical causality, nor are clearly marked in terms of group membership. Instead, they are governed by social conventions—shared rules, or a group’s characteristic ways of doing things that are arbitrary in nature. They include rules such as when and where one must wear clothing, whether it is acceptable to litter, and what utensils (or which hand) should be used for eating (Bickman, 1972; Elster, 1989; (Searle, 2010; Tomasello & Rakoczy, 2003).
One cue that could hint at conventionality for cultural novices is that the prevalence of behaviours tend to correlate positively with how accepted they are (Cialdini, Reno, & Kallgren, 1990). For instance, the socially accepted manner of eating a sandwich is with one’s hands, which corresponds with the observation that most people eating sandwiches can be seen eating them with their hands. In contrast, ravioli is eaten with cutlery, and the majority of ravioli eaters do so, with few people eating it with their hands. For a naïve individual buying a sandwich at a deli, a quick look to other deli patrons may indicate to him or her that the accepted and safe thing to do is to eat a sandwich with his or her hands, rather than with fork and knife or chopsticks. Thus, when it comes to conventional behaviours, a mechanism for identifying a “good” social partner may involve assessing the degree to which someone’s actions are prevalent in the environment.

A recent study by Powell and Spelke (2013) suggest that there might be innate expectations for conventionality in infancy. The study showed that 8 to 12 month old infants expected members of social groups to behave as fellow group members do. This expectation existed only for animate, social agents (self-propelled shapes with eyes), and not for inanimate objects (similar shapes without eyes, and propelled by an external force). Infants made attributions of same-group membership for individuals who engaged in similar actions, even if their appearances differed. This study supports the notion that infants may possess inherent expectations that group members produce similar behaviours. That is, they may have some notion that behaviours are bound by conventions.
Given infants’ apparent sensitivity to conventional behaviours, can they use this to evaluate social others who appear to conform to them? Positively evaluating and associating with individuals who perform conventional acts may serve a naïve learner well, particularly in situations where individuals’ group identity is uncertain. However, when one is in familiar environs, associating with individuals who may be more knowledgeable may be preferable. More-knowledgeable individuals may deviate from conventional behaviours and appearances because they have access to techniques and skills that perform better than average. For example, while the majority of children can identify a green leafy organism as a “plant”, some children might have the additional ability to identify the plant as “stinging nettle” and know of its poisonous properties. Thus, while labeling the organism as a “plant” in English rather than in Spanish is a good indicator of group membership in an English speaking culture, labeling that plant as "stinging nettle" puts one in a knowledgeable minority. Associating with the latter group of more-knowledgeable individuals would be beneficial to a naïve learner.

Are infants sensitive to the distribution of frequent behaviours (widely distributed frequent behaviours being a sign of conventionality)? And can they use such distributional information to inform their evaluations of individuals who perform the actions, and do so in a context-flexible manner? Infants have already demonstrated sensitivity to the frequency of exposure in learning contexts in past studies. Preverbal infants prefer people, faces, gender, flavours and languages to which they have received more exposure and are therefore more familiar (Kelly et al., 2005; Kinzler et al., 2007; 2010; Langlois & Roggman, 1990; Mennella et al.,
2001; Ramsey, Langlois, & Marti, 2005). However, not all frequent behaviours are equivalent. Whereas an individual repeatedly performing an action can provide a predictable signal that facilitates learning, or suggest that a particular individual has a preference for performing the behaviour, it is only when several individuals perform the same behaviour that it is possible to assume that the behaviour is conventional amongst a group.

In the set of studies presented here, we examined whether 7-month-old infants use actors’ performance of prevalent behaviours to inform their social evaluations. We investigated whether infants’ evaluations differ according to contextual information provided; specifically, the distribution of frequent behaviours, and whether the targets of evaluation demonstrated prior knowledge of the frequent behaviours. Study 1 presented infants with videos in which several animated shapes with faces (Demonstrators) performed physical movements that resemble dances. Demonstrators exited after their dance, followed by the appearance of 2 Protagonists; one performed the same movement sequence as the Demonstrators, and the other completed a novel sequence of movements (from here on in, referred to as a “dance”).

Study 1 created a scenario where the Protagonist lacked opportunity to learn the Demonstrators’ dance. Opportunity to learn the dance was manipulated by Protagonists’ physical presence vs. absence onscreen during the dance demonstration. Protagonists’ absence during the demonstration was intended to convey their lack of visual access to the performance, and thus lack of opportunity to learn the physical dance sequence. Previous studies have found infants to be
sensitive to visual access, taking into account barriers and blindfolds that can obstruct one’s view (Brooks & Meltzoff, 2002; Luo & Baillargeon, 2007), and thus, access to situationally relevant information. For example, 16-month-olds are more surprised by agents who incorrectly label a familiar object when they are facing the object, than when they are facing away from the object (Koenig & Echols, 2003). Thus, Protagonists’ absence is intended to convey their lack of visual access, and therefore opportunity to learn the Demonstrators’ dance, and performance of the same dance is due to the Protagonist’s prior knowledge.

Half of study participants saw the Consensus condition stimuli described above; the other half saw the Repetition condition stimuli in which the dance is repeatedly performed by a single Demonstrator, rather than by all 4 Demonstrators. This was designed to contrast a scenario in which the Demonstrators’ dance was a shared, conventional dance. In contrast, the high frequency dance did not have the characteristics of appearing conventional in the Repetition condition. If infants form preferences based on a group-level analysis, they should only show a preference in the Consensus, and not the Repetition condition. However, if infants perform a frequency-based analysis, then they should show a preference in both Consensus and Repetition conditions and disregard the distribution of behaviours across Demonstrators.

Study 2 used the same video stimuli, save for 1 difference: in this study, the Protagonists were present during the Demonstrators’ dance. This alteration created a scenario in which Protagonists could imitate the Demonstrators on the spot, and therefore provided no information regarding Protagonists’ prior knowledge of the
group dance. In this altered context, the Protagonist who performed the more common behaviour would merely be a copycat, rather than someone who was “in the know”. Given everyone’s equal standing in access to the group dance, the question prompted in Study 2 may be “who knows more?” As with Study 1, this question requires a group-level analysis, since “knowing more” requires an assessment of the average knowledge level of the group. A novel dance may be perceived as a new piece of dance if everyone else performed the same dance (the average knowledge level is the one piece of dance); however, a novel dance performed in the context of an oft-repeated dance by a single Demonstrator does not provide any information about how much more or less the dancer knows relative to everyone else in the group. When there is information about average knowledge in a group, infants who prefer more knowledgeable individuals may show a preference for the maverick, or the novel-dance Protagonist. Infants’ preferences in both studies were measured by their choice between same-dance and novel-dance Protagonists.

2.2 Study 1

The present study examined whether infants prefer those who have knowledge of common actions.

2.2.1 Method

Sixty-four full term 7-month-old infants participated in this study. Thirty girls (47%), 34 boys (M age = 7.0; range = 6.3 – 7.6) participated. Data from 7 additional infants were discarded because of fussiness (n = 4), failure to make a choice (n = 1), parental interference (n = 1), and equipment failure (n = 1). Infants
were from a range of ethnic backgrounds (51% European, 18.5% East Asian, 11% South and South East Asian, 5% North American, including First Nations, 3% Central and Latin American, 1.5% African, and 10% from other ethnicities, and 15% were born to families from 2 or more cultures). Infants were recruited through the database maintained by the University of British Columbia Early Development Research Group, and were given a token gift for their participation. Infants watched these videos while seated in their parent’s lap in front of a TV screen. Parents were instructed not to communicate or to point during the presentation of the stimuli.

Videos depicted animated characters engaging in neutral, arbitrary action sequences (“dances”), and which did not contain intrinsic indicators of quality or correctness. Two Demonstrator dances were used, a somersault dance, and a jumping dance, and 2 novel dances were used, a rolling dance, and a jittering dance. Dances were equated for amount of physical displacement and rate of movement, so as to appear similar in attractiveness. In one video, the Demonstrator(s) performed the somersault dance as the frequent dance; the same-dance Protagonist also performed the somersault dance, and the novel-dance Protagonist performed the rolling dance. In the other video, Demonstrator(s) performed the jumping dance as the frequent dance; here, the same-dance Protagonist also performed the jumping dance, whereas the novel-dance Protagonist performed the jittering dance. Each infant was familiarized to 2 repetitions of both videos (presentation order of videos was counterbalanced), for a total of 4 one-minute videos. Thus, every infant saw Demonstrators perform both the somersault and jumping dances as frequent
dances; to evaluate the Protagonists, they had to extract the similarity of their dances to the Demonstrators’ across both videos.

Each video contained 3 phases: an entrance phase, a demonstration phase, and a performance phase. The entrance phase begins with 4 Demonstrators entering from the left side the screen. Demonstrators are simple geometric shapes with eyes, each bearing a unique colour. These “Demonstrators” proceeded to the right side of the screen, arrange themselves in a vertical column, and directed their eye gaze toward the centre of the screen. During the demonstration phase, each Demonstrator moved to the centre of the screen, performed the somersault (or jumping) dance, and then returned to its place in the right column. At the end of the demonstration phase, all of the Demonstrators exited the screen on the top right.

To examine the effect of knowledge on social preference, the targets of evaluation (Protagonists) were absent during the Demonstration phase. This is to convey that the Protagonists do not have an opportunity to learn the somersault (or jumping) dance on the spot, and their subsequent performance of the same dance is a product of prior knowledge (presumably because they are part of the in-group). Once the Demonstrators leave, two “Protagonists” enter together from the left side, arrange themselves into a vertical column on the left, and direct their gaze toward the centre of the screen. Finally, during the performance phase, the 2 Protagonists on the left side of the screen take turns performing dances. One Protagonist performs the somersault dance (same dance as the Demonstrators) suggesting it has prior knowledge of the Demonstrators’ actions, and the other performs the rolling dance (novel dance) suggesting that it may not have prior knowledge of the
Demonstrators’ actions. The order in which Protagonists performed their dances was counterbalanced across subjects. See Figure 1 for stills of the video sequences.

In order to compare the effect of consensus frequency vs. repetitive frequency on infants’ preferences, half of our participants were assigned to a Repetition condition. In contrast to the Consensus condition described above, only a single Demonstrator performed the same dance 4 times during the demonstration phase, while the rest remained stationary. The stimuli and procedures were otherwise identical across the two conditions. We predicted that infants would prefer the Protagonist who performed the same action as the Demonstrators, exhibiting prior knowledge of that group’s actions, in the Consensus, but not in the Repetition condition.

**Figure 2.1** Stimuli for Study 1: only Demonstrators enter the screen (top left). Demonstrators perform same action sequence one after another (top right). After Demonstrators leave stage, Protagonists enter stage; one performs the same dance as Demonstrators, the other Protagonist performs a new dance.
Following presentation of the stimuli, parents were asked to close their eyes. A research assistant blind to the condition (Consensus or Repetition condition) and to the identity of the Protagonists (who performed the same vs. novel dance) presented the infant with a choice of the Protagonists, and asked, "Would you like to play with one?" A successful choice was noted when the infant looked at both choices, then reached for one of them via a visually guided reach.

### 2.2.2 Results

Infants in the Consensus condition preferred the Protagonist who performed the same dance as the Demonstrators, suggestive of prior knowledge of the group’s actions (23 vs. 9; binomial probability test, \( p = .01 \)). In contrast, infants in the Repetition condition chose the same-dance and novel-dance Protagonists equally; suggesting that simply performing a frequently observed dance is insufficient to generate a preference (17 vs. 15; binomial probability test, \( p = .43 \)). The difference between these conditions was marginally significant in the predicted direction (one-tailed Fisher’s Exact probability test = .098). There was no effect of order of events, type of dance, color or side of Protagonist on any comparison.

### 2.2.3 Discussion

Seven-month-old infants preferred actors who performed an action that was previously performed by a 4-member consensus. However, they did not show such a preference for someone who performed an equally frequent, but non-consensus behaviour. By holding the frequency of dances constant across conditions, we were able to rule out familiarity preference as the reason for infants’ choice, since infants received equal exposure to the Demonstrators’ dance in the Repetition condition as
in the Consensus condition, without a commensurate increase in preference for the same-dance Protagonist. This suggests that infants used the distribution of frequency information to evaluate actions, and those who perform them.

Furthermore, infants’ choices in the Consensus condition are consistent with our prediction that infants prefer individuals who know the group’s shared dance.

A question that remains unaddressed by the present study is the possibility that rather than liking those “in the know”, infants prefer individuals who imitate others. For example, infants could have inferred the presence of the Protagonists off-stage during the Demonstrators’ performance, and subsequently mimicked their dances after their departure. Indeed, humans are quite sensitive to imitation, and respond well to being imitated. In experimental settings, people show greater liking, higher levels of trust, and more prosocial helping to those who imitate us (Bargh & Chartrand, 1999; van Baaren, Holland, Steenaert, & van Knippenberg, 2003). Could Study 1 results be explained by a consistent preference for imitators to mavericks?
There are reasons to believe that this is not necessarily the case. While those who behave conventionally signal that they are members of the in-group, the average Joe is also limited as a source of new insight. If infants are motivated to identify good sources of cultural knowledge and can flexibly moderate their motivations and criteria for “good social partner” according to situational need, they might prefer to associate with extra-knowledgeable individuals who deviate from the group because they have better-than-average information (as in the plant vs. poison ivy example given earlier).

2.3 Study 2

To determine whether infants’ preferences are driven by identifying good sources of knowledge, or by identifying imitators, we modified Study 1 stimuli so that the Protagonists are present during the Demonstration phase, and thus the state of their prior knowledge of the Demonstrators’ dance is explicitly ambiguous: Protagonists could have prior knowledge of the dance, but it is also possible that they learned it from observing the Demonstrators through imitation. If infants like those who follow conventions, or are willing imitators, we predict a similar pattern of results to Study 1. If on the other hand, infants seek out extra-knowledgeable individuals, we should see the opposite pattern, one where the maverick is preferred.

2.3.1 Methods

A separate group of 64 full term 7-month-old infants participated in this study. Twenty-seven girls (42%), 37 boys (M age = 7.07; range = 6.53 – 7.57) participated. Infants were from a diverse range of ethnicities (52% European, 23%
East Asian, 9% South and Southeast Asian, 5% North American, including First Nations, 2% African, and 3% from other ethnicities, and 16% were born to families that identifies with 2 or more cultures). Data from 7 additional infants were discarded because of procedural error (n = 2), fussiness (n = 1), equipment failure (n = 3), and parental interference (n = 1). As in Study 1, infants were recruited through the database maintained by the University of British Columbia Early Development Research Group, and were given a token gift for their participation. The procedures are identical to Studies 1. The only difference is an alteration in the stimuli shown. In the video, Protagonists enter the screen immediately after the Demonstrators, and are present during the demonstration phase and observe their dances in real time. In this case, performing the same action as the Demonstrators does not require prior knowledge, as it could be learned during the demonstration.

**Figure 2.3** Stimuli for Study 2, Consensus condition: Demonstrators and Protagonists enter the stage (top left). Demonstrators perform identical dances one after another (top right). After Demonstrators exit the screen, one Protagonist performs the same dance, the other Protagonist performs a novel dance.
2.3.2 Results

Unlike in Study 1, infants in the Consensus condition of Study 2 significantly preferred the novel-dance Protagonist to the same-dance Protagonist (23 of 32 infants, binomial probability test, p = .01). Replicating Study 1, infants in the Repetition condition of Study 2 were equally likely to choose the same-dance Protagonist as the novel-dance Protagonist (15 of 32 infants, binomial test, p = .58), again supporting our hypothesis that infants are sensitive to the distribution of behaviours, and not just to their frequency. The difference in choice patterns between Consensus and Repetition conditions was marginally significant (Fischer’s Exact Test, p = .098). There was no effect of order of events, color or side of Protagonist on any comparison.

**Figure 2.4** Infants’ Protagonist choices by condition in Study 2.

<table>
<thead>
<tr>
<th>Protagonist choice</th>
<th>Consensus</th>
<th>Repetition</th>
</tr>
</thead>
<tbody>
<tr>
<td>novel dance</td>
<td>23</td>
<td>17</td>
</tr>
<tr>
<td>same dance</td>
<td>9</td>
<td>15</td>
</tr>
</tbody>
</table>
2.3.3 Discussion

As with Study 1, 7-month-old infants were sensitive to the distribution of frequency information, showing a clear preference in the Consensus condition and no clear preference in the Repetition condition. In contrast to Study 1, however, infants showed an opposite pattern of preferences, preferring the maverick (novel-dance) Protagonist, to the imitator (same-dance) Protagonist. These results do not support a general preference for imitators, but rather a context-specific preference for those “in the know” when the targets of evaluation lacked opportunities to acquire group behaviours on the spot, and a preference for mavericks when opportunities for imitation were plentiful. This view is further strengthened by null results in the Repetition condition: a simple preference for imitators should lead infants to prefer anyone who repeats another’s actions, rather than a selective preference for those who introduce novel dances to a group where everyone can produce the same dance.

2.4 General discussion

Infants’ choice patterns across the 2 studies support context-sensitivity in social evaluation. Whereas infants predominantly preferred the same-dance Protagonist in Study 1, they showed a preference for the novel-dance Protagonist in Study 2.

In addition to infants’ differing visual access to the Protagonists (the manipulated difference between Studies 1 and 2), a few other factors could be relevant to explaining this difference. First, the number of characters present on screen and to which infants could potentially attend during the demonstration
phase is greater in Study 2 than in Study 1. The presence of 2 additional individuals during the demonstration phase could have imposed a greater cognitive load on infants. Past research indicates that infants tend to prefer to allocate their attention toward the familiar in more complex tasks and toward the novel in simpler tasks, perhaps as a way of managing cognitive load (Kidd, Piantadosi, & Aslin, 2012). The difference in the number of individuals present at the outset could have had an effect on infants’ subsequent attention, leading them to prefer the familiar under higher cognitive load, and the novel under lower cognitive load.

The presence of the Repetition conditions, however, renders this explanation less likely. As Demonstrators are matched to the Consensus conditions in the number of characters present, the number of times an action is performed, and the spatial grouping of the individuals. The pattern of results from these conditions suggest that it is unlikely for the cognitive demands arising from the presence or absence of the imitator/observers to explain the differences in the Consensus conditions, since infants’ choices were always at chance in the Repetition conditions. However, the Repetition condition may be less cognitively taxing overall due to the action being concentrated in a single Demonstrator, cutting down on the demands of tracking the actions of several individuals.

Another alternative account for the results is that rather than using the presence or absence of the Protagonists as a signal of knowledge, infants used physical proximity as a cue to group membership, founded on a prepared system for reasoning about groups and social behaviours (Powell & Spelke, 2013). Due to their locations on either side of the screen, and the separate timing of their entrances in
Study 1, infants may have perceived the Demonstrators and Protagonists as two distinct social groups, each presumed to have their respective conventional dance. Infants’ preference for the maverick in Study 2 could reflect an aversion towards those who follow another group’s conventions (the imitator). However, the lack of consistency in such preferences across the two studies renders this explanation less plausible. If infants always prefer those who perform the different, in-group dance, and are using physical proximity as a cue to group membership, we would expect to see a preference for the novel-dance Protagonist for both studies. Instead, the reversal of preference from Study 1 to Study 2 suggests that the Protagonists’ presence during the Demonstrators’ performance likely created two different contexts in infants’ minds.

Infants’ preferences for the absent same-dance Protagonist in Study 1 and the present novel-dance Protagonist in Study 2 are most parsimoniously explained by a preference for individuals who are knowledgeable. In Study 1, when the Protagonists’ relationship to the Demonstrators was unclear, infants preferred the individual who behaved like an in-group member. In Study 2, when Protagonists were present to observe and mimic the Demonstrators’ dance, infants preferred the Protagonist who introduced a novel dance. This is not surprising, given that previous research has found infants to take contextual information into account when evaluating agents’ valenced actions (Hamlin, 2014). In particular, visual access (and presumably situational knowledge) of protagonists plays an important role in informing infants’ evaluations (Hamlin, Ullman, Tenenbaum, Goodman, & Baker, 2013). If our interpretation is correct, the current studies build on this growing
understanding of early context-sensitivity in learning, and suggest that infants’ hedge their bets (or control their exposure to risk) when it comes to evaluating social partners. When there is a great deal of uncertainty surrounding the target identities, infants prefer the safer bet who demonstrates their knowledge of group behaviours. On the other hand, when group identity is less in question, infants eschew the imitator for someone who demonstrates knowledge of novel behaviours.

We have interpreted our results in Study 1 as infants liking those in the know. However, due to the forced binary choice format of the current study, and without a comparison between the same-dance and novel-dance Protagonists with a neutral character, we are unable to draw conclusions regarding which is driving the preference: are infants’ choices of the same-dance Protagonist motivated by liking of that individual, or an aversion of the novel-dance Protagonist? In Study 2, our ability to conclude that infants prefer the more-knowledgeable individual is similarly constrained by lack of a neutral comparison. Are infants choosing the maverick because they want they prefer individuals who are different, or because they are motivated to avoid imitators (possibly imitators of out-group conventions)? Follow-up studies are needed to help disentangle the directionality of these preferences.

Different result patterns between Consensus and Repetition conditions in both studies support the proposal that infants’ are sensitive to the distribution of frequently observed behaviours. This is consistent with the interpretation that infants identify prevalent behaviours as shared amongst members of a community, and thus, conventional. In real human groups, behaviours and ideas are distributed imperfectly across individuals (less than 100%) for a number of reasons. For
example, hand washing after using the bathroom is a very prevalent behaviour in many societies with access to indoor plumbing. However, even within these societies, there are some individuals who do not consistently wash their hands after using the bathroom. Yet adults who observe a day’s activities in a public bathroom would easily make the inference that hand washing is a group norm, even with imperfect agreement across observations. To be a useful mechanism for identifying knowledgeable members of the in-group, some tolerance for imperfect levels of agreement in behaviours should be expected. Future studies could identify the boundary conditions on infants’ sensitivity to the level of consensus required across group members for conducting the group-level analyses seen in the studies above.

Finally, the studies in this chapter present preliminary evidence that infants may be motivated to evaluate social others in order to identify knowledgeable individuals. It was difficult to directly address the question of learning with a preverbal population. In the following chapter, we discuss a study in which we examine 2- to 6-year-olds’ use of frequency information to inform both preference and learning.
3. Preschoolers like and learn from nonconformists

3.1 Introduction

Cultural learning presents a conundrum: to learn good cultural information, a learner must identify high quality sources. Yet learners are typically at a disadvantage, lacking sufficient expertise to evaluate the quality of content offered by alternative sources. A discriminating learner must successfully identify characteristics of knowledge sources that are correlated with, or indicative of, information quality. While recent work has found children to be astute choosers of knowledge sources, these studies shared the assumption that young children make “epistemically adaptive” safe bets such as following a consensus (Koenig, 2013). The only cases to the contrary occur when children are able to successfully gauge that a minority is more successful than the group. However, children hold many irrational beliefs. Is this because children are not astute judges after all? Or might there be a rational reason why despite their best efforts to evaluate their knowledge sources, children still end up with “out there” beliefs?

There is a growing literature showing that children are selective about whom to learn from. Though they may lack the ability to evaluate the quality of content itself, young children appear capable of assessing the quality of sources it comes from. Three-year-olds are more likely to learn from previously accurate sources (Birch et al., 2008; Clément, Koenig, & Harris, 2004; Jaswal & Malone, 2007; Jaswal & Neely, 2006; Koenig & Harris, 2005; Pasquini et al., 2007; Scofield & Behrend, 2008), rejecting information from informants who have shown ignorance of labels for
familiar objects (Koenig & Harris, 2005; Sabbagh & Baldwin, 2001). By their 4th year, children track the degree of informants’ past reliability in deciding whom to trust (Pasquini et al., 2007). This tendency to evaluate informant past accuracy is clearly adaptive, as it can help children avoid learning inaccurate information from ignorant or misinformed individuals. However, it requires children to have prior knowledge on which to base such assessments of competence.

A dimension that does not require direct evaluation of competence is an individual’s willingness to share knowledge. Benevolence is an important attribute of good sources, since informants could be stingy about sharing knowledge, or give misleading information. Three to five year olds have demonstrated an ability to evaluate informants’ benevolence in experimental settings, preferring to learn from previously helpful informants to unhelpful ones (Liu et al., 2013). However, even evaluations of benevolence require some knowledge of an individual’s past behaviour, specifically, whether they have acted with good intentions in the past. Strategies that rely on having historical knowledge may be insufficient to help learners decide between potential informants, as the ultra-sociality of human groups present many situations in which one must assess and learn from strangers. How can naïve learners rely on contextual information to make an informed guess regarding which individual is a better cultural informant in terms of quality and benevolence?

Lacking the ability to directly assess the quality of information, and the opportunity to assess informants’ past behaviours, confidence provides a measure of the speaker’s own assessment of accuracy. There is some evidence that 2- and 3-
year-old children prefer to learn from confident actors and speakers, compared to hesitant ones (Birch et al., 2010; Jaswal & Malone, 2007), providing one way for learners to evaluate the competence of complete strangers. However, there is accumulating evidence that people tend to err on overconfidence in their own abilities (Kruger & Dunning, 1999; Robins & Beer, 2001; Svenson, 1981; Williams & Gilovich, 2008). Thus, while a useful metric, relying on informants’ own assessments may be prone to error, and result in misinformation. Ideally, learners could deploy additional metrics to assess the quality of potential informants.

Paying attention to the prevalence, or frequency of occurrence, of behaviours is another useful metric for learning behaviours that lead to good outcomes. Learners could prefer to learn commonly seen behaviours, or, alternatively, choose to learn rarely seen behaviours. Both strategies are “frequency-dependent learning”, because they are decision rules based on the property of frequency of occurrence of behaviours, rather than their content or outcomes. In other words, frequency-dependent learning does not require evaluating the content or payoff of possible behaviours, but instead, focuses on characteristics of the situation, namely the proportion of people performing it (Boyd & Richerson, 1985; Henrich & McElreath, 2003; Laland, 2004). Both variants of frequency dependent learning play a role in cultural learning, and each can lead to favourable learning outcomes in different situations.

It may be beneficial to learn commonly occurring behaviours because they have been tried and tested. This strategy is particularly useful when physical causality between actions and outcomes are relatively opaque, and the efficacy
difficult to assess immediately. In these situations, looking to the majority lets other people do the work of filtering out bad strategies that lead to poor outcomes.

Several studies show that children use information about whether an individual formed part of a majority to inform their choice of whom to learn from. In one study, 4 year olds were presented with novel objects and given the task to learn their labels. One informant provided labels while bystanders assented with smiles and nods, thus forming a consensus with the informant. A second informant provided labels while bystanders dissented with frowns and head shakes, thus putting them in the minority. Lacking direct means to assess the accuracy of the labels, children took into account whether labels were met with assent or dissent from observing bystanders, preferring to learn from the informant who received bystanders’ assent (Fusaro & Harris, 2008). In another study, 3 and 4 year olds looked to consensus information, preferring to learn from those who belonged to a consensus rather than a lone dissenter when deciding whether or not to trust an informant’s testimony (Corriveau, Fusaro, & Harris, 2009). One study further showed that while children were hesitant to trust an informant who was a member of an out-group, they were willing to suspend their skepticism when these informants formed a consensus (Chen, Corriveau, & Harris, 2012). Thus, a number of studies point to children being more persuaded by consensus information, sometimes, even over their own better judgment.

On the other hand, despite the critical importance of learning from and associating with the majority in human social life, innovation is also an ubiquitous aspect of cultural learning, and can lead to true improvement upon existing
knowledge (Legare & Nielsen, in press). While it is a safe bet to look to the majority when outcomes are difficult to assess directly, by definition it results in only average payoffs. Experts may deviate from the majority of individuals in their domain of expertise because of greater efficacy or ability to innovate improvements to the existing process (Muthukrishna et al, 2015).

Recent studies showed that children are willing to endorse a successful but unconventional informant over conventional but unsuccessful ones (Scofield, Gilpin, Pierucci, & Morgan, 2013). Similarly, Seston and Keleman (2013) found that children followed consensus when majority and minority opinions were equally plausible, however, they followed minority opinion if it was deemed more plausible. Finally, children observing demonstrations of how to open novel puzzle boxes were equally likely to learn from an individual as a group. However, they were more likely to learn from a successful individual than an unsuccessful group (Wilks, Collier-Baker, & Nielsen, 2014). Together, these studies suggest that when able, children will choose to learn from a minority if they trust that they will be more successful.

Despite evidence supporting children’s own tendencies to use frequency-dependent learning strategies, little work has been done looking at whether children prefer others who perform uncommon and widespread behaviours, and their tendencies to learn from such individuals. For the same reasons that learners may at times prefer mavericks and at others, conventional actors, they may prefer others who do similarly. To the extent that conventional behaviours indicate that an actor is a part of one’s ingroup, interacting with such individuals should facilitate coordination. When there are multiple potential models whose group memberships
are unclear, interacting with someone who appears to be in one’s ingroup will also insure against accidentally learning outgroup behaviours. On the other hand, in homogeneous group environments where the occurrence of such mistakes are relatively unlikely, interacting with unconventional individuals who may be extra-skilful could be advantageous both in the resources they may gain through proximity, and in the higher quality skills they can learn from such individuals.

The link between an individual’s likeability and suitability as a cultural model is an important one because in real life, we don’t always get opportunities to evaluate others in a group setting at the moments when we want to learn. Generating a conclusion about the quality of a potential model beyond the evaluative context is an important feature of cultural learning. Children and adults tend to form such generalizations, from positive evaluation due to competence in one domain, to imitation in unrelated domains. Such generalizations explain why celebrity endorsements work, and why Olympic figure skaters are recruited to sell toothpaste. Do children generalize from positive evaluations in one domain to suitability as a cultural model in an unrelated domain?

There are at least 3 routes by which liking someone can increase one’s propensity to learn from them, including proximity, trust, and perceived competence. For one, we may favourably evaluate someone specifically because they are competent in a content area that we deem important, and we want to associate with them to acquire their skills (consciously motivated, or not). In this case, liking is a direct assessment of whether an individual is good to learn from.
However, skill alone may be insufficient, if an individual is unwilling to impart their knowledge, or intentionally distorts it to their advantage.

Another important reason why we may prefer to learn from those we like is because we have deemed them to be trustworthy. Generally, we tend to prefer individuals who uphold their promises to others, and ourselves, and who do not appear to be deceitful. Trustworthiness is the foundation to smooth social interactions, as we expect others to fulfill their explicitly stated intentions (to arrive at 7pm, or to provide food at a party), as well as to uphold implicitly shared social obligations (to not sit in an elevator, or to return lost belongings). It’s a good idea to preferentially learn from trustworthy individuals because bad information can lead to costly errors, and verifying it can be difficult, so we should avoid people who may intentionally mislead us.

In addition to qualities that are directly relevant to learning, we may like someone for a variety of other reasons: they may be funny, or own a game we like to play. Regardless of why we do so, liking can lead to spending more time in close proximity to that individual, and adopting the person’s behaviours and attitudes due to regular exposure. Research on attitude change find that we are indeed more likely to be persuaded to change our beliefs and attitudes by people we like (Chaiken, 1980; Petty & Cacioppo, 1981). At the same time, by spending time with one individual, one forgoes the opportunity to learn from other potential models during this time. Thus, in the broadest sense, liking someone can lead to learning from them through mere exposure, and a willingness to be like them.
Existing evidence is suggestive that children extend social evaluations to inform model preferences for food, and toy choices (Hamlin & Wynn, 2012; Kinzler et al., 2010). Can children use frequency information for picking informants? Studies in the previous chapter demonstrated that in a 3rd party context, 7-month old infants are sensitive to the similarity of an individual’s actions to a group’s, suggesting that young humans are at least capable of forming an evaluation on these grounds. However, what does such preferences say about one’s propensity to learn from a positively regarded individual?

3.2 The present study

The present study extends on Chapter 2 by looking at the developmental trajectory of frequency-based social evaluations in 2-6 year olds, and examines the additional question of whether children use 3rd party frequency-based analysis for choosing informants. Specifically, we ask: do children evaluate others based on their performance of a commonly seen behaviour? And, do children use frequency information to guide informant choices in a different domain?

Study methods from Chapter 2 were adapted to be more suitable for preschool-age children. We created a live action dance show using generic Smurf plush toys (lacking identifying features of the main characters), while maintaining the basic structure of the show. The experiment was conducted following the recent release of a Smurfs movie, so the toys were familiar and engaging to many children. Importantly, Smurfs look like members of a distinct social group, and were introduced as such by the Experimenter, by saying “Do you know who these guys are? They are Smurfs!”
Four identical Smurfs were “Demonstrators” and 2 were “Protagonists”. Protagonists were distinguishable from each other by wearing vertically striped vs. horizontally striped hats; they were otherwise identical. Smurfs were manipulated by the Experimenter to perform dances. To control for familiarity and novelty effect, we maintained the 2 (between-subjects) conditions: in the Consensus condition, 4 Demonstrators each performed the same dance once; in the Repetition condition, the number and type of dances was kept equivalent to that in the Consensus condition, however, all 4 were performed by a single Demonstrator. In both conditions, after the 4th and final dance, all 4 Demonstrators were removed from the stage.

Replicating the design of Study 1 from the previous chapter, Protagonists were absent during the demonstration phase, and were introduced only after Demonstrators had exited the stage. Despite the superficial similarity in structure between the current and previous Chapter’s studies, an important alteration was made. Whereas group membership was never explicitly addressed, but may have been implied by the Protagonists’ presence vs. absence in the infant studies, the Smurfs’ common group membership was explicitly stated during the introduction of the current study. If children prefer and wish to learn from an extra-knowledgeable Smurf, they may choose the novel-dance Protagonist, as in Study 2. However, if they prefer a conventional Smurf, they may choose the same-dance Protagonist, as in Study 1.
3.2.1 Method

One hundred and ninety-eight children participated in the study (Mean age = 3.98, 44.6% female, range = 2 years, 0 days – 6 years, 0 days). Data from 19 children were excluded due to parental interference, or to providing no choice on both the dependent measures. Participants were recruited during a visit to the local Science Museum. Parents were approached with a description of the study, and if they were interested, were invited to visit a specific area of the museum where there were designated testing rooms. The majority of participants were White and all were English speaking (though not necessarily as a first language), though a range of ethnicities and SES backgrounds were represented.

Children were tested individually in a testing room, seated across a table from the Experimenter. To introduce the study, the Experimenter gestured to 4 Demonstrator Smurfs seated in a group to the left and 2 Protagonist Smurfs seated in a group to the right, all across from participants on the table, and asked, “Do you know who these guys are? That’s right, they’re Smurfs! We’re going to see these Smurfs do a dance today.” After the introductions, Protagonists were removed from the table and placed out of sight, while Demonstrators remained seated on the table in their positions.

Next, the Experimenter transitioned to the demonstration phase, and in the Consensus condition, proceeded to animate each Demonstrator in turn to perform a dance. Each dance was preceded by an excited “My turn!” as the Smurf was being animated, followed by moving to the centre of the stage. Demonstrators performed one of 2 dances: the Jumping dance and the Swaying dance. The Jumping dance
consisted of Smurfs jumping up and down 4 times, and the Swaying dance consisted of swaying side to side 4 times; both dances were performed at the same rhythm, for the same total duration, and Smurfs moved approximately the same distance (up or side to side) from their starting places during each one. After the Demonstrators’ performance, the Experimenters said, “ok Bye! See you later!” and were removed together from the table. In the Repetition condition, all procedures were identical, but rather than 4 Demonstrators performing in sequence, a single Demonstrator performed the same dance 4 times. Between each performance, the Demonstrator travelled back to its starting position, exclaimed “my turn!” and proceeded to the centre of the table to perform its dance. Its physical actions and words thus closely matched that of the Consensus condition.

Following the demonstration phase, the Protagonists were reintroduced to the table. The Experimenter said, “Let’s see what these guys do”, and one of the Protagonists performed the same dance as the Demonstrators, and the other Protagonist performed the novel dance. For example, when the Demonstrators performed the Jumping dance, the same-dance Protagonist also performed the Jumping dance, while the novel-dance Protagonist performed the Swaying dance. Dances performed by the Demonstrator(s), performance orders, and Protagonist type (whether they performed the same or novel dance) were counterbalanced across subjects.

After each child viewed the dances, they were presented with the 2 Protagonists side-by-side in the centre of the table and asked, “Which one do you like more?” If the child did not provide a choice after 3 seconds, they were prompted
by the Experimenter, “Do you like one of these guys more than the other?” A small number of children (n = 9, 4.3 % of the sample) claimed to like the 2 Protagonists equally; their responses for Liking were excluded from the analyses.

Following their response for Liking, an unfamiliar object (a metal thermos cap) was introduced. The Experimenter held the object and rotated it in different angles, then placed it on the table in front of the child. Children were asked if they knew what it was; none did. The Experimenter then said, “These guys have different names for this object, let’s hear what they think it’s called.” The Experimenter then picked up each of the Protagonists in turn to point at the cap and label it; one said, “it’s a pavo!” and the other said, “it’s a loba!” Children were then asked, “What do you think it’s called?” Children’s responses were recorded, and all participants were thanked and given a sticker for their participation.

3.2.2 Results

3.2.2.1 Liking

In response to the question “who do you like more?” children picked the novel-dance Protagonist more often in the Consensus condition (57 of 81, or 70.3%, binomial probability test, p <.001, 2-tailed), but did not show a preference in the Repetition condition (51 of 90, or 56.6%, binomial probability test, p = .246, 2-tailed). This supports our prediction that children’s social preferences may be informed by the distribution of observed behaviours. Furthermore, their preference for the novel-dance Protagonist corroborates our explanation that when individuals’ group identity is clear, children prefer individuals who introduce novel, rather than
conventional, behaviours. However, these preferences show marked differences by age.

Effect of age

Two- and 3-year-old children do not show significant preferences for either Protagonist in either Consensus or Repetition conditions. The proportion of 2-year-olds who preferred the novel-dance Protagonist was 53% in the Consensus condition (binomial probability test, p = 1), and 62% in the Repetition condition (binomial prob. test, p = .27), and proportion of 3-year-olds was 65% in the Consensus condition (binomial prob. test, p = .21) and 69% in the Repetition condition (binomial prob. test, = .21). Furthermore, there was no significant difference between conditions at either age (Fisher’s Exact Test, p = .76 for 2 year-olds, and p = 1 for 3 year olds). Children started to show a significant preference for the novel-dance character at age 4 (proportion choosing novel-dance Protagonist = 76%, p = .016, 2-tailed), and did so only in the Consensus, but not the Repetition, condition (Fisher’s Exact Test, p = .089, 2 tailed). This pattern becomes more pronounced by age 5, where 88% of children in the Consensus condition chose the novel-dance Protagonist (p = .006), compared to 44% in the Repetition condition (p = .81). The difference between conditions is significant by a Fisher’s Exact Test (p = .013). In summary, the overall pattern described earlier was due to the 4 and 5 year olds both differentiating between Repetition and Consensus conditions, and preferring the novel-dance Protagonist in the Consensus condition.
**Figure 3.1** Proportion of children who liked the novel-dance Protagonist, by age and by condition.

![Graph showing proportion of children who chose the novel-dance Protagonist by age group.](image)

**Table 3.1** Children’s probabilities of liking the novel-dance Protagonist, by age and by condition.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Consensus</th>
<th>Repetition</th>
<th>difference between conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pr(novel)</td>
<td>p-value*</td>
<td>Pr(novel)</td>
</tr>
<tr>
<td>2 to 3</td>
<td>0.53</td>
<td>1</td>
<td>0.62</td>
</tr>
<tr>
<td>3 to 4</td>
<td>0.65</td>
<td>0.21</td>
<td>0.69</td>
</tr>
<tr>
<td>4 to 5</td>
<td>0.76</td>
<td>0.016</td>
<td>0.52</td>
</tr>
<tr>
<td>5 to 6</td>
<td>0.88</td>
<td>0.006</td>
<td>0.44</td>
</tr>
</tbody>
</table>

*Binomial probability test (2-tailed)  **Fisher’s Exact Test

**Magnitude estimates for liking**

We employed a second analytic strategy to examine the magnitude of effects of age and condition on children’s likelihood of preferring the novel-dance Protagonist. For this analysis, a binary logistic regression was run using combined
data from participants of all age groups. In the binary logistic regression model, condition (Repetition, Consensus), age (centred on sample mean of 3.98), sex (female, male), and a condition by age interaction term were entered as model predictors for likelihood of choosing the novel-dance Protagonist.

An omnibus test of the model was significant ($\chi^2 (4) = 10.977, p = .027$), improving our ability to predict infants’ Protagonist choices on 3% of cases. Together, the coefficients explained approximately 8.2% of the variance in target choice (Nagelkerke $R^2 = .082$). Logistic Regression coefficients and standard errors for each predictor variable are shown in Table 3.1.

Looking at individual predictors, analyses revealed that being in the Consensus condition predicted children being 1.7 times as likely to pick the novel-dance Protagonist, compared to the Repetition condition (logistic regression coefficient = -0.546, $p = .096$, Odds Ratio = .579). Sex was a significant predictor, such that boys were nearly twice as likely to prefer the novel-dance Protagonist as girls (logistic regression coefficient = -0.673, $p = .042$, Odds Ratio = .51) regardless of condition. Age alone was not a significant predictor; however, children's likelihood of differentiating their choice by condition increased with age, indicating that for every 1 year increase in age, children were 1.8 times as likely to prefer the novel-dance Protagonist in the Consensus condition as compared to the Repetition condition (or .57 times as likely to prefer the same-dance Protagonist; logistic regression coeff = -0.583, $p = .055$, Odds Ratio = .558).
3.2.2.2 Learning

Overall, children were more willing to adopt the label for the unfamiliar object from the novel-dance Protagonist in the Consensus condition (60.5% or 49 of 81 children, binomial probability test, \( p = .075 \), 2-tailed), but not in the Repetition condition (39 of 89, or 43.8%, binomial probability test, \( p = .289 \), 2-tailed).

Consistent with our results for liking, children appeared sensitive to the distribution of observed behaviours for making informant choices. In particular, children preferred to adopt the unfamiliar object label from a Smurf who performed a novel dance, after having seen a group of Smurfs first perform a shared dance. As with learning, children's informant preference becomes increasingly pronounced with age.

*Effects of age*

Two-, 3-, and 4-year old children were equally likely to learn from the novel-dance Protagonist as the same-dance Protagonist in both Consensus and Repetition conditions (see Table 3 for probabilities of learning from the novel-dance Protagonist and associated binomial probability test \( p \)-values at each age). Only 5-year-olds made a significantly different choice of informant in the Consensus condition than from the Repetition condition, preferring to learn from the novel-dance Protagonist in the Consensus condition (binomial probability test, \( p = .024 \), 2-tailed). The difference in choice patterns between Consensus and Repetition conditions was significant by a Fisher's Exact Test (\( p = .005 \)).
Magnitude estimates for learning

Using the same analytic approach as for the liking measure, we conducted a binary logistic regression to examine the magnitude of difference in likelihood by age and by condition. Condition, age, sex, and age-by-condition interaction term were

Table 3.2 Children’s probabilities of learning from the novel-dance Protagonist, by age and by condition.

<table>
<thead>
<tr>
<th>Age group</th>
<th>Consensus</th>
<th>Repetition</th>
<th>difference between conditions</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Pr(novel)</td>
<td>p-value*</td>
<td>Pr(novel)</td>
</tr>
<tr>
<td>2 to 3</td>
<td>0.53</td>
<td>1</td>
<td>0.54</td>
</tr>
<tr>
<td>3 to 4</td>
<td>0.55</td>
<td>1</td>
<td>0.5</td>
</tr>
<tr>
<td>4 to 5</td>
<td>0.58</td>
<td>0.55</td>
<td>0.41</td>
</tr>
<tr>
<td>5 to 6</td>
<td>0.81</td>
<td>0.024</td>
<td>0.29</td>
</tr>
</tbody>
</table>

*Binomial probability test (2-tailed)  **Fisher's Exact Test

Figure 3.2 Children’s probabilities of learning from the novel-dance Protagonist, by age and by condition.
entered as model predictors for likelihood of choosing the novel-dance Protagonist.

An omnibus test of the model was significant ($\chi^2(4)=10.997$, $p = .027$), improving our ability to predict infants’ informant choice on 9.2% of cases. Together, the coefficients explain approximately 8.1% of the variance in informant choice (Nagelkerke $R^2 = .081$).

Turning to the individual predictors, children in the Consensus condition were nearly twice as likely to endorse the novel-dance Protagonist’s label for the bottle cap as those in the Repetition condition (logistic regression coeff = -.579, $p = .065$, OR = .56). Age was a marginally significant predictor, such that older children were 1.45 times more likely to prefer the same-dance Informant (logistic regression coeff = .334, $p = .076$, OR = 1.397). However, a significant Condition by Age interaction indicates that with every year increase in age, children in the Consensus condition were 2.1 times as likely to endorse the novel-dance Protagonist’s label for the bottle cap, compared to the Repetition condition (logistic regression coeff = -.783, $p = .008$, OR = .457). Unlike the preference measure, sex was not a significant covariate for which Protagonist’s label children endorsed.

**Table 3.3**

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Preference</th>
<th>Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (centered)</td>
<td>.068 (.184)</td>
<td>.372 (.192)$^+$</td>
</tr>
<tr>
<td>Sex</td>
<td>-.664 (.331)$^*$</td>
<td>.256 (.323)</td>
</tr>
<tr>
<td>Condition</td>
<td>-.560 (.329)$^+$</td>
<td>-.554 (.314)$^+$</td>
</tr>
<tr>
<td>Age * Condition</td>
<td>-.563 (.305)$^+$</td>
<td>-.783 (.293)$^{**}$</td>
</tr>
<tr>
<td>Observations ($n$)</td>
<td>176</td>
<td>174</td>
</tr>
</tbody>
</table>

$^+$p < .10, $^*$p < .05, $^{**}$p < .01, $^{***}$p < .001

Logistic regression coefficients are the natural log (ln) of odd ratios for each predictor. Standard errors are presented in parentheses.
3.2.2.3 Liking predicts learning.

Children's liking for a Protagonist significantly predicted whom they wanted to learn from. In a separate logistic regression model using Liking to predict Informant choice, children who reported liking a Protagonist were 5 times as likely to learn from that same Protagonist than were children who did not report the same preference (logistic regression coeff = 1.605, \( p < .001; \) OR = 4.98). In this model, Condition moderated by Age continues to be a significant predictor in this model (logistic regression coeff = -.642, \( p = .039, \) OR = .526). That is, children increasingly differentiated their preferences across study conditions, showing a preference to learn from the novel-dance Informant in the Consensus condition, and no clear preference in the Repetition condition. In this analysis, we removed Sex as a covariate, since it was a non-significant predictor in the full model, and including it greatly hampers the model's predictions fit to the observed data. Hosmer and Lemeshow test indicate that the predicted data did not significantly differ from the observed data (\( \chi^2 (8) = 5.594, p = .693 \)), indicating good model fit. Together, preference (same-dance Protagonist, novel-dance Protagonist), condition, age, and an age-by-condition interaction term accounted for 22.8% of variability in children's Informant choices (Nagelkerke \( R^2 = .228 \)) and also improved predictions of those choices on 19% of cases.
Table 3.4
Learning predicted by Liking (Preference), Age, Condition, and Age x Condition interaction term

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Learning</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age (centered)</td>
<td>.339 (.202)†</td>
</tr>
<tr>
<td>Condition</td>
<td>-.441 (.340)</td>
</tr>
<tr>
<td>Age * Condition</td>
<td>-.642 (.310)*</td>
</tr>
<tr>
<td>Preference</td>
<td>1.605 (.362)***</td>
</tr>
<tr>
<td>Observations (n)</td>
<td>169</td>
</tr>
</tbody>
</table>

†p < .10, *p < .05, **p < .01, ***p < .001
Logistic regression coefficients are the natural log (ln) of odd ratios for each predictor. Standard errors are presented in parentheses.

3.2.3 Discussion

In both preference and learning measures, children’s choices differed by age. The youngest tested groups (2 and 3 year olds) did not differ in their choice of Protagonist across Consensus and Repetition conditions—it appears that they were insensitive to the distribution of information across individuals. In contrast, 4 and 5 year olds were influenced by behavioural consensus across individuals (they preferred the Protagonist who did a novel dance), but not repetitive actions by a single individual (in which they chose the 2 Protagonists equally); this effect is more pronounced in older children. The transitional age at which children in our sample differentiated between Consensus and Repetition conditions occurs around 4 years of age for preference, and a year later for Informant choice. Five-year-olds in our sample preferentially learned a novel object label from the novel-dance Protagonist, but were equally likely to learn from the same-dance Protagonist and novel-dance Protagonist in the Repetition condition.

The above preference results provided a conceptual replication of studies in Chapter 2, where 7-month-old infants preferred a novel-dance Protagonist in the
Consensus, but not Repetition condition. While common group membership was addressed explicitly in the current study, it may have been implied in the infant studies by Protagonists’ presence and absence during the Demonstrators’ dances. Thus, there appear to be developmental continuity in preference for mavericks when there are opportunities to imitate the group dance, and when individuals’ group identities are known. This may be due to an assumption that when everyone can imitate on the spot, or everyone is a member of the same group, that there is a common core of shared knowledge. However, it is also possible that 2 independent motivations drove infants’ and children’s preferences for the maverick.

Two and 3-year-olds did not show differential preferences across conditions in the present study. One important difference between the infant and child studies is the nature of the dependent measures: while the infant studies required nonverbal, spontaneous responses through reaching, the children study used an elicited, verbal measure of preference. Such U-shaped relationships between age and ability, in which young infants show an ability on implicit measures, and on which young children fail on explicit versions, only to succeed a couple of years later have been found in several other areas in social cognitive development (e.g. ToM; Baillargeon, Scott, & He, 2010; Clements & Perner, 1994; Onishi & Baillargeon, 2005). It is plausible that a similar mechanism is in operation in this case, and that the change in methodology underlies the apparent disappearance of an earlier emerging ability, rather than true conceptual change.

Children’s tendency to learn from the novel-dance Protagonist in the Consensus condition appears inconsistent with previous findings that children trust
informants who were part of a consensus over a maverick (Corriveau et al., 2009). However, differences between the studies may account for this. One important design component of our study involved establishing consensus in one domain (dance), and followed by a learning task in a different domain (object labeling). Thus, children were initially introduced to the potential Informants in a context where learning was not a relevant objective. Children’s subsequent desire to learn from an Informant may be informed by positive feelings towards the individual formed during the dance phase, rather than a direct assessment of their skill in word labeling.

The age patterns in our results provide some support for this interpretation: 4 year olds in our sample reliably showed a preference for a Protagonist, a full year before they as a group reliably learned from a Protagonist. The timing of these effects, together with the strong relationship between children’s expressed preference and their subsequent choice of Informant, suggests that children may first form a favorable impression of a Protagonist, which informs who they choose to learn from in a different context. Such willingness to generalize trust in an individual beyond the context in which favourable attitudes were formed may be one way in which children mistakenly acquire less-than-optimal knowledge, and yet is clearly an important aspect of cultural transmission.

In our particular experimental set-up, children were invited to play a game, and likely assessed it to be a situation in which uniqueness and self-expression are acceptable responses. This could be possible because there were no obvious repercussions for learning from the “wrong” model. Future studies should
investigate the effect of incentives/stakes for learning outcomes to further clarify contextual features that promote learning from a consensus and ones that encourage learning from a maverick.
4. Infant social referencing differs by culture and by domain

4.1 Introduction

Young humans possess an exceptional capacity to learn from others (Herrmann et al., 2007). One of the earliest means at their disposal for accessing knowledge in other people’s minds is sensitivity to emotional information. Emotions rapidly convey evaluations such as approval and disapproval, as well as appraisals of threat and safety. These evaluations can be spontaneous reactions without an intended recipient, or intentional communicative displays and/or vocalizations. Can preverbal infants exploit the rapid, nonverbal and universal nature of basic emotions for cultural learning?

By the middle of their first year, preverbal infants can both accurately distinguish among some basic emotions, and show an incipient ability to use them appropriately to modify their own behaviours towards targets of emotional reactions. Infants are able to perceive and distinguish among anger, fear, and happiness by 4 months of age (Haviland & Lelwica, 1987; LaBarbera et al., 1976; Montague & Walker-Andrews, 2001). By 5 months, they can discriminate among emotional vocalizations presented in infant-directed speech, and adult-directed speech when accompanied by a facial expression (Fernald, 1993). Already, at 5.5 months, infants are able to regulate their behaviours towards unfamiliar objects based on other people’s fearful or happy reactions, when the reactions are communicated both visually and vocally (Vaillant-Molina & Bahrick, 2012).
From the second half of the first year and through the second year, infants become competent users of emotional information for learning about the physical world. Between 10 and 12 months of age, infants begin to reliably moderate their behaviours toward novel objects or environments in response to emotional reactions, preferring to approach objects associated with a happy reaction, and avoiding objects associated with a fear reaction (Mumme et al., 1996; Sorce et al., 1985; Walden & Ogan, 1988). By 18 months of age, infants can use a Bystander’s neutral vs. angry reaction toward objects to make inferences about his/her enduring object preferences (Repacholi & Meltzoff, 2007): they are less likely to play with an object toward which an Bystander has previously expressed anger rather than a neutral expression. Critically, 18-month-olds’ likelihood to play with an object that is the target of anger depends on whether the original Bystander is present during infants’ exploration of the object, suggestive that their attribution is person-specific. That said, infants also appear capable of using additional cues present in emotional displays to infer the content of shared attitudes: Eighteen-month-olds infer shared attitudes (held by individuals other than the original Bystander) when emotional reactions are preceded by infant-directed eye contact (an ostensive signal of intentional teaching), but infer person-specific attitudes in the absence of eye contact (Egyed et al., 2013). Together, these studies show a sophisticated use of emotional information in which infants differentiate between individual and shared attitudes towards unfamiliar aspects of the physical world.

Although relatively large quantities of evidence have accumulated for infants’ ability to use emotions to learn about unfamiliar physical objects or environments,
considerably less has been done to investigate whether infants use others’ emotions to also learn about the social world. Indeed, the social world poses its own set of opportunities and threats to naïve learners; individuals vary in their level of benevolence and cooperativeness during social interactions, as well as in their level of skill and ability in navigating the environment. Although identifying cooperative and knowledgeable individuals to associate with and learn from may be critical for optimal development, it is not necessarily trivial to understand who these individuals are, and the risks of misidentification may be severe. Therefore, it would greatly benefit young humans to be able to learn the value of potential interaction partners by looking to the reactions of other, more experienced individuals in their environment, and to use those reactions to infer whom should be approached and whom avoided. By engaging in this social referencing about social targets, Bystanders can significantly increase the likelihood of associating with benevolent and skilled individuals.

Some evidence exists suggesting that infants can use emotional information to learn about social targets. Ten-month-old infants are more likely to approach and offer toys to a stranger after their mothers speak to them about the stranger in a positive tone compared to when mothers spoke in a neutral tone (Feinman & Lewis, 1983). However, these results do not hold if the infants merely observe mothers speak in a positive tone (vs. a neutral tone) to the stranger, suggestive that at 10 months the capacity to engage in ‘social’ social referencing may be weak. In another study, 15-month-old infants smiled more and were also more willing to accept toys from a stranger after observing their mothers interact positively with her, compared
to when they had no interaction (Feiring, Lewis, & Starr, 1984). However, while its use of naturalistic manipulation of positive vs. neutral interaction strengthens ecological validity, the latter study did not control for factors outside of emotions, such as physical distance or amount of eye contact, which could have affected infants’ willingness to interact with the stranger. Furthermore, each of the studies described above focused on comparing the effect of a positive vs. a neutral (or lack of) interaction; neither examined how infants respond to observing a Bystander display a negative emotion toward a social target. To our knowledge, only one study has been conducted explicitly examining 12-month-old infants’ social referencing for a social target, by examining the impact of maternal emotions on infants’ subsequent behaviour. The study found that infants who observed their mothers displaying behavioural cues of anxiety when interacting with a stranger were significantly less likely to approach the stranger themselves than infants whose mothers exhibited no anxious symptoms (de Rosnay, Cooper, Tsigaras, & Murray, 2006).

None of the above studies just described compared the effects of both positive and negative emotions on infants’ behaviour within the same study. While each study had a control comparison to neutral or absence of interaction, this does not rule out the explanation that physiological arousal from experiencing any emotion could have caused subsequent changes in behaviour. Another important issue pertains to the studies’ inability to speak to the mechanism by which mothers’ emotions influenced infants’ behaviour: were infants more inhibited around the stranger due to emotional contagion from their mothers, or did infants understand
the informational content of emotions, without personal experience of emotions
being necessary? The latter mechanism would provide more support for emotional
understanding as a means for cultural learning, as it permits the learner to hold
learned attitudes even when the original emoter is absent, thus generalizing beyond
the learning context.

4.2 The present studies

The current studies set out to examine infants' ability to use social
referencing to learn about social targets. In particular, it aimed to address 4 goals.
Our first goal was to examine the effect of seeing observers emote both positively
and negatively about distinct social targets, to rule out physiological changes
associated with general arousal (rather than a particular discrete emotion per se) as
responsible for infants' tendency to avoid targets of their mothers' negative
emotions in past studies. Two of the earliest distinguishable and recognized
emotional expressions are positively valenced expressions (smiles) corresponding
to happiness and negatively valenced expressions (frowns) corresponding to anger
(LaBarbera et al., 1976; Montague & Walker-Andrews, 2001). We hypothesized that,
by attending to positively and negatively valenced emotional reactions, preverbal
infants could accurately use emotional information referentially and moderate their
own behaviours toward the target of these emotions. These emotions might provide
crude, but adequate evaluations of people and object targets. We expected infants to
prefer targets of positive emotional reactions to targets of negative emotional
reactions.
Second, we wanted to investigate whether infants use social referencing in similar ways for social and asocial targets. As summarized above, many studies show sensitivity to emotional information for objects targets by 10 months. Given the paucity of studies on social targets, infants' ability to use others' emotional displays to regulate their behavior toward social targets is less well understood. Given that social targets operate via invisible mental states that cannot be directly assessed, that they can self-locomote and carry out behaviours according to invisible intentions, it may be that it is more difficult to reliably link others' emotional displays to social than to asocial targets. On the other hand, compared to object targets, social agents can potentially cause greater harm to a vulnerable infant, and are important potential sources of cultural information. The potential for both benefit and harm from unknown social others makes it critical that young humans can reliably discern their value. Therefore, one might expect infants to be more sensitive to evaluative emotional information about social versus asocial targets.

Third, we intended to investigate whether infants understand emotions as referential, or whether their modulation of behaviours is a result of mood contagion. As discussed above, observed emotions may exert influence on Bystanders by reproducing the same emotional arousal and subsequent action tendencies in them, as in the original emoter. Alternatively, the Bystander could perceive and interpret the implications of observed emotions without personally experiencing the physiological arousal or behavioural and cognitive effects. What is the nature of the link between observed emotions and infants' behaviours?
Finally, we were interested in whether infants being raised in different cultural milieus would exhibit differences in their understanding and use of emotional information. On the one hand, universal basic emotions may emerge spontaneously, independent of cultural input, and serve as a mechanism by which events are subsequently interpreted and learned. On the other hand, sociocultural theories argue that differences in display rules, emotional expressivity and recognition of emotions have been noted in adults across cultures, so culture must play a role in constructing individuals’ understanding of emotion concepts. Group differences in the emergence of basic cognitive abilities resulting from different experience are not uncommon. For instance, Salomo and Liszkowski (2013) documented earlier pointing in triadic (joint attention) situations in Chinese infants compared to Dutch and Mayan infants, corresponding to the amount of pointing that caregivers engaged in with their infants. Infants’ rate of word acquisition also varies by SES, differing by parents’ use of gesture (Rowe & Goldin-Meadow, 2009), and by the amount of time spent in joint attention (Tomasello & Farrar, 1986). It remains an open question, however, how early cultural learning starts producing these differences in even basic emotional understanding.

Indeed, despite the early emergence of emotional understanding documented in North American infants, the amount of experience infants receive regarding emotion-laden exchanges likely varies across cultures. Researchers have documented differences in how much face-to-face vs. side-by-side experience infants have with their mothers as a product of the socialization values of autonomy vs. relatedness (Keller et al., 2007). Cultures that value autonomy tend to structure
interactions with infants in a physically autonomous arrangement, involving more face to face, and at-a-distance interactions. In contrast, cultures that value relatedness tend to structure interactions that produce more physical proximity, involving more touching and holding. These physical behaviours may have implications for the amount of experience infants have receiving emotional communications, which provide information efficiently from a distance. For example, a parent who is physically holding an infant can keep him or her safe by staying away from potential hazards, or moving away from it. However, when separated by physical distance, a parent must communicate prohibition or warning in another way, by tone of voice or facial expression. It follows that infants socialized in a culture that values autonomy might have more practice and must begin to rely on emotional communications sooner and to a greater extent than an infant socialized in a culture of relatedness.

To examine these questions, we used a choice method to measure infants’ preference for targets of positive vs. negative emotional reactions. Across several studies, infants observed the same 6 individuals: 4 Bystanders and 2 Protagonists, and the same two objects. In each event, the Bystanders observed one Protagonist move toward and pick up one of the two objects, and the Bystanders responded either positively or negatively (smiled with raised eyebrows or frowned with lowered eyebrows). All infants observed a series of 4 events, in which each Protagonist picked up each object once. Across 4 between-subjects conditions (described in detail below), Bystanders directed their positive and negative emotions either consistently toward single social targets (smiling whenever
Protagonist A chose either object; frowning whenever Protagonist B chose either object) or consistently toward single objects (smiling whenever either Protagonist chose object A and frowning whenever either Protagonist chose object B). We reasoned that if infants can engage in both social and asocial social referencing, they should prefer the targets of positive emotions in all conditions, choosing Protagonist A over Protagonist B and object A over object B.

In order to control the magnitude and consistency of information across events and conditions, stimuli were animated videos in which Bystanders and Protagonists consisted of different coloured geometrical shapes and animated eyes. The use of similar simple animations has been used successfully in past work examining infants’ understanding of social others (Csibra, Biró, Koós, & Gergely, 2003; Geraci & Surian, 2011; Kuhlmeier, Bloom, & Wynn, 2004), and, given that subtle differences in expressive style between members of different cultural groups may make it more difficult to decode expressions by cultural out-group members (e.g., Elfenbein & Ambady, 2002; Elfenbein, Mandal, & Ambady, 2004; Kilbridge & Yarczower, 1983; Markham & Wang, 1996), reduced the possibility that an in-group recognition bias would influence results. Specifically, by using models without a particular ethnicity, animated emotions should be equally (un)familiar to all infants.

4.3 Study 1a – social targets

4.3.1 Methods

Sixty-five 6-month-olds (48.5% female; M = 6.14, SD = .307, range = 5.33 – 6.9) and fifty-eight 12-month-olds (49% female; M=11.95, SD=.308, range = 11.26 – 12.63) participated. We chose to study both 6- and 12-month-olds because 5.5
months is the earliest social referencing toward objects that has been demonstrated (Vaillant-Molina & Bahrick, 2012) and 12 months is the average age at which infants can reliably use social referencing.

Because we were interested in whether there are any cultural differences in infants’ tendency to socially reference, parents were asked to report their infants’ ethnicity and linguistic exposure on a provided demographic questionnaire. For ethnicity, parents were asked to check/list all that applied to their child: 36 infants were identified as Western European (eighteen 6-month-olds, eighteen 12-month-olds), 36 as East Asian (Chinese, Japanese and Korean; eighteen 6-month-olds, eighteen 12-month-olds), 28 of mixed East Asian and European ethnicities (thirteen 6-month-olds, fifteen 12-month-olds), and 23 of other ethnicities (including Caribbean, Fijian, Ukrainian, Turkish, Thai, Vietnamese and Filipino Canadian). For linguistic exposure, parents were asked to list all languages that their child hears, and to provide an estimated percentage of time that each is heard in their infants’ daily life. We reasoned that because we were completing our research in the multi-cultural city with several generations of immigrant groups represented, language exposure may provide a more fine-grained, continuous measure of variability in acculturation than does reported ethnicity.

Data from 26 additional infants were discarded because of fussiness (n=10), no choice (n = 4), parental interference (n=5), procedural error (n=6), and equipment malfunction (n=1). Furthermore, the sample size of infants who were not Western European and/or East Asian (n=23) was too small to inform conclusions about how infants from those ethnic backgrounds behaved. Therefore they were
excluded from the analyses reported below. In total, 100 infants were used for analyses. Infants were recruited through a database maintained by the University of British Columbia Early Development Research Group. Participating families were given a token gift for their participation.

Infants sat in a square testing room on their parent’s lap, approximately 1.5 metres from a 50-inch screen TV; the room was otherwise unadorned. Parents were instructed to refrain from speaking or directing their infants’ attention in any way.

**Introductory trials.** In all conditions, infants were first shown a 36 second familiarization video in which 6 animated characters of different colours and shapes with eyes were introduced moving around a screen to background music. Infants’ on-screen and off-screen looking time during the video was measured using an eye-gaze coding program (jHab). Infants who reached a minimum looking criterion of 75% of the entire trial duration proceeded to habituation trials; otherwise the introductory trial was repeated until the criterion was reached.

**Habituation trials.** Infants watched videos of two Protagonists (a blue square and a yellow triangle with eyes) each alternately approaching 2 objects (a bottle and a shell) for a total of 4 unique videos. At the beginning of each video, four Bystanders are arranged across the top of the screen on a black and white checkered background, and two Protagonists sit below the Bystander ‘gallery’, on either side in the centre of the screen. The 2 objects sit at the bottom of the screen. One of the two Protagonists moves to the centre of the screen, and appears to deliberate between the two objects: It first briefly approaches one object, and then returns to the middle of the screen, and then gazes toward and briefly approaches
the second object, and then returns to the centre again. From the gallery above, the Bystanders’ eyes move so that they are following along with the Protagonist’s movements; to ensure that infants see the Bystanders’ eye movements, the checkerboard flickers to attract their attention. After the Protagonist has checked out each object in turn, it then gazes at and moves to contact the object it first approached, moving the object a few inches toward the side of the display and pausing, as though choosing that object rather than the other one. Following the Protagonist’s choice, the Bystanders all simultaneously express either a positive expression (smiling) or a negative expression (frowning) while continually directing their gaze towards the Protagonist. Smiling is depicted dynamically with a short horizontal line transforming into an upturned mouth and eyebrows that turned up at the inner corners by 15 degrees. Frowning is depicted using identical but opposite movements: mouths widened and turned downward, and the inner corners of the eyebrows turned down by 15 degrees. Looking time coding for each video began after the Protagonist’s object choice was made and the Bystanders emoted, and continued until the infant looked away for 2 consecutive seconds, or after 30 seconds elapsed.

In Study 1a, one Protagonist was always smiled at, regardless of which object it picked; the other was always frowned at. For example, one infant may see the yellow triangle Protagonist smiled at both after picking the shell in trial 1, and after picking the glue bottle in trial 2; the same infant would see the blue square Protagonist always frowned at, both after picking the shell in trial 1, and after picking the glue bottle in trial 2. This design was utilized to imply that Bystanders
differentially valued the Protagonists, but not the objects the picked. Bystanders’
differential valuations were depicted across 4 different videos, for each combination
of Protagonist and object (2 positive and 2 negative reactions). Infants were shown
the stimuli repeatedly until they habituated, or until they viewed 3 complete
iterations of the 4 videos for a total of 12 trials. The habituation criterion was
established after the first 4 trials: Infants were considered habituated when looking
time during their last 4 trials were less than half of that of their first 4 trials, which
could happen for the first time on trial 8. Protagonist receiving the positive
evaluation (yellow triangle, blue square), Protagonist side (left, right), order
(positive first, negative first), and Bystander expression valence were
counterbalanced across participants (across 16 different script versions).

**Figure 4.1** Video stimuli for Study 1: Bystanders reacting positively to the blue
square picking the shell (left). Bystanders reacting negatively to the yellow triangle
picking the shell (right). Not depicted are 2 additional videos depicting the blue
square and yellow triangle picking the glue bottle, and again eliciting different
reactions from the Bystanders (positive for the blue square, negative for the yellow
triangle). Together, the 4 videos show 2 different contexts in which Bystanders
differentially evaluate the Protagonists for taking identical actions.
Choice measure. After the habituation criterion was reached, infants were presented with a choice measure. Parents were instructed to turn their chair 90 degrees to the right, so that they were no longer facing the TV screen, and to close their eyes. An Experimenter who was blind to the infant’s assigned condition presented a white board with the choices presented 25 cm apart (foam replicas of Protagonists shown in stimuli videos), initially out of the infant’s reach. Infants were required to have looked at both possible choices before the choice board was moved within reach. The Experimenter recorded the first Protagonist that the infant intentionally touched, defined as visually guided contact with a Protagonist. The side of the positively and negatively evaluated Protagonist was counterbalanced during choice.

4.3.2 Results

As a group, infants did not appear to exhibit a preference for the targets of positive emotional reactions (57 of 100; binomial probability = .194), either at 12 months alone (29 of 51; binomial probability test, \( p = .4 \)) or at 6 months alone (28 of 49; binomial probability test, \( p = .39 \)). However, when broken down by the ethnicity of the infants, Protagonist choices were significantly influenced by bystanders’ emotional reactions in a subset of the infants.

Twelve-month-olds. Infants’ choices were significantly influenced by bystanders’ emotional reactions. Supporting our predictions, 15 of 18 Euro-Canadian infants chose the Protagonist whose actions were followed by positive bystander reactions (binomial probability test, \( p = .01, 2\)-tailed). In contrast, East Asian infants did not show a clear preference for either Protagonist (8 of 18 chose
the positively evaluated Protagonist, binomial probability test, \( p = .81 \), 2-tailed). The difference between European and East Asian infant choices is significant by a Fisher’s Exact Test \((p < .035\), 2-tailed\). Similarly, Mixed infants did not reliably prefer targets of either emotional reaction (6 of 15 chose positive, binomial probability test, \( p = .60 \)).

**Six-month-olds.** Consistent with the predicted direction, twelve of eighteen 6-month-old Euro-Canadian infants chose the Protagonist who received positive bystander reactions (binomial probability test, \( p = .238\), 2-tailed). Unexpectedly, only 4 of 18 East Asian Canadian infants chose the positively evaluated Protagonist; a significant majority of infants chose the Protagonist who evoked a negative emotional reaction from the Bystanders (binomial probability test, \( p = .03\), two-tailed). Infants of mixed East Asian and European descent showed a similar choice pattern to Euro-Canadians—they did not show a reliable preference for either Protagonist (9 of 13 infants chose the positively evaluated Protagonist; binomial probability test, \( p = .267\), 2-tailed).

**Figure 4.2** Infants choices by Protagonist valence, ethnicity, and age for Study 1a.
**Likelihood of choosing the positively evaluated Protagonist, by culture**

We used a second analytic strategy to investigate the magnitude of the difference in likelihood of choosing the Protagonist who evoked positive emotional reactions, compared to Protagonist who evoked negative reactions. Two binary logistic regressions were run, a full model including all predictors and covariates, and a partial model with all non-significant predictors in the full model removed ("Using multivariate statistics," 2001), and the amount of variance explained were compared. In the full model, ethnicity (European, East Asian, and Mixed), age, sex (male, female), Protagonist that elicited the emotional reaction (yellow triangle Protagonist or blue square Protagonist), and reaction order (whether negative or positive emotional reaction trials were presented first) were entered as model predictors for likelihood of choosing the positive Protagonist.

An omnibus test of the full model was significant (Chi-square(6) = 14.038, p = .029), improving our ability to predict infants’ positive vs. negative Protagonist choices on 11% of cases. Together, the coefficients explained approximately 17% of the variance in target choice (Nagelkerke R-square = .172). Looking at the individual predictors, the analyses revealed that an infant’s ethnicity is the only variable that helps predict whether an infant will pick the positive Protagonist. Specifically, an infant identified by parents as being of European ethnicity (including East Asian-European mixed infants) significantly predicted a 3.187 times increase in likelihood of picking the positive Protagonist, compared to infants who do not have any European ethnicity (logistic regression coefficient = 1.159, p = .036, Odds Ratio = 3.187). Infants’ sex, age, the order of stimuli presentation did not significantly
contribute to the model’s predictive power, nor was there a colour or shape preference in infants’ choices.

A partial model was also run, containing European ethnicity dummy variable (the only significant predictor in the full model) as a predictor, and age as a covariate. With only these predictors, the partial model is a better fit to the data than the full model: it significantly improves prediction of infants’ choices by 15% (omnibus test chi-square (2) = 12.098, p = .002), and explains 15% of the variance in infants’ choices (Nagelkerke R-square = .15). In this model, being ethnically European increases an infant’s likelihood of choosing the positive Protagonist 4.121 times, compared to infants of other ethnicities (logistic regression coefficient = 1.416, p = .002, Odds Ratio = 4.121). The probability of picking the positive Protagonist increases with age, but was not significant at conventional levels (coefficient = .107, p = .149, Odds Ratio = 1.112).

Table 4.1 Logistic regression models predicting Protagonist choice in Study 1a. Full model uses Ethnicity, age, sex, protagonist, and order to predict Protagonist choice. Partial model uses only significant predictors from Full Model to predict Protagonist choice.

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Full Model</th>
<th>Partial Model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Choice coefficient (B)</td>
<td>Standard Error (SE)</td>
</tr>
<tr>
<td>European</td>
<td>1.159*</td>
<td>0.553</td>
</tr>
<tr>
<td>East Asian</td>
<td>-0.517</td>
<td>-0.517</td>
</tr>
<tr>
<td>Age (centered)</td>
<td>0.107</td>
<td>0.077</td>
</tr>
<tr>
<td>Sex</td>
<td>-0.356</td>
<td>0.436</td>
</tr>
<tr>
<td>Protagonist</td>
<td>0.094</td>
<td>0.454</td>
</tr>
<tr>
<td>Reaction order</td>
<td>-0.237</td>
<td>0.432</td>
</tr>
</tbody>
</table>

*p < .05, **p < .01, ***p < .001

We were also interested in using language exposure as a continuous measure of infants’ exposure to different cultural practices. In a separate logistic regression
model, the amount of an East Asian language that an infant is exposed to significantly predicts their choice of target (model chi-square (1) = 10.449, p = .001, Nagelkerke R² = .13). In this model, each percentage increase in reported exposure to an East Asian language is associated with being 1.02 times as likely to choose the negative target (coefficient = -.019, p = .002, OR = .981). To illustrate, based on our model we can calculate the likelihood that a 6-month-old will choose the positive emotion target at 0%, 50% and 100% East Asian language exposure, each of which were commonly-reported language percentages in our sample. According to the model, with 100% exposure to an East Asian language, the child has a 20.2% probability of picking the positive emotion target; at 50% exposure, the likelihood rises to 42.02% (an increase of 22%); at 0% exposure (in this sample, 0% East Asian language exposure is strongly correlated with full time exposure to English) the probability of picking the positive target is 67.44%. Thus, compared to infants who receive no exposure to English, those who are exposed only to English are 47% more likely to pick the target of positive emotional reactions, regardless of their ethnicity.

4.3.3 Discussion

Six-month-old European infants in our sample did not reliably pick positively evaluated targets, while their East Asian counterparts preferred the negatively evaluated target. By 12-months, both East Asian and European infants showed a shift towards preferring positively evaluated targets. Twelve-month-old European infants chose targets of positive emotional reactions, suggesting that they do reliably use social referencing. East Asian infants were at chance and no longer
preferred the negative target. Overall, results of the binary logistic regression indicate that at both 6 and 12 months of age, being raised in a primarily European cultural upbringing predicts greater likelihood of an infant preferring the positively evaluated target.

   Mixed infants as a group did not show clear use of social referencing at either age. They showed choice patterns that were somewhat varied: more similar to European infants at 6 months, and more similar to East Asian infants at 12 months. These patterns may be due to the greater heterogeneity of socialization experiences mixed infants encounter, as reflected in the greater variability in their language exposure. One way to address this heterogeneity in enculturation is to employ an analytic method that treats ethnicity as a continuous predictor. The amount of exposure to languages can serve both as a proxy for degree of enculturation to different cultures represented in our sample. Higher percentages of exposure to an East Asian language should correspond to greater exposure to East Asian cultural practices that give rise to infants’ differential response to emotional stimuli, and vice versa with English and mainstream North American culture. Consistent with this interpretation, more exposure to an East Asian language predicted greater likelihood of choosing the negative emotional target, consistent with the pattern of choice using ethnicity as a predictor.

   Cultural differences in infants’ social preferences may be due to several possible differences in infants’ experience with emotional expressions, including differential abilities in interpreting our stimuli, in interpreting emotional expressions, and differing interpretations of the situational demands of our study.
For example, European infants may be more familiar with both positive and negative emotions, and further, understand their significance and employ them effectively to regulate their own actions. Our understanding of the development of social referencing is based on predominantly European-American samples, who are exposed to different emotional experiences than infants growing up in other cultural contexts (Bornstein et al., 2012; Fernald & Morikawa, 1993; Keller et al., 2006). East Asian infants may have failed to differentiate their behaviours towards positively and negatively evaluated targets as a result of less familiarity with the significance of emotional communications, or less ability to regulate their own behaviours in response to observed emotions. That more infants of all ethnicities reached for the negative target at 6 months may also reflect this lower level of understanding in both European and East Asians infants at this age, which gives way to improved understanding and a shift in preference towards positive targets at 12 months.

Although our results suggest that European-Canadian infants understand and use the evaluative significance of emotional expressions, an alternative possibility is that an association between the salient target (i.e. Protagonist who was actively doing the choosing just before the emotional display) and a contiguous emotional expression could account for infants’ choices. This account does not require infants to interpret the interaction between Bystanders and their target as an evaluative social situation in order to develop a preference; it merely requires infants to associate a target with a preferred emotion (through emotional contagion, temporal contiguity, or statistical relation). On the other hand, if infants understand emotions as being about a target, rather than merely associated with one, then they should not
show any preference for targets that are accompanied by emotions that are directed away from them (for example, if Julie smiles immediately after Gary makes a funny face behind her back, we would infer that since she couldn’t see Gary, Julie is likely smiling about something other than Gary’s funny face). Study 1b was designed to examine the nature of infants’ understanding of the relationship between emotional reactions and their targets, by looking at whether they are sensitive to Bystanders’ visual access to the actions of their targets.

4.4 Study 1b - undirected gaze

4.4.1 Methods

Fifty-one full-term infants participated in this study ($M$ age = 7 months, range = 5;15 – 12;15). Eighteen were Western European, 15 were East Asian, and 12 were East Asian-European mixed. As in Study 1a, data from 6 infants of other ethnicities were not included in the analyses because there were not enough participants from the same ethnic background to sufficiently draw conclusions about the group. Twelve infants were excluded from the analyses due to fussiness (n=10), procedure error (n=1), and no choice (n=1).

Identical procedures were followed for Study 1. The only stimuli modification was that at the beginning of each video, rather than gazing down at the Protagonists the Bystanders instead gaze upward, away from the scene, and remained fixed pointing upward for the remainder of each vignette. Through this modification, Bystanders have no visual access to the actors’ object choices. Thus, although the Bystanders make the same emotional displays at the very same time, their expressions do not appear to refer to the scene below.
**Figure 4.3.** Video stimuli for Study 1b. Bystanders’ gaze is directed away from the scene below so they have no knowledge of the yellow triangle’s actions (left). Bystanders express negative emotions away from the yellow character’s choice (right).

<table>
<thead>
<tr>
<th>Positively evaluated Protagonist</th>
<th>Negatively evaluated Protagonist</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image1" alt="Positively evaluated Protagonist" /></td>
<td><img src="image2" alt="Negatively evaluated Protagonist" /></td>
</tr>
<tr>
<td><img src="image3" alt="Positively evaluated Protagonist" /></td>
<td><img src="image4" alt="Negatively evaluated Protagonist" /></td>
</tr>
</tbody>
</table>

**4.4.2 Results**

Infants were equally likely to choose targets associated with positive and negative emotional expressions, regardless of their ethnicity (7 of 18 European infants, 7 of 15 East Asian, and 5 of 12 Mixed infants chose the positively associated target). Infants’ age and sex did not affect their choice (see Table 4.2 for coefficients).

**Figure 4.4** Infants’ Protagonist choice, by ethnicity, in Study 1b.
4.4.3 Comparing Study 1a and 1b

The pattern of results for this study differs significantly from that of Study 1a, in which Bystanders’ gaze was directed at the Protagonists and their actions. Consistent with results of the simple binomial probability tests above, analyses using a binary logistic regression combining data across the 2 studies reveal that there is a significant interaction between Ethnicity (European vs. non-European) and Study (directed gaze vs. undirected gaze; logistic regression coefficient = 1.64, p = .037, Odds Ratio = 5.156). That is, European infants differed significantly in their choices between Studies 1a and 1b, while East Asian infants did not. Similarly, using percent exposure to English as a predictor supports the interpretation that there is a significant interaction between infants’ cultural background and their choice preferences across the 2 studies (coeff = .027, p = .01, OR = 1.027).

Table 4.2 Logistic regression models comparing results of Study 1a and 1b. Model 1: Study and Ethnicity predicting Protagonist choice (left 2 columns), and Model 2: Study and % English exposure predicting Protagonist choice (right 2 columns)

<table>
<thead>
<tr>
<th>Predictors</th>
<th>ETHNICITY predictors model</th>
<th>LANGUAGE predictors model</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Choice coefficient (B)</td>
<td>Standard Error (SE)</td>
</tr>
<tr>
<td>Study</td>
<td>-0.065</td>
<td>0.463</td>
</tr>
<tr>
<td>European</td>
<td>-0.288</td>
<td>0.645</td>
</tr>
<tr>
<td>European*Study</td>
<td>1.64*</td>
<td>0.785</td>
</tr>
<tr>
<td>% English</td>
<td></td>
<td></td>
</tr>
<tr>
<td>% English * Study</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

†p < .10, *p < .05, **p < .01, ***p < .001

4.4.4 Discussion

The current study found that infants did not show consistent preferences for Protagonists whose actions were merely temporally associated with positive versus
negative expressions from social others in a display, but that were not interpretable as referring to the Protagonists themselves. Unlike in Study 1a, infants’ preferences did not differ based on ethnicity. In contrast, when Bystanders’ gazes were directed towards the Protagonists (Study 1a), European infants, as well as Mixed and East Asian infants with large amounts of exposure to English, showed a preference for the positively evaluated target. Thus, earlier than previously demonstrated (14 months; Luo & Beck, 2010; Sodian, Thoermer, & Metz, 2007), infants appear to be sensitive to the relationship between visual access and relevance of bystanders’ emotional displays: they only took into account their emotional reactions when bystanders had visual access to the Protagonists’ actions, but not when their gaze was directed away. Overall, the difference in choice patterns across Studies 1a and 1b supports the interpretation that infants with high levels of exposure to European-Canadian culture find emotional expressions to be informative when they are directed at a referent, but not when they are merely spatially and temporally contiguous with its actions. In contrast, East Asian infants with lower levels of acculturation were less likely to differentiate between directed emotional reactions and undirected emotional expressions, and to use the former to inform their social evaluations.

Another possible explanation remains for how infants’ may be influenced by Bystanders’ emotional reactions, without true conceptual understanding of the informational value of emotions. An observed emotion may affect behaviour via a process of emotional contagion, whereby infants exposed to others’ emotional states then internally reproduce the physical states corresponding to those emotional
states, accompanied by the same behavioural tendencies provoked by the emotions. Infants who successfully used others’ emotional expressions to guide their subsequent choices in Study 1a may have personally experienced the Bystanders’ emotions due to contagion, accompanied by the corresponding approach and avoidance behavioural tendencies, or they may have been able to understand the significance of emotional expressions without personally experiencing those emotions themselves. We address these possibilities in Study 1c, by coding infants’ affective displays and behaviours during the study session.

4.5 Study 1c – Behavioural coding

Emotional states can be transferred between people via emotional contagion, and affect people’s attitudes and behaviours (Barsade, 2002; Cacioppo, & Rapson, 1994). In the absence of infants’ ability to report on their affective experiences, an expedient method to examine whether infants’ choices were driven by “caught” affective states is to look at whether their expressions mirrored the Bystanders’ expressions in the stimuli. Preverbal infants generally have limited capacity to regulate or mask their subjective experiences, and are thus expected to reveal their affective states through observable behaviours. If emotional contagion is at work in driving infants’ social preferences, we would expect infants to express more positive affect on trials in which a Protagonist is positively evaluated by the Bystanders, and to express more negative affect on trials containing negative emotional reactions (i.e. correspondence between trial valence and infants’ affective behaviours).

In addition to affective expressions, we were interested in whether infants’ looking behaviours could help explain their target choices. Previous research on
gaze has shown it to be a reliable indicator of self-regulation (Stifter, 2002; Stifter & Braungart, 1995). Infants are able to control their exposure to stimuli by averting their eyes during arousing situations (Stern, 1974; Stifter & Moyer, 1991), both positive (Stifter & Moyer, 1991) and negative (Field, 2002). Along this line of reasoning, we wanted to measure infants’ gaze, including when they engaged in watching the stimuli, and when they turned to reference their caregiver.

### 4.5.1 Methods

To this end, 10-second clips featuring 12-month-old infants who participated in Study 1a described above were created. We reasoned that 12-month-olds greater reliability in producing affective expressions would produce greater reliability in coding, and hence, more useful data. Each clip began immediately after infants saw the Bystanders’ emotional expressions at the end of each trial, and ended when infants looked away from the screen for 2 seconds or more. Videos were centered on the infants’ head and torso while seated on a caregiver’s lap, giving a clear view of their face and movements. Each clip was labeled using a series of numbers and letters so as to avoid providing coders with identifying information. A West Asian coder who was blind to participants’ condition, and trial valence coded each video.

**Coding Scheme**

Each video was coded for positivity-negativity, frequency of referencing the caregiver, and frequency of looks away from the screen.

Positivity-negativity was coded on a 5-point Likert scale, ranging from -2 (very negative) to +2 (very positive). Zero, the midpoint, denoted neutral affect. Coders were instructed to use a holistic assessment of facial, vocal, and bodily
posture to code each video (Aknin, Hamlin, & Dunn, 2012). Naïve coder ratings have been shown to correlate highly with validated emotion coding systems, such as Baby FACS (Oster, 2003).

Referencing. Infants who turn to immediately look at their caregiver were considered to engage in referencing (which may be due to desire to for reassurance, or to seek out information). The total number of times an infant referenced the caregiver was counted and recorded.

**Reliability**

Reliability between the primary and a second coder was established on an independent set of 50 videos (from another study) before coding on the current study began. Agreement was 89% on the positivity-negativity scale, and 96% for frequency of caregiver referencing and looks away from screen between the 2 coders. Discrepant coding was discussed and resolved before coding on the current set commenced.

**4.5.2 Results**

Ratings from the primary coder are reported below. Overall, infants did not differ in their expressions across positive and negative trials (mean difference = -0.027, p = .817).

To investigate whether the lack of association between trial valence and infant affect applies equally across ethnicities, a generalized linear mixed model was used. This method was chosen because it can account for non-independent errors on repeated measures (since each infants has 4 trials that have non-independent errors). Using trial valence, ethnicity, and ethnicity-by-positivity interaction to
predict infants’ positivity, we found no significant main effects of either valence (estimate of fixed effect = -0.132, p = .753) or ethnicity (estimate of fixed effect (East Asian) = .241, p = .339; estimate of fixed effect (European) = .145, p = .551). However, there was a significant interaction of ethnicity by valence, such that Mixed infants were significantly more positive on positively valenced trials, and more negative on negatively valenced trials than both East Asian and European infants (estimate (East Asian) = -0.528, p = .025; estimate (European) = -0.450, p = .047; Mixed ethnicity is the reference group). This is an unexpected interaction that we did not have any a priori prediction or theoretical explanation for. Given the lack of main effect of ethnicity and valence, it is possible that it is an artifact of capitalizing on chance (especially given the small sample of Mixed infants).

Finally, we examined whether trial valence predicts the number of times an infant references his or her parent. We found no relationship between the valence of the stimuli and the number of times infants look to their parent. However, there is a small marginal effect of trial number, such that infants are more likely to reference his or her parents with later trials, regardless of valence (estimate = .071, p = .084). This result is likely due to increasing boredom, as infants approach the habituation criteria.

4.5.3 Discussion

Infants’ expressions and behaviours are not associated with the valence of each stimulus trial, and thus, we did not find evidence of emotional contagion influencing infants’ target choices. This preliminary step does not rule out the
possibility that infants did experience emotional contagion. However, we were unable to detect it through their facial and behavioural expressions.

So far, Study 1 has examined preverbal infants’ understanding of emotional reactions in association with social targets. Study 1b ruled out associative learning as a mechanism for infants’ choices, and Study 1c helps discount emotional contagion as another potential mechanism. Taken together, it is plausible European-Canadian infants’ preference for the target of positive emotional reactions was due to an understanding of the meaning conveyed by positive reactions, rather than a result of affective contagion, or a temporal association between salient physical characters and positive emotional expressions.

Next, we turn to address the second question outlined earlier, comparing infants’ use of social referencing for asocial targets with social targets. While numerous studies have examined infants’ use of social referencing for asocial targets, showing that by 10 months, infants reliably use observed emotions to regulate behaviours towards novel toys and objects, none has included social referencing for social targets in the same study (Mumme et al., 1996; Sorce et al., 1985; Walden & Ogan, 1988). Thus, we were interested in using a standardized methodology to conduct such a comparison. We turn to this question in Study 2.

4.6 Study 2 – Object targets

4.6.1 Methods

One hundred and three full term infants participated in this study (53 6-month-olds, 50 12-month-olds; $M$ age= 9.23 months, range = 5;15 – 12;16). Thirty-six were Western European, 34 were East Asian, and 18 were East Asian-European
mixed. Fifteen infants of other ethnicities also participated in the study. However, due to large number of cultural backgrounds represented, there were insufficient participants from the same ethnic background to draw conclusions about the broader cultural group. Thus, they were excluded from results presented below. An additional 46 infants were excluded from the analysis due to fussiness (n = 15), no choice (n = 15), parental interference (n = 8), and procedural error (n = 8).

Procedures were identical to Study 1. As with Study 1, infants watch videos of two characters (a blue square and a yellow triangle with eyes) alternately choosing between 2 objects (here, a bottle and a highlighter). The only difference is in modifications to the stimuli such that across the set of 4 habituation trials, one object is always smiled at, regardless of which character chooses it; the other is always frowned at. This design is utilized to imply that Bystanders differentially value the objects, but not the characters.

If infants can learn about objects as bystanders to others’ emotional reactions, then their object choices should be reliably affected by the emotions they witnessed being expressed towards the objects. Furthermore, they should prefer and reach for objects that were the targets of positive emotional reactions more than objects that were targets of negative emotional reactions.
Figure 4.5 Stimuli for Study 2: Bystanders reacting positively to the blue square picking the blue bottle (left). Bystanders reacting negatively to the blue square picking the purple highlighter (right). Not shown here: same scenarios depicting the yellow triangle making the same choices as the blue square, and eliciting the same reactions from the Bystanders.

4.6.2 Results

Six-month-old infants did not show a significant preference for either positively or negatively evaluated object (12 of 18 European infants, 8 of 18 East Asian, and 4 of 9 Mixed infants chose the positively associated target). 12-month-old infants in our sample similarly showed a lack of distinct object preference based on the valence of Bystanders’ emotional reactions. Ten out of 18 European infants, 9 out of 16 East Asian infants, and 3 out of 9 Mixed infants picked the positively evaluated object target.

Repeating our analytic strategy from Study 1, we conducted a binary logistic regression combining the 2 age groups to predict infants’ target choice. Infants’ ethnicity, age and sex did not affect their choices.
Next, we compared results across Studies 1a and 1b in order to examine whether 6 and 12-month-old infants use social referencing similarly for social and asocial targets. Conducting a binary logistic regression model using Study (social vs. asocial), ethnicity (European vs. non-European), and Study-by-ethnicity interaction term to predict infants’ target choices based on valence of Bystanders’ emotional reactions, we found that overall, infants did not choose differently across the 2 studies ($B = .44, p = .186, OR=1.552$). This is due to a significant cultural difference in how infants used social referencing: European infants were $3.87$ times as likely to pick targets of positive emotional reactions, compared to non-European infants ($B = 1.352, p = .002, OR= 3.867$). Furthermore, the extent to which European-Canadian infants used social referencing varied by Study: their preference for the positively evaluated Social target was nearly 4 times as large as for the positively evaluated Asocial target ($B = -1.342, p = .003, OR = .261$).
4.6.3 Discussion

Unlike previous studies of social referencing, results of the present study found that infants who observed bystander evaluations of novel objects did not reliably use those evaluative expressions to guide their behaviours with regards to the objects. This also stands in contrast to Euro-Canadian infants’ demonstrated ability to use the same emotional evaluations to guide their social evaluations in Study 1. A few design differences between the current and previous studies may account for these contrasting results.

Previous studies of social referencing with infants in their first year have only shown direct emotional expressions towards objects, and not towards people interacting with objects. It is possible that social targets, as intentional agents, are privileged as targets of social referencing. And while doable, social referencing of objects may involve more complex cognitions, which proved to be too challenging for even the oldest infants tested here (12.5 months). The only published study showing successful use of emotional reactions to an individual interacting with an object occurs at 18 months (Repacholi & Meltzoff, 2007), several months older than infants in our sample. That infants may privilege affective reactions to social targets over object targets is corroborated by the fact that extracting Bystanders’ evaluations of object targets in Study 2 required the exact same process of aggregating evaluative information across 4 trials as to identify the favoured Protagonist in Study 1a. Hence, rather than greater salience of social compared to object targets in these stimuli in particular, the difference in infants’ performance
across the two studies may be due to infants’ differential sensitivity to social vs. asocial targets more broadly.

4.7 General discussion

Our hypotheses regarding the influence of observed valenced emotional expressions on infants’ behaviours were partially supported. European infants preferred social targets that received social approval in the form of positive emotional reactions over those who received social rejection in the form of negative emotional reactions in Study 1a; their choices did not appear to be driven by a mere temporal association between a salient action and a contiguous emotional expression (Study 1b), nor due to affective contagion from the Bystanders to the infant (Study 1c). In contrast, the very same emotional reactions did not influence European infants’ preferences for asocial targets (Objects); at both 6- and 12-months infants chose equally between positively and negatively evaluated object targets (Study 2).

Unlike Euro-Canadian infants, East Asian infants did not prefer the positively evaluated Protagonist. At 6 months of age, East Asian infants preferred the negatively evaluated Protagonist, and by 12 months chose equally between Protagonists who provoked positive versus negative emotional reactions (Study 1a). As with European infants, East Asian infants also did not use others’ emotional reactions to asocial targets to inform their preferences, choosing at chance in response to observing positive and negative emotional reactions to objects at both 6 and 12 months of age (Study 2). Furthermore, their choices do not appear to be driven by temporal contiguity (Study 1b) or affective contagion (Study 1c).
From a social referencing perspective, we expected infants to choose the target that had elicited positive emotional reactions from the Bystanders because it communicates that the referent is valued. There are a variety of reasons why infants would prefer the valued Protagonist. First, socially vetted individuals tend to have a history of being prosocial, and cooperative, thus rendering interactions with such individuals relatively low risk, and potentially beneficial. Another reason is that through interacting with popular individuals, one’s reputation might improve by association, through the logic of a friend of a friend is my friend. Finally, by paying attention to the valued individuals, one may learn skills that led their achieving social esteem in the first place (Foulsham, Cheng, Tracy, Henrich, & Kingstone, 2010; Henrich & Gil-White, 2001). The results observed in Euro-Canadian infants are consistent with this explanation.

We did not compare positively and negatively evaluated target against neutral target, thus it is unclear what motivated infants’ choices: avoidance of the negatively evaluated target, or approach of the positively evaluated target. Previous work suggests that infants may exhibit a negativity bias in emotional processing (see Vaish, Grossmann, & Woodward, 2008 for a review). The greater weight given to negative information may extend to other areas as well, such as sociomoral evaluations. For example, Hamlin and colleagues (Hamlin et al., 2010) found that 3-month-olds prefer neutral to antisocial targets, but did not differentiate their response to helpful and neutral targets, suggesting that avoidance of potential threat may be more important than seeking out beneficial opportunities. Future work
would need to be conducted to see whether avoidance of the negatively evaluated target is similarly driving infants’ choices here.

As noted in the introduction of this chapter, there have been documented differences in parental behaviours across cultures. One such difference is in the amount of physical contact parents have with infants in relatively autonomous European and North American cultures, compared to relatively interdependent cultures in East Asia and Latin America (Keller et al., 2006; Salomo & Liszkowski, 2013). One consequence of being in direct physical contact with the caregiver is that infants may receive less practice with interpreting remote, affective cues from parents (since physical contact usually entails side-by-side, rather than face-to-face interaction). As a consequence, East Asian infants may gain proficiency at using others’ emotions to self-regulate at a slower rate than their European-Canadian counterparts.

A related explanation is that accuracy of perception of negative emotions may be lower amongst East Asian compared to Europeans (see Ekman, Friesen, et al, 1987; Izard, 1977; Matsumoto, 1992). This is a variant of the above explanation, where less familiarity may have led to confusion between similar expressions, such as anger and sadness, 2 emotions that have lower cross cultural recognition rates even among adults (Calvo, Gutiérrez-García, Fernández-Martín, & Nummenmaa, 2014; Nelson & Russell, 2013). By this account, East Asian infants may have perceived the negative faces to be sad rather than angry. Furthermore, studies have documented cultural differences in the degree to which parents encourage the development of other-regarding concern vs. mastery of the physical environment.
(Tamis-LeMonda, Katz, & Bornstein, 2002). Parental encouragement to prioritize other-regarding concern, combined with interpreting the stimuli faces as expressions of sadness could have activated a desire to approach and comfort the negatively evaluated target Protagonist, superseding a desire to avoid a potentially bad social partner.

In observations of Japanese and American mother-infant dyads, Japanese mothers tended to put more emphasis on rehearsing social routines with their infants and instilling empathy for others’ feelings, while American mothers tended to emphasize individual autonomy and direct infants’ attention to extra-dyadic objects (Fernald & Morikawa, 1993; Tamis-LeMonda, Bornstein, Cyphers, Toda, & Ogino, 1992). For example, Fernald and Morikawa (1993) documented a two-fold difference in the frequency with which Japanese and American mothers led their infants in social routines that practiced social exchanges, empathy and greetings. The implication of such differences in emphasis during socialization is that Euro-Canadian infants may learn to prioritize interpreting emotional cues to accurately identify the best social partner (crucial to navigating the world as an autonomous agent and avoiding danger), while East Asian infants may learn to prioritize social harmony (approaching the socially rejected target to provide comfort and affiliation) over avoidance of negatively evaluated targets.

Are there cultural differences in parents’ reliance on emotional communications to convey evaluative information about people and objects? If so, what other means of communications are used to do so? In order to better understand infants’ experiences with evaluative communications in our sample, we
use structured observations to investigate how parents in our sample interact with their infants to convey information about approval and disapproval toward 2 different targets. This study is outlined in the following chapter.
5. Parents’ affective communications across cultures

5.1 Introduction

The current chapter investigates differences and similarities in parenting practices across East Asian and European-Canadian cultures that may account for differences in infants’ use of social referencing in Chapter 4.

Parents constitute a vital aspect of infants’ developmental context. Parents play a significant role in structuring infants’ interactions by shaping basic aspects of cognition, including directing attention (Tomasello & Todd, 1983), co-regulating emotions (Murray & Trevarthen, 1985; Reddy, Murray, & Trevarthen, 1997), and shaping expectations for social relationships (Johnson et al., 2007; 2010). They are also primary agents of cultural transmission in early life, modeling and encouraging culturally valued behaviours, emotions and attitudes, and responding negatively to counter-normative ones. Indeed, although there are undoubtedly idiosyncrasies in the details of behaviours that are modeled across individual parent-child dyads, these are likely to be yoked to a specific culture and its particular set of social norms.

Parenting practices share both important similarities and differences across cultures, reflecting local perspectives of ideal end points in development (Keller et al., 2006). Individualistic cultures, typified by North Americans of European descent, perceive the ideal end point of development to include achieving autonomy and well defined personal preferences, attitudes, and goals. Correspondingly, parenting practices in individualistic cultures (e.g. American mothers) propagate these values by encouraging physical autonomy, tending to let their infants take the lead in
initiating activities and interactions (Kuchner, 1981). Parents also foster self-esteem by focusing on children’s personal attributes, preferences and judgments (Mullen & Yi, 1995; Wang, Leichtman, & Davies, 2000); for example, casting their child as the central character in narratives of past events, and focusing conversations on the child’s thoughts and feelings, rather than other features of the situation, such as how others were feeling, or discussing contextually normative behaviours. Individualistic cultures also tend to hold the view that emotions are an authentic expression of the self (Markus & Kitayama, 1995), reflecting one’s true feelings, rather than culturally prescribed scripts for one’s particular role in a situation.

In contrast, interdependent cultures common in East Asia and Latin America tend to emphasize relatedness among group members and social harmony (Kagitcibasi, 2005; Keller et al., 2006; Markus & Kitayama, 1991). Consistently, in interdependent cultures, parenting behaviours emphasize social routines that show greater tolerance for other-reliance, and promote relatedness and concern for others (Dennis, Talih, Cole, Zahn-Waxler, & Mizuta, 2007).

Studies comparing parental behaviours across American and East Asian cultures have documented both universality and cultural variability (Callaghan et al., 2011). In naturalistic observations of mothers and infants freely interacting in their homes, Japanese and Amerian mothers appeared to spend similar proportions of time engaging their infants in social and pedagogical interactions (Bornstein, Azuma, Tamis-LeMonda, & Ogino, 1990). Mothers are similar in overall levels of maternal expressiveness, touching, and vocalizing (Fogel et al., 1988). However, studies have also documented mean differences in the amount of maternal-initiated
interactions across American and East Asian samples. For instance, Japanese
mothers speak more to their infants than do American mothers; consistent with the
above observation that American mothers tend to let their infants take the lead.
Similarly, Japanese mothers initiate more interactions, especially exchange routines
(used in offering, requesting, and accepting objects politely) and empathy routines
(used to encourage infants to behave positively towards a person or object) at every
age of comparison (Fernald & Morikawa, 1993). Japanese mothers also initiate
interactions much earlier in life than do American mothers, showing substantial
levels at 6 months and increasing in frequency over the first 2 years. In contrast,
American mothers do not regularly initiate interactions like these until their infants
are 12 months of age, and the rate of increase is slower (Fernald & Morikawa, 1993).

Indeed, even when overall levels of parent-child behaviours are similar,
contextual differences in when, and the circumstances under which they occur are
observable. For example, American mothers tend to respond to their infants’
overtures with vocal and facial displays, whereas Japanese mothers are more likely
to respond with touching and other nonverbal behaviours (Fogel et al., 1988).
Furthermore, though mother-infant dyads tend to engage in similar levels of play
with toys, subtle differences also emerge in how mothers used toys to engage their
infant: American mothers labeled objects more frequently, while Japanese mothers
tended to use objects to engage infants in social (exchange or empathy) routines
more often (Fernald & Morikawa, 1993).

Cultural differences in a number of behaviours vary as a function of early
input. Japanese and American mothers’ differential use of objects in interactions
with infants have been shown to produce differences in infants’ vocabularies: American mothers’ more frequent labeling of objects is associated with mothers’ reported infants’ greater noun vocabulary, while Japanese infants’ less frequent exposure to object labels corresponded with smaller mother-reported noun vocabularies (Fernald & Morikawa, 1993). In another case, greater amount of parental deictic pointing is associated with higher frequency of joint attention among Dutch, Chinese, and Mexican Mayan infants at 18 months (Salomo & Liszkowski, 2013): the highest observed amounts of parental deictic pointing corresponded to the highest frequency of joint attention in Chinese infants, and the lowest amount of deictic pointing corresponded to the lowest frequency of joint attention in Mexican Mayan infants.

5.2 The present study

The present study examines how East Asian and Euro-Canadian parents communicate approbation and disapprobation to their preverbal infants, in an effort to understand whether infants’ experience with affectively valenced messages impacts their social referencing ability. Specifically, we reasoned that if East Asian and Euro-Canadian infants experience different patterns of affective communication, that this might provide an explanation for why they showed differential patterns in the social referencing in the studies outlined in Chapter 4. To examine how parents communicate approbation and disapprobation, both East Asian and Euro-Canadian parents were asked to convey positively and negatively valenced information about two targets, a rubber whale and a rubber crab bath toy. Aside from being told to communicate to their infants that one toy was OK to play
with and the other was not, parents were free to communicate in whatever way they wished. Coded behaviours of interest included vocal and facial cues parents used to convey valenced information about the targets to their infants, whether parents engaged in physical behaviours that either helped or hindered their infants’ access to the targets, as well as how parents and infants allocated their attention during the interaction.

Since we are primarily interested in infants’ experience with emotional communications, we focused on parental production of facial and vocal communications toward the infants. As reviewed in Chapter 4, facial expressions of basic emotions are highly reliable signals that are universally and rapidly recognized. In addition, another method of reliably conveying emotional states is to modulate one’s voice. Indeed, vocal affect is a highly effective means of communicating emotional states, especially at a distance or when one’s facial expressions are otherwise obscured. For example, studies have demonstrated that nonsense sentences intended to convey fear, joy, and anger are associated with a higher vocal pitch (fundamental frequency of speech) than are neutral sentences, whereas those conveying sadness are associated with a lower pitch (Bachorowski, 1999; Banse & Scherer, 1996; Leinonen, 1997; Scherer, Banse, Wallbott, & Goldbeck, 1991).

Indeed, there are good reasons to expect that the verbal modality might be an especially powerful form of affective communication, even when infants are too young to understand the semantic content of the verbalizations themselves. From extremely early in life, infants respond to prosodic characteristics of speech, such as
frequency, intensity, and rhythm (Mehler, Bertoncini, Barriere, & Jassik-Gerschenfeld, 1978; Mehler et al, 1988; Moon, Cooper, & Fifer, 1993; Nazzi, Bertoncini, & Mehler, 1998), and prefer their own native language to a non-native language based on these prosodic cues (Mehler et al, 1988). Young infants also use prosodic cues to perceive vocally communicated emotional speech. In fact, newborn infants appear to differentiate happy vocalizations from other emotions in their native language (angry, sad, and neutral; Mastropieri & Turkewitz, 1999). Three-month-olds can further differentiate changes in vocal affect, from happy to sad, and by 5 months infants can successfully detect changes in both directions (happy to sad, and sad to happy; Walker-Andrews & Grolnick, 1983). Another study found that 5-month-olds discriminate between angry, sad, and happy vocal expressions when accompanied by a face, regardless of whether the facial expression matches the vocal expression (Walker-Andrews & Lennon, 1991). Finally, studies suggest that vocal communications alone are reliably decoded at an earlier age than facial communications alone, although the two in concert are most effective at regulating infants’ behaviours (Vaish & Striano, 2004). Given this evidence, we were interested in the kinds of vocally expressed emotional experiences infants receive.

In addition to facial and vocal communications, physical manipulation of an infant’s body is another way caregivers can transmit information about the environment. Caregivers can encourage exploration by stretching out an infant’s hand toward a target, discourage approach behaviours by blocking or suppressing their reaches, and redirect their attention towards novel targets by repositioning their bodies. Outside of the North American context, caregivers in many
communities emphasize physical, instead of visual, face-to-face contact (Konner, 2005; Ochs & Schieffelin, 2001; Richman, Miller, & LeVine, 1992). These differences may extend to how adults engage in pedagogy with their infants: caregivers in a Vanuatu community engaged in more physical manipulation of their infants (physical triadic engagement) to teach them about an object, compared with American caregivers, who engaged in more visual triadic engagement, using shifts in eye gaze to draw their infants’ attention to the target (Little et al., 2015). Physical manipulation can thus be thought of as an alternative means (to vocal and visual/facial communication) of regulating infants’ attention and behaviours.

Finally, we used allocation of attention as a crude measure of the proportion of time infants attended to the parent, the referents of the parents’ communications, and to targets outside of the parent-infant-objects triad. We reasoned that these measures could also speak to the 2 proposed accounts for results found in Study 1 of Chapter 4. First, the different-motivations account, whereby infants are similar in ability to interpret emotional signals, but are socialized to prioritize different motivations (accuracy or affiliation) when interacting with a social target, should produce an emphasis on different patterns of attentional engagement between parent-infant dyads. In order to examine whether parents differentially emphasize social routines and extra-dyadic exploration, we sought to quantify the amount of time dyads spent in mutual attention (focused on each other), shared attention (or triadic joint attention; focused on the same target outside of the dyad), or divergent attention (each partner focused on a non-shared target outside of the dyad). Specifically, Euro-Canadian dyads would be expected to spend a greater proportion
of time in joint attention (consistent with practice decoding the environment), and East Asian dyads would be expected to spend a greater proportion of time in mutual attention (consistent with more practice in social routines).

In contrast to the different-motivations account, the different-ability account proposes that differences in infants’ experience with informative emotional communications lead to differences in their ability to decode emotional communications. The resulting difference could be a difference in age of onset, whereby both groups eventually perform at similar levels, but the rates of change differ. Or, the difference could be in overall ability, whereby recognition rates for some emotions are higher in adults of one culture than that of another. In either form of this different-ability account, Euro-Canadian parents are predicted to produce more valenced affective facial and vocal communications to relay evaluative information about targets than their East Asian counterparts. If East Asian infants are receiving substantially less practice decoding evaluative emotional communications (e.g., as a function of their spending more time in side-by-side physical contact with parents, and less time face-to-face), their performance at social referencing task may suffer accordingly. This account does not predict cultural differences in parents’ concern with infants’ safety. Rather, parents may employ different means to ensure infants’ wellbeing. In individualistic cultures that encourage early autonomy, parents may provide face-to-face cues (such as vocal and facial emotional communications) to encourage independent judgment and decision-making. In interdependent cultures, parents may achieve the same goals by
using more hands-on physical manipulations and interventions on their infants’ bodies.

The different-abilities account is not clearly at odds with the different-motivations account above. In fact, predominant patterns of attentional engagement associated with each culture could be correlated with the amount of experience interpreting emotional communications. For example, parents may preferentially provide evaluative affective information during joint attention (predicted Euro-Canadian predominant pattern), and not display many evaluative emotions while in mutual attention (predicted East Asian predominant pattern). In this way, the type of attentional engagement could drive frequency of emotional communications, or vice versa.

5.2.1 Methods

Twenty-one East Asian infants (38% female; mean age = 8.95, range = 5.6 – 12.43) and 20 Western European infants (50% female; mean age 8.73, range = 5.73 – 16.3) and their parents participated in this study. For each ethnicity, half of the infant sample was between 6-9 months and half were between 9-12 months. Families were recruited through a database maintained by the University of British Columbia Early Development Research Group. Participating families were given a token gift for their participation.

Procedures

Parents were asked for consent to participate in a study looking at how families spend time with their infants. Each session was divided into 2 components, an unstructured component, and a structured component, both of which took place
in the same room; the structured component is the subject of the current coding. At the beginning of the study, participating families were led to a 2.5-by-2.5 meter square room containing a small Ikea table and chairs, and toys in large Tupperware containers. Families were given time to settle in, and told to feel free to do whatever they would typically do if they were with their child at home. The experimenter then left the room.

After 3 minutes of unstructured interaction time, the experimenter returned to the room with two rubber bath toys, and greeted the family. The experimenter then asked parents to convey that the whale is good to play with, and the crab is bad and should not be touched (good and bad targets were counterbalanced across families) to their child. If parents asked how to convey this information, the experimenter responded that they could convey this information in any way they wished, or typically would if they wanted to encourage their child to play with, or to stay away from them at home. The family was recorded for 2 minutes (120 seconds), and thanked for their participation.

Due to the native-language requirement of vocal recognition of emotions (Mastropieri & Turkewitz, 1999; Mehler et al, 1978), and to increase ecological validity, we asked parents to communicate in the language that infants were most often exposed to at home.

**Coding**

Coding was done using the coding program Observer (Noldus, 2014), using a custom-built coding scheme. Two research assistants, naïve to our hypotheses, coded the interactions from 2 video angles. The coders were trained together by a
primary experimenter until a sufficient level of agreement (80%) was reached, after which they completed coding independently. The coders overlapped on 25% of the subjects. Each video was coded for attention and parent-initiated behaviours regarding the targets.

*Communicating about good and bad targets.*

Concurrent with changes in attentional states, parent-initiated episodes of communications about the target toys were coded. A new episode was deemed to be the first time a parent referred to a particular target by vocal, facial, or behavioural means, with the intention to draw the infants’ attention to the crab or the whale. An episode ended immediately after the parent’s action was complete (including verbal and facial behaviours). It was possible for more than one type of means to be coded at a time (e.g. a parent who pushed the bad target towards the infant and modulated his vocal pitch would simultaneously be coded as “bad target” with “push toward” as behavioural modifier, and “low pitch” as vocal modifier).

*Behavioural coding.* Actions to put a target to closer proximity to the infant were coded as “push toward”, and actions to put a target out of reach from the infant were coded as “push away”. If parents intervened with infants’ efforts to grasp a target, a facilitative intervention (such as helping them stay upright) was coded as “support”, and a hindering intervention (such as blocking their reach) was coded as “restraint”.

Facial coding. The number and duration of positive emotional displays (e.g. smiles), negative emotional displays (e.g. frowns), or neutral faces were coded.
holistically and based on commonsense understanding of these expressions. Only changes from one facial expression to another were coded as novel episodes.

*Vocal coding.* Vocal coding was done subjectively, relative to the parents’ normal speaking voice (recorded during interaction with the Researcher) as baseline. Parents who raised the pitch of their voice were coded as “high pitch”, and lowered pitch was coded as “low pitch”. Otherwise, “normal pitch” was coded.

*Attention.*

Attention was coded as one of 3 mutually exclusive states: mutual, divergent, and shared (joint) attention. Mutual attention was coded when parent and child are engaged in attention toward each other at the same time. Divergent attention was coded when parent and child are focused on different targets, for example, parent on the child, and child on a bath toy. Shared (or joint) attention was coded when parent and child are attending to the same, external target (e.g. a bath toy). To be coded, an attentional state must have lasted a minimum of 1 second; otherwise the previous coded state was maintained until the dyad switched to a state of longer duration.

### 5.2.2 Results

Below we compare mean frequency and duration of attentional states, as well as behavioural, facial, and vocal communications about good and bad targets across cultures, using independent samples t-tests. Given the number of (planned) contrasts being tested, a Tukey correction should be applied to control for family-wise Type I error. However the correction would be impractical to apply here, given the limited sample size. Thus, the results shown here should be read as qualitative
observations of possible patterns that may exist in the population, and which should be tested with a substantially larger sample to support inferential claims about similarities and differences in parent-initiated communications across cultures. Statistics are thus provided for reference only.

**Target-related communications.** To examine whether there is a mean effect of target valence, total frequency and duration of all communications about the good target were compared against those about the bad target, using paired samples t-tests. Overall, parents of both cultures communicated about good targets more frequently, and for a substantially longer duration than about bad targets to their children (East Asians mean difference in number = 4.3 times, mean difference in duration = 63.178; Euro-Canadians mean difference in number = 5.4 times, mean diff in duration = 71.114 seconds, all comparisons p < .001 in paired samples t-test).

**Table 5.1** Comparison of parents’ communications about good and bad targets, by ethnicity

<table>
<thead>
<tr>
<th>Ethnicity</th>
<th>Measure</th>
<th>Communications about Good target</th>
<th>Communications about Bad target</th>
<th>Mean difference</th>
</tr>
</thead>
<tbody>
<tr>
<td>East Asian</td>
<td>Frequency</td>
<td>13.905</td>
<td>9.667</td>
<td>4.238***</td>
</tr>
<tr>
<td></td>
<td>Duration</td>
<td>116.508</td>
<td>53.335</td>
<td>63.173***</td>
</tr>
<tr>
<td>Euro-Canadian</td>
<td>Frequency</td>
<td>11.65</td>
<td>6.25</td>
<td>5.4***</td>
</tr>
<tr>
<td></td>
<td>Duration</td>
<td>103.884</td>
<td>32.771</td>
<td>71.113***</td>
</tr>
</tbody>
</table>

Comparing ethnicities, East Asian parents made an overall greater number of target-related communications (mean difference = 5.67, t(29.5)= -2.155, p = .039) and for a longer total duration (mean difference = 33.19 seconds, t(39) = -1.563, p = .126) than Euro-Canadian parents. That is, East Asian parents made more frequent
attempts to communicate target-related information to their infants during the 2-minute interaction.

Next, considering each type of target in turn, East Asian parents made a significantly greater number of communications about bad targets (mean difference = 3.4 times, $t(39) = -2.165, p = .037$) and for longer period of time (mean diff = 20.56 seconds, $t(39) = -1.791, p = .081$) than their Euro-Canadian counterparts. A similar trend can be seen for communications about good targets, however these patterns were not significant at conventional levels (mean difference in number = 2.25 times, $t(27.8)=-1.696, p = .101$; mean difference in duration = 12.624 seconds, $t(39) = -.833, p = .410$). Thus, although parents of both ethnicities communicated substantially more about the good target than the bad target, this difference was less pronounced in East Asian parents’ communications, indicating that the extra communicative efforts were about the bad target.

**Exposure to vocal, facial and behavioural communications.** We were interested in whether East Asian and Euro-Canadian infants differed in their experiences of the 3 modes of communication. East Asian infants experienced a greater number (mean difference = 2.3 times, $t(29.119)=-1.695, p = .101$) and duration of vocal communications (mean difference = 15.125 seconds, $t(39) = -1.518, p = .137$) about the targets than their Euro-Canadian counterparts. East Asian infants also experienced more helping and hindering actions with regard to the targets than did Euro-Canadian infants (mean difference = 2.93, $t(31.955) = -1.903, p = .066$). Thus, consistent with previous study findings, East Asian infants experienced a greater number of proactive communications about the targets than
Euro-Canadian infants. Unfortunately, after having run the bulk of our subjects we discovered that our ability to reliably code facial expressions of emotion was limited, as parents had the tendency to look down at their infants and because mothers’ hair often obscured their faces. These issues should be improved upon in subsequent studies; but in all subsequent reports herein emotional facial coding is not included.

**Valence congruent communications.** In addition to looking at overall amount of communication about various targets and overall amount of different types of communication reflecting proactive, effortful parent-initiated interactions, it may additionally be useful to examine whether parents’ communications were useful for infants’ learning about the valence of the referents of that communication. That is, are vocal, facial, and behavioural interactions conveyed in a valence-congruent manner? If communications convey useful information about valence, we would expect, for example, utterances about good targets to have higher pitch, and utterances about bad targets to have lower pitch. Parents may also provide more support to facilitate reaching for good targets, while imposing more restraint with bad targets, as well as to push good targets closer to infants, while putting bad targets out of reach. If parents are not making valence-congruent communications, there should be no consistent association between target valence and parents’ vocal pitch or facial expressions.

**Voice.** Parents of both groups were comparable in the frequency and duration of using high-pitched voices to refer to the good target (frequency mean diff = .278 times, t(34) = -.396, p = .694; duration mean diff = 6.681 seconds, t(34) = -.663, p =
and low-pitched voices to refer to the bad target (frequency mean diff = .452 times, t(24)=.474, p = .447; duration mean diff=5.369 seconds, t(24)=1.071, p = .295). However, East Asian parents made more utterances overall, and these extra utterances tended to consist of both valence-neutral and valence-incongruent vocalizations. East Asian parents used normal pitched voice significantly more than Euro-Canadian parents to refer to both the good target (mean diff = 2.214 times, t(29) = -2.186, p =.037) and to the bad target (mean diff = 2.085 times, t(17.387) = -2.364, p = .03). Similarly, East Asian parents spoke for longer durations using normal pitched voices about both targets than Euro-Canadian parents (good target mean diff = 11.784 seconds, t(29) = -1.416, p = .167; bad target duration mean diff = 14.329 seconds, t(19.664) = -2.596, p = .017). Furthermore, East Asian parents also used high-pitched voices to refer to the bad target for a significantly longer time than Euro-Canadian parents (duration mean diff = 11.63 seconds, t(6.7) = - 2.384, p = .05). Across the board, these patterns indicate that Euro-Canadian parents tended to use more valence-congruent vocal pitch to refer to the targets compared to East Asian parents.

Facial communications. As noted above, due to the perspective of our cameras and parents’ facial angles, we were unable to code for facial expressions of emotion.
Table 5.2 Comparison of East Asian and Euro-Canadian parents’ communications about good and bad targets, by communication type.

<table>
<thead>
<tr>
<th>COMMUNICATION ABOUT GOOD TARGET</th>
<th>EAST ASIAN</th>
<th>EURO-CANADIAN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Duration</td>
</tr>
<tr>
<td>Voice pitch (3 levels)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High pitch</td>
<td>3.667</td>
<td>38.741</td>
</tr>
<tr>
<td>Normal pitch</td>
<td>6.214</td>
<td>40.69*</td>
</tr>
<tr>
<td>Low pitch</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Physical manipulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of target (2 levels)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Push target towards infant</td>
<td>5.667</td>
<td>48.425</td>
</tr>
<tr>
<td>Push target away from</td>
<td>2</td>
<td>17.333</td>
</tr>
<tr>
<td>infant</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physical manipulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of infant (2 levels)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physically support infant</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Physically restrain infant</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>OVERALL COMMUNICATIONS</td>
<td>11.65</td>
<td>103.884</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>COMMUNICATION ABOUT BAD TARGET</th>
<th>EAST ASIAN</th>
<th>EURO-CANADIAN</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Duration</td>
</tr>
<tr>
<td>Voice pitch (3 levels)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>High pitch</td>
<td>2.143</td>
<td>15.283*</td>
</tr>
<tr>
<td>Normal pitch</td>
<td>4.267*</td>
<td>24.099*</td>
</tr>
<tr>
<td>Low pitch</td>
<td>2.33</td>
<td>11.1123</td>
</tr>
<tr>
<td>Physical manipulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of target (2 levels)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Push target towards infant</td>
<td>3.429</td>
<td>22.427</td>
</tr>
<tr>
<td>Push target away from infant</td>
<td>3</td>
<td>12.757</td>
</tr>
<tr>
<td>Physical manipulation</td>
<td></td>
<td></td>
</tr>
<tr>
<td>of infant (2 levels)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Physically support infant</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>Physically restrain infant</td>
<td>--</td>
<td>--</td>
</tr>
<tr>
<td>OVERALL COMMUNICATIONS</td>
<td>6.25</td>
<td>32.771</td>
</tr>
</tbody>
</table>
Behavioural interventions. Few parents provided physical support for infants’ attempts to reach for target objects (1 Euro-Canadian and 2 East Asian parents helped reach for the good target, none helped for the bad target), and none restrained their infants’ attempts to reach for the targets. Instead, most parents manipulated the targets to move them in and out of infants’ grasp. All parents pushed the good target towards infants at least once, though Euro-Canadian parents did so fewer times (4.58 vs. 5.67 times, t(30.8)= -1.602, p = .119) and for shorter periods of time (43.64 vs. 48.43 seconds, t(38)= -.632, p = .531) than did East Asian parents. Fewer parents of both ethnicities pushed the bad target towards their infants (8 of 20, or 40% of Euro-Canadian, and 14 of 21, or 67% of East Asian parents did so). However, East Asian parents did so more frequently (3.43 vs. 2.88 times, t(20) = -.478, p = .638), and for longer duration, t(20) = -.925, p = .366) than Euro-Canadian parents.

When it comes to putting good targets out of reach, 7 Euro-Canadian and 8 East Asian parents did so; there was no significant difference in either the frequency (1.29 vs. 2 times, t(13) = -1.358, p = .198) nor the duration (14.09 vs. 17.33 seconds, t(13)= -.588, p = .566). Finally, 75% (15 of 20) Euro-Canadian parents moved the bad target farther away, while 76% (16 of 21) East Asian parents did so. In terms of the frequency and duration, East Asian and Euro-Canadian parents put the bad target out of reach with similar frequency (3 vs. 2.33 times, t(29)= -1.554, p = .131), and for a comparable duration (12.76 seconds, vs. 12.49 seconds, t(29)= -.084, p = .934). Overall, as with the vocal patterns, Euro-Canadian parents were more differentiated in their actions about the good and bad targets (more parents pushed
good targets toward infants, and put bad targets farther away), whereas East-Asian parents made more frequent, but less differentiated actions.

Next, we turn to examine patterns of attentional engagement between parent and infant during the 2-minute interaction.

**Attention.** Parent-infant dyads of both ethnicities engaged the most in shared attention (48% for Euro-Canadian dyads, and 51% for East Asian dyads), during the 2-minute session, followed closely by divergent attention (40% for Euro-Canadians, and 46% for East Asians), and very little in mutual attention (6.6% for Euro-Canadians, and 1.2% for East Asians). These results also indicate that duration of different states of attention did not differ significantly across cultures (mean diff (mutual attention) = 12.3%, t(12) = .869, p = .402; mean diff (divergent)= .33%, t(36) = .036, p =.871; mean diff (shared) = .226%, t(35) = .254, p = .801). In light of the instructions given to parents (to convey information about specific targets), the large proportion of time spent in shared attention, and low proportion of time spent in mutual attention suggests that parents followed instructions closely.

While the duration of attention allocation was comparable across cultures, the frequency with which dyads switched from one attentional state to another did differ across cultures. East Asian dyads engaged in a greater number of shared and divergent attentional states than did Euro-Canadians (7.4 vs. 4.9 episodes of divergent attention, t(39) = -2.225, p = .032; and 7.3 vs. 4.4 episodes of shared attention, t(39) = -2.448, p = .019). This difference indicate that Euro-Canadian dyads sustained each attentional state for a longer period of time, whereas East Asian dyads maintained each attentional state for a shorter duration, and initiated
new episodes more frequently during the 2-minute interaction. These findings are consistent with the target-oriented communications results described above.

As attention was coded as states, we did not precisely capture which party initiated and broke the type of attentional engagement in each episode. Despite not having systematically quantified this information, coders made the informal observation that East Asian parents actively solicited infants’ attention towards different targets more often than did Euro-Canadian parents, who tended to allow infants to take the lead in deciding how long they examined a target, before changing their allocation of attention. This active structuring vs. passive participation may explain differences in the number of attentional states observed above (i.e. East Asian parents made more attempts to change infants’ attentional focus).

Table 5.3 Parent-infant attentional states, by ethnicity and attention type

<table>
<thead>
<tr>
<th>ATTENTION TYPE</th>
<th>EAST ASIAN</th>
<th>EURO-CANADIAN</th>
<th>Mean diff. in Frequency</th>
<th>Mean diff. in Duration</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Frequency</td>
<td>Duration</td>
<td>Frequency</td>
<td>Duration</td>
</tr>
<tr>
<td>Mutual</td>
<td>0.9</td>
<td>7.911</td>
<td>0.667</td>
<td>1.384</td>
</tr>
<tr>
<td>Divergent</td>
<td>4.9</td>
<td>48.025</td>
<td>7.381</td>
<td>55.786</td>
</tr>
<tr>
<td>Shared</td>
<td>4.4</td>
<td>58.068</td>
<td>7.286</td>
<td>61.629</td>
</tr>
</tbody>
</table>

5.2.3 Discussion

We had discussed the possibility that differences in attention allocation could provide evidence to evaluate the motivational account for cultural differences in infants’ social target choice in Chapter 4 Study 1a. The present pattern of results indicate that East Asian parent-infant dyads spent less time in mutual attention than did Euro-Canadian dyads, suggesting that within the constraints of the task, East
Asian infants did not receive more experience engaging in social routines, as proposed by the different-motivations account. However, it is possible that a more unstructured task would reveal such a difference.

Regarding the different-abilities hypothesis, a detailed look at target-related communications reveals more frequent communications across modalities from East Asian parents, compared to Euro-Canadian parents. This applies to both good and bad targets. However, despite the active attempts to shape and direct infants’ attention towards targets, these communications were less differentiated by target valence. That is, Euro-Canadian parents provided more vocal and behavioural cues that were congruent with, and potentially more informative of the valence of the target. These data are consistent with the possibility that culture moderated infants’ choice in Chapter 4 Study 1a because they actually differed in their experience with valence-congruent affective communications, and consequently, their ability to use those reactions to inform their target choices.

The ability to draw such connections is limited in the current study because our data derives from primarily vocal and behavioural communications, whereas Study 1a in Chapter 4 used visual facial cues. Despite finding consistent evidence that East Asian parents provide less valence-differentiated information to infants in both modalities, it is still possible that it would not be true of facial emotional cues.

A second limitation has to do with the stimuli used: we chose to use bath toys whose features were as close to the stimuli in Chapter 4 as possible. However, while those stimuli also contained cartoon faces, just like the bath toys, they also engaged
in self-propelled motion, and thus were more agentic. It is unclear whether parents would have acted similarly about object-like targets as with more agent-like targets.

Finally, as with all structured observational studies, there are necessarily limitations on ecological validity: the typical situation in which parents tend to communicate approbation and disapprobation may differ from the situation constructed in the lab. For one, demand characteristics may play a role in shaping parents’ behaviours, such that they will act in ways consistent with how parents think they ought to behave in the situation. Therefore, we may be capturing normative, rather than typical, parenting behaviours. This effect would be most limiting if one group was experiencing demand characteristics to a greater extent than the other, for example, due to differential familiarity and comfort levels in university research lab environments. The setting being an English-speaking university in a North American city, the overall environment and associated expectations and norms may have seemed more foreign and less familiar to our East Asian participants, many of whom were first generation immigrants. This could have led these participants in particular to feel more nervous and appear more disorganized during the study than the European-Canadian participants. Efforts were made to reduce this unfamiliarity and increase the level of ease by having East Asian researchers conduct the study with East Asian families. Despite these measures, overall comfort levels may still have differed across the two groups, leading East Asian families to behave in ways that are less representative of their typical interactions than Euro-Canadian families in the study.
Second, truly valenced communications do not always emerge in pedagogical contexts; they may emerge spontaneously in reactive circumstances, such as situations involving true risk to an infants’ physical well being. It is possible that we did not capture either the intensity or the frequency of emotional communications due to the artificial situation created in the lab. Nevertheless, we observed both similarities and important differences that may underlie differences in infants’ target choices found in the previous chapter. Future studies may improve on the design by conducting the studies using same-culture researchers in participants’ homes, and by using agentic targets, such as puppets or videos of people.

In the current chapter, we have focused on immediate experiential environmental factors that may explain differences in emotional understanding in a sample of European and East Asian Canadians in a Western city. However, variation at any point in development is a product of the interaction between an individual’s genotype and the environment. There may in fact be genotypic differences that can help account for variance in emotional understanding and infants’ choices on social referencing tasks. Indeed, studies with adults have identified group-level differences in the frequency of alleles that are implicated in emotion regulation (Gelernter, Kranzler, & Cubells, 1997; Saini et al., 2014). Future research may enrich our understanding of emotion comprehension and regulation by exploring the combinatorial effects of environment and genetics.

The aim of the present study was to examine the interaction patterns of infants and caregivers from 2 culturally distinct urban populations during brief 2-minute snapshots. Despite observed similarities in overall attention patterns,
variation in parents’ proactive attempts to shape infants’ attention towards targets, and the extent to which they were valence-congruent, suggest that parents’ pedagogical strategies are not universal. These differences may contribute to an explanation for infants’ different abilities in using social referencing to learn about social targets at 12 months of age. These data also add to a small but growing literature examining the impact of early socialization experiences on diverse developmental trajectories in social cognition.
6. General discussion

To successfully navigate through life, human infants must begin to identify and acquire accurate and relevant cultural knowledge to adapt to the local environment. This dissertation examined some of the earliest cues that infants have at their disposal to identify individuals who may serve as good cultural informants of conventional knowledge. Four sets of studies described in the preceding chapters looked at the development of sensitivity to frequency and affective cues in 3rd party contexts, as well as pedagogical experiences that are provided by caregivers in the first years of life. The studies suggest that young humans have access to a variety of means to assess and learn about the suitability of potential models, in culturally variable ways. Furthermore, infants’ evaluations in the first 3 chapters provide evidence that they employ these tools in a domain-specific manner, privileging group-level consistency over intra-individual consistency, and evaluations of social targets over asocial targets. Together, these studies point to an early preparedness in human infancy for learning the conventional behaviours of one’s culture.

6.1 Summary of results and implications

The studies in Chapter 2 build upon previous research showing that infants are sensitive to the frequency and consistency of events, and that they expect members of a group to behave in a consistent manner. The studies asked whether 7-month-old infants form social preferences based on intra- and inter-individual consistency of arbitrary behaviours. The results suggest that infants do use the consistency of individuals’ actions to form social evaluations, and carry them out in a context-dependent manner. Infants appear to selectively form evaluations when
consistency is maintained across individuals, but not within an individual, suggesting that consistency at the group level may be crucial to such evaluations.

These studies raise important questions about the relationship between expectation and preference in infants’ social cognitive processing. Whereas Powell and Spelke (2013) found that preverbal infants hold expectations for characteristics of group members, specifically, that group membership predicts similar behaviours, these studies found that infants sometimes prefer group consistent behaviours, and sometimes, inconsistent behaviours. This begs the question of whether infants’ own preferences may sometimes deviate from their expectations for how others ought to or will behave, or if these results point to a novel facet of contextual variability in infants’ expectations about groups and group behaviours that has yet to be documented.

A number of studies of fairness and altruism in infants and young children have documented similar divergences between expectations and behaviours (see Sommerville, Schmidt, Yun, & Burns, 2012 for a review). The gap between them is mediated by the motivation to implement expected behaviours, and may be influenced by aspects of executive control, such as the ability to suppress prepotent responses (for example, knowing that equal distribution is the norm, but being unable to suppress the urge to keep a disproportionate amount of resources for oneself). However, the fairness studies differ from the studies presented here in an important way: the former asked infants and children to personally allocate resources, a measure that relies on executive control. In contrast, the studies in Chapter 2 asked infants to make 3rd party evaluations of others’ actions, thus
rendering immature impulse control a less likely explanation. Despite this
dissimilarity, it is still possible that visual attention paradigms underlying
expectations studies ask infants to perform a qualitatively different task than do
choice paradigms, thus producing the divergence.

On the other hand, innovation has been a reliable feature of cultural learning
as a means of introducing novel information to a cultural repertoire, and of adapting
to changing environments. Given this, it is also plausible that under some conditions,
infants expect group members to deviate from consensus behaviours, or at least,
withhold strong expectations that all group members behave in uniform ways.

A third possibility that may reconcile this puzzling discrepancy between
expectations and behaviour, is that the expectations of covariance between group
membership and behavioural uniformity captured by Powell and Spelke (2013) is
imperfect. Specifically, while infants may use common actions to identify members
of the same group, the reverse—expecting all group members to act identically—
may not be as strong. If such an expectation were selected for its usefulness for
categorizing the social world, its utility would be maintained even if some
individuals deviated from it, so long as the heuristic served to correctly identify
common group members more often than not.

Chapter 3 explicitly addresses the question of learning, by investigating
whether toddlers and preschool-aged children continue to show sensitivity to the
distribution of frequently observed arbitrary behaviours, and further, use it to
choose cultural informants. The results show that a shift occurs between ages 4 to 5,
wherein children younger than 4 do not appear to form social evaluations based on
the frequency of behaviours, nor exhibit sensitivity to their distribution, whereas 5 year olds do both. As for the question of learning, evaluations based on the frequency and the distribution of behaviours preceded and predicted informant choices for a different domain, suggestive that children do prefer to learn from those they like.

Chapter 4 raised the question of whether infants use social referencing similarly for social and asocial targets, finding that infants appear to privilege referencing of social targets. These results bolster proposals of specialized early-emerging cognition for reasoning about social entities. Replicating earlier work, 6-month olds do not reliably use social referencing, but by 12 months, Euro-Canadian infants do use others’ emotional reactions to modify their social choices. Potential emotional contagion and associative learning effects were ruled out, suggesting that emotional comprehension is the most likely explanation for these results. However, by sampling from a population previously not well represented in the literature, the established 12-month-old milestone for successful social referencing is complicated by the finding that East Asian and Mixed ethnicity infants do not show the same choice patterns as their European counterparts.

In an effort to explain these cultural differences, Chapter 5 looked at similarities and differences in parenting practices across East Asian and Euro-Canadian families. In particular, we looked at how parents communicate evaluative information to their infants across physical, visual, and aural modalities. While both differences in motivation and in ability were entertained, the study results provided support for experience leading to differences in ability.
6.2 How do these abilities develop?

Based on the reviewed literatures and the results of the last 2 chapters, experience clearly plays a role in infants’ ability to learn from others. As to the question of how such abilities emerged in the first place, there are a few possibilities.

Infants could have learned to be sensitive to behavioural distribution when evaluating individuals through repetitive, general-purpose learning. In theory, it is possible for someone to learn that when frequently observed behaviours are spread out amongst people, this carries prescriptive weight for the observer and everyone else, and that this does not apply when the frequently observed action is being seen repeatedly on a single individual. However, differentiation between results of the frequency and consensus conditions speak against such rote, associative learning mechanisms being solely responsible for infants’ performance. Our participants being so young (7 months old), it is difficult to imagine infants having enough experience viewing contrastive examples (of distributed behaviours and of single repetitive behaviours), and also to have experienced others imposing these expectations on them, accompanied by incentives to induce learning.

An alternative account suggests that aspects of these evaluative abilities rest on innate, or built-in cognitive processes. Such processes may specify that repetitive information from a single source should be treated differently than repetitive information from multiple sources, and perhaps grant greater weight to the latter. Furthermore, the current studies, consistent with previous work, suggest that our minds are primed to differentiate agents from non-agents, and treat them according
domain-specific, specialized rules. Such rules may assign different multipliers, or weights to different types of information, such as “when emotions refer to social targets, multiply the effect of observing emotions (that refer to inanimate targets) by 5.” They could also lead to qualitatively different processes altogether. For instance, repetitive behaviours from multiple social sources passing some threshold of saturation (e.g. 50% of people observed in a given context, or 70%) may be qualitatively transformed, and tagged with “ought”, while repetitive behaviours from a single source may not receive such a tag, but merely be better remembered (and perhaps better liked) due to greater familiarity.

A potential pitfall of invoking nativism to explain mechanisms that appear too difficult to have been acquired through experience (especially in a short amount of time) is that it merely pushes the burden of explanation back in time, and may grant the illusion of clarity. Though this alone does not provide a compelling reason to cease proposing nativist hypotheses, it does call for more work to specify the selection pressures of the environment of evolutionary adaptedness (EEA) that may have brought about such adaptations, and test them against archaeological evidence, as well as flesh out ontogenetic processes by which early preparedness may unfold with experiential input.

*To what extent are these cultural learning mechanisms?*

In the broadest sense, cultural learning involves any information acquired from another member of one’s species. As the mechanisms examined in this dissertation involved people as their sources, and prompted systematic, differentiated responses from infants, they can be considered mechanisms for
cultural learning. More specifically, based on the observation that infants’ and children’s responses were more differentiated when the source was a group of individuals, than when it was a single individual (Chapters 2 and 3), these mechanisms appeared successful at helping infants learn about a special type of cultural knowledge—conventional acts.

6.3 Limitations and future directions

It is extremely difficult to design studies to test for direct evidence of cultural learning in infancy. Infants’ ability to manifest and express their learning are limited by their immature motor and language abilities, constraining the possible measures that can be used to measure learning outcomes. As a result, even though studies in this thesis were expressly interested in infants’ learning, it was necessary to use indirect methods, such as reaching, to approximate these variables.

The dependent measure employed across studies with infants involved measuring choice using a visually guided reach. We have interpreted reaching as an indication of preference, consistent with previous studies in the literature. These interpretations are corroborated by consistent results using looking time measures in young infants, and verbal measures in older children (e.g. Hamlin, Wynn & Bloom, 2010; Kinzler et al, 2007). However, a limitation of this interpretation is that while reaching is indicative of approach, it can be motivated by numerous factors apart from liking or preference, including curiosity, a desire to explore, or to provide comfort to the approached individuals. Of particular relevance to this thesis, the choice method has not been as thoroughly validated and corroborated with cross-cultural infant populations. There is thus some difficulty in interpreting results of
Chapter 4, with regards to what East Asian infants’ choices indicate, and whether these are equivalent in significance to European-Canadian infants’ choices. An important next step would entail using alternative dependent measures to corroborate the interpretation of these choice results.

Studies in Chapters 2 and 4 employed animated videos of agents who performed simple actions. This method was chosen to grant us a greater amount of control in producing the amount of positivity and negativity in emotion, and to render physical actions identical across actors. However, a limitation of these stimuli is that they necessarily reduce the realism of stimuli, including natural variation across individuals’ expressions and actions. That is, infants’ tolerance for perturbations or inconsistencies in evaluation across contexts was beyond the scope of this thesis. Hence, these results are more indicative of infants’ capabilities in a perfect environment, and less so of what they actually do in noisy environments with imperfect actors that are characteristic of learning environments encountered by infants day to day. Nevertheless, this research contributes to painting a clearer picture of infants’ rather sophisticated conceptual capabilities for categorizing and learning about the social world that are present from the first year of life.

In addition to the controlled precision of the experimental stimuli, this research also focused on a brief presentation of actions in a single domain. In real life, learners encounter caregivers and other individuals’ behaviours on numerous occasions and across a variety of contexts. This research did not address how these encounters may be aggregated or filtered in a coherent fashion. A fruitful avenue of research may involve clarifying the depth of impact that evaluations have both
across time and across domains. For example, infants may be susceptible to primacy or recency effects in evaluations of an individual, as adults often do, or they may average across evaluative instances and take a more balanced assessment of potential informants. Although infants appear to make domain-specific inferences related to conventional acts and from social sources, domain-general cognitive development (e.g. working memory) may nevertheless play a role by affecting who, what, and how long they remember. Thus, it is an open question whether such social evaluations have an enduring effect on infants’ attention allocation and preferential efforts to engage individuals in social interaction. These questions are important to address in order to validate the extent to which infants have access to the learning mechanisms examined in this thesis in real life learning situations.

The finding in Chapter 4 that infants’ use of social referencing appear to differ by 6 months across cultural contexts should serve as a call to conduct more cross-cultural research regarding “basic” cognitive capacities often presumed to be universal. While they are an interesting and provocative finding, a significant limitation of this thesis is that it is unable to offer but a small step to probe the source of such cultural differences. Further work is needed to probe the nature of the cultural differences, whether they are differences in the rate of development, or differences in average ability that persist into adulthood. Microgenetic designs can be used to probe the importance of experience with valence-congruent emotional communications on infants’ abilities to use social referencing. More intensive, naturalistic observation and genotype analyses can be employed to look at a wider
range of experiential factors and genetic factors that could contribute to producing divergences in emotional understanding during infancy.

6.4 Concluding statement

All newborns share a common goal: to acquire the skills necessary to navigate successfully through life. For humans, cultural learning is a crucial part of successful adaptation, though the specific content that will help do so will vary according to the specific ecological and social context. This thesis has demonstrated a set of tools available to preverbal infants that can be wielded across a wide range of environments and social contexts. These include attending to the frequency, rather than the content of behaviours, in order to identify knowledgeable individuals. Infants may also use other people’s affective displays and communications to learn about the valence of people and their behaviours; however, the extent to which this is useful may depend on the expressivity of the local people. Even cultural learning is culturally variable: infants are surrounded by people who intentionally teach them, and the way in which they do so not only transmit information about the specific target of reference, but through their choice of means, the goals and values of the local culture.
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