NEW TO ME OR NEW TO YOU?
DETERMINING OBJECTS OF INTEREST ON THE BASIS OF NOVELTY IN THE SECOND YEAR OF LIFE

by

Amy Christine MacPherson

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Dedication

I would like to preface my dissertation with an introduction to the inspiration behind my graduate work. The way I see it, researchers tend to begin studying infants for one of two reasons: (1) an interest in some aspect of epistemology (i.e., the origins of knowledge), which is best studied early in the lifespan, or (2) a love and fascination toward infants. For me it was the latter; yet my graduate research experience has shown me that in spite of babies' charms, no matter how ingenious the task you devise, adopt, or modify, and regardless of whether you sit the infant in front of a computer or engage them in a face-to-face task that is more fun and interactive for everyone concerned, sooner or later these miniscule individuals will be reduced to little data points. If you let them, that is, and I'm sad to say that sometimes I have. The fun can be lost or dampened by a focus on whether or not this little participant is going to behave as predicted. In order for a research endeavour of any kind to be fulfilling, it is important not to lose sight of the impetus for undertaking it in the first place which, in my case, was the aforementioned love and fascination toward infants. Thus, I embark on the writing of this dissertation determined to tell the story of what roughly 250 little ones demonstrated to me about their understanding of my attention in a way that focuses your attention on them. Those of you who approach infancy research from a more epistemological point of view need not worry, however, for I have been 'raised' in that tradition!

With all of that in mind, I dedicate this dissertation, with love, to my youngest cousins: Sophie Lillianne Jenny Arnaud and Alice Claudine Sarah Arnaud. Your radiant little faces and personalities gave me the boost I needed to finally get this thing written! I further dedicate this work to the baby I'm carrying right now – I love you already!!

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Abstract

Describes three variations on a procedure devised by Tomasello and Haberl (2003) to assess infants' understanding of what is new (and presumably interesting) to another person. Their claim was that both eighteen- and twelve-month-olds could figure out what was new to another person on the basis of prior knowledge that people tend to get excited about things that are new to them and on immediate past experience that a particular object was new to the experimenter. The present research was undertaken with some scepticism about the ability of infants as young as twelve months to understand the intentional relations of others to the extent asserted by Tomasello and Haberl. Experiment 1 sought to replicate and extend their findings with twelve- and eighteen-month-olds in three conditions: a New to Experimenter – Absent Condition (in which the experimenter left the room during presentation of the target object), a New to Experimenter – Present Condition (in which the experimenter watched the interaction with the target object from across the room), and a New to Baby Condition (specific to the present research; in which the experimenter played with a toy across the room from the baby). Eighteen-month-olds in the NE-P and NB Conditions, but not the NE-A Condition, gave or chose the target object significantly more often than expected by chance, while twelve-month-olds showed only a trend in that direction. Experiment 2 pitted the NB and NE-P Conditions against each other to differentiate between twelve- and eighteen-month-olds. Indeed, twelve-month-olds tended to choose the NB object while eighteen-month-olds chose the two significant objects (i.e., the NB and NE-P objects) with almost equal frequency. Twenty-four-month-olds were expected to round out the developmental story by choosing the NE-P object most often, while in actual fact they behaved more like the twelve-month-olds. Experiment 3 was a replication of Experiment 2 with one major difference: the objects to choose from in the final request procedure included only the NE-P object and the distracters. The results of Experiment 3 were inconclusive. These findings are discussed in terms of infants' understanding of the intentional relations of others as independent from their own.

Acknowledgements

First and foremost, I want to thank my wonderful mother, Jeannine Carol Carr. Mum, you have held me through hurts and joys, a broken heart and true love, a very deep depression and now this great triumph. You are a true friend, the epitome of motherhood and, in every way, the goal to which I aspire. You always seem to know just what I need and you are so very loving and supportive, always believing in me and praying for me no matter what. At this special time, I want to thank you for one of the hardest things you ever had to do: When I was at a very low point in my depression and still struggling with the seemingly impossible goal of finishing my degree, you assured me that it would be okay if I decided not to finish after all; that you and Dad would love me just as much if I never finished it. Somehow, that was just what I needed to hear and for the first time I was able to consider that option very seriously. It took less than 24 hours for both of us to know that I really had to finish… and now I have. **We did it!** Thanks Mum – I love you!!

Paradoxically, I want to thank my supervisor, Dr. Chris Moore, for the exact *opposite* thing. Chris, right around the time described above, we had our first meeting after your return from Toronto. I was nearing the end of my rope and I told you that I was doubtful about my ability to finish, but you never let not finishing be an option. In fact, you helped me right then and there to set some goals and even a definite timeline for finishing. That was *not* what I expected, but it *was* what I needed. I thank you for that and for all of your help and guidance over the past 6 years and especially the past 6 months!

Continuing on the academic side of things, I want to thank Dr. Vincent LoLordo and Dr. Sophie Jacques. Your guidance as members of my thesis committee has been invaluable. Thank you for being there when Chris could not and for being patient when it

looked like this day might never come. Finally, I thank you in advance for your helpful comments on this manuscript!

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Although they are not directly involved with my dissertation research per se, I would like to express gratitude to my comp chair: Dr. Philip Dunham, and my comp committee members: Dr. Patricia McMullen and Dr. Raymond Klein, as well as the administrative staff of our department: Mary MacConnachie, Nancy Gibbons, Suzanne King, Beatrice Hanisch, and *even* Linda MacNutt; to Chris Wright and Bud Eisner in the workshop; and to Dr. Bradley Frankland, our department's superb statistical consultant. Each of you has played a role in my graduate education and I am deeply appreciative.

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For each and every one of the 250 plus testing sessions that went into the collection of data for this work, there were two experimenters. I was always E2, but the role of E1 has been filled by several bright, young undergrads over the past 3½ years. For the first year of testing, this role was filled most often by Jennifer Blair. Thanks so much,

Jenn; it was a joy working with you! I would also like to thank Natasha Wirtanen, Anisa Tallman, and Jennifer Mealiea who each spent a few months in the role of E1. Great job, Ladies! In addition, I am grateful to Matthew Newell, Raquel Nahas, and Giselle Shea for their work behind the scenes and to Adrian Delorey, Matthew Murphy, and Valerie Wilson for their help with coding. Thanks so much! Most recently, my studies have benefited greatly from the efficient and reliable work of Laura Knickle and Gillian Alcolado. These two young ladies answered my request for volunteers in the Fall of 2003 when they were both second year undergrads. During the past 2½ years they have been with me through thick and then, including two major bouts of depression and the recruitment and testing of over 100 infants! I am proud to say that they will both receive Honours degrees from our department this May. Laura and Gillian, congratulations and thank you for everything!!

Two hundred and fifty infants is a huge sample, and every single one of them was brought into the lab by a loving parent willing to volunteer their time and energy for the sake of my research. Dear parents and infants, I thank you from the bottom of my heart for your selflessness in contributing to my dissertation research. You are awesome!

My preparation for graduate school was due largely to the training I received at St. Thomas University. I am very grateful to Dr. Kimberley Fenwick, Dr. Doug McKenzie-Mohr, and the many other professors in the psychology department at STU for their contributions to my training in research, writing, and oral presentation skills. You'll be happy to know that I've come along way since my Honours thesis defence. My experience at STU was even more special because I was following in Mum's footsteps!

Although Mum has been the driving force in my education and much of my life, my Dad and the rest of my family have had strong influences as well. Dad, thank you for your Godly example and strong Christian testimony, for all those books you made me read and tapes you made me listen to in order to develop self esteem and a positive mental attitude, for the sacrifices you made so Mum could stay home with us kids, and for your unwavering love and support. Terrence Edward Carr, you are "...a wonderful, wonderful, amazing man..." *Remember that line?* I love you and I couldn't have done this without you!

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Ryan, my love, you have held my hand and my heart for almost six years. I have been a graduate student for as long as you have known me, and we have been together for as long as I have been a graduate student! I look forward to taking some time to really embrace my role as your wife and I am very excited that we will soon be sharing the awesome experience of parenthood!! Thank you, my Sweet Boy, for always believing in me and for helping me to conquer this challenge. Thanks for putting up with me through those difficult summers when I suffered with depression and for living without me these past few months so I could finally finish. I'm coming home and life will be better than ever!!! I love you more than I have words to express and I promise that I always will.

Your loving wife, Amy

Last but far from least… Heavenly Father, I thank you for sending your Son, Jesus. In Him are my hope and my salvation. Thank you for blessing me with the ability, the perseverance, and the help I needed, directly from you and from all of the sources mentioned above, to achieve this goal. I ask that you would continue to direct my paths so that I may live a life pleasing to you.

In Jesus' Name I pray, Amen

Chapter 1: Introduction

Whether you call them the 'Terrible Twos' or the 'Terrific Twos,' the typical two-year-old is quite remarkable. In just two short years most children progress from helpless newborns to walking, talking bundles of energy. These feats of locomotion and language acquisition are matched by impressive developments in cognition and social understanding. In what follows we will explore the nature and timing of infants' and toddlers' growing understanding of others as independent intentional agents whose perspectives may differ from their own. An important part of this learning process is the acquisition of information about the intentional relations of self and other. Intentional relations involve a sensorimotor, emotional, or cognitive connection between an agent and an object (Moore, in press). The object can be real or representational and the relation can be any of three types: epistemic, conative, and affective (see Table 1).

This tripartite scheme for classifying the capacities of the human mind is as old as the discipline of scientific psychology (Hilgard, 1980). From the early 18th century to the early 20th century, this system was very much in vogue, although the three parts were called by a variety of names and their relative importance debated. During the era of Behaviorism that followed, interest in the capacities of the mind waned as observable behaviour came to be seen as the only scientific way to study psychology. Eventually mental processes regained favour in scientific psychology; however, with the Cognitive Revolution of the 1950's thinking, knowing, and understanding (i.e., the cognitive component) took center stage, to the neglect of feeling (i.e., the affective or emotional component) and willing, acting, or desiring (i.e., the conative component; Hilgard, 1980). The cognitive component of the traditional classification scheme combines with

Table 1

Classification of Intentional Relations by Object and Type, Including Definitions.

	Definition of Relation Type	Object of Relation	
Relation Type		Real	Representational
Epistemic	Thinking, knowing, understanding	Ryan **sees** Saturn through his telescope.	James **thinks** the Leafs will win the Stanley Cup.
Conative	Willing, acting, desiring	Bob **craves** lemon meringue pie.	Scott **wants** the Canadiens to win the Stanley Cup.
Affective	Feeling	Jeff **loves** Rugby.	Dad **detests** being late for church.

perceptual relations into what we now call epistemic intentional relations (Moore, in press). Whereas cognitive psychology and the interdisciplinary field of cognitive science have continued to expand their sphere of influence, the years since Hilgard's (1980) historical account have seen renewed interest in the affective and conative capacities of the mind as well (e.g., Hornik, Risenhoover, & Gunnar, 1987; Lagattuta, 2005; Martin & Green, 2005; Murphy & Eisenberg, 2002; Prencipe & Zelazo, 2005; Rieffe, Terwogt, & Cowan, 2005; Ruffman, Slade, Rowlandson, Rumsey, & Garnham, 2003; Wellman, Phillips, & Rodriguez, 2000).

Likewise, recent developmental research on the understanding of intentional relations in infants and toddlers has addressed itself variously to each component of the tripartite scheme described above. Gaze-following and false belief tasks, for example, have been used to assess young children's understanding of such epistemic intentional relations as seeing and believing (e.g., Atance & O'Neill, 2004; Carlson, Wong, Lemke, & Cosser, 2005; Caron, Butler, & Brooks, 2002; Carpenter, Nagell, & Tomasello, 1998; Corkum & Moore, 1998; Moll & Tomasello, 2004; Müller, Zelazo, & Imrisek, 2005). Similarly, Repacholi and Gopnik's (1997) clever forced choice giving task with broccoli and Goldfish crackers examined infants' understanding of the conative intentional relation of desire combined with the affective intentional relations of liking and disliking. Social referencing is another key task used to assess affective intentional relations (e.g., Hertenstein & Campos, 2004; Hornik et al., 1987; Mumme & Fernald, 1996; Slaughter & McConnell, 2003; Vaish & Striano, 2004), while studies requiring inferences about the goal-directedness of behaviour, including those comparing imitation of intended and accidental actions, explore more conative intentional relations (e.g., Baldwin & Baird,

2001; Behne, Carpenter, Call, & Tomasello, 2005; Bellagamba & Tomasello, 1999; Carpenter, Akhtar, & Tomasello, 1998, Carpenter, Call, & Tomasello, 2005; Gergely, Nádasdy, Csibra, & Bíró, 1995; Meltzoff, 1995; Olineck & Poulin-Dubois, 2005; Shimizu & Johnson, 2004; Woodward, 1999).

Before going into the details of infancy research on intentional relations in particular, I believe a more general introduction to research with infants is appropriate. As mentioned at the outset, the transformation from helpless newborn to busy and socially aware toddler involves major developments in a range of areas. While physical growth can easily be quantified with a scale or tape measure, maturation in most other areas, including understanding of intentional relations, requires more sophisticated assessment strategies. This is never truer than with infants, whose very name takes its root from the Latin *īnfāns* meaning "not able to speak" (The American Heritage Dictionary of the English Language, 2000). Insights that might otherwise be gained through verbal responses (e.g., interviews or questionnaires) must be inferred through the more subtle responses of which infants are capable.

Clearly then, Fantz (1958; 1963; 1964) did a great service to subsequent students of infancy when he developed his infant 'looking chamber' and the accompanying methodology for studying preferential looking in young infants. He discovered that even newborns show a natural preference for patterned stimuli over solid colours (Fantz, 1963) and that by two to three months of age infants can recognize previously-viewed stimuli, habituate to them, and prefer novel stimuli over these now familiar ones (Fantz, 1964). Fantz's apparatus required one researcher to measure fixations online by watching the reflected stimuli in the infant's cornea through a tiny hole in the chamber and another to

keep track of the timing of each stimulus and to change the stimulus cards by hand. Please take a moment to imagine what this apparatus might be like for a four-month-old: Baby Alice is placed in a hammock-type crib and slid into a large illuminated box. Above her head is a frequently changing stream of pictures interspersed with white blinds that are pulled across the pictures each time they are changed. She appears to find most of the pictures quite fascinating, but at the age of four months she is already able to recognize that some pictures keep popping up over and over again. With these repeated exposures she seems less and less interested and looks away after increasingly shorter periods of time. In doing so, Alice demonstrates her capacity to remember previously viewed stimuli and to discriminate them from novel ones. Whereas modern technology has supplanted this ingeniously complex apparatus, the preferential looking and habituation techniques pioneered by Fantz are still key methods in infancy research some 40 years later (e.g., Baldwin, Baird, Saylor, & Clark, 2001; Csibra, Bíró, Koós, & Gergely, 2003; Golinkoff, et al., 2002; Sommerville & Woodward, 2005, Xu, Spelke, & Goddard, 2005).

According to Fantz: "The importance of novelty is evident from the differential fixation of novel and familiar patterns," and "Response to novelty might thus be described as an unlearned visual interest in a complex stimulus which has not been habituated by experience" (Fantz, 1964, p. 145). Subsequent uses of the habituation technique have capitalized on this 'unlearned visual interest' in novel stimuli in order to learn about various aspects of infant development, from its origins and continued use in the study of visual perception (e.g., Courage, Howe, & Squires, 2004; Fantz, 1964; Johnson, Bremner, Slater, Mason, & Foster, 2002) to studies of intentional relations and social cognition relevant to the present research (e.g., Baldwin et al., 2001; Csibra et al.,

2003; Gergely & Csibra, 2003; Gergely et al., 1995; Király, Jovanovic, Prinz, Aschersleben, & Gergely, 2003; Kuhlmeier, Wynn, & Bloom, 2003; Guajardo & Woodward, 2004; Shimizu & Johnson, 2004; Sommerville & Woodward, 2005a; 2005b; Sommerville, Woodward, & Needham, 2005; Wagner & Carey, 2005; Woodward, 1998; 1999; 2003; Woodward & Sommerville, 2000).

One main approach to the study of intentional relations as understood by young infants is a variation of the habituation technique called 'violation-of-expectation,' as employed by Csibra, Gergely, and their colleagues (Csibra et al., 2003; Gergely & Csibra, 2003; Gergely et al., 1995) and by others (e.g., Kuhlmeier et al., 2003; Wagner & Carey, 2005). In their studies, which feature computer-animated shapes in the role of intentional agents, infants are typically habituated to an action sequence that could be interpreted as goal-directed or not goal-directed. Thus, these studies explore infants' understanding of conative intentional relations. In a study by Gergely and his colleagues (1995), for example, infants in the Rational Approach Condition were habituated to a small circle jumping over a rectangular obstacle to reach a larger circle, while infants in the Non-rational Approach Condition were habituated to a small circle jumping over to a larger circle, but with the obstacle removed from its path (but still within view) and no other clear purpose for the jump. Infants were then shown two test events: an Old Action event (e.g., the small circle jumping in the absence of any obstacle) and a New Action event (e.g., the small circle moving in a straight path over to the larger circle). Gergely and his colleagues (1995) found that twelve-month-olds in the Rational Approach Condition dishabituated to the Old Action but not the New Action, while those in the Nonrational Approach Condition dishabituated to both actions. This pattern of results

implies that infants in the Rational Approach Condition construed the small circle in the habituation phase as a rational agent with a goal and were thus not surprised to see it use the rational strategy of moving in a straight path toward its goal, in the absence of an obstacle, even though this path was different from the previously chosen one. In their own words, Gergely and colleagues argue that their results "provide independent empirical support for the general conjecture that by the end of the first year infants are indeed capable of taking the intentional stance (Dennett, 1987) in interpreting the goal-directed behavior of rational agents" (1995, p. 184). More recent research from this group indicates that not only are one-year-olds capable of interpreting complete sequences of behaviour as goal-directed, they can also make inferences about unseen aspects of the sequence, something that nine-month-olds are not able to do (Csibra et al., 2003).

The principal technique for using habituation to study the understanding of intentional relations, and in particular goal-directed actions (i.e., conative intentional relations), early in the first year of infants' lives was developed by Woodward and has been used extensively by Woodward, Sommerville, and their colleagues (Guajardo & Woodward, 2004; Sommerville & Woodward, 2005; Sommerville et al., 2005; Woodward, 1998; 1999; 2003; Woodward & Sommerville, 2000) as well as by others (e.g., Király et al., 2003; Shimizu & Johnson, 2004). Take a few moments to imagine a young participant in the Hand Condition of their basic procedure (Woodward, 1998, Study 1). Nine-month-old Makayla sits in an infant seat in front of a little stage. Most of what she sees is black including two pedestals on which she sees a white bear and a colourful ball. A sound from behind the curtain draws her attention to the toys, at which point she sees an arm clothed in a magenta sleeve reach in from one side and gently grasp

the ball without picking it up. She watches this hand grasping the toy for a while, but eventually looks away. At this point (or after two minutes of continuous looking), a white screen comes up and occludes Makayla's view of the toys. This sequence of events occurs repeatedly until she starts to get bored and to look at the grasping event for shorter and shorter lengths of time (i.e., habituation occurs; average of 8.3 trials). Then something changes: this time when the screen goes down she sees that the toys have switched places and she looks at them intently until the screen goes up again. When the screen goes down, Makayla sees the same hand reaching for the same spot, where the white bear is now located, and this time the hand grasps the bear (new goal/old path). After having seen this hand grasp the ball so many times she seems surprised to see it choose the bear this time, so she stares until the screen goes up (i.e., dishabituation or 'recovery from habituation'). The next time the screen goes down the hand reaches to the other pedestal (old goal/new path) and grasps the ball. Having seen this hand grasp the ball many times, she finds this event boring and looks away after a short time (i.e., no dishabituation). These two test events alternate until Makayla has seen each of them three times.

The scenario detailed above describes the basic procedure and a representative example of the results obtained for nine-month-olds in the Hand Condition (Woodward, 1998, Study 1). Please note, however, that the initial placement of the toys and the initial goal of the actor's reach were counterbalanced, as were the order of events during the test phase. Nevertheless, infants tended to dishabituate to the new goal/old path event but not to the old goal/new path event regardless of the initial goal object or its placement. These findings indicate that by nine months, infants can selectively encode aspects of behaviour

that are related to a person's goal (Woodward, 1998). In a comparison condition (i.e. the Rod Condition), in which the arm was replaced by a rod made to physically resemble it (i.e., a poster tube wrapped in magenta paper with a nubbly tan sponge attached to one end), nine-month-olds showed no significant difference in looking times for the two types of test events (i.e., new goal/old path and old goal/new path). These results suggest that nine-month-olds do not interpret the actions of inanimate objects as intentional or goal-directed, (i.e., they do not ascribe conative intentional relations to them) in that they do not find a change in goal any more interesting or surprising than a change in path of motion. Taken together, the findings from these two conditions provide evidence that, by nine months of age, infants attribute goals to people but not to inanimate objects and that they make these attributions based on the selective encoding of relevant situational factors (Woodward, 1998). Furthermore, infants at this age can discriminate between purposeful and non-purposeful actions and they attribute goals for purposeful actions like grasping but not for non-purposeful actions like a hand with palm up dropping carelessly and resting on the toy as in the Back-of-Hand Condition (Woodward, 1999).

Similar studies with younger infants have shown that six-month-olds responded like nine-month-olds (Woodward, 1998, Study 4), and even five-month-olds showed a trend toward the older infants' pattern of dishabituation to the new goal/old path test event (Woodward, 1998, Study 2; Woodward, 1999, Study 2), suggesting that they were beginning to selectively encode goal-relevant aspects of the situation. Furthermore, like the nine-month-olds, these young infants showed no significant difference in looking times between the two test events when the agent performing the actions was an inanimate object, or in the non-purposeful Back-of Hand Condition, and what difference

they did show was in the opposite direction (i.e., longer looking on old goal/new path test trials) (Woodward, 1998; 1999). More recently, Woodward and Sommerville have used more complex variations of Woodward's basic technique to study twelve-month-olds' interpretations of goal-directed actions (Sommerville & Woodward, 2005a; 2005b; Woodward & Sommerville, 2000), and Sommerville and colleagues have examined this type of understanding in infants at the young age of 3 months (Sommerville, Woodward, & Needham, 2005).

Woodward and her colleagues have also explored infants' understanding of epistemic intentional relations through studies manipulating such communicative behaviours as looking and pointing, rather than goal-oriented actions like grasping, in a procedure otherwise identical to that described above (e.g., Woodward, 2003; Woodward & Guajardo, 2002). Woodward and Guajardo assessed nine- and twelve-month-olds' comprehension of pointing as an object-directed action. After being habituated to an event in which an actor pointed to a particular toy and touched it with her index finger twelve-month-olds looked reliably longer at subsequent test events with a change in referent than with a change in location (See Moore, 1999, for a similar result with 13-month-olds). Nine-month-olds, on the other hand, looked longer at whichever type of test trial they had seen first. To account for the possibility, raised by Moore (1999), that for young infants pointing simply acts as an attentional spotlight rather than a clue to the intentional relations of the person doing the pointing, Woodward and Guajardo compared the proportion of time on each trial that was spent looking at the referent to the proportion of time spent looking at the nonreferent. They found that infants, regardless of age, looked longer at the referent than at the nonreferent, indicating that the pointing hand is a

powerful attentional spotlight for both age groups. However, the fact that the attentional spotlight was at work for both groups argues against the interpretation that twelve-month-olds' differential responding on the two types of test trials was the result of this effect. This combination of results suggests that twelve-month-olds, but not nine-month-olds, interpret pointing as an object-directed action, in that they react more to a change in the relationship between referent and object than to a change in the surface attributes of the actor's movements (Woodward & Guajardo, 2002). Thus, in this situation, twelve-month-olds show evidence of understanding the epistemic intentional relations of others.

A second experiment in the same study used an identical procedure to assess comprehension of pointing as object-directed along with production of object-directed pointing in infants between 8.5 months and 11 months of age. They found that 'pointers' (i.e., infants who produced object-directed pointing during the session or who were known to do so from parental reports) behaved like the twelve-month-olds in Experiment 1, whereas 'non-pointers' behaved more like the nine-month-olds in Experiment 1. Again, attentional spotlighting was ruled out as a likely explanation for this differential pattern of results. These results suggest that the development of an interpretation of pointing as object-directed coincides with the development of the production of object-directed pointing (although it is as yet unclear whether the development of one ability drives the other) and that these co-occurring developments take place toward the end of the first year of life (Woodward & Guajardo, 2002).

During the same period, infants begin to understand the epistemic intentional relation between a looker and the object of his or her gaze (Woodward, 2003). In a study with seven-, nine-, and twelve-month-olds, Woodward (2003) found that although all age

groups followed the actor's gaze, only the twelve-month-olds reacted to a change in the relation between looker and object from habituation to test (i.e., they looked longer on new object trials than new gaze direction trials) in the absence of a more obvious intentional relation such as grasping. These results support the idea that gaze-following in early infancy does not necessitate understanding of the connection between looker and object (e.g., Moore & Corkum, 1994) and specify that the understanding of this connection develops between the ages of nine and twelve months (Woodward, 2003).

Understanding the connection between looker and object is just one part of a more general pattern of development in social understanding that occurs toward the end of the first year of life. In their account of this period of social development, Moore and Corkum (1994) describe the "commonsense view" of joint attention held by many theorists and highlight the assumptions that this view requires us to make about the sophistication of infants' social cognition. The first assumption is that infants understand that people can look at things or, more generally, that people can have intentional relations toward objects. If this assumption is true, then when infants bring their gaze in line with an adult social partner's direction of gaze, they are trying to find out what the adult is looking at. The second assumption is that infants engage in gaze-following based on their understanding of the adult's intentional relation toward the object of their gaze. According to this assumption, the infant recognizes the similarity of self and other with respect to intentional relations toward objects, especially visual ones. Considering these assumptions, Moore and Corkum reject the commonsense view of joint attention in young infants in favour of two leaner alternatives (i.e., the learning perspective and the evolutionary perspective; see also Corkum & Moore, 1998) both of which, they argue,

can account for infants' observed social abilities (including joint attention, social referencing, and communicative acts) without over-interpreting them. Furthermore, they explain that these very social abilities are responsible for the development later in infancy of the sophisticated types of social understanding assumed by the commonsense view (Moore & Corkum, 1994).

Moore (1999) discusses twelve-month-olds' knowledge of the intentional relations of others and how their own intentional relations and their interactions with others help them to gain this knowledge. In keeping with the 'leaner alternatives' mentioned above, Moore summarizes the views expressed in previous work (e.g., Barresi & Moore, 1996; Moore & Barresi, 1993; Moore & Corkum, 1994) including the argument that twelve-month-olds do not understand that others can look at or attend to things, the claim that infants at this age tend to interpret others in terms of their actions rather than their intentions, and the idea that understanding self-other equivalence is an important precursor to understanding intentional relations more generally and one that poses quite a problem to such a naïve observer of intentional activity as the human infant.

On the point of self-other equivalence, Moore reiterates an account from previous work with Barresi (e.g., Barresi & Moore, 1996; Moore & Barresi, 1993) in which they described the qualitatively different features of first-person information available about one's own intentional activity and the third-person information available about others' intentional activity. In particular they argue that whereas the information available about another agent's intentional activity is focussed on their actions, information about one's own activity is focussed on the object toward which the activity is directed. As such, the information from the two sources (i.e., self and other) emphasizes different aspects of the

intentional relation. According to Moore, integrating these two types of information into a single representation presents an epistemic problem for the naïve observer of intentional activity (i.e., the infant). Barresi and Moore (1996) set forth two conditions which would need to be satisfied in order for such an integrated representation of a particular intentional relation to come about. First, there has to be both first-person and third-person information available about the intentional relation of interest. This can be achieved through joint attention, imitation, or imagination. Specifically, two people can be jointly involved in an interaction around the same object, one person can imitate the intentional activity of the other, or one person can 'imagine' the information missing from the situation (either first-person or third-person) by using memory-based information to mentally represent objects in their absence. Once a joint representation of the two types of information is established, there is the second condition to contend with: the observer must be able to attend simultaneously to both types of information. The integration achieved when both conditions are met results in what Barresi and Moore have called the "intentional schema." Joint attention, imitation, and even imagination of information missing from the intentional schema require either real or imagined interactive contexts. As Moore (1999) explains, interactive contexts provide the kind of experience required for infants to construct an understanding of self-other equivalence for intentional relations (i.e., the intentional schema). Further, Moore suggests that before this intentional schema is fully formed " there is a period in development during which infants can participate in shared intentional relations without being able to attribute an intentional relation to an individual agent, either self or other" (p. 46). This period is thought to begin around the age of nine months and to continue until about the middle of the second year. During this

period, and particularly around an infant's first birthday, "intentional relations exist in the interaction and are not a property of, or descriptive of, individuals" (Moore, 1999; p. 48).

Unlike younger infants who typically have a limited repertoire of possible responses, most notably looking (as is clear in the literature reviewed above), infants in the second year of life are capable of participating in more interactive tasks and providing more active responses including imitating and giving (Bellagamba & Tomasello, 1999; Carpenter, Akhtar et al., 1998; Meltzoff, 1995; Olineck & Poulin-Dubois, 2005; Repacholi & Gopnik, 1997). These tasks provide a window on infants' developing understanding of the intentional relations of others. Meltzoff (1995), for example, pioneered an imitation task to determine the capacity of eighteen-month-old infants to infer the intentions of an adult social partner. In his study, infants participated in one of four conditions in which an adult: (1) successfully completed a target action on an object (Demonstrate Target Condition), (2) unsuccessfully attempted a target action on an object (Demonstrate Intention Condition), (3) provided no demonstration at all (Control Baseline Condition), or (4) performed nontarget actions on an object (Control Manipulation Condition). After each object, infants in all conditions had the chance to manipulate the experimental object for 20 seconds. Picture, for example, 18-month-old Michael participating in the Demonstrate Intention Condition. Michael watches the experimenter as he picks up a small wooden dumbbell and pulls on both ends. As he pulls, his fingers slip off one end. The experimenter performs this same action sequence two more times then he gives Michael a turn to play with the object. Michael picks up the dumbbell, pulls on both ends, and successfully removes the block from one end. Apparently, Michael has inferred that the experimenter's intention was to pull the block

off, even though he was unsuccessful in doing so. As the session continues, the experimenter continues to portray unsuccessful attempts at target actions and Michael continues to successfully perform these target actions. Interestingly, Michael's responses are typical of infants in the Demonstrate Intention Condition. Furthermore, there was no significant difference in the number of target acts performed by infants in the Demonstrate Target and Demonstrate Intention Conditions, while both of these conditions differed significantly from the two Control Conditions. According to Meltzoff (1995), these results indicate that by eighteen months, infants can recognize and imitate a goal even when it is not successfully achieved. A second experiment, in which infants imitated the unsuccessful intentions of people but not inanimate devices, showed that only animate agents (e.g., people) are interpreted by infants within the psychological framework of intentional relations.

Bellagamba and Tomasello (1999) replicated and extended Meltzoff's findings. They tested both twelve- and eighteen-month-olds and found that whereas eighteen-month-olds could imitate both successful and unsuccessful intentions, twelve-month-olds could only imitate successful ones. According to Bellagamba and Tomasello, it is possible that infants at both ages share a predisposition to imitate "fully witnessed acts" (p. 281) but only eighteen-month-olds have the ability to imagine potential outcomes of intentional acts without actually seeing them produced. Tomasello was also involved in the creation of an alternative procedure for examining the imitation of intended acts in the second year of life: Carpenter, Akhtar et al. (1998) tested infants from fourteen to eighteen months of age in a procedure contrasting intended and accidental actions. Specifically, an experimenter modeled six sequences of actions, two each of intentional-

accidental (I-A Condition), accidental-intentional (A-I Condition), and both intentional (I-I Condition). Accidental actions were marked with "Whoops!" while intentional ones were marked with "There." Both verbalizations were delivered with appropriate intonation. Carpenter and her colleagues found that more infants imitated intentional actions than accidental ones and that imitation of both actions in the correct sequence was most likely when both actions were intentional (I-I Condition). Their interpretation of these findings was that infants may understand something about adults' intentions earlier than previously shown (i.e., shown at eighteen months in Meltzoff's study) and that by imitating intended actions preferentially over accidental ones, infants demonstrated imitative learning rather than simple mimicry. Thus, it appears that between the ages of fourteen and eighteen months infants develop a sophisticated understanding of the conative intentional relations of others.

Olineck and Poulin-Dubois (2005) recently adapted the procedure created by Carpenter, Akhtar et al., (1998) in order to examine the developmental progression of infants' understanding of adults' intentions. To do so, they tested separate groups of fourteen- and eighteen-month-olds. In addition to marking accidental and intentional actions with "Whoops!" and "There!" respectively with suitable intonation, Olineck and Poulin-Dubois added the additional cues of gaze direction (i.e., averted gaze for accidental actions, directed gaze for intentional ones), facial expression (i.e., surprise for accidental actions, smiling for intentional ones), and upper body movement (i.e., jumping slightly for accidental actions, leaning in for intentional ones) to aid in the detection of intentional actions. In addition, each action sequence included one intentional action and one accidental one, alternating their order across six trials. Olineck and Poulin-Dubois

found that eighteen-month-olds imitated significantly more intentional actions than fourteen-month-olds, but that there was no difference in the number of accidental actions imitated by the two age groups. Furthermore, when infants produced only one action on a trial, eighteen-month-olds were significantly more likely than fourteen-month-olds to produce the intentional action. According to Olineck and Poulin-Dubois, "The results of this study suggest that, although 14-month-old infants have a nascent understanding of intention, their ability to differentiate between intentional and accidental actions is not as well-developed as that of 18-month-old infants" (p. 97). Thus, there seems to be consensus that the understanding of conative intentional relations in the form of intentional actions develops between the ages of fourteen and eighteen months.

Repacholi and Gopnik (1997) have examined both conative and affective intentional relations in infants at these ages. Using a fascinating procedure in the tradition of social referencing, they examined infants' ability to use an adult's previous emotional expression to determine which of two possible food items she desired. Imagine eighteen-month-old Oliver, as a participant in the Mismatched Condition. He sits in a highchair across the table from a female experimenter, who, after a brief period of free play initiates a little game of "Give and Take" to determine Oliver's willingness to share with her. This playtime is followed by the Food Request Procedure in which the experimenter places two bowls of food between herself and Oliver. The bowl on her left contains Pepperidge Farm Goldfish crackers, while the bowl on her right contains raw broccoli flowerets. These bowls are left within Oliver's reach for 45 seconds to determine which he likes better. Oliver, like all other infants in the study, prefers the Goldfish crackers. Then the bowls are removed from his reach and as he watches, the experimenter tastes the Goldfish

crackers and reacts with an expression of disgust, saying "Eww! Crackers! Eww! I tasted the crackers! Eww!" Then she tastes the broccoli and reacts with an expression of happiness, saying "Mmm! Broccoli! Mmm! I tasted the broccoli! Mmm!" After tasting and reacting to both foods, the experimenter extends her hand palm-up midway between the two bowls and says to Oliver: "Can you give me some?" Thus, Oliver has to choose between the crackers he likes and the broccoli she likes. Like most eighteen-month-olds in the Mismatched Condition, Oliver gives her some broccoli. Eighteen-month-olds in the Matched Condition also give the experimenter her preferred food (i.e., the crackers), whereas fourteen-month-olds in both conditions are more likely to give the experimenter the food they prefer (i.e., the crackers). Thus, eighteen-month-olds can use the experimenter's previous emotional expression to infer her desire, whereas fourteen-month-olds have more trouble differentiating the perspectives of self and other. According to Repacholi and Gopnik, these results allow for the conclusion "that by 18 months, the toddler has a genuine though still relatively simple understanding of desire" (p. 20). In this case, the infant must use an understanding of affective intentional relations to determine the conative intentional relations (i.e., desires) of the experimenter.

Tomasello and Akhtar (1995) tested 27-month-olds' understanding of epistemic intentional relations in two studies in which a novel word: "modi," was introduced at a strategic point in the procedure when the researcher was performing a particular action with a particular object. They found that these young children were able to use pragmatic cues to determine the aspect of the situation to which the novel label applied. Specifically, when the researcher had performed several different actions with a particular nameless object and then used a novel label when performing a new action

with the same old object, participants inferred that the label referred to the action; whereas when the researcher had performed a particular nameless action with several different familiar objects and then used a novel label when performing the same old action with a new nameless object, participants inferred that the label referred to the object (Tomasello & Akhtar, 1995, Experiment 1). The toddlers demonstrated these inferences through their responses to the experimenter's exclamation and request in the test phase: "Look over there! Can you show me modi?" (p. 209). Responses indicating that the child interpreted the novel label as referring to the target object included pointing to it, showing it to the experimenter, and giving it to the experimenter, whereas the main response indicating an action interpretation of the novel label was to perform the target action with an object other than the target object. Performing the target action with the target object was an ambiguous response, for obvious reasons, so when this occurred the request was repeated. In the event that this same response was performed repeatedly, it was counted as an action response, based on pretest findings that none of these children had ever performed an action when requested to show a known object, suggesting that their decision to perform an action at test was prompted by an action interpretation of the novel label. The basic finding of this experiment is that 27-month-olds learned to apply a novel label to whichever element was new to the discourse context, whether it was an action or an object. The interpretation of this finding was that these children learned the new word for the new element either (1) because they were automatically drawn to this new element (i.e., the egocentric view) or (2) because they were sensitive to the adult's referential intentions (i.e., a conative intentional relation toward the action or object) and the pragmatics of discourse when making inferences about the meaning of the novel label

(Tomasello & Akhtar, 1995). Whereas this particular study could not differentiate between these interpretations, the authors referred readers to another relevant study of theirs (i.e., Akhtar, Carpenter, & Tomasello, 1996).

Like Tomasello and Akhtar (1995), Akhtar and her colleagues found that two-year-olds attributed a novel label to whichever object was new to the situation (Akhtar et al., 1996). Imagine 24-month-old Sophie sitting on the floor in a small playroom with her mother and two people she has just met (E1 & E2). Once she starts to seem comfortable with the situation, E1 reaches into a bag and takes out an object that Sophie has never seen before. Sophie, her mother, E1, and E2 play together with this object and then take turns dropping it down a plastic chute. All of this playing happens without anyone ever saying what the object is called. This sequence happens two more times with other objects that Sophie has never seen. Then her mother and E2 take Sophie to play in another part of the room. When they return, they see a clear plastic box with the three objects they played with earlier and another one that they have never seen. E2 gets excited and says: "Look, I see a modi! A modi! I see a modi in there!" and Sophie's mother says: "Look, a modi! I see a modi!" (p. 638). Sophie has never heard of a 'modi' and nobody is looking or pointing at any particular object, so she assumes that this word is the name for the new object in the box; the one that she has never seen before. After that, Sophie gets a chance to play with all four objects for a few minutes. Then E1 takes out a box of familiar objects and asks Sophie to show her each object (e.g., Can you show me the spoon?) until she has shown them all. Finally, E1 replaces the familiar objects in the box with the unusual ones they played with earlier and asks: "Can you show me the

modi?" (p. 638). Sophie points to the target object; the one she had previously inferred was the modi.

The experience detailed above is a description of the Experimental Condition for Experiment 1 of the study by Akhtar and her colleagues (1996) and Sophie's response is typical of 24-month-olds in their study. Children in the Control Condition had a very similar experience, but they did not hear the novel label until the final question, and they showed no preference toward the target object when asked to 'show me the modi.' Experiment 2 included many of the same participants as Experiment 1. Infants who took part in the Experimental Condition of Experiment 1 were in the Control Condition for Experiment 2 and vice versa. Experiment 2 was essentially the same as Experiment 1, but with different objects and one crucial procedural difference: E1 and the baby played together with the fourth object (i.e., the target) before the objects were placed in the clear box. Although the target was no longer new to toddlers at the time of E2's exclamation: "Look, I see a gazzer! A gazzer! I see a gazzer in there!" and the parent's addition: "Look, a gazzer! I see a gazzer!" (p. 641), two-year-olds in this study performed very similarly to those in Experiment 1, suggesting that they assigned the novel label to the object that was new to the situation *from the point of view of E2 and the parent.* Akhtar and her colleagues (1996) interpret infants' ability to effectively use these types of pragmatic cues across a range of discourse contexts as an indication of "a deep and flexible understanding of the behavior of other persons and their referential intentions" (p. 644).

This study by Akhtar and her colleagues (1996) indicates that two-year-olds can recognize what is new to another person and that *other people* are interested in things that are new to them, but what about younger children? At what point in infancy do these

abilities develop? Figuring out the point in development at which infants begin to understand what is new and interesting to someone else is of value in that it provides a window onto two key elements of infants' social cognition, namely their understanding of (1) the general principle that others can be interested in things and (2) the fact that another person's perspective (and interests) may be different from their own. According to Moore (in press), interest is a concept that lies at the boundary of epistemic and affective intentional relations.

In a recent paper, Tomasello and Haberl (2003) reported a pair of studies indicating that both twelve- and eighteen-month-olds are capable of determining the object of focus of an adult's attention and expressions of excitement (Moore, in press, conceptualizes this as "interest") on the basis of novelty. According to Tomasello and Haberl, infants in their studies based these determinations on prior knowledge that the adult was familiar with only two of three available objects, and on their previous experience that people tend to get excited about things that are new to a situation. Their experiments were preceded by a warm-up task with familiar toys (e.g., a ball, a toy car, and a teddy bear) to ensure that the infants understood the requests that would occur during the experiment. After the warm-up task, the baby and an experimenter (E1) played with three novel objects in succession. A second experimenter (E2) was there, playing with them, for two of the three objects. For the other "target" object (either the first or the last) E2 either announced an errand and left the room (Experimental Condition) or got up and adjusted the camera without leaving the room (Control Condition). At this time, E1 said the German equivalent of: "Oh, she's gone. She can't see, but it doesn't matter. We'll keep playing anyway" or "Oh, she's over there. But she can still see us. So we'll just keep

playing." At the end of the trial, a tray containing all three objects was given to the baby by E1. Upon seeing the objects, E2 portrayed an excited reaction toward an object in the set, the identity of which could not be determined from gaze direction or gestural cues, and said the German equivalent of "Wow! Look! Look at that! So look at that! Just give it to me, please."

In Experiment 1, the majority of eighteen-month-olds in the Experimental Condition, but not in the Control Condition, gave E2 the target object (which, in that case, was the most recently presented object). Likewise, twelve-month-olds in the Experimental Condition were more likely to give E2 the target object than either of the other objects, however, twelve-month-olds in the Control Condition also tended to give E2 the most recent object. Thus, in Experiment 1, twelve-month-olds tended to give the most recent object regardless of whether or not it was the target. As a result, Tomasello and Haberl found no significant difference between the two conditions for the twelve-month-old group. To further examine this elusive effect with twelve-month-olds, Tomasello and Haberl conducted a second experiment in which the first object, rather than the last, was subject to the experimental manipulation. In this case, infants in the Experimental Condition tended to choose the target object (i.e., the first object to be presented) whereas those in the Control Condition tended to choose either the second or the third object over the first. It is important to note, however, that only one of the three analyses used to compare the two conditions indicated a clearly significant difference. Specifically, a Fisher's Exact Test showed that there were significantly more target responses in the Experimental Condition than in the Control Condition, whereas the Goodness-of-Fit Test showed no significant difference from chance in either condition,

and the Binomial Test showed a marginally significant difference from chance in the Experimental Condition. With a larger sample size, created by comparing the twelve-month-olds in the Experimental Conditions from both experiments, a significant result was obtained by a Chi-square test of independence. Pooling both the Experimental and Control Conditions from the twelve-month-olds in both studies resulted in another significant Chi-square.

The fact that the eighteen-month-olds showed a robust effect with a sample size of only twelve infants per group while two experiments each having twenty-four infants per group had to be pooled to show a robust effect with twelve-month-olds casts some doubt on the strength of the effect in this younger group. Furthermore, the results with eighteen-month-olds are not surprising, given evidence that they are capable of correctly inferring the goals, desires, and intentions of others and of acting on these inferences through such responses as differential imitation and giving (Bellagamba & Tomasello, 1999; Carpenter et al., 1998; Meltzoff, 1995; Olineck & Poulin-Dubois, 2005; Repacholi & Gopnik, 1997). The results with twelve-month-olds however, *are* surprising (as acknowledged by Tomasello & Haberl, 2003) and are therefore more difficult to interpret.

In particular, although several habituation studies have found that young infants show some sensitivity to intentional relations (e.g., (Csibra et al., 2003; Gergely & Csibra, 2003; Gergely et al., 1995; Woodward, 1998; Woodward & Guajardo, 2002), we are not aware of any studies in which infants as young as twelve months have been shown to make inferences regarding the intentional relations of others *and* to make overt and active responses based on these inferences (i.e., giving or imitation rather than dishabituation or simple looking). According to Tomasello and Haberl, the ability to

make these types of overt responses is "evidence that the child understands at a level sufficient to justify adaptive behavioral decision making" (p. 910). Nevertheless, these authors claim that their twelve-month-olds chose the target object because, like the eighteen-month-olds, they understood that it was novel to the adult and thus inferred that it was the focus of her interest. Furthermore, they invoke the seeing-knowing connection as a factor affecting infants' differential performance in their Experimental and Control Conditions. The contrasting alternative proposed here is that while eighteen-month-olds in the Experimental Condition tended to choose the target based on their understanding of E2's attention and desire as well as the propensity of people to be interested in things that are new, some twelve-month-olds showed a superficially similar tendency because they recognized the target object as the only one for which they had not shared an interaction with the experimenter and they wished to do so[1]. Whereas the former explanation is in line with "the theoretical position that children at around 9–12 months of age possess a genuine understanding of other persons as intentional and attentional agents like themselves" (Tomasello & Haberl, 2003, p. 911), the latter suggests a reliance on shared experiences more in line with the view "that at 12 months the infant's understanding of intention is grounded in interactive contexts not in individuals" (Moore, 1999, p. 44). In order to differentiate between these explanations, it is necessary to provide a context in which the object that is novel to the adult is not the only object for which the child and adult have not shared an interaction.

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[1] Please note that this was also the case in Tomasello and Haberl's Control Condition (i.e., no shared interaction with the target in that condition either), however the pragmatics of that particular situation may have indicated to the child that E2 was not interested in the object that she had not played with (i.e., she saw the object but did not return to the table until after E1 and the baby had finished playing with it). A more detailed exploration of this possibility can be found in the next section.

The present research provided such a context. Specifically, in the first of three experiments, a "New to Baby" Condition was introduced which was specific to the present research. In this condition E2 played with the target object at a separate table, away from the baby and E1. Thus, at the time of the final request procedure (modeled after that of Tomasello & Haberl, 2003) there were two objects for which the infant, E1, and E2 had shared an interaction, and a third which was new to the baby in the sense that he or she had not had the opportunity to play with it or participate in a shared interaction with it. In addition to maintaining the basic structure of two objects with which the baby and E2 had engaged in a shared interaction and one object with which no shared interaction occurred, this condition set up a context to examine whether infants at twelve and eighteen months are capable of representing the desires of another person separately from their own. In other words, would babies base their inferences about the object of the experimenter's interest on their own interests? This question was examined further in Experiment 2, for which Experiment 1 provided a baseline (by testing the New to Baby and New to Experimenter Conditions separately).

In Experiment 2, a fourth (initially) novel object, with which the child had seen the adult playing but for which no shared interaction had occurred (i.e., a New to Baby object), was present in addition to the other three in the tray (i.e., a target object and two distracter objects) during the final request procedure. This modified task was intended to allow differentiation between twelve-month-olds and eighteen-month-olds in a way that Tomasello and Haberl's (2003) studies did not. It was expected that given the choice between a "New to Experimenter" (NE) object like the "target object" in the Tomasello and Haberl studies and a "New to Baby" (NB) object as described above, that twelve-

month-olds would behave egocentrically by giving E2 the NB object which they found most interesting, while eighteen-month-olds would be better able to infer that E2 was excited about the NE object, and give her that one. As described above, evidence for this type of pattern was found by Repacholi and Gopnik (1997). As you will recall, in their study, most fourteen-month-olds responded to the experimenter's request for food by giving her a food that they themselves found desirable, regardless of the preference that they had seen her express; whereas most eighteen-month-olds gave the experimenter the food for which she had expressed a preference even when it did not match their personal preference. This result suggests that eighteen-month-olds, but not fourteen-month-olds, are capable of understanding that other people have desires that are different from their own (Repacholi & Gopnik, 1997). Thus, in the present research eighteen-month-olds were expected to respond more maturely and less egocentrically than twelve-month-olds.

Experiment 3 of the present research came about as the result of an unusual pattern of results in Experiment 2. Specifically, since the results of twelve- and eighteen-month-olds in Experiment 2 suggested an interesting developmental trend that could potentially be rounded out by testing older infants, a group of twenty-four-month-olds was tested. These older infants unexpectedly behaved like the twelve-month-olds rather than behaving more maturely as one would expect. Thus, a third experiment was undertaken to differentiate these younger and older groups, by minimizing the potentially distracting effects of the NB object.

Chapter 2: *Experiment 1*

The objectives of the first experiment in the present research were: (a) to replicate Tomasello and Haberl's (2003) results with twelve- and eighteen-month-olds using slight modifications of their Experimental and Control Conditions – the New to Experimenter-Absent and New to Experimenter-Present Conditions, respectively; (b) to introduce a New to Baby Condition in which the child had seen the experimenter playing with one of the objects but the child and experimenter had not shared an interaction with this object; (c) to provide a plausible reason for E2 to leave the play situation that was consistent across all conditions; (d) to include two experimental trials with separate sets of novel objects in order to improve statistical power and reduce the required sample size; and (e) to set the stage for Experiment 2 – a comparison of twelve- and eighteen-month-olds in a single four-object condition pitting a New to Baby object against a New to Experimenter object, as described above. It was intended from the beginning that the results of Experiment 1 would be considered in determining which procedure (i.e., New to Experimenter - Present or New to Experimenter -Absent) should be followed for the object to be pitted against the New to Baby object in Experiment 2.

Experiment 1 was devised to allow an examination and comparison of the New to Baby Condition and the two New to Experimenter Conditions (Present & Absent) in a case where there was no competition between them; something akin to a baseline. It was predicted that if twelve-month-olds' understanding of intention depends on interactional contexts, as suggested by Moore (1999), then since each condition had a single object that had not been involved in a shared interaction, the three conditions would produce very similar patterns of results when presented separately. Alternatively, if twelve-month-

olds infer that people direct excitement toward things that are new to them, their performance would be at chance in the New to Baby Condition because none of the objects was new to the experimenter. In the New to Experimenter-Present Condition, the experimenter would have seen but not played with the object, which may or may not make it "new" to her from the infant's perspective.

The New to Experimenter-Present Condition in the present research takes the place of what Tomasello and Haberl (2003) called the "Control Condition." As a control condition, theirs seems rather odd in that it does not provide the type of baseline comparison one would expect; there is no shared interaction with the target object in either condition, so pragmatically both conditions pull for the target object. Specifically, it would seem that, in the absence of an object the experimenter had not seen, the child would choose an object the experimenter had seen but not played with. Nevertheless, in the Control Condition of Tomasello and Haberl's first experiment, where the experimenter had seen but not played with the last object, eighteen-month-olds (but not twelve-month-olds) chose this object *less* frequently than either of the others. Furthermore, in the Control Condition of their second experiment, where the experimenter had seen but not played with the first object, twelve-month-olds chose this object *less* frequently than either of the others. One explanation for this pattern of findings is that because the adult had seen the object but had not returned to the table until after it was put away, infants assumed that she did not like the object and for this reason they did not give it to her. The equivalent condition in the present research (New to Experimenter-Present) accounted for this possibility by including a plausible reason why the experimenter did not return to the table right away, a reason that was

incorporated into all conditions for the sake of consistency. Thus, in each condition, a phone located on an adjacent table rang just before presentation of the second (target) object and E2 got up to answer it. In the New to Experimenter-Present Condition E2 said: "Oh really? Yes, you'd better tell me," and stayed on the phone at the other table while watching E1 and the baby play with the target object. In the New to Experimenter-Absent Condition E2 said: "Oh really? Okay, I'll be right there" and then left the room while E1 and the baby played. In the New to Baby Condition E2 said: "No. I'm sorry, you must have the wrong number," and stayed at the other table while playing alone with the object. For the other two objects (the first and the last) in each condition, both experimenters and the baby played together. After all three objects had been presented and returned to a tray on the floor beside the table E1 picked up the tray of objects and put it on the table between E2 and the infant. At this time, E2 looked at the group of objects and said: "Oh, wow! Look at that! Just look at that! Wow! Could you give it to me, please?" As in Tomasello and Haberl's (2003) study, the direction of E2's gaze did not allow infants to infer the location of her attention, so infants' choices were either random or based on cues from earlier in the procedure.

Completion of the first trial was followed after a short snack break by a second trial in the same condition with a new set of novel objects. Whereas Tomasello and Haberl (2003) required a sample size of twenty-four infants per condition when studying twelve-month-olds, the inclusion of a second experimental trial in the present research was designed to increase statistical power, thereby reducing the number of participants needed in each condition and allowing the addition of a third condition without increasing overall sample size.

Method

Participants

Participants were forty-eight 12- to 14-month-olds (21 girls and 27 boys) and forty-eight 18- to 20-month-olds (24 girls and 24 boys). The younger participants ranged in age from 12 months; 10 days to 14 months; 29 days, with a mean age of 13 months; 24 days (*SD* = 23.0 days) and the older participants ranged in age from 17 months; 25 days to 21 months; 2 days, with a mean age of 19 months; 6 days (*SD* = 22.7 days). The names of these infants and their parents were obtained from birth announcements in a local newspaper and from lists of participants and siblings from previous studies in the lab. Participants were then recruited through scripted telephone calls to their parents from the primary experimenter. In addition to the final sample described above, the original sample included a further twelve 12- to 14-month-olds and five 18- to 20-month-olds who were excluded because they failed the warm-up task (n = 12), were fussy or uncooperative (n = 3) or were outside the intended age ranges (n = 2).

Apparatus

All testing sessions took place in a cubicle measuring roughly 3.2 m x 2.0 m enclosed in plain brown curtains to minimize distractions, with black wooden panels on two sides. The cubicle (as illustrated in Figure 1) contained two small tables, each measuring 63 cm in height, with white tops measuring roughly 71 cm x 71 cm. At the testing table there was a brightly-coloured highchair for the participant along with two child-size wooden chairs so the experimenters could sit at eye-level with the child. The white highchair tray was used for most 12- to 14-month-olds, but not for the older children. Each person had their own side of the table, with E1 seated to the child's left

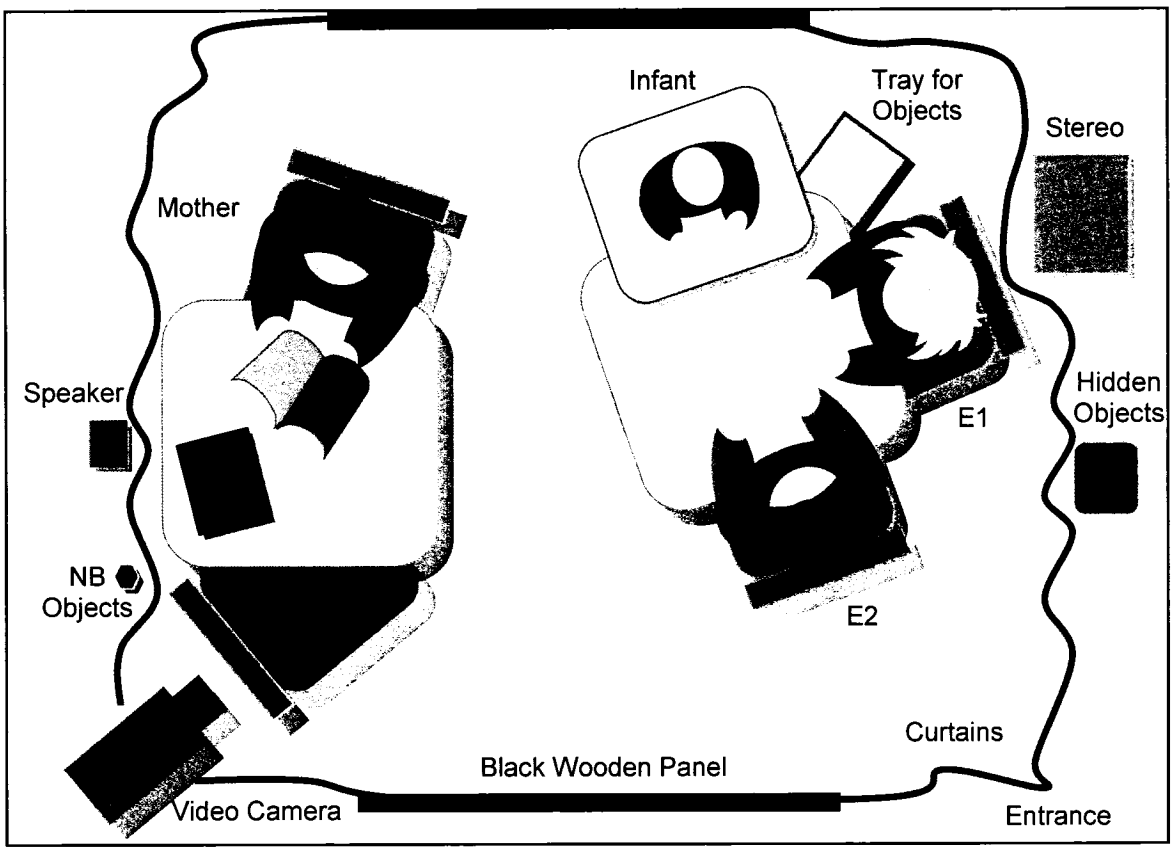

Figure 1. Lab set-up for Experiments 1 – 3.

and E2 seated across from the child. At the other table there were two larger chairs; one just a few feet from the child for the parent to use throughout the session and the other on the opposite side for E2 to use during experimental manipulations (at a distance of roughly 1.8 m from the child). On the parent's side of the table there was an assortment of magazines and on E2's side there was a blue telephone. In the corner beyond this table (on E2's side) there was a camcorder which provided a view of the testing table and its surroundings, including the infant, both experimenters, and all objects used during the session.

When not in use, the warm-up toys and novel objects were stored in a plastic bin behind the curtain, slightly behind and to the left of E1's chair. Mounted on the wall above the bin were the randomly selected presentation orders for the participant at hand, so that E1 could refer to them as necessary during the session. Both the bin of objects and the presentation orders could be viewed by E1 while remaining invisible to E2 and the child. Behind the curtain and to the right of E1's chair was a stereo cassette player with a tape of a phone ringing. Behind the curtain on the other side of the cubicle was a speaker which was connected to the stereo, but located on a chair just a few inches from the telephone. Thus, E1 could make the phone "ring" from across the room by surreptitiously pressing the buttons on the stereo.[2] Prior to each session in the New to Baby condition, the appropriate target objects were hidden on the floor behind the curtain on E2's side of the table with the phone, for use during the experimental manipulations. Clearly, the plain curtains provided many essential hiding places in addition to fulfilling their primary purpose of minimizing distractions for the young participants.

Materials

The materials included a set of familiar toys for the warm-up task, two sets of novel objects for the test trials, a clear plastic tray (measuring 33 cm x 22 cm x 6 cm and lined with yellow paper) for presentation of the objects as sets, two dark blue cloth napkins to conceal the target objects, and fun bite-size crackers for the snack between trials. The warm-up toys (shown in Figure 2) included a bright red plastic car with a

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[2] Initially, the stereo was controlled by a third experimenter in an adjacent control room, however the difficulty in coordinating schedules for multiple undergraduate research assistants eventually necessitated moving the stereo into the testing room to allow for sessions with just the primary experimenter and a single assistant. The transition went very smoothly and resulted in virtually identical testing sessions from the point of view of the participant.

yellow roof and blue wheels, a brown fuzzy teddy bear with a tiny plaid bowtie, and a brightly-coloured ball with characters from Disney's Winnie the Pooh. The three toys were attractive and had similar dimensions.

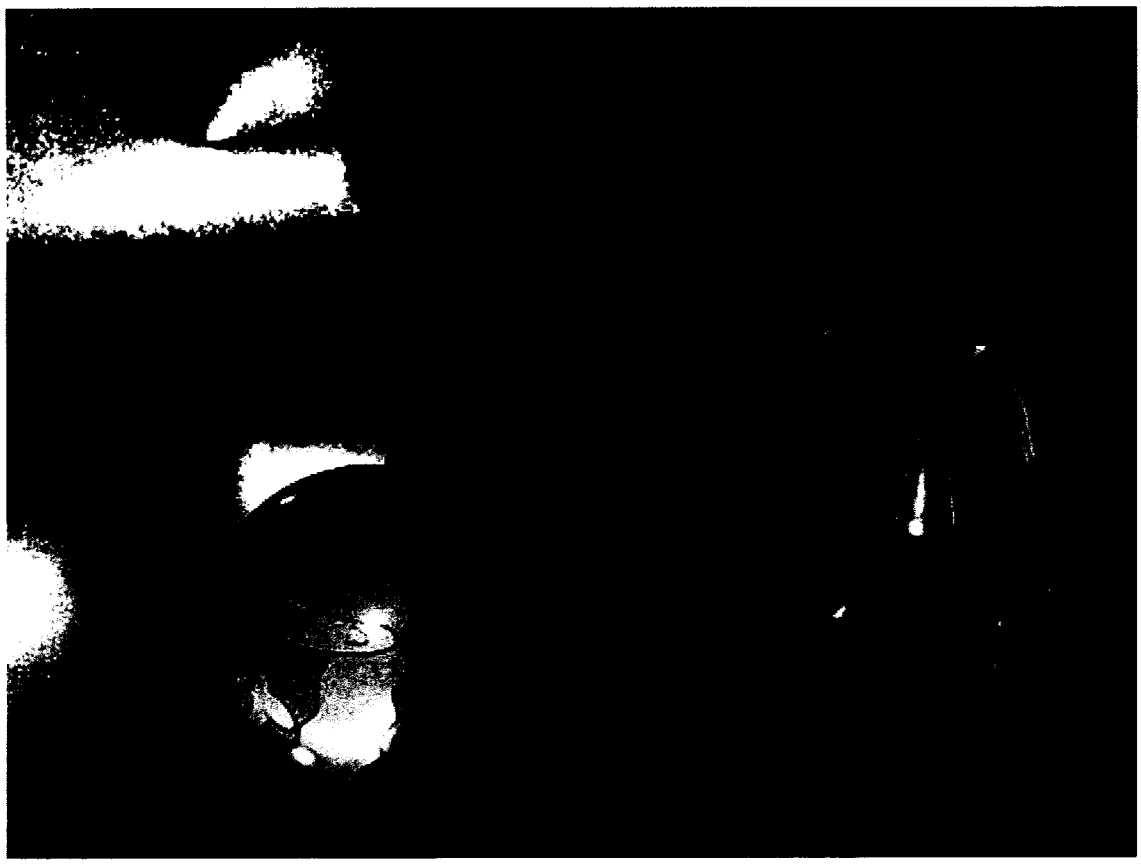

Figure 2. Toys used for warm-up task in Experiments 1 – 3.

For novel objects, Tomasello and Haberl (2003) used unusual instances of garden tools, kitchen utensils, and pet toys, each of which made a distinctive sound when manipulated. The novel objects in the present experiment were chosen from just one of these categories (i.e., kitchen utensils) because of difficulties finding two safe and appropriate exemplars from each of the other two categories. Thus, both sets of novel objects consisted of slightly unusual kitchen utensils for which the children were unlikely

to have learned specific names. These objects were free of sharp edges and were too large to pose a choking hazard. The objects used for Trial 1 are as follows: a large whisk with a grey plastic handle, arches of smooth metal wire, and a metal ball inside for breaking the yolk; a small strainer with a green and black plastic handle, a metal frame with small loops at the top for resting on a can or bowl, and a small strainer bowl made of fine mesh; and a knife sharpener with a green and black plastic handle identical to the one on the strainer and a metal casing enclosing two sets of small silver and black wheels. As shown in Figure 3, these kitchen utensils were fairly similar in size although the knife sharpener was somewhat smaller than the other two.

Figure 3. Kitchen utensils used as novel objects in Trial 1 of Experiment 1.

The objects used for Trial 2 are as follows: a white tubular frosting dispenser with an opening at one end, arched grips on either side, and a plunger on a metal rod down through the middle with a plastic ring at the end; a black plastic meatball maker with handles that open like scissors and two cups that close to form a sphere; and a coiled whisk made of one long wire extending straight out from the coil and then looping back to form the handle. As shown in Figure 4, the objects in this set were fairly uniform in size and were somewhat smaller than the ones in the first set.

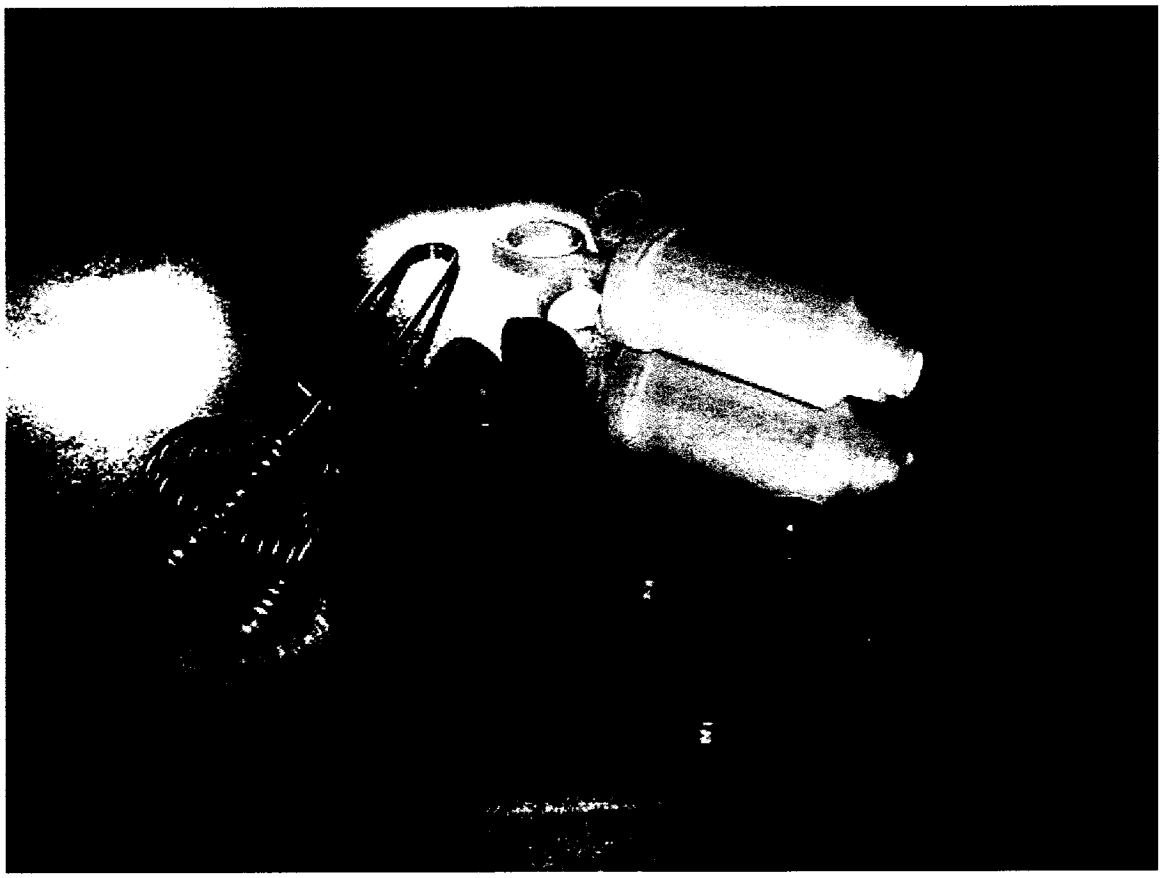

Figure 4. Kitchen utensils used as novel objects in Trial 2 of Experiment 1.

Design

Participants from each age group were randomly assigned to one of three conditions in which they had to choose which object to give in response to a request from E2. They chose from a set including two objects that E1, E2, and baby had played with together and one that was treated differently in some way (the target). In the New to Experimenter – Absent Condition, E2 completely missed the target object because she was out of the room while it was presented. In the New to Experimenter – Present Condition, E2 saw all of the objects but missed out on playing with the target object because she was on the phone while it was presented. In the New to Baby Condition, E2 played with all three objects, but she played with the target object all alone and the baby saw it but did not get to play with it. In each of these conditions, we might expect children to choose the target object simply because it was treated differently or because E2 and the baby had not shared an interaction centred on that object.

In addition to being randomly assigned to a condition, participants were randomly assigned, for each trial, to one of the six possible orders in which a set of three objects can be presented. As described above, these presentation orders were mounted behind the curtain prior to the testing session. In addition, the objects were arranged in the posted order so that they could be easily located when needed. Regardless of the presentation order, the second object was always the target. Thus, each object was chosen to be the target for roughly equal numbers of participants.

Procedure

Each session began with an informal playtime to allow the child to become familiar with the two experimenters while the parent read the consent letter and filled out

the necessary forms. During this time the experimenters engaged the child in play by presenting various toys (e.g., a set of stacking rings, a dump truck full of blocks, an Elmo doll) and using them in fun ways (e.g., spinning the rings, building towers of blocks for the child to knock down, and having Elmo talk to the child). The duration of this familiarization time depended on the child's mood and temperament, in that it continued until the child seemed comfortable and willing to play. At this point, the primary experimenter invited the parent to bring the child into the testing area and get him/her buckled into the highchair. She also encouraged the parent to sit at the adjacent table and look at some magazines while pretending not to pay attention to the task. If the child refused to sit in the highchair, the latter was moved behind the curtain and the parent's chair was moved to the highchair's former location so the child could complete the task while sitting on the parent's lap (see Figure 5). Again, the parent was asked to pretend not to pay attention to the task. In the event that the child began the session in the highchair but subsequently became upset or unwilling to remain there, the seats were moved as described above to allow the child to complete the remainder of the session on the parent's lap. Whenever possible, this transition was made between trials.

Warm-up Task: Once the child was settled, the experimenters took their seats and recording of the session began. At this point, E1 took the toys for the warm-up task from behind the curtain and placed them in the lined plastic tray, already on the table, saying: "Look at these." After giving the child a chance to look at and touch the toys, E2 (Amy) proceeded to ask for the toys one at a time, in no particular order. For instance, she would say: "Noah, could you give me the *ball,* please?" and hold out her right hand with her palm facing up. If the child gave her the appropriate toy she would say thank you and

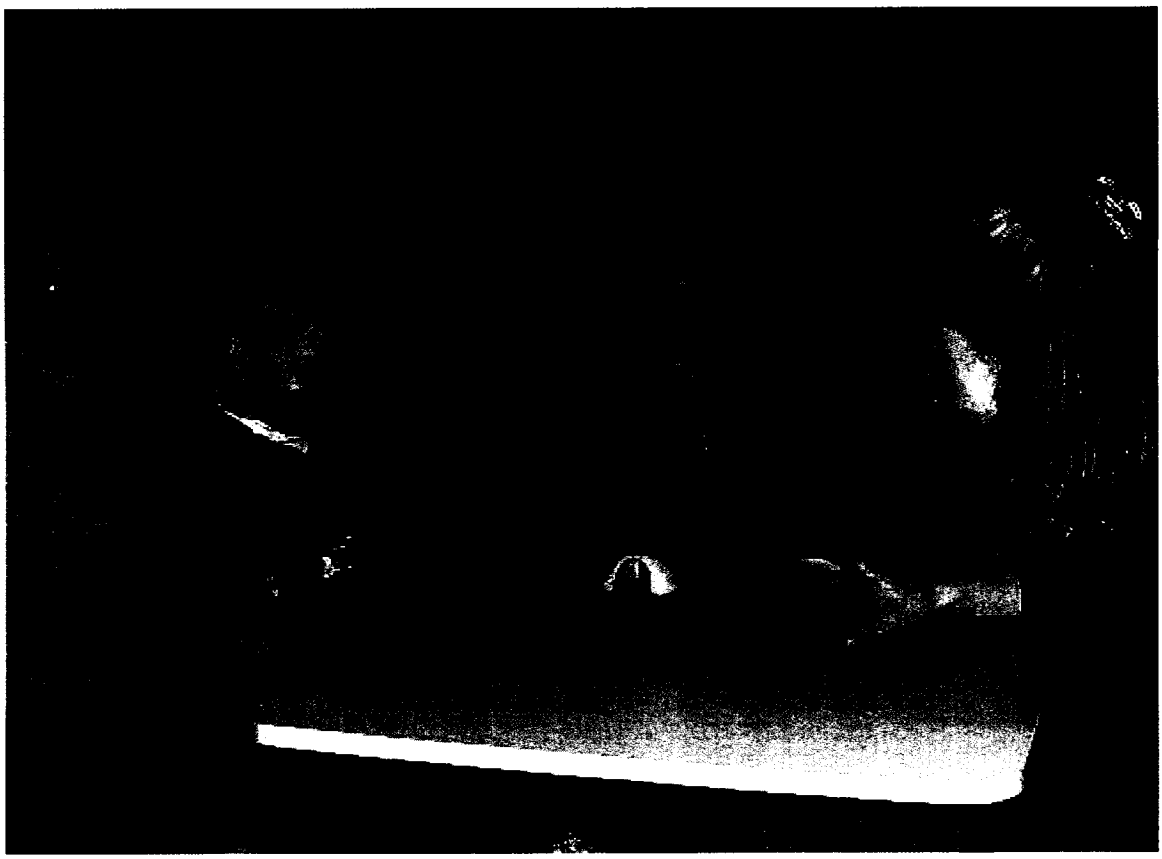

Figure 5. Example of a child (Noah, age 24 months)[3] seated on his mother's lap.

then request another toy in the same manner. If the child gave her a different toy instead of the requested one, E2 would accept it, but say, for example: "This is the *car,* could you give me the *ball,* please?" then she would return the unrequested toy to the tray to be requested later in the task. If the child did not give a toy right away, E2 repeated the request, and if the child continued to refuse, E2 requested another toy instead. The

[3] The children shown in Figures 5 – 7 belong to close friends of mine: Sharelyn Stone brought in her son, Noah Joseph Stone, and MaryAnne Clark brought in her daughter, Brooklyn May Clark, for a special photo session. The photographs were taken by my research assistants, Gillian Alcolado (shown as E1 in Figure 5) and Laura Knickle (shown as E1 in Figures 6, 7, & 27). Please note that there were no children as old as Noah and Brooklyn in Experiment 1, however Experiments 2 and 3 had infants in the range of 24 to 26 months.

purpose of the warm-up task was to ensure that the child understood the requests and that he/she was willing to give something to E2 when requested. Thus, the warm-up task was concluded when E2 had requested all three toys and the child had provided at least one toy immediately after it was requested (a pass) or when it was clear that the child had no understanding of the requests or no intention of giving any toys (a fail). Although this criterion is somewhat lenient compared to that of Tomasello & Haberl (2003) who required that the child give one of the first two toys requested, it serves the purpose stated above without unnecessarily excluding suitable participants. The few children who did fail the warm-up task were allowed to continue participating if their mood allowed and their parents wished to proceed, however data from these participants was not analysed.

Object Presentation: Upon conclusion of the warm-up task, all toys were returned to the bin behind the curtain and the plastic tray was placed on the floor between the highchair and E1's chair, where the baby could see it by looking over the right arm of the highchair. Trial 1 began with the presentation of a novel kitchen utensil by E1, saying: "Look at this!" E2 did not say anything, but took the toy and looked it over with apparent interest, made some noise with it by tapping or rolling it on the table (see Figure 6), and then offered it to the baby. She then watched attentively as the baby played and joined in whenever possible by touching the object in order to create a shared interaction centred on it. E1 also joined in the interaction and she nodded subtly to E2 after one minute had passed (timed on a wristwatch) so that E2 could attempt to retrieve the object from the baby. This retrieval sometimes proved difficult, as when the baby held on tightly to the object or became upset at the prospect of losing it, thus E1 continued keeping track of the time in order to allow similar exposure to the remaining objects in the set. When the

object was finally retrieved (rarely more than 90 seconds after its initial presentation), E1 placed it in the tray on the floor beside the highchair, saying: "I'll just put this here." Just then, E1 surreptitiously activated the stereo, causing the illusion that the phone in the room was ringing. E2 got up to answer it saying: "Oh, the phone!" or "Telephone!" Up to that point the experience had been equivalent for participants in all three conditions; however, the experimental manipulation began with the response of E2 upon answering the phone[4].

New to Experimenter – Absent: E2 sat down at the table, and after the second ring, she picked up the phone and said: "Hello?" followed a few seconds later by: "Oh, really?" and "Okay, I'll be right there. Thank you. Bye." After hanging up the phone, she stood up and said (to the child and E1): "I have to go! I'll be right back, okay?" and disappeared through the opening by which they had entered the cubicle prior to the session and proceeded to the door which she opened and shut audibly. Thus, from the child's perspective, E2 had left the lab and could neither see nor hear what went on during her absence. In actuality, E2 shut the door from inside the lab and remained there, silently awaiting her cue to return. Upon hearing the door shut, E1 said to the baby: "Oh, Amy's gone. She can't see us, but that's okay, we'll just keep playing." With that she reached behind the curtain and presented a second novel kitchen utensil (the 'target object'), saying: "Look at this!" Then she and the child played together with the object,

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[4] Whereas Tomasello and Haberl (2003) presented the target object as either the first or last of the three objects in their set, the target in Experiment 1 was always the second of the three objects in each set. This was done in order to set the stage for Experiment 2 in which there would be two potential targets (NB and NE) presented as the second and third of four objects in each set (counterbalanced across trials). Thus in the present research the target objects were always presented in between two distracters (the first and last objects) that E1, E2 and Baby all played with together.

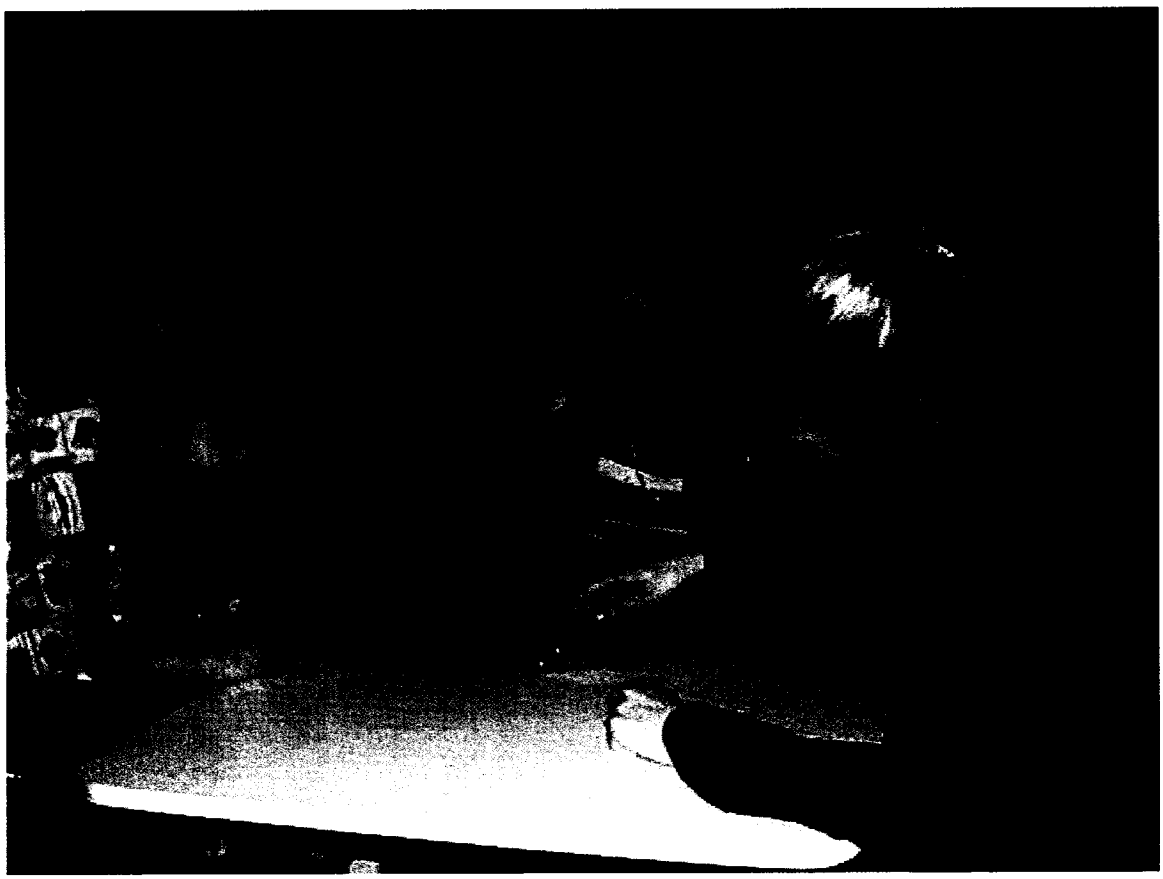

Figure 6. Example of a child (Brooklyn, age 22 months) participating in Experiment 1.

similar to what had occurred with the first object. After roughly one minute, or an amount of time equivalent to that for the first object, E1 attempted to retrieve the object from the baby. She then wrapped it in a cloth napkin and placed it in the tray, saying: "I'll just put this here." After hearing that phrase, E2 returned from the doorway and into the cubicle where she greeted the baby by name and said: "I'm back!"

New to Experimenter – Present: E2 sat down at the table, and after the second ring, she picked up the phone and said: "Hello?" followed a few seconds later by: "Oh, really? Yes, you'd better tell me." She then stayed on the phone while E1 said: "Oh, Amy's over there but she can still see us, so we'll just keep playing" and presented the

target object as in the NE-A Condition. During the interaction, E2 stayed on the phone, watching the interaction between E1 and the baby, but listening attentively and responding occasionally with brief comments (e.g., yes, uh-huh, no, I don't think so, right, yeah, etc.) until E1 had wrapped the object in a cloth napkin and said: "I'll just put this here." At that point E2 wrapped up the call with: "Yes, that sounds good. Okay. Thank you. Bye." She then returned to the table and greeted the baby.

New to Baby: E2 sat down at the table, and after the second ring, she picked up the phone and said: "Hello?" followed a few seconds later by: "No. No, I'm sorry you must have the wrong number. That's okay. Bye." Then E1 said to the baby: "Oh, Amy's over there, but we can still see her, so let's just watch her playing." As E1 said this, E2 reached behind the curtain where she found a novel kitchen utensil, surreptitiously removed the cloth napkin that was wrapped around it, looked it over as she had done with the first object and then proceeded to play with it for approximately one minute or until she received the nod from E1. During this time, E1 and the baby sat and watched E2, although some babies watched more patiently than others. After receiving the signal, E2 wrapped the object in the cloth napkin and returned to the table, passing the wrapped object to E1 beneath the edge of the table. E1 took the object and placed it in the tray, with the familiar: "I'll just put this here."

Object Presentation Resumes: Thus, the experimental manipulations for all three conditions concluded with E1, E2, and the baby, seated at the table and the tray beyond the table containing the first object and the target object, which was wrapped in a cloth napkin. At this time, E1 brought out a third novel kitchen utensil from behind the curtain, saying: "Look at this!" As with the first object, E1 gave it to E2 who examined it and

passed it to the baby, and the three shared an interaction centred on the object for approximately one minute. Then the object was retrieved from the baby and E1 placed it in the tray, saying: "I'll just put this here."

Rather than proceeding directly from the presentation of novel objects to the test procedure (as done by Tomasello & Haberl, 2003) it was decided (on the basis of pilot testing revealing that infant's tended to immediately grab the object that they had just been playing with) that a distracter toy should be provided in between. Thus, E1 reached behind the curtain and took out the ball or one of the other toys from the warm-up set. Then the three played together with the toy for roughly one minute, at which time E1 returned it to the bin behind the curtain, saying: "I'll just put this here."

Request Procedure & Scoring: The request procedure was the part of the procedure during which a response was elicited from the young participant. E1 reached down and removed the cloth napkin from the target object, lined up the objects in a random order and lifted the tray up past the infant, placing it in front of E2 without saying anything. Immediately upon seeing the tray of objects, E2 had the following excited reaction (see Figure 7): "Oh, wow! Look at that! Just look at that! Wow! Brooklyn, could you give it to me, please?" and extended her hand above the tray and in front of the infant as she had done in the warm-up task. E2 was careful to look at the whole tray as it was brought out, but then to make eye contact with the child to avoid any cueing by gaze direction. At this point, E1 moved the tray of objects closer to the infant (for young infants using the highchair tray, she moved the tray of objects from the table to the highchair tray) to allow a response. If the child did not give anything following the initial request, additional requests were made at times when the child was not holding any

objects. If the child gave one or more object(s), the first object to be given was scored as the child's response. If the child did not give any objects, the first object to be picked up was scored as the child's response. If the child did not pick up any objects, the trial was excluded for having no clear response. The child's responses were recorded immediately following the session with consultation between E1 and E2. All trials were subsequently scored from videotapes by a trained coder naïve to the hypotheses of the study, in order to ensure reliability and to provide additional information (e.g., the placement of objects in the tray, the order of responses if multiple objects were given or chosen) of potential interest.

Figure 7. Example of Amy's excited reaction (as E2) during the Request Procedure.

Snack Time: Once Trial 1 was completed and the infant was finished playing with the objects, E1 put the objects away behind the curtain and brought out the snack. With the parent's permission children were given a few small crackers. The purpose of this snack time was to regain the child's interest before the second trial and to keep them from becoming upset about being confined to a high chair or their parent's lap. The snack time lasted until the child had finished eating the crackers or until it became clear that he/she had no interest in doing so, at which point the crackers were removed from the table.

Trial 2: Following their snack, each child completed a second trial in the same condition as they had experienced in Trial 1. Although different sets of novel kitchen utensils were used for the two trials, the procedure itself was identical across trials in any given condition. Following Trial 2, E2 said: "Guess what? You're all done this game! You did a great job! What a good [boy/girl]!" Finally, E2 thanked the parents and gave them a certificate for the baby.

Results & Discussion

Each participant received a score from zero to two based on his/her responses on the two trials. Participants received one point for each trial on which the first object they gave or chose was the target object, half a point for the rare occurrence of a child picking up or giving the target and another object simultaneously (n = 1), one third of a point (i.e., the value of chance)[5] if no response was made on a particular trial (n = 6), and no points for any trial on which a distracter object was the first object to be given or chosen. These scores were analyzed using a 2 x 3 ANOVA with age group (12-14 months & 18-20 months) and condition (New to Experimenter – Absent, New to Experimenter – Present, & New to Baby) as fixed between-subjects factors (see Figure 8). This analysis revealed a marginally significant main effect of condition, $F(2, 94) = 2.67$, $p = .075$. Tukey's HSD indicated that this effect was due to the difference in scores between participants in the NE-A Condition and the NB Condition ($p = .091$). Also, as illustrated by frequency data[6] in Figures 9 and 10, both twelve- and eighteen-month-olds showed similar patterns of responding in the NE-P and NB Conditions, but rather different (and

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[5] The rationale for giving the value of chance in place of missing data is that the analyses are based on scores taking into account infants' performance across two trials. Infants who provided responses on only one of the two trials were still included as participants and giving them the value of chance seemed like more conservative way of calculating these infants' scores than, for instance, just giving them whatever score they received on the trial that was completed successfully. This scoring procedure was used to account for missing trials in all three conditions, with the value of chance adjusted as appropriate. As noted in the Participants section, infants who provided no response on either trial were excluded from the sample.

[6] These and other similar figures in this work contain raw frequency data (often averaged across both trials) representing the number of infants who gave or chose each object. These figures are modeled after those used by Tomasello and Haberl (2003) and are included because they illustrate the results in a clear and concise manner. Unfortunately this raw frequency data does not lend itself very well to inferential statistics, so other scores were calculated and used for the main analyses.

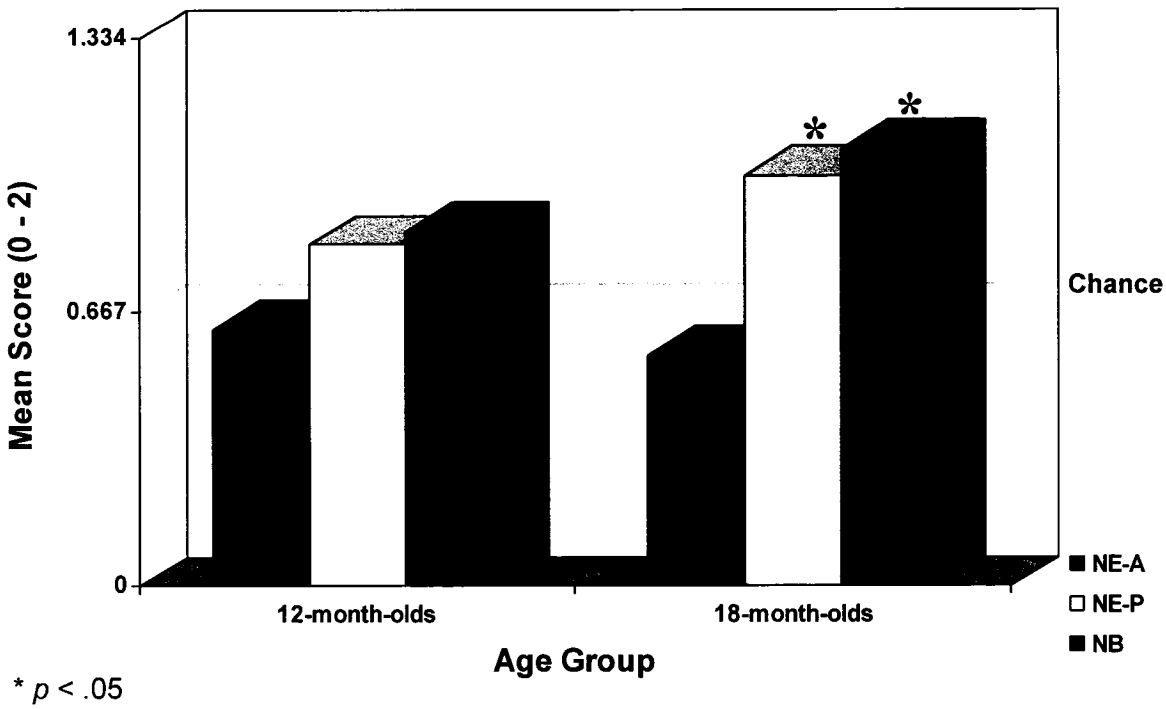

Figure 8. Mean scores (0-2) representing overall performance of twelve- and eighteen-month-olds in all three conditions.

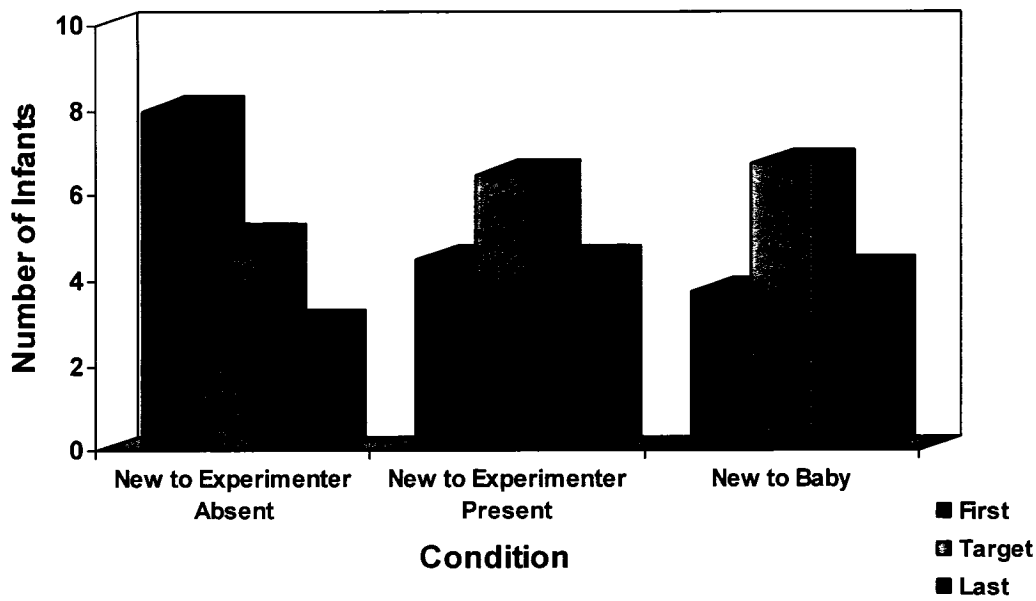

Figure 9. Responding by 12-month-olds in each condition, averaged across trials.

unexpected) patterns in the NE-A Condition. The main effect of age group, $F(1, 95) = .500$, $p = .481$ (ns), and the age group x condition interaction, $F(2, 94) = .333$, $p = .718$ (ns), were not significant.

Planned comparisons were conducted via One Sample T-tests examining the scores for each combination of age group and condition against the chance value of 0.667 (i.e., 1 of 3 objects x 2 trials). These T-tests indicated that the scores of twelve-month-olds were right around chance in all three conditions (all t's < 1, all p's > .35). The eighteen-month-olds performed much better, with scores significantly above chance in the NE-P, $t(15) = 2.38$, $p = .031$, and NB Conditions, $t(15) = 2.33$, $p = .034$, but not in the NE-A Condition, $t(15) = -.664$, $p = .517$ (ns). These findings are shown as scores tested against chance in Figure 8 and as overall response frequencies in Figure 10.

The eighteen-month-olds' tendency to give or choose the target object significantly more often than either of the distracter objects in both the NE-P and NB

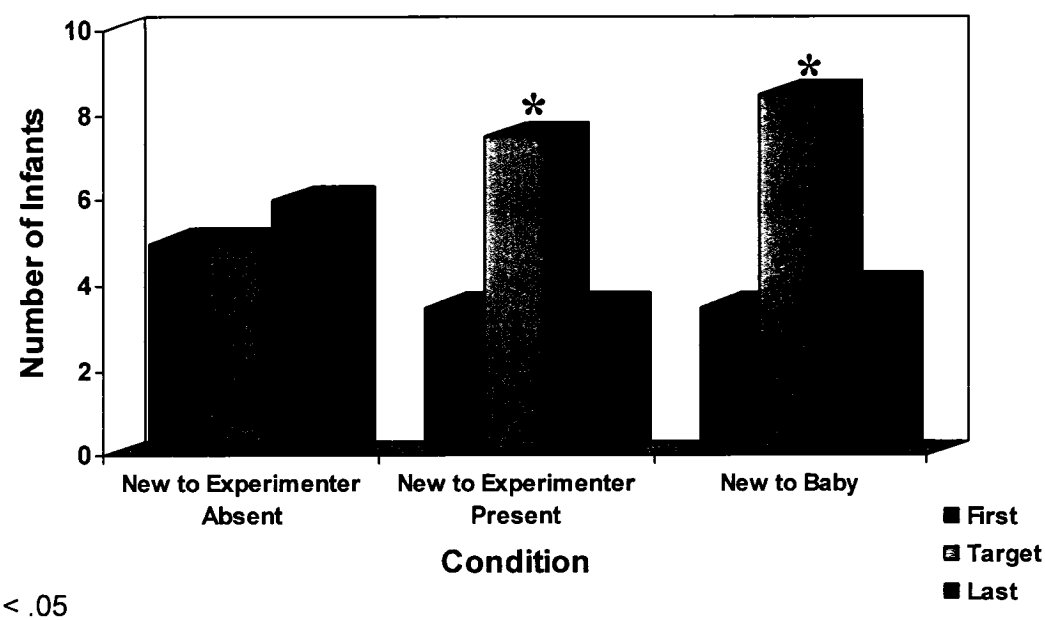

Figure 10. Responding by 18-month-olds in each condition, averaged across trials.

Conditions and the twelve-month-olds' trend toward doing so in these conditions is consistent with the idea that infants are making their choice based on (1) their awareness that there is one object (i.e., the target) for which they have not shared an interaction with E2 and (2) their desire to do so. However, the finding that neither age group showed even a trend toward giving or choosing the target object preferentially in the NE-A Condition is surprising in that (1) it is inconsistent with the proposed 'shared interaction' view and (2) it represents a failure to replicate the significant effects found by Tomasello and Haberl (2003) in their Experimental Condition with the same age groups. Further examination of the data was conducted in order to account for these discrepant findings.

One possibility to be explored was that infants were basing their choices on something other than the pragmatics of the task (e.g., a bias toward or against a particular object or position). A thorough examination of the frequency data for the choice of objects by twelve-month-olds revealed no clear preference for any object in any condition, however there did seem to be a bias against one object (the sharpener) across all conditions (i.e., only 6 out of 48 infants gave or chose this object first and only once out of these 6 occasions was that object the target; thus, out of the fifteen times when this object appeared as target, only once was it chosen. Although this apparent bias is striking, the fact that it was consistent across conditions makes it an unlikely candidate for explaining the differential responding of infants in the NE-A Condition, as compared to the other two. As shown in Figure 9, the clear difference between the NE-A Condition and the other two is that infants in this condition tended to give or choose the first object more often than either of the other two. Plotting the two trials separately (see Figures 11 & 12) revealed that this bias was confined to the first trial, in which fully 10 out of 16

infants gave or chose the first object, while in the second trial these infants showed a subtle trend toward choosing the target object, as was the trend in the NE-P and NB Conditions. This tendency for infants to choose the first object on the first trial is

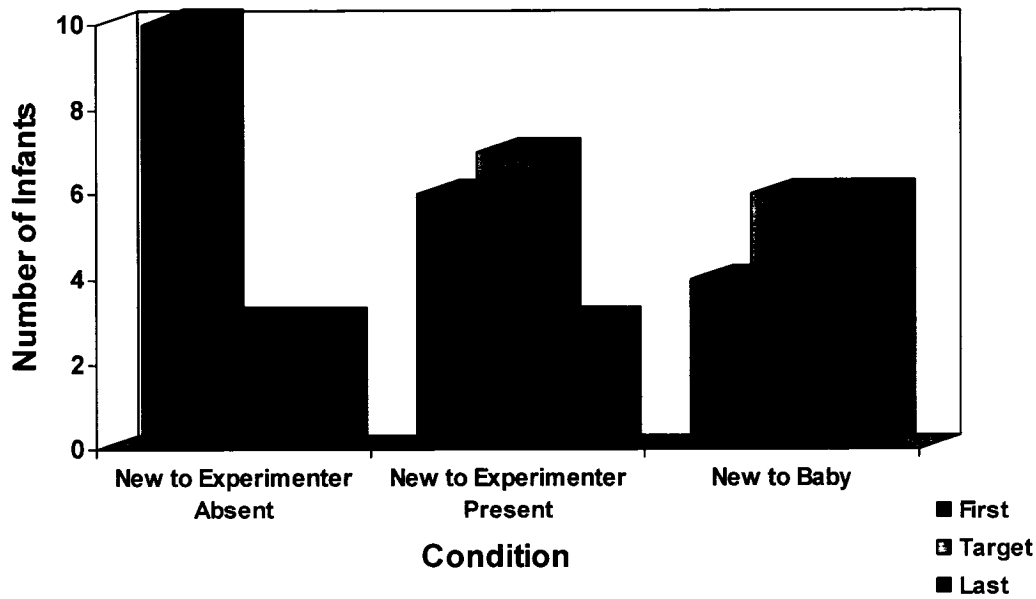

Figure 11. Responses from 12-month-olds in Trial 1 of each condition.

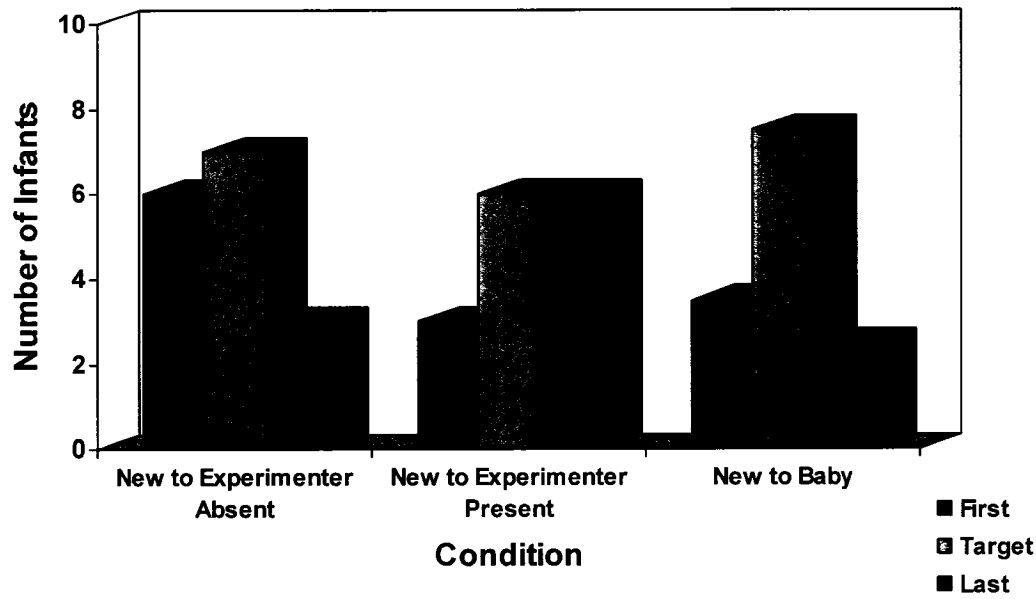

Figure 12. Responses from 12-month-olds in Trial 2 of each condition.

puzzling given that in the equivalent condition of Tomasello and Haberl's study they found that twelve-month-olds tended to choose the target object regardless of whether it was the first object or the third. Nevertheless, it seems that many infants in the NE-A Condition of the present study found the unexpected departure of E2 disrupting or distracting, and thus failed to register the significance of the target object. Further, it seems that after having experienced Trial 1 in its entirety, infants were better prepared for Trial 2 and therefore were less distracted by the departure of E2.

One further item of potential interest with respect to the twelve-month-olds' results is the type of responses they tended to give (i.e., whether they actually gave an object to E2 or whether, in the absence of any giving, the first object they picked up had to be coded as their response, as was done by Tomasello & Haberl, 2003). Plotting the giving and choosing responses separately (but still averaging responses across trials) revealed similar patterns for the two types across conditions, as shown in Figures 13 and 14. The only noticeable difference in the two patterns was that in the NE-P Condition more infants gave the last object than the other two, but among infants who did not give anything, fewer chose the last object than the other two. Binomial tests against the chance value of .50 confirmed that there was no significant difference in response type on either Trial 1 ($p = .312$, ns) or Trial 2 ($p = .658$, ns).

As with the twelve-month-olds' data, the frequency data for the choice of objects by eighteen-month-olds was thoroughly examined to check for biases toward or against particular objects. This examination revealed no clear preferences among the objects for Trial 1 in any condition, but a strong preference for the black meatball maker in Trial 2 of both the NE-A (10 out of 16) and NE-P Conditions (9 out of 16), but not the NB

Condition (4 out of 16). This object bias is of considerable interest since the results of Trial 1 are fairly consistent across conditions, but those in Trial 2 are not (see Figures 15 & 16). Specifically, in Trial 1 infants across all conditions responded preferentially to the target object, but the only significant effect among them was in the NE-P Condition, $t(15) = 2.28$, $p = .038$. Although not a significant effect, it turns out that the infants in the NE-A Condition *did* show the expected pattern in Trial 1; in Trial 2, however, *fewer* infants gave or chose the target object than either of the others, resulting in the almost completely random pattern shown in Figure 10 when the two trials were averaged.

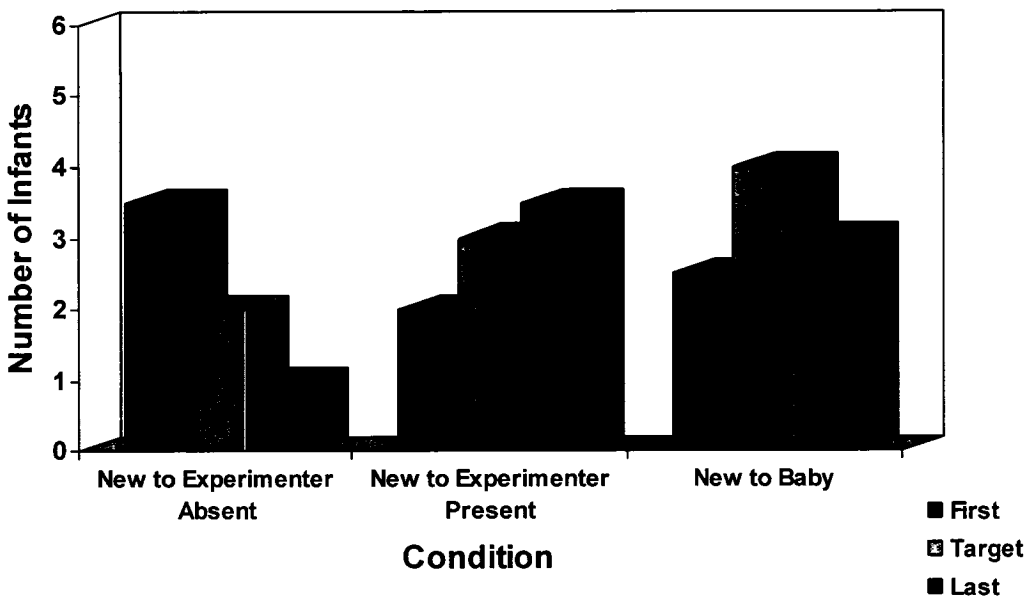

Figure 13. Giving responses **only** for 12-month-olds in each condition, averaged across trials.

The results in Trial 2 for NE-P and NE-A were clearly influenced by the object bias in favour of the meatball maker; the difference, however, is that this object was chosen more in the NE-A Condition when it was a distracter object (8 out of 10) than the target object, and in the NE-P Condition the meatball maker was chosen slightly more

often when it was the target (4 out of 9). Thus, the overall pattern of results for the NE-P Condition conformed to the hypothesis whereas that for the NE-A Condition was more unusual and unexpected.

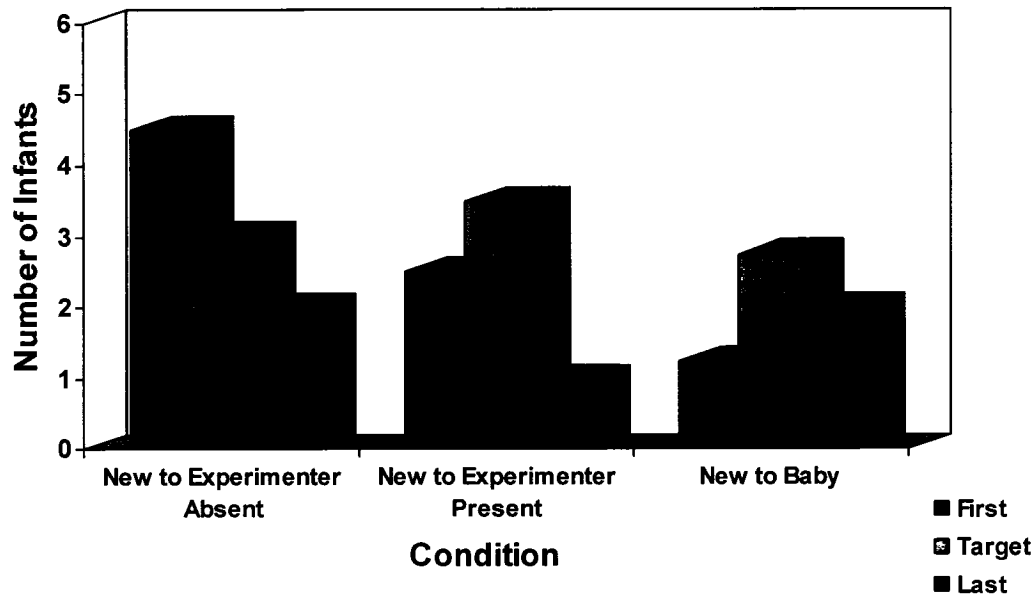

Figure 14. Choosing responses **only** for 12-month-olds in each condition, averaged across trials.

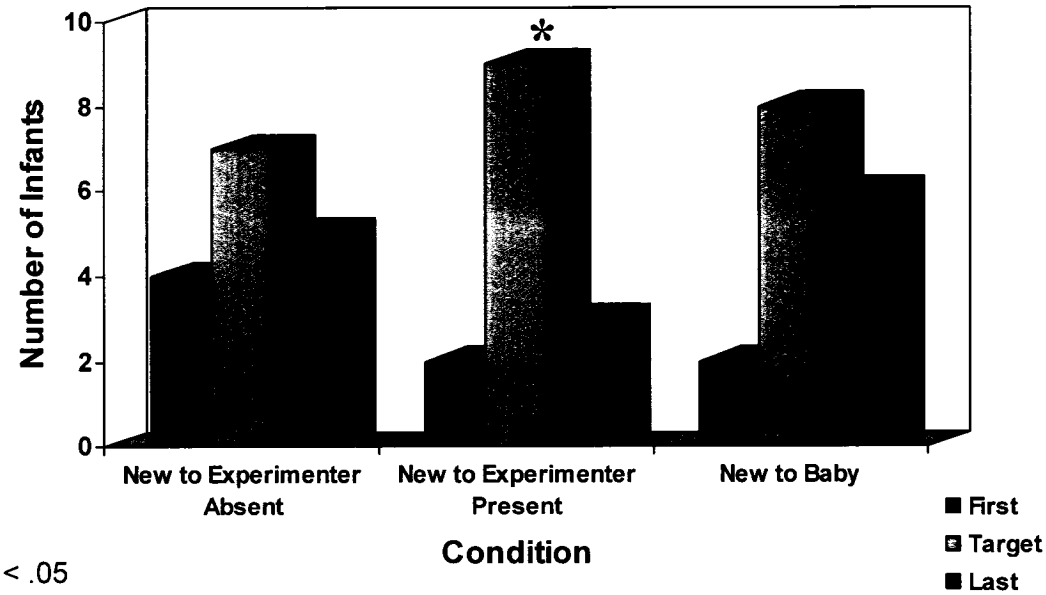

Figure 15. Responding by 18-month-olds in Trial 1 of each condition.

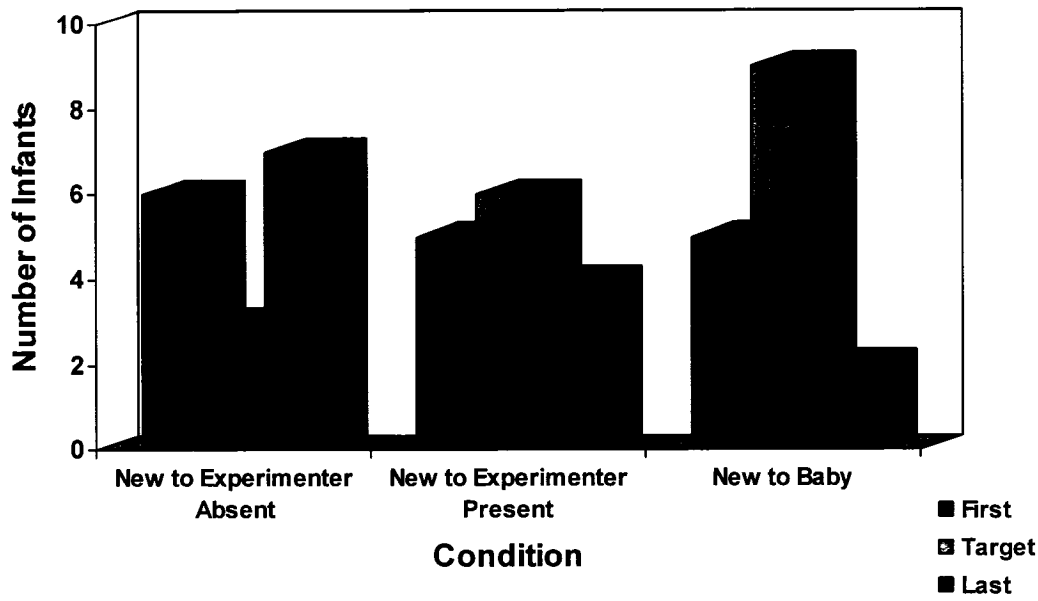

Figure 16. Responding by 18-month-olds in Trial 2 of each condition.

Unlike twelve-month-olds, eighteen-month-olds were more likely to actually *give* an object in response to E2's request than to choose an object and keep it (see Figures 17 & 18). Binomial tests showed that, across conditions, giving was the predominant response by a significant margin in Trial 1 (74% vs. 26%, $p = .002$), but not in Trial 2 (60% vs. 40%, $p = .243$, ns). Interestingly, in the NE-A Condition infants who chose the meatball maker when it was a distracter object tended to keep it for themselves rather than giving it to E2 (6 out of 8). Thus in eighteen-month-olds, whereas the choosing response represented only 40% of all responses for Trial 2, it represented 50% of all responses in the NE-A Condition, 60% of the responses by participants in the NE-A condition who picked the meatball maker, and fully 75% of the subset of that group who picked the meatball maker when it was not the target object: yet another unusual aspect of the Trial 2 results in the NE-A Condition.

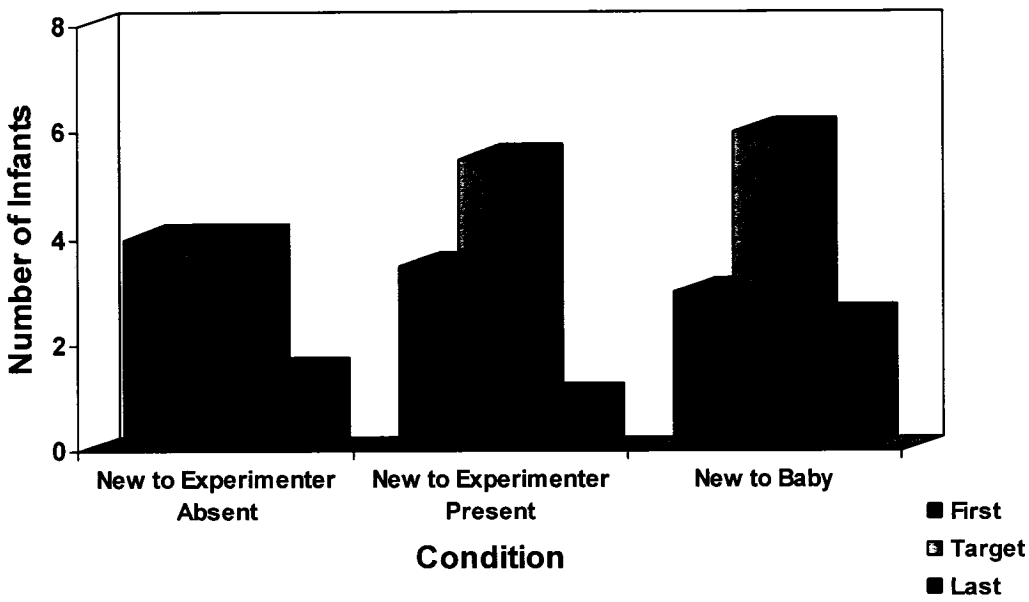

Figure 17. Giving responses **only** for 18-month-olds in each condition, averaged across trials.

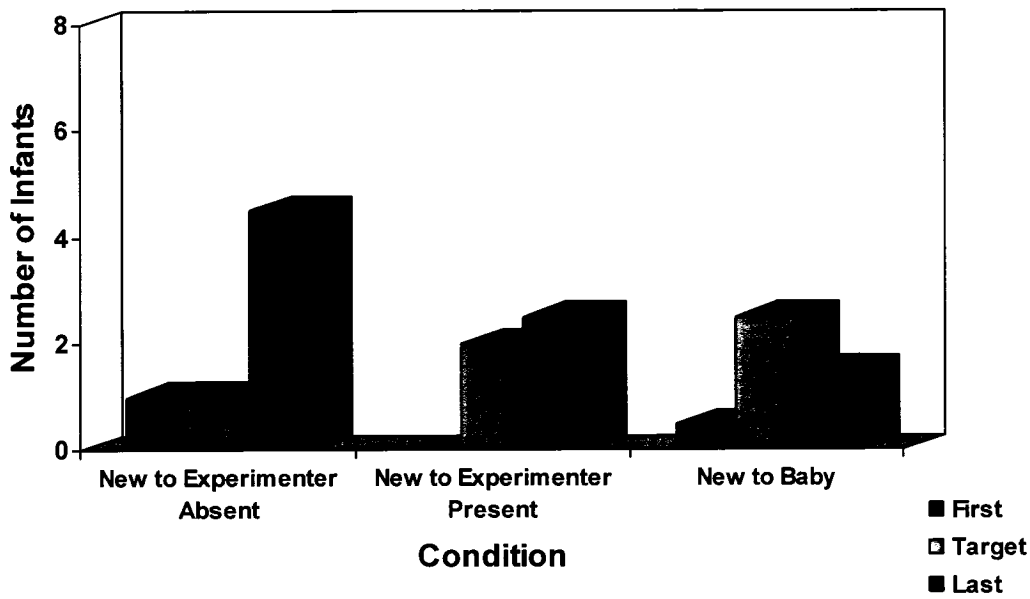

Figure 18. Choosing responses **only** for 18-month-olds in each condition, averaged across trials.

Since several different female research assistants played the role of E1 during this experiment, there was a chance that these RAs could have influenced infant performance

in some way. To rule out the possibility of experimenter effects, we repeated the original 2 (age group) x 3 (condition) ANOVA, adding RA as a random factor. As in the original analysis, the main effect of condition was marginally significant, $F(2, 72) = 2.76$, $p = .080$. The main effects of age and RA were not significant and the only significant interaction was between these two variables, $F(1, 72) = 51.03$, $p = .010$. This interaction was due in part to the larger number of different RAs involved in the testing of eighteen-month-olds (n = 7) compared to twelve-month-olds (n = 3). The fact that neither of the variables involved in the interaction had a significant effect suggests that there is little cause for concern. Nevertheless, the number of RAs involved in testing was reduced to a total of four in Experiment 2 and only three in Experiment 3.

An unanticipated result discovered during examination of the raw data for the two age groups was that male infants tended to consistently choose the target object across both trials (i.e., receive the maximum score of 2) more often than female infants. A 2 x 3 ANOVA with Condition (NE-A, NE-P, and NP) as a fixed between-subjects factor and sex as a random factor revealed a marginally significant effect of sex, $F(1, 95) = 10.78$, $p = .082$. Unlike the age group x condition ANOVA, in this case the main effect of condition did not reach significance, $F(2, 94) = 6.58$, $p = .132$ (ns). The condition x sex interaction, $F(2, 94) = .402$, $p = .670$ (ns), was not significant either.

One Sample T-tests were used as a follow-up to the ANOVA in order to examine the scores for each combination of sex and condition against the chance value of 0.667 (see above). These T-tests indicated that the girls' scores were right around chance in all three conditions (all t's < .6, all p's > .4). The boys' performance was much better with scores significantly above chance in the NE-P, $t(16) = 2.45$, $p = .026$, and NB Conditions,

$t(16) = 2.57, p = .021$, but not in the NE-A Condition, $t(16) = -.136, p = .894$ (ns), as illustrated in Figure 19.

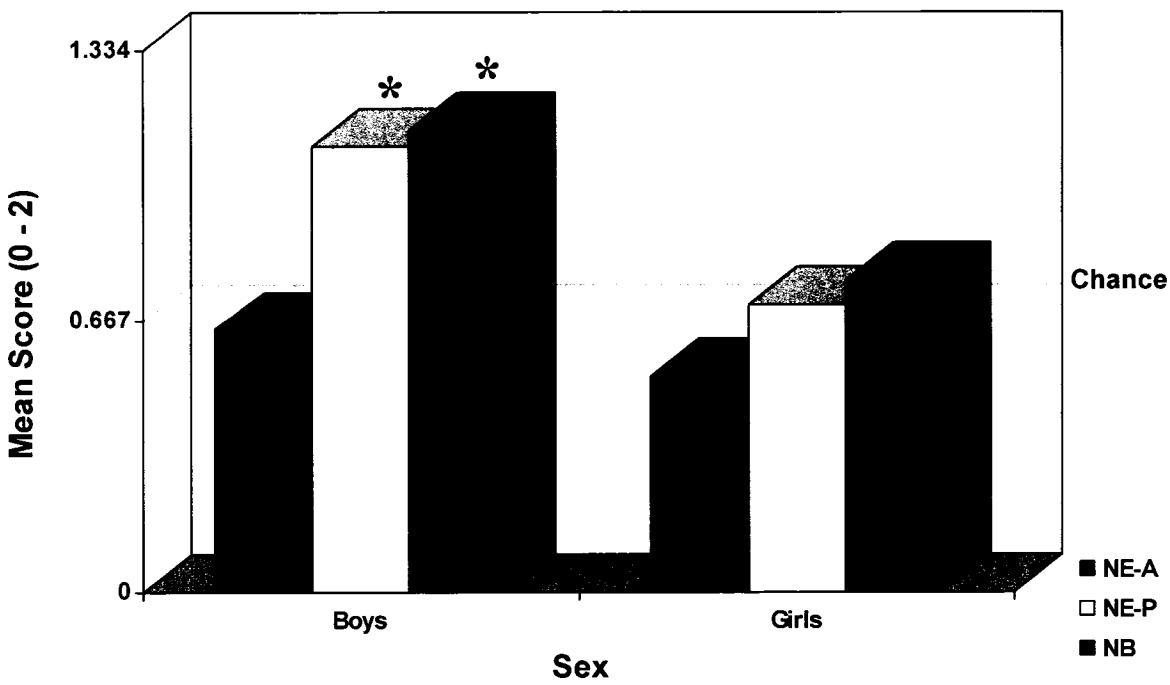

Figure 19. Mean scores (0-2) representing overall performance of infant boys (n = 51) and girls (n = 45) in all three conditions.

A thorough examination of the literature reviewed earlier in this work revealed very few reported gender differences. A few studies specifically reported not finding any gender differences (Behne et al., 2005; Bellagamba & Tomasello, 1999; Brooks & Meltzoff, 2002; Repacholi & Gopnik, 1997), most others made no mention of them (Baldwin & Baird, 2001; Baldwin et al., 2001; Carpenter, Akhtar et al., 1998; Corkum & Moore, 1998; Csibra et al., 2003; Gergely & Csibra, 2003; Meltzoff, 1995; Moll & Tomasello, 2004; Moore, 1999; in press; Moore & Corkum, 1994; Olineck & Poulin-Dubois, 2005; Tomasello & Akhtar, 1995; Tomasello & Haberl, 2003; Woodward, 1998; 1999; 2003; Woodward & Guajardo, 2002;), and only two studies reported significant

gender differences (Guajardo & Woodward, 2004; Repacholi, 1998). In Experiment 3 of their study, Guajardo and Woodward found a difference in looking time patterns between girls and boys at the age of seven months. While girls looked reliably longer at a change in object than a change in location (the expected result), the boys failed to differentiate between the two trial types. As a result of the small number of female infants in the experiment (n = 7), this sex difference was said to require confirmation and was not discussed any further. In Repacholi's study examining the understanding of emotional expressions in fourteen- and eighteen-month-olds, gender was part of a significant four-way interaction. Although she describes the interaction, Repacholi provides no interpretation of the gender difference in particular. It seems, then, that the significant gender difference observed in the present experiment is virtually unprecedented in the study of intentional relations in the second year of life. Gender differences are discussed further in Experiments 2 & 3.

Clearly, Experiment 1 had some expected results and some unexpected ones. The eighteen-month-olds chose the target object preferentially in the NE-P and NB Conditions, but in the NE-A Condition an object bias in favour of the meatball maker in Trial 2 disturbed what might otherwise have been a predictable pattern. The twelve-month-olds showed a trend toward preferring the target in the NE-P and NB Conditions, but in the NE-A Condition, a strong tendency to choose the first object, possibly as a result of the disruption caused by the departure of E2, left an unusual pattern of results. Unexpectedly, there was a significant gender difference across age groups with boys but not girls choosing the target object at greater than chance levels in the NE-P and NB Conditions.

One purpose of Experiment 1 was to replicate the basic effect found by Tomasello and Haberl (2003), in which infants around 18 months and even as early 12 months of age were able, in response to a purposely ambiguous request from a social partner, to accurately choose the object that was new to the situation (and therefore, presumably interesting) from that person's point of view. Thus, the most surprising aspect of the present results was the failure, particularly in the eighteen- to twenty-month-old group, to replicate this effect in the NE-A Condition, while a similar effect was found with eighteen-month-olds in the other two conditions. Although a replication in the twelve- to fourteen-month-old group was considered unlikely given the paucity of studies providing evidence of such sophisticated understanding of intentional relations in infants in this age range, a replication in the older age range, for which there is considerable evidence of such understanding, was considered to be almost a given. As described above, an object bias in Trial 2 seems to be partially to blame for the unexpected results in the NE-A Condition, though even that cannot account for the weak pattern in Trial 1, particularly when compared to the strong performance on that trial by infants in the NE-P Condition. In fact, these discrepant findings remain unexplained at this point.

Leaving aside the findings from the NE-A Condition, how do the other results of Experiment 1 relate to Tomasello and Haberl's interpretation of their findings? How do they relate to the alternate explanation set forth in the introduction to the present work? First of all, in both the NE-P and NB Conditions, the infants knew that E2 had seen the target object before making the final request, nevertheless, eighteen-month-olds tended to give her the target object significantly more often than the other two. Thus, an understanding of the seeing-knowing connection, which Tomasello and Haberl claimed

was partially responsible for their significant findings, cannot explain the differential responding to the target in these conditions: infants were clearly not choosing based on whether or not E2 had seen the object, since she had seen all of them. These findings are, however, consistent with the proposed explanation that infants chose the target object because it was the only one for which they had not shared an interaction with E2 and they wished to do so. This explanation does not differentiate the two conditions, which brings us to the second purpose of Experiment 1: as a baseline for Experiment 2. Before pitting a New to Baby object against a New to Experimenter object it was important to determine how objects from these conditions would be treated when presented separately. In addition, the two NE Conditions in Experiment 1 were pragmatically similar such that either could potentially serve as a suitable comparison for the NB Condition, thus it was determined that whichever of them had the most reliable result would be chosen for Experiment 2. Clearly, the NE-P Condition best fits this description.

Chapter 3: *Experiment 2*

In this second experiment infants completed two trials with two separate sets of four novel objects. The purpose of this experiment was to compare twelve- and eighteen-month-old infants' responses to the New to Baby and New to Experimenter objects by pitting them against one another. The other two objects in each set served as control objects for which both experimenters and the baby shared an interaction. As described above, this procedure was expected to differentiate twelve- and eighteen-month-olds in terms of their ability to determine the object of another's interest on the basis of novelty. Thus, the specific research question addressed by this experiment was whether twelve- and eighteen-month-olds would produce significantly different patterns of results in this four object condition.

If infants under eighteen months of age represent intentional relations in terms of shared interaction (see Moore, 1999), the object that a twelve-month-old would choose in response to E2's request in the presence of two objects for which they had not shared an interaction would presumably provide a more sensitive measure of their understanding of what is new for someone else than either the NB or NE objects when presented separately. A related assumption was that twelve-month-olds would be unable to represent the intentional relations of others separately from their own and would therefore choose the NB object because it was the one in which they were most interested, and as a result they would assume that this object was of interest to E2 as well. Eighteen-month-olds, on the other hand, were expected to choose the NE object, presuming on the basis of its novelty to E2 that it was the object of her request. Based on these assumptions, it was

hypothesized that most twelve-month-olds would choose the NB object and most eighteen-month-olds would choose the NE object.

It should be noted here that presentation of the NE object in Experiment 2 was equivalent to what took place in the New to Experimenter-Present Condition in Experiment 1. The NE-P procedure was chosen for comparison with NB because in Experiment 1 both of these conditions yielded the expected results (i.e., infants tended to choose the target object most often) with significant effects in eighteen-month-olds and weak but otherwise similar patterns in twelve-month-olds. The NE-A Condition yielded results that were less consistent and apparently random. The interesting discovery that eighteen-month-olds in this condition actually showed a trend toward the anticipated effect in Trial 1 and that this effect was masked by the very different pattern in Trial 2 – resulting from a preference in that group for one particular object which tended to be chosen regardless of whether or not it was the target object – was made long after data collection for all three experiments was completed. Thus, as a result of the unexpected and, at that time, unexplained pattern of results in the NE-A Condition, the NE-P Condition, in which infants behaved as expected, was chosen for use in Experiment 2.

Another important difference between Experiment 1 and Experiment 2 was the choice of novel objects. It was intended from the beginning that different novel objects be used for Experiment 2 than for Experiment 1 because it was anticipated that some of the infants who participated in Experiment 1 as twelve-month-olds would participate in Experiment 2 as eighteen-month-olds as a result of the limited number of possible participants and the temporal spacing of the two experiments. In addition, the kitchen utensils used in Experiment 1 turned out to be more attractive than originally anticipated,

which often caused trouble in getting infants to relinquish each object after just one minute of playtime (i.e., they had not achieved the intended state of mild boredom). Furthermore, because the kitchen utensils tended to have many long, thin parts for little fingers to wrap around, it was sometimes difficult or nearly impossible to physically remove the objects from the infants' grip. Thus, two new and completely different sets of objects were devised to be initially attractive but not to actually "do anything" interesting, thereby allowing them to produce mild boredom after a minute or so of playing. Furthermore, rather than having one set of objects for Trial 1 and a second set for Trial 2 as in Experiment 1, the set used on each trial was counterbalanced.

Whereas the original plan was to test only twelve- and eighteen-month-olds in Experiment 2, the combined results from these two groups (described below) demanded the addition of an older comparison group to help round out the developmental story. For this reason, a group of 24-month-old children were tested in the same procedure as the younger participants. Testing of this age group took place shortly after completion of testing with the original groups.

Method

Participants

Participants were twenty-four 12- to 14-month-olds (13 girls and 11 boys), twenty-four 18- to 20-month-olds (12 girls and 12 boys), and twenty-four 24- to 26-month-olds (11 girls and 13 boys). The youngest group ranged in age from 12 months; 7 days to 14 months; 24 days, with a mean age of 13 months; 15 days (SD = 22.7 days), the middle group ranged in age from 18 months; 0 days to 19 months; 22 days, with a mean age of 18 months; 26 days (SD = 16.8 days), and the oldest group ranged in age from 23 months; 26 days to 26 months; 20 days, with a mean age of 25 months; 8 days (SD = 21.8 days). The recruitment procedure was the same as for the first experiment. In addition to the final sample described above, the original sample included six further infants (one each from the two younger groups and four from the oldest group) who were excluded because they were fussy or uncooperative (n = 5) or were distracted from the task (n = 1).

Apparatus

Testing took place in the same cubicle described for Experiment 1.

Materials

Whereas the toys for the warm-up task were the same as in Experiment 1, two new sets of novel objects were used in this experiment. One set consisted of plastic bath or personal care items, while the others were wooden objects assembled from decorative shapes, specifically for use in this experiment (See Figures 20 & 21). Regardless of its set, each object was just one colour and, aside from being an appealing colour, was relatively boring because it did not "do anything" or have a clear purpose. The plastic objects were as follows: a light green ridged cylinder used as a rolling foot massager; an

orange translucent scrubber consisting of a flat oval, with a handle on one side and short rounded pegs on the other; a dark pink transparent massager consisting of two curved rods with balls on each end connected across the center by a third rod serving as the handle; and a purple face sponge with a transparent handle and coordinating mesh sponge. As shown in Figure 20, the plastic objects were similar in overall size.

Figure 20. Plastic bath objects used as novel objects in Experiments 2 and 3.

The wooden objects were as follows: a blue object consisting of a ball on a round flat base with a little honey-pot protruding at an angle from a spot near the top of the ball; a red object consisting of a heart-shaped disk, with a smooth drawer knob protruding from the base on one side and an egg cup protruding from one of the arches on the other

side; a yellow object consisting of a curtain rod finial resembling a chess pawn with a bell shape attached to the base; and an orange object consisting of a cube with one little bell shape at the top left corner of one face and an identical bell at the bottom right corner of an adjacent face. As shown in Figure 21, the wooden objects were similar in overall size. Each of the wooden objects was given several coats of an acrylic paint with a matte finish. Because of its potential toxicity, no varnish was used.

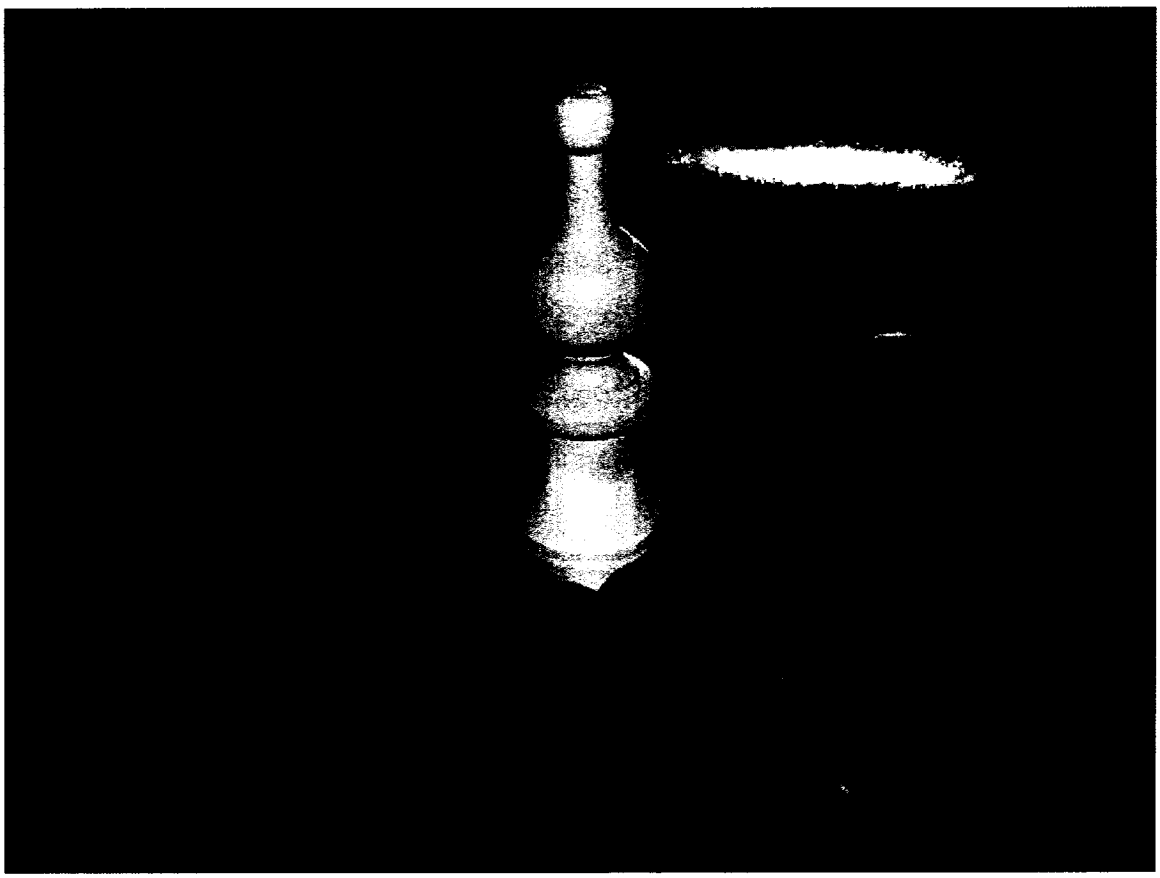

Figure 21. Wooden creations used as novel objects in Experiments 2 and 3.

Aside from these new objects, the only other difference in materials from Experiment 1 was the addition of two more blue cloth napkins to accommodate the transition from one target object per trial to two.

Design

Like Experiment 1, Experiment 2 required participants to choose which object to give in response to a request from E2. Unlike Experiment 1, Experiment 2 had only one condition. In this single condition infants had to choose from a set including two objects that E1, E2, and baby had played with together and *two* that were each treated differently in some way: a New to Experimenter object that E2 had missed out on playing with because she was on the phone while it was presented, and a New to Baby object that E2 had played with all alone, so the baby had seen it but had not had an opportunity to play with it. Thus, this experiment pits the New to Experimenter – Present and New to Baby Conditions against one another.

Because there were four objects on each trial rather than three, the number of possible presentation orders for the objects jumped from 6 to 24. With 24 participants per age group, each participant in a given age group was randomly assigned to a different presentation order from all other participants in that age group, on each trial. Furthermore, because there were two significant objects on each trial rather than a single target, the order in which these two objects were presented had to be counterbalanced across trials. This was done by making the NB object the second one in half of the presentation orders and the NE-P object the second one in the other half, while controlling for the number of times each object appeared as the NB or NE-P object. If the NB object was the second one in a particular presentation order, the NE-P object was the third one and vice versa. Moreover, rather than having one set of objects for Trial 1 and the other set for Trial 2, as in Experiment 1, the use of the two sets was counterbalanced

across trials; half of the participants played with the plastic objects first and the wooden objects second, and the other half played with the two sets in the opposite order.

Procedure

The familiarization time, the warm-up task, and the presentation of the first object were the same as in Experiment 1. The only exception was that the novel objects were the plastic and wooden objects described above rather than kitchen utensils. As in Experiment 1, E2 responded to the phone ringing by getting up to answer it, saying: "Oh, the phone!" or "Telephone!" She sat down at the other table, picked up the phone after the second ring, and then said: "Hello?" This greeting was followed by one of two possible responses corresponding to the NB or NE-P conditions. The content of the ensuing phone conversation as well as the procedure that followed were the same as those described for Experiment 1. Once the second object had been presented, played with by the appropriate person or people, wrapped in a cloth napkin, and placed in the plastic tray, the phone rang again and E2, who had returned to her original seat, responded as usual and the procedure not followed for the second object was followed for the third object. When both significant objects had been wrapped in cloth napkins and placed in the tray, the experimental manipulation was complete and the rest of the trial was completed just as in Experiment 1: the infant and both experimenters shared an interaction centred on the final object, they played with the distracter toy, and then the request procedure took place, this time with four objects in the tray rather than three. As in Experiment 1, a brief snack time took place between the two trials and the second trial followed the same procedure as the first (except of course that in Experiment 2 the NB and NE-P objects were presented in the opposite order on Trial 2 than on Trial 1).

The conclusion of the session, including praise of the child, thanking of the parents, and recording of the responses, was the same as in Experiment 1.

Results & Discussion

As in Experiment 1, each participant received a score from zero to two based on his/her responses on the two trials. The scoring system however, was quite different since there were now two significant objects (i.e., the NB and NE-P objects) with which to contend. From the point of view of our hypotheses, either choice among these significant objects would be of interest; therefore we wanted our preliminary analysis to assess how often infants chose one of the target objects as opposed to one of the distracter objects. In this scoring system, participants received one point for each trial on which the first object they gave or chose was one (or both) of the significant objects, half a point (i.e., the value of chance)[7] if no response was made on a particular trial (n = 5), or if one significant object and one target object were given or chosen simultaneously (n = 1), and no points for any trial on which a distracter object was the first object to be given or chosen, or when both of the distracter objects were given or chosen simultaneously. These scores were analyzed using a One-Way ANOVA with age group (12-14 months, 18-20 months, & 24-26 months) as a fixed between-subjects factor. This analysis revealed no significant effect of age group, $F(2, 71)$ .957, $p = .389$ (ns), as shown in Figure 22. Planned comparisons via One Sample T-tests examined the overall scores for each age group against the chance value of 1 (i.e., 50-50 chance of choosing a significant object: 0.5 on each of two trials). These T-tests indicated that the scores of twelve-month-olds approached significance, $t(23) = 1.90$, $p = .070$, while the eighteen-month-olds performed even better, $t(23) = 3.19$, $p = .004$, and the twenty-four-month-olds' performance was

[7] See justification of this scoring decision in Footnote 5.

better still, $t(23) = 4.66$, $p < .001$, with both older groups scoring significantly above chance. The mean scores for each age group are shown in Figure 22, while the overall

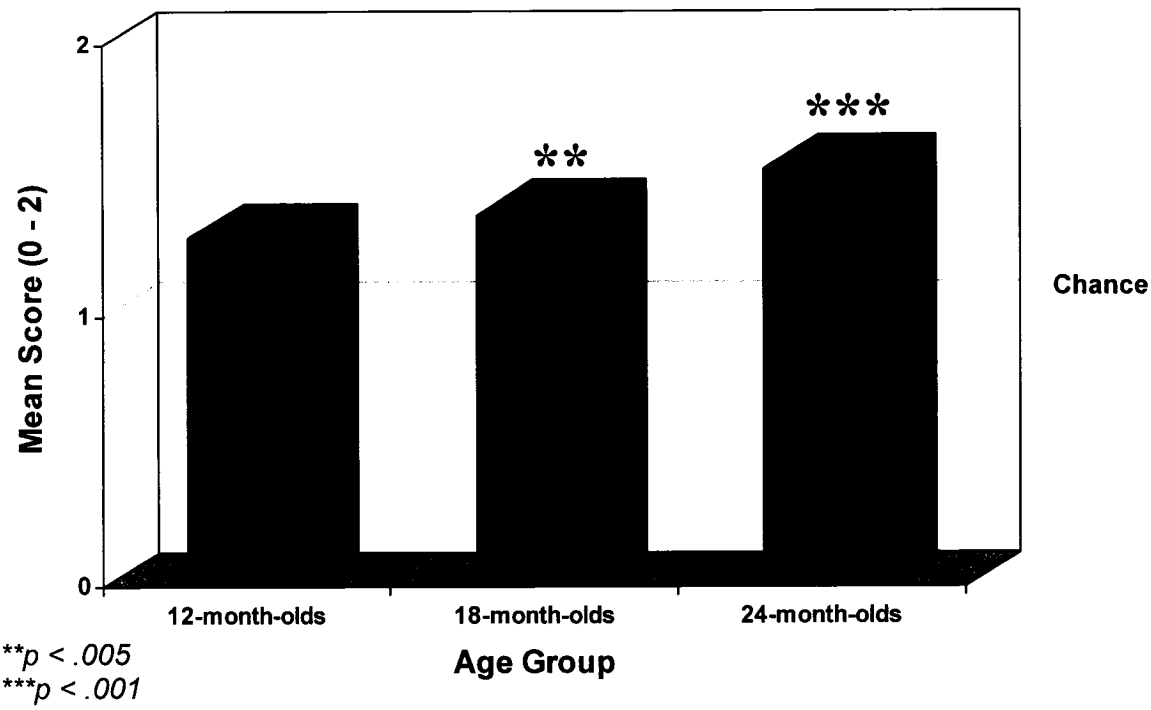

Figure 22. Mean scores (0-2) for choice of significant objects over distracter objects in twelve-, eighteen-, and twenty-four-month-olds.

patterns of responding are shown (as frequency data) in Figure 23. Figure 22 suggests that the likelihood of an infant giving or choosing a significant object in response to E2's request increased slightly with the age of the infant, while Figure 23 indicates that infants in all three age groups showed a strong tendency to choose the two significant objects, but not in equal proportions. Twelve-month-olds clearly gave (or chose) the NB object more often than the NE-P object, while the eighteen-month-olds gave (or chose) the two objects with almost equal frequency. The plan at the outset had been to test just these two age groups, yet upon examination of the data from these two original age groups, the developmental story seemed incomplete. Specifically, it seemed that twelve-month-olds'

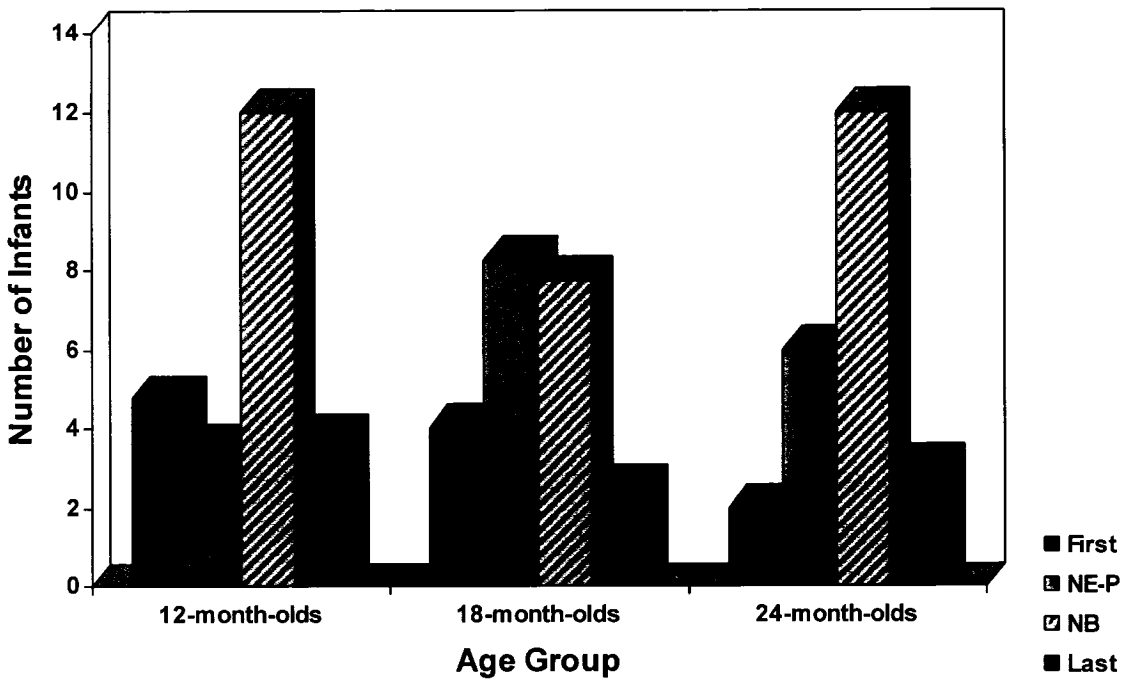

Figure 23. Combined responses for all three age groups, averaged across trials.

performance suggested an egocentric view of intentional relations in which the intentional relations of others are presumed to be equivalent with one's own, whereas eighteen-month-olds were showing a more mature and perhaps transitional way of responding, suggesting a somewhat more sophisticated understanding of the independence of different individuals' intentional relations. Thus, it was anticipated that testing a group of older infants (i.e., twenty-four-month-olds) would result in a pattern with most infants responding maturely by giving or choosing the NE-P object in response to E2's request, clearly indicating that they represented her interest independently of their own. As is clear from Figure 23, however, that was not the case. Like twelve-month-olds, the twenty-four-month-olds chose the NB object preferentially.

In order to statistically examine the relative proportion of infants giving or choosing the NE-P object (i.e., the actual target) over the NB object (i.e., a test of the possibility that early in the second year infants represent the intentional relations of others as equivalent to their own; also controls for the possibility that infants are simply choosing based on their recognition that there are objects for which they have yet to share an interaction with E2), an additional score was calculated for each infant by taking the number of times the NE-P object was given or chosen and dividing it by the total number of times a significant object was given or chosen (i.e., NE-P + NB). This calculation yielded the proportion of significant responses that were actually correct; a score between 0 and 1. These scores were then compared to the chance value of 0.5 using One Sample t-tests. These t-tests showed that twelve-month-olds gave or chose the NE-P object significantly *less* often than expected by chance, $t(23) = -5.13$, $p < .001$, while neither the eighteen- nor the twenty-four-month-olds had scores significantly different from chance, $t(23) = -.036$, $p = .972$ (ns), and $t(23) = -1.66$, $p = .110$ (ns), respectively. In addition to the T-tests, these proportion scores were analyzed using a One-Way ANOVA with age group (12-14 months, 18-20 months, & 24-26 months) as a fixed between-subjects factor. This analysis showed a significant main effect of age, $F(2, 69) = 3.97$, $p = .023$. Tukey's HSD indicated that this effect was due to the significant difference between the scores of 12-month-olds and those of 18-month-olds ($p = .017$). The mean proportion scores for each age group are shown in Figure 24.

As in Experiment 1, a thorough examination of the frequency data for the choice of objects was conducted to determine whether infants were making responses based on the pragmatics of the task or some other factor. In the twelve-month-old group, this

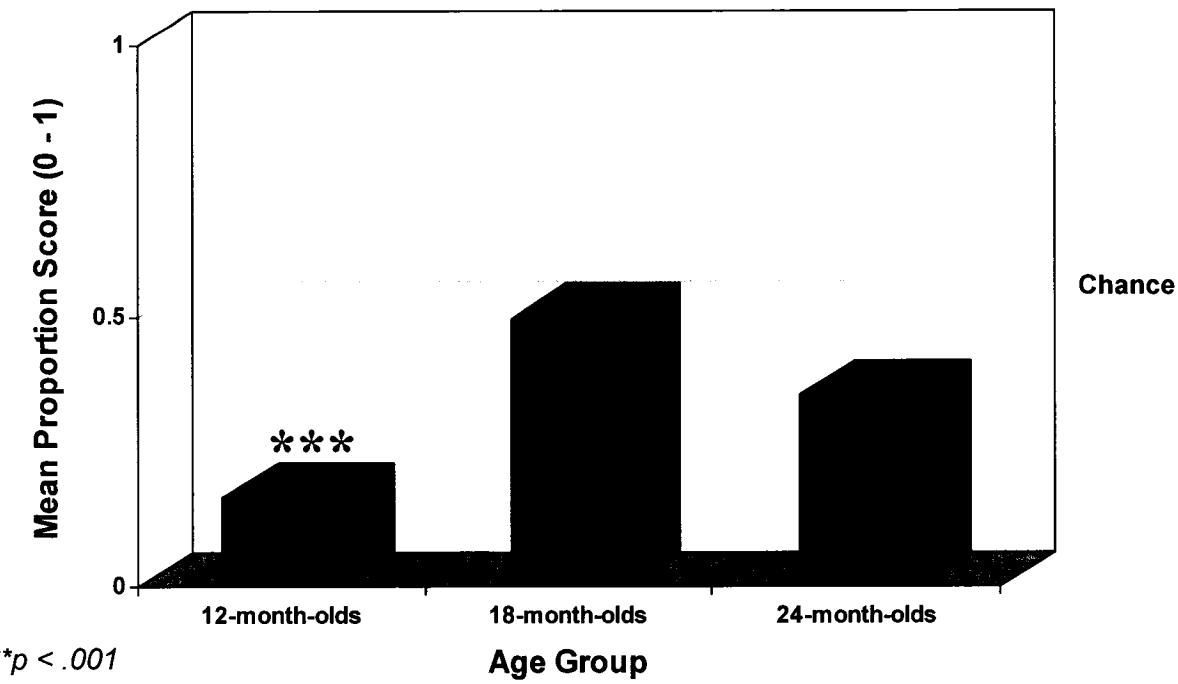

Figure 24. Mean proportion scores {0-2; NE-P/(NE-P+NB)} for all three age groups.

examination revealed clear object preferences; however these were specific to the female infants. In particular, girls tended to choose the pink object from the set of plastic objects and the blue object from the set of wooden objects, while boys showed no such preferences. Interestingly, that was not the only difference in performance between boys and girls in this age group: girls also tended to actually *give* more objects than boys did and they were more likely to choose the NE-P object, whereas boys were more likely to choose the NB object. Like the gender difference observed in Experiment 1, these findings are interesting, yet puzzling, not to mention unprecedented in this research area.

The impact of object preference in eighteen-month-olds did not vary with the gender of the infant, rather, both boys and girls tended to prefer the pink object from the set of plastic objects, while neither group showed any clear preference among the wooden objects. Furthermore, both boys and girls tended to choose one of the two significant

objects on the trial during which the plastic objects were used. Specifically, 10 of the 12 girls and 9 of the 12 boys chose a significant object from the plastic set. In contrast, only boys tended to choose significant objects preferentially from the wooden set: on these trials 9 of the 12 boys, but only 4 of the 12 girls chose a significant object.

In twenty-four-month-olds there was no clear preference among objects in the plastic set, but in the wooden set the blue object was chosen most frequently, particularly when it was one of the two significant objects. Further, fully 22 of the 24 infants who made a clear choice from among the objects in the wooden set chose one of the significant ones, compared to just 15 of the 24 in the plastic set. Another interesting finding specific to the wooden objects was that on trials when that set was used boys were more likely to give or choose the NE-P object than girls were. In particular, 6 boys but only 2 girls gave or chose the object that was new to E2 in response to her request.

Interestingly, as was the case in twelve-month-olds, twenty-four-month-old girls were more likely to actually *give* an object than were boys of the same age: 10 out of 12 girls, but only 7 out of 12 boys made giving responses. Further, all 24 (100%) of the twenty-four-month-olds who made clear responses on both trials made the same type of response both times, compared to 18 out of 21 (86%) eighteen-month-olds and only 15 of the 24 (63%) twelve-month-olds who made responses on both trials. As seen when the two different types of responses are plotted separately (see Figures 25 & 26), giving responses were more common than choosing responses and the latter were less common in eighteen- and twenty-four-month-olds than in twelve-month-olds. Binomial tests against the chance value of .50 indicated that for twelve-month-olds there was no significant difference in response type on either Trial 1 (63% vs. 37%, $p = .307$, ns) or

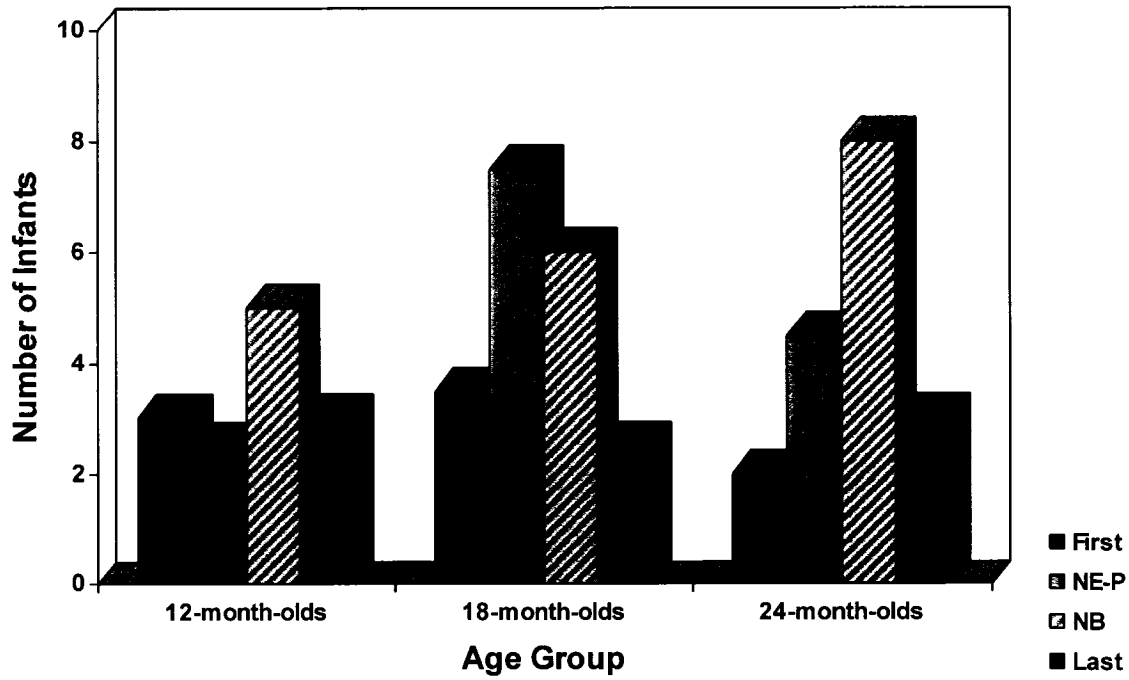

Figure 25. Giving responses **only** for all three age groups, averaged across trials.

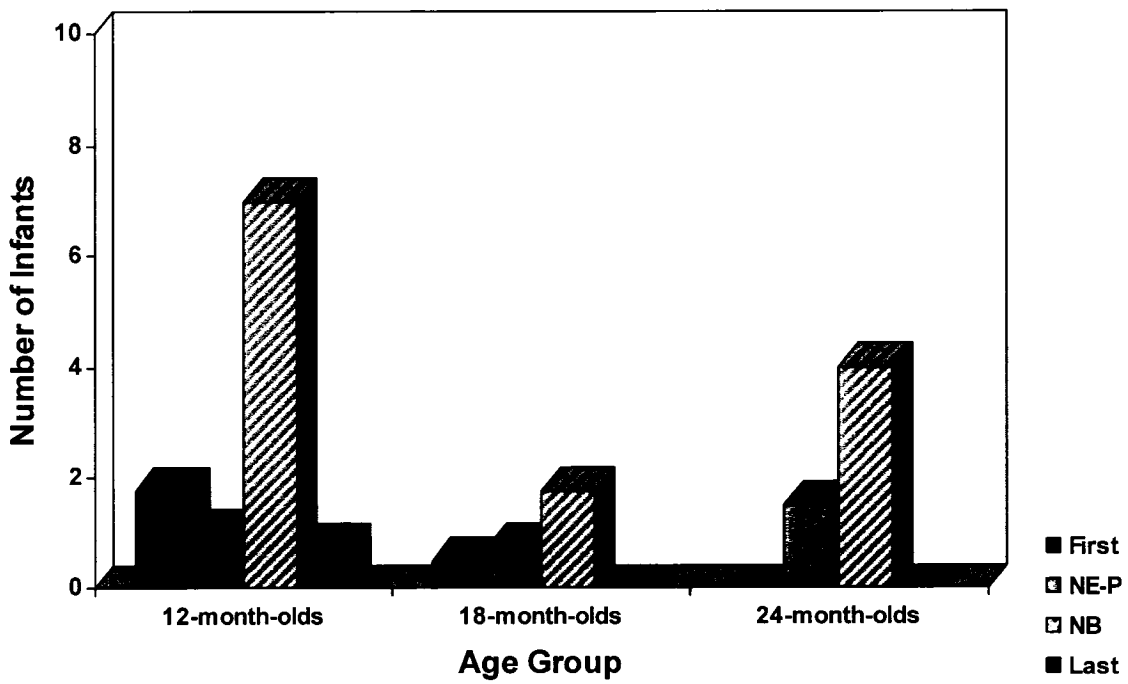

Figure 26. Choosing responses **only** for all three age groups, averaged across trials.

Trial 2 (50% vs. 50%, $p = 1.00$, ns), whereas eighteen- (Trial 1: 85% vs. 14%, $p = .001$; Trial 2: 87% vs. 13%, $p < .001$) and twenty-four-month-olds (Trial 1: 74% vs. 26%, $p = .035$; Trial 2: 78% vs. 22%, $p = .011$) were significantly more likely to make a giving response than a choosing response on both trials. Considering that giving was the requested response, it is not surprising that such responses were more common in older than younger infants.

In considering the different object effects and response types in the data from Experiment 2, the issue of gender has risen repeatedly. But was there an overall effect of gender as in Experiment 1? To examine this possibility, a One-Way ANOVA with infants' scores (from 0-2) as the dependent measure and sex as a random factor was conducted. This analysis revealed no significant effect of sex on infants' performance, $F(1, 70) = .135, p = .714$ (ns). Thus, despite some interesting differences between the responses of girls and those of boys, the overall performance of boys and girls across age groups did not differ significantly. Unfortunately, not finding a significant gender difference on infants' scores in this experiment means that the significant difference from Experiment 1 remains unexplained.

As in Experiment 1, the potential effects on infant performance of having several different RAs in the role of E1 was explored in a 2 x 3 ANOVA with age group as a fixed factor and RA as a random factor. This analysis revealed no significant effect of RA, $F(4, 62) = 5.65, p = .961$ (ns). Also, neither the age group effect nor the age group x sex interaction was significant (all p's > .1).

With the inclusion in this experiment of older and more verbally adept infants (i.e., twenty-four-month-olds) the responses of infants in the different conditions became

increasingly telling with regard to their thought processes. For instance, in the NB Condition while E2 plays with the target object at a separate table across the room from the young participant, several behaviour patterns are possible from watching patiently to gesturing (see Figure 27) or vocalizing (requesting, whining, etc.). One particularly memorable little boy, realizing that he was too far away to reach the object but his mother was not, said: "Mommy, get it from the lady!"

Figure 27. Two possible responses during the NB presentation phase: watching patiently (left) and gesturing (right).

To determine whether the occurrence of these behaviours during presentation of the NB object was related to infants' performance, all sessions were scored by a trained coder naïve to the purpose of the experiment. This coder filled in scoring sheets in which the NB and NE-P object presentation phases were identified by the phone answering response that preceded them (e.g., NB = "Sorry, wrong number."), so as not to highlight the fact that each of these significant objects was new to a particular person. The coder assigned one point if the infant gestured toward E2 during the presentation of the NB object (roughly one minute) and one point for vocalizing toward E2 during that time, resulting in a maximum score of two points per trial. The rationale behind this coding

was that infants who made overt reactions toward E2 or, more specifically, toward the object with which E2 was playing may have tended to choose the NB object more often than infants whose reactions were more patient and subdued, since the former group may have been more interested in the NB object than the latter. Additional coding of the presentation phase for the NE-P object followed similar logic: infants who looked over at E2 while playing with the NE-P object were thought to be more likely to notice that object as new to E2 and thus, more likely to give it to her (in the case of infants old enough to represent the intentional relations of others separately from their own). To account for this possibility, the coder assigned a score of one or zero on each trial depending on whether or not the baby looked over at E2 while playing with the NE-P object. In addition to separate scores for each trial, each infant's scores on each variable were summed across trials (e.g., looking on Trial 1 + looking on Trial 2 = total looking). To examine the overall effects of these variables on infants' overall performance, a One-Way ANCOVA was conducted with infants' scores (0-2) based on their responses across trials as the dependent measure, age group as a fixed between-subjects factor, and both the total score for looking (at E2 during presentation of the NE-P object) and the total score for vocalizing and gesturing (toward E2 during presentation of the NB object) as covariates. This analysis revealed a significant effect of looking scores as a covariate, $F(1, 64) = 10.82$, $p = .002$. This effect was confirmed by a significant Pearson correlation between overall scores and looking scores, $r(65) = .355$, $p = .004$. Interestingly, when the effects of looking and the combined effects of vocalizing and gesturing were covaried out, the effect of age group approached significance, $F(2, 64) = 2.68$, $p = .077$, which was not the case in the original analysis. The combined effect of vocalizing and gesturing as a

covariate was not significant, $F(1, 64) = .899$, $p = .347$ (ns). Equivalent ANCOVAs were conducted separately for Trials 1 and 2, substituting infants' performance scores on the trial of interest for the dependent measure and their scores for looking and the combination of vocalizing and gesturing on the trial of interest as the covariates. These analyses revealed that the effect of looking as a covariate was specific to Trial 2, $F(1, 67) = 4.20$, $p = .045$, with no such effect in Trial 1, $F(1, 67) = .026$, $p = .872$. There were no other significant effects in either of these follow-up ANCOVAs.

The significant relationship between looking toward E2 while playing with the NE-P object with infants' performance suggests that infants who noticed her absence from the play situation were more likely to correctly choose the object of her interest and desire (i.e., the NE-P object). The finding that the significant relationship between looking and performance was specific to the second trial suggests the possibility that infants had become familiar with the trial structure during Trial 1 and were thus more attentive to potential cues about which object might be of most interest to E2 in Trial 2. However, "performance" in this case was based on a score evaluating the dichotomous choice of significant objects over distracter objects rather than the more stringent criteria of choosing the NE-P object, which E2 had not played with before and in which she was thus presumably more interested from the point of view of a mature observer of intentional relations. Thus, an additional ANCOVA was conducted with age as a fixed between-subjects factor, looking as a covariate (chosen because of its relation to the NE-P object) and proportion scores (also specific to the NE-P object) as the dependent measure. This analysis revealed no significant effects. Therefore, it seems that the significant relationship between looking and performance on Trial 2 reflects a pattern of

increased attention in general rather than of having noticed the significance of the NE-P object from the point of view of E2 in particular.

The best summary of the results of Experiment 2 is provided by Figure 23 (above) in which the frequency (averaged across trials) with which each object was chosen is depicted for each age group. This figure shows that twelve-month-olds chose the NB object preferentially while the other three objects were chosen with approximately equal frequency, suggesting that they could not represent E2's intentional relations apart from their own; eighteen-month-olds tended to choose both significant objects preferentially over both distracters, and with roughly equal frequency, suggesting a transitional period in the representation of others' intentional relations; and twenty-four-month-olds tended to choose the NB object most often, the NE-P object fairly often, and the distracter objects least often, suggesting that either they too had difficulty representing the intentional relations of E2 as independent from their own or that they found the NB object so appealing that it distracted them from paying attention to E2's independent point of view even though they would otherwise be capable of doing so.

Experiment 3 addressed itself to the unusual pattern of responding found in the twenty-four-month-olds. Specifically, it is a replication of Experiment 2 as far as the presentation of novel objects goes, but is unique in that the final request procedure includes only the NE-P object and the two distracters. Thus, the experience of infants in Experiment 3 was identical to that of infants in Experiment 2 except that in Experiment 3 there was no possibility of choosing the NB object (as most twelve- and twenty-four-month-olds did) because it was not one of the choices. This modification was intended to differentiate the twelve-month-olds from the twenty-four-month-olds in a way that

Experiment 2 did not. In particular, it was anticipated that with the direct temptation and distraction of the NB object removed from their sight, the twenty-four-month-olds would show their understanding of E2's intentional relations as independent of their own. Based on the results of Experiment 1, twelve-month-olds in Experiment 3 were expected to show only a slight preference for the NE-P object over the distracters. Eighteen-month-olds, who behaved quite maturely in Experiments 1 and 2, were expected to do so in Experiment 3 as well, by choosing the NE-P object preferentially.

Chapter 4: *Experiment 3*

Up to the point of the final request procedure, Experiment 3 was a replication of Experiment 2 (i.e., a 4-object condition including one NB object, one NE-P object, and two distracters). However, after presentation of all four objects, a tray containing only three of these objects was placed in front of the child and the experimenter said "Oh wow! Look at that! Just look at that! Wow! Could you give it to me, please?" Thus, the difference between Experiments 2 and 3 was that in the latter experiment the tray that was placed before the child in the final request procedure contained only the NE-P object and the two distracters, but not the NB object. The purpose of this manipulation was to see how infants would respond when they had been pre-exposed to an object that was new (and particularly interesting) to them and then had to choose between three objects that they had already played with, one of which happened to be new to the experimenter. In Experiment 1, in which there were NB and NE-P conditions, twelve- and eighteen-month-olds treated these conditions similarly, with twelve-month-olds showing a slight preference for the target object in both conditions and eighteen-month-olds showing a somewhat larger preference for the target object in both conditions. However, as described above, Experiment 2 was able to distinguish between these two age groups, suggesting that twelve-month-olds tend to be egocentric in their choices while eighteen-month-olds seem to be in a transition between egocentric thinking and increased sensitivity to the desires of others. Unexpectedly, 24-month-olds responded more like twelve-month-olds than like eighteen-month-olds in that experiment. The goal of Experiment 3 was to further elucidate the developmental pattern in choosing between an object of interest to the self and an object of interest to another person, discussed in

Experiment 2. It seemed from that experiment that although twenty-four-month-olds were expected to be more sensitive to what is new to another person than younger infants, in the presence of an object that was new to them this sensitivity did not show up, possibly because they were distracted by this novel object. Experiment 3 was designed to help clarify whether the NB object must be present in the test phase to have its distracting effect or whether pre-exposure to an NB object is sufficient – in other words, would infants (twenty-four-month-olds, in particular) choose the NE-P object in the absence of the NB object (like the eighteen-month-olds in Experiment 1), or would the lingering effects of their interest in the NB object cause them to treat the NE-P object more like one of the distracters (as both twelve- and twenty-four-month-olds seemed to do in Experiment 2)? This was the key question addressed by Experiment 3. Whereas twelve- to fourteen-month-olds were not expected to respond maturely in this condition, it was expected that by 18 – 20 months and certainly by 24 – 26 months there would be a clear preference for the NE-P object in the absence of an NB object.

Method

Participants

Participants were twenty-four 12- to 14-month-olds (13 girls and 11 boys), twenty-five 18- to 20-month-olds (9 girls and 16 boys), and twenty-five 24- to 26-month-olds (14 girls and 11 boys). The youngest group ranged in age from 12 months; 6 days to 14 months; 24 days, with a mean age of 13 months; 13 days (*SD* = 23.7 days), the middle group ranged in age from 18 months; 0 days to 20 months; 14 days, with a mean age of 19 months; 7 days (*SD* = 18.9 days), and the oldest group ranged in age from 23 months; 28 days to 27 months; 0 days, with a mean age of 24 months; 27 days (*SD* = 20.5 days). The recruitment procedure was the same as for the first two experiments. In addition to the final sample described above, the original sample included a further two 18- to 20-month-olds, and two 24- to 26-month-olds who were excluded because they were fussy or uncooperative (n = 4).

Apparatus

Testing took place in the same cubicle described for Experiment 1.

Materials

All materials were identical to those used in Experiment 2.

Design

The task orders and the random assignment of participants to these task orders was the same as for Experiment 2.

Procedure

The procedure was identical to that for Experiment 2, with one notable exception: during the request procedure, rather than presenting a tray containing all four objects, E1

subtly removed the NB object from the tray while removing the napkin from the NE-P object and hid the NB object, napkin and all, under the table. As a result, the tray that she presented to E2 and the baby contained only three objects: the NE-P object and the two control objects that all three had played with together (i.e., the first and the fourth). This procedural modification was made on both trials.

Results & Discussion

As in Experiment 1, each participant received a score from zero to two based on their responses on the two trials. Participants received one point for each trial on which the first object they gave or chose was the NE-P object, half a point for the rare occurrence of a child picking up or giving the NE-P object and another object simultaneously (n = 3), one third of a point (i.e., the value of chance)[8] if no response was made on a particular trial (n = 2), and no points for any trial on which a distracter object was the first object to be given or chosen. These scores were analyzed using a One-Way ANOVA with age group (12-14 months, 18-20 months, & 24-26 months) as a fixed between-subjects factor. This analysis revealed no significant main effect of age, $F(2, 94) = 1.02$, $p = .365$ (ns). Planned comparisons were conducted via One Sample T-tests examining the scores for each age group against the chance value of 0.667 (i.e., 1 of 3 objects x 2 trials). These T-tests indicated that there was no significant difference from chance in twelve-month- olds, $t(23) = 1.54$, $p = .138$ (ns), eighteen-month-olds, $t(24) = -.110$, $p = .913$ (ns), or twenty-four-month-olds, $t(24) = 1.58$, $p = .126$ (ns). These findings are shown in Figure 28. The frequency data shown in Figure 29 illustrates that twelve- and twenty-four-month-olds, but not eighteen-month-olds, showed some tendency to respond preferentially to the target (i.e., NE-P) object.

As in Experiments 1 and 2, a thorough examination of the frequency data for the choice of specific objects was conducted to determine whether infants were making responses based on the pragmatics of the task or some other factor. In the twelve-month-old group, this examination revealed no clear object preferences. There was however, one

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[8] See justification for this scoring decision in Footnote 5.

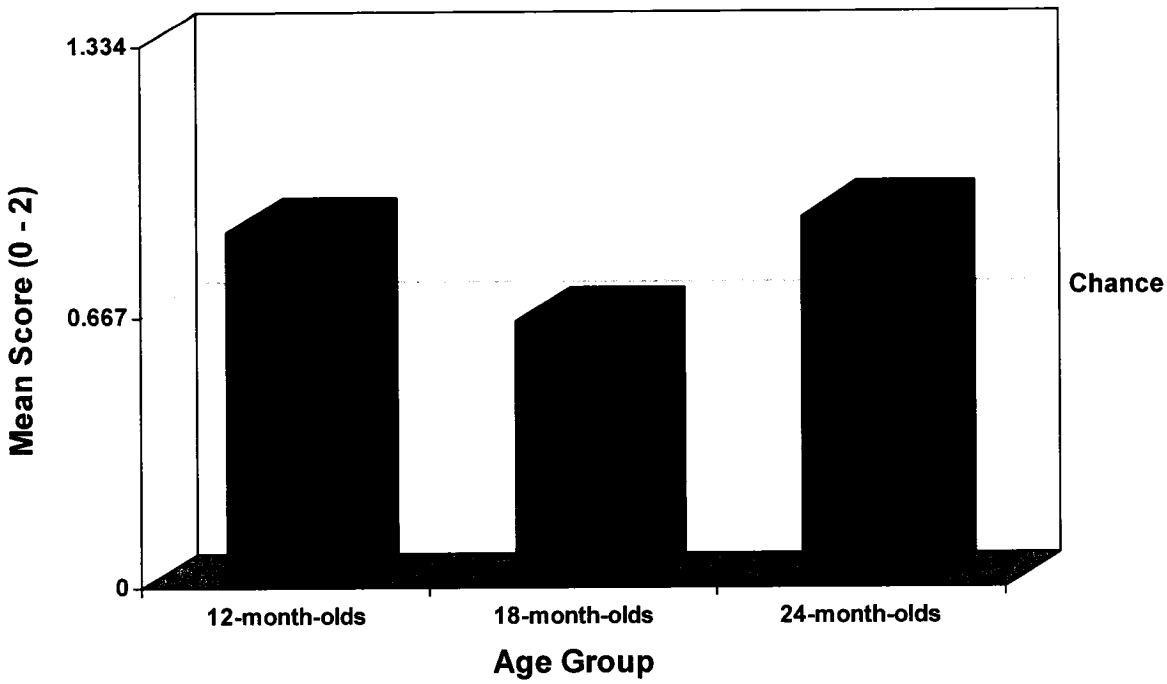

Figure 28. Mean scores (0-2) representing overall performance for twelve-, eighteen-, and twenty-four-month-olds.

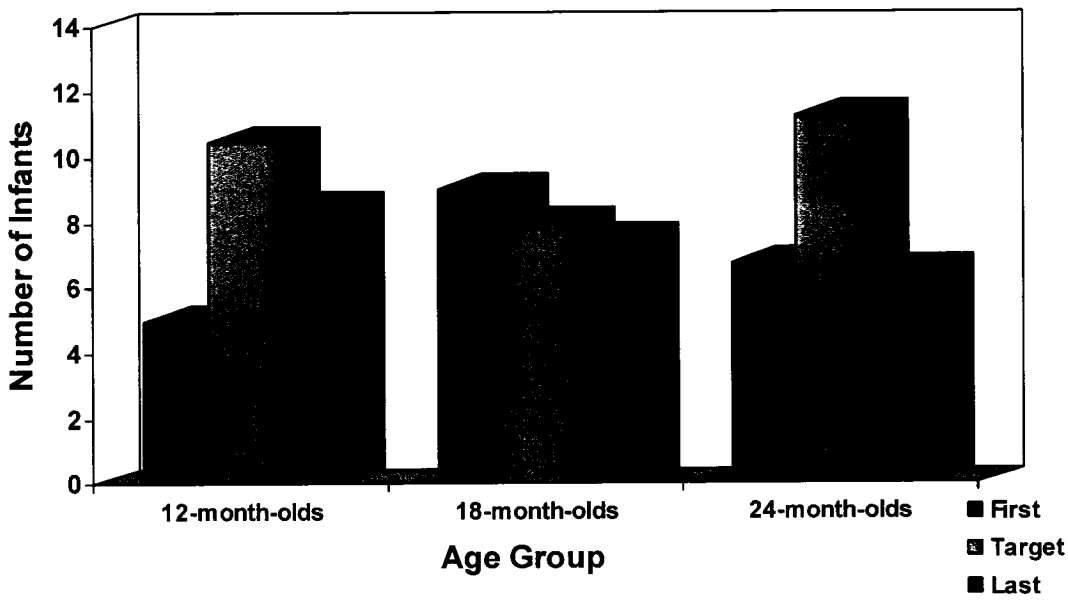

Figure 29. Responding by all three age groups, averaged across trials.

difference in performance between the two sets of objects: for the plastic objects, girls were more likely to choose the NE-P object than boys were (63% vs. 27%), whereas for the wooden objects, boys and girls chose the NE-P object at more similar frequencies (35% vs. 50%). Examination of the eighteen-month-olds' data showed a preference for the pink object (9 out of 25 = 36%) from the set of plastic objects and an even stronger preference for the red object (12 out of 24 = 50%) from the wooden set, while the yellow object from that set was chosen only once (1 out of 24 = 4%). It is also important to note that in Experiment 3, the NB object was removed from the tray before the final request procedure, meaning that any given object was absent from the final tray on roughly 25% of trials. Thus, the percentages of times these objects were chosen when they were available to choose from (i.e., about 75% of the time) are even more striking (9 out of 19 = 47%, and 12 out of 18 = 67%), especially when you consider that the red object was chosen fully twice as often as expected by chance (i.e., 33% vs. 67%). Unfortunately, these object preferences do not seem to fully account for the seemingly random performance of eighteen-month-olds in general. These infants chose both the red and orange objects from the wooden set equally often whether they were the first distracter, the target, or the final distracter, which was the case with most objects in the plastic set as well. There were no obvious gender differences to help account for the findings either. Examination of the twenty-four-month-olds' data revealed no clear object preferences from the plastic set, while from the wooden set there was a clear preference for the red object (42% overall, 55% when not NB) and a strong bias against the orange object (10% overall, 13% when not NB). As found in twelve-month-olds, twenty-four-month-old girls

were more likely to give the NE-P object than boys were (52% vs. 38%), although this difference was larger in the younger group.

As in Experiments 1 and 2, the types of responses (i.e., giving vs. choosing) were also examined. Binomial tests against the chance value of .50 indicated that twelve-month-olds were significantly more likely to make a giving response on Trial 1 (75% vs. 25%, $p = .023$) but not on Trial 2 (54% vs. 46%, $p = .839$, ns). The same was true for eighteen-month-olds (Trial 1: 76% vs. 24%, $p = .015$; Trial 2: 67% vs. 33%, $p = 152$, ns). Twenty-four-month-olds (Trial 1: 92% vs. 8%, $p < .001$; Trial 2: 92% vs. 8%, $p < .001$) were far more likely to make a giving response than a choosing response on both trials (see Figure 30). These results indicate that the likelihood of engaging in a choosing response decreased with age, as shown in Figure 31.

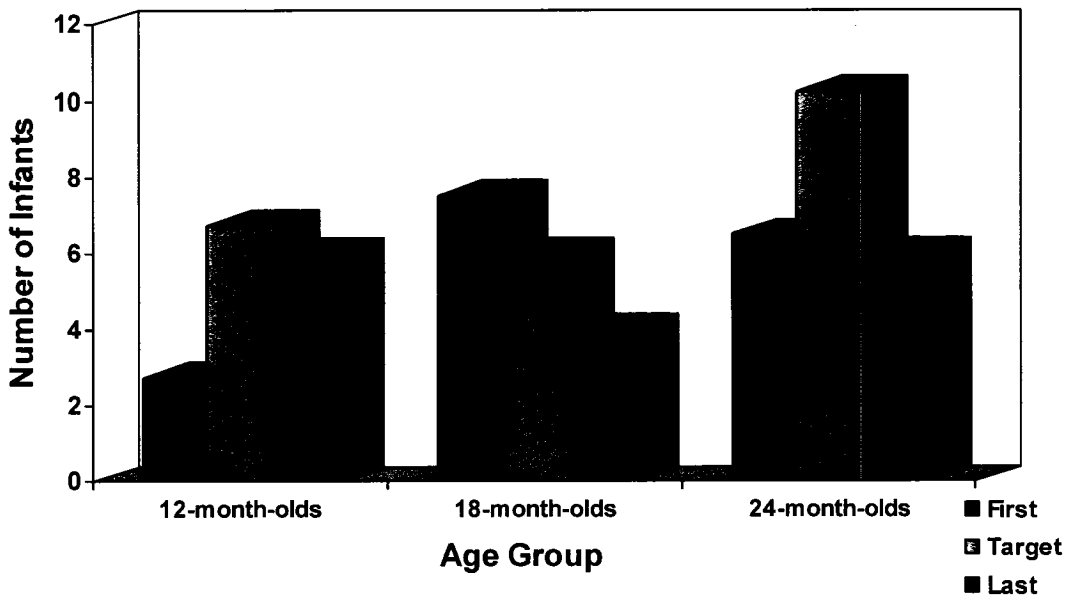

Figure 30. Giving responses **only** for all three age groups, averaged across trials

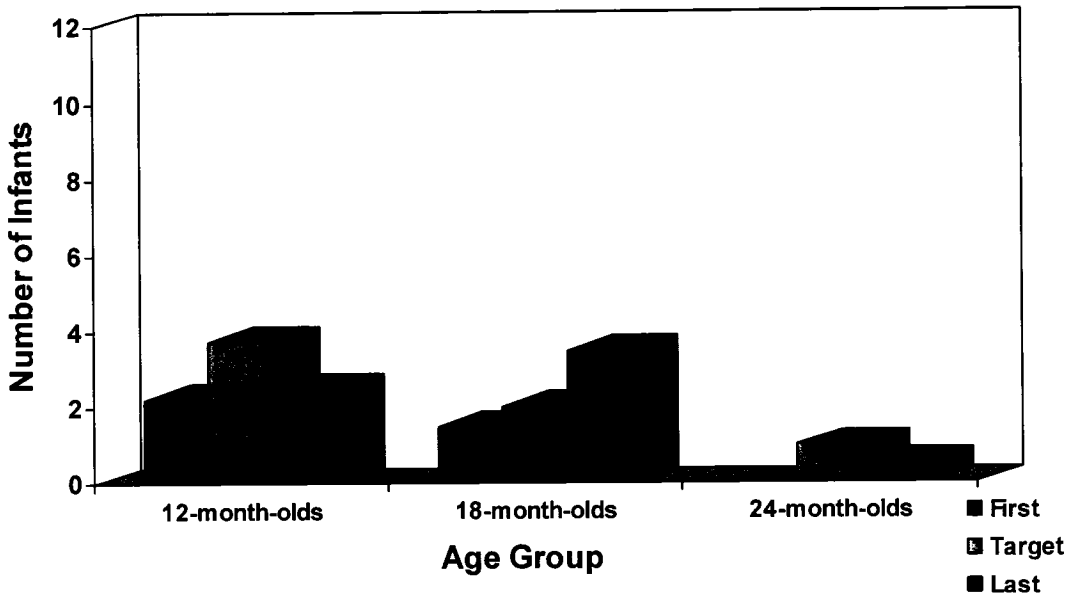

Figure 31. Choosing responses **only** for all three age groups, averaged across trials.

To examine the relationship between infants' overall performance and their behaviour during presentation of the target objects, additional coding was done as described in Experiment 2. Specifically, infants were scored (0-1 per trial) on whether or not they looked over at E2 while playing with the NE-P object and whether or not they vocalized or gestured toward E2 while she was playing with the NB object (0-2 per trial: one point each for gesturing and vocalizing). These data were examined in a One-Way ANCOVA (as in Experiment 2) with infants' scores (0-2) based on their responses across trials as the dependent measure, age group as a fixed between-subjects factor, and both the total score for looking (at E2 during presentation of the NE-P object) and the total score for vocalizing and gesturing (toward E2 during presentation of the NB object) as covariates. This analysis revealed a marginally significant effect of the combined total of vocalizing and gesturing as a covariate, $F(1, 70) = 3.52, p = .065$. A Pearson correlation

was calculated to confirm this effect, but it was not significant. No other effects in the ANCOVA were significant. Further, as in Experiment 2, equivalent ANCOVAs were conducted separately for Trials 1 and 2, substituting infants' performance scores on the trial of interest for the dependent measure and their scores for looking and the combination of vocalizing and gesturing on the trial of interest as the covariates. There were no significant effects revealed by either of these follow-up ANCOVAs.

Experiment 3 was expected to differentiate twenty-four-month-olds from twelve-month-olds, in that the former group were expected to choose the NE-P object preferentially in the absence of an NB object, whereas the latter group were expected to show only a slight tendency to do so (based on their performance in Experiment 1). As shown in Figure 29 (above), however, this was not the case. In fact, both twelve- and twenty-four-month-olds showed a slight and non-significant tendency to choose the NE-P object and the eighteen-month-olds did not even do that: their responding appeared completely random. None of the main analyses were significant and the additional exploration of data provided little help in determining the cause of these unexpected and disappointing results. One possibility is that the presentation of the NB object and its persistence in short-term memory caused a distraction to infants as they chose among the three remaining objects in the tray. Testing this possibility would require testing infants in each age group with two different trial types: One resembling the NE-P Condition in Experiment 1 (i.e., a Three-Object Condition) and the other resembling the Four-Object Condition of Experiment 3. If infants, particularly eighteen- and twenty-four-month-olds chose the NE-P object more often in the Three-Object Condition than the Four-Object Condition, it would confirm the proposed distraction effect caused by the memory of the

NB object. A related possibility raised by Moll and Tomasello (personal communication, ICIS 2004) is that presenting four experimental objects as well as a distracter toy prior to the final request procedure pushes the limits of infants' memory, perhaps causing them to forget which object was new from the experimenter's point of view. This possibility could be tested by manipulating the number of objects presented on any given trial to determine whether infants show a general tendency toward better performance when fewer objects are presented. In any case, the results of Experiment 3 are inconclusive with respect to infants' ability to understand the intentional relations of others as independent and potentially different from their own.

Chapter 5: General Discussion

This dissertation describes three experiments that were variations on a procedure devised by Tomasello and Haberl (2003) in which the novelty of (and hence the level of interest in) a particular object (i.e., the target object) from the point of view of an adult social partner was manipulated, while infants were allowed to become mildly bored with the target and two other objects (i.e., the distracters). In any given session, a twelve- or eighteen-month-old infant interacted with two female experimenters (E1 and E2) as the distracter and target objects were presented one at a time for approximately one minute each. Their studies had two conditions: an Experimental Condition in which E1 and the infant played with the target while E2 was out of the room, and a Control Condition in which E1 and the infant played with an object (not technically labelled as a target) while E2 was away from the table where they were playing, but still in the room and able to see the object. In a final request procedure a tray containing all three objects was presented to the infant by E1 accompanied by an excited reaction from E2, followed by a request to "Give it to me, please." Eighteen-month-olds chose the target object preferentially in the Experimental Condition but not in the Control Condition, suggesting an understanding that E2's excited reaction was a response to the object she had never seen before. Twelve-month-olds in their first experiment showed similar responding across both conditions, choosing the object that was new to the situation in both cases.

Thinking that twelve-month-olds in the Control Condition may have been showing a recency effect (because the object that E2 had not played with was the last of the three objects to be presented), Tomasello and Haberl completed a second experiment with this age group in which the position of the target object in the presentation phase

was switched from last to first. Although results from the two conditions were not significantly different from one another, Tomasello and Haberl did find that infants in the Experimental Condition tended to choose the target object preferentially, whereas those in the Control Condition were less likely to choose the first object than either of the other two. By combining the results from twelve-month-olds in both experiments (n = 96), they found a significant effect. Thus, eighteen-month-olds showed a very robust effect, while the effect in twelve-month-olds was more tenuous. Nevertheless, Tomasello and Haberl's claim was that their results indicated that both eighteen-month-olds' and twelve-month-olds' responses were based on their understanding that people tend to get excited about things that are new to them and their immediate experience that E2 had not seen a particular object. Specifically, they claimed that infants in both of these age groups "know what is new to other persons" (Tomasello & Haberl, 2003, p. 906).

The present research was undertaken with some scepticism about the ability of infants as young as twelve months to understand the intentional relations of others to the extent asserted by Tomasello and Haberl. Specifically, given that past research has shown this type of understanding only from about eighteen months of age (e.g., Bellagamba & Tomasello, 1999; Carpenter, Akhtar et al., 1998; Meltzoff, 1995; Olineck & Poulin-Dubois, 2005; Repacholi & Gopnik, 1997), the effect found in eighteen-month-olds seemed perfectly acceptable, whereas the less robust effect found in twelve-month-olds raised some doubts. Experiment 1 sought to replicate and extend the findings of Tomasello and Haberl, by testing twelve- and eighteen-month-olds in three conditions: a New to Experimenter – Absent Condition (NE-A; the equivalent of their Experimental Condition), a New to Experimenter – Present Condition (NE-P; the equivalent of their

Control Condition), and a New to Baby Condition (NB; a condition specific to the present research in which E2 played with a toy across the room from the baby). In addition to the goal of replicating the results of Tomasello and Haberl (which was actually expected in eighteen-month-olds only), Experiment 1 addressed the possibility that twelve-month-olds infants do not represent the intentional relations of others as independent of their own. In particular the NB Condition provided a context in which the object that was new to the context of the final request procedure was new to the baby rather than to E2. Thus, according to the theory of Tomasello and Haberl, infants in this condition should show no preference for the target object in response to E2's request. If, on the other hand these infants represent the intentional relations of E2 as equivalent to their own, they would expect that the object that was most interesting from their perspective was most interesting to E2 as well, and would be more likely to give her the NB object in response to her request (or to behave egocentrically by choosing that object and keeping it for themselves).

In Experiment 1 of the present research, eighteen-month-olds in the NB Condition and the NE-P Condition chose the target object significantly more often than expected by chance, and twelve-month-olds showed a trend toward preferring the target object in both of those conditions. These results were consistent with the predictions described above; in the NE-A Condition however, neither twelve- nor eighteen-month-olds showed the anticipated effect. Thus, in Experiment 1, the effect found by Tomasello and Haberl in their Experimental Condition was not replicated in the equivalent NE-A Condition. Finding effects similar to those of Tomasello and Haberl in the other two conditions, however, was encouraging.

One possible explanation for infants' propensity to choose the target object is that, in any of the three conditions, babies might recognize that the target object is the only one for which they have not shared an interaction and they wish to do so and choose accordingly. This possibility could only be addressed by a condition in which the object that was new to the experimenter was not the only object that was new to the baby. This brings us to Experiment 2, in which the NB Condition was pitted against the NE-P Condition. Whereas both age groups treated these two conditions as similar to one another in Experiment 1 (which provided a baseline), pitting them against one another in Experiment 2 was expected to differentiate between the two age groups in a way that neither Experiment 1 nor the studies of Tomasello and Haberl could do. Indeed, Experiment 2 was successful in differentiating these two age groups: twelve-month-olds tended to choose the NB object preferentially while treating the other three objects as equivalent; eighteen-month-olds, on the other hand, chose both significant objects (i.e., the NB and NE-P objects) with almost equal frequency and chose the distracter objects far less frequently. This pattern of results suggested that twelve-month-olds were behaving egocentrically in the sense that they did not represent E2's desires as distinct from their own and therefore chose the object that they found most interesting. In contrast, eighteen-month-olds behaved more maturely and seemed to be in a transitional period between representing the intentional relations of E2 as equivalent to their own and representing them as independent of their own. It was thus expected that twenty-four-month-olds tested under the same conditions would choose the NE-P object preferentially because they would have a mature understanding of the intentional relations of others as distinct from their own. For this reason, a group of twenty-four-month-olds was tested.

Unexpectedly, however, these two-year-olds responded in almost the same pattern as the one-year-olds: they too chose the NB object most often, though they also chose the NE-P object fairly often. In any case, the twenty-four-month-olds did not respond as expected on the basis of the apparent developmental trend shown by the two younger groups. Experiment 3 was designed to address this discrepancy.

Experiment 3 was a replication of Experiment 2, but with one major difference: just before the final request procedure, the NB object was removed from the tray, such that the objects the baby had to choose from included only the NE-P object and the two distracters. It was expected that in this case, the twelve-month-olds would be distracted by the memory of the NB object and choose randomly among the other three, or perhaps they would show a slight tendency to choose the NE-P object (as in Experiment 1). Eighteen-month-olds and twenty-four-month-olds were expected to choose the NE-P object preferentially. The results of Experiment 3 were disappointing, however, with no group choosing the NE-P object significantly more often than expected by chance, no significant difference between the three age groups, and no clear explanation as to why, even after a thorough examination of the data (including biases toward or against particular objects, differences in response types, gender differences, and infant behaviour during presentation of the significant objects).

Thus, the present research, like most research in this area, suggests that eighteen-month-olds, but not twelve-month-olds, are capable of representing the intentional relations of others as independent from, and potentially different than, their own, and of making overt and active responses to demonstrate their capacity to understand those intentional relations. In Experiment 2 for instance, twelve-month-olds gave or chose the

object that was most interesting to them (i.e., the NB object) in response to E2's request even though there was another object (i.e., the NE-P object) that was new and presumably more interesting to her. Eighteen-month-olds in that experiment were equally likely to give or choose the NE-P object as the NB object in response to E2's request, suggesting a growing sensitivity to the intentional relations of others.

These results are reminiscent of those in Repacholi and Gopnik's (1997) study, in which fourteen-month-olds gave the experimenter the food item they preferred (i.e., Goldfish crackers) regardless of her expressed preference, while eighteen-month-olds gave the experimenter the food for which they had seen her express a preference regardless of whether or not it matched with their own. Thus, the eighteen-month-olds in their study appear to have responded more maturely than those in Experiment 2 of the present work. It is important to note, however, that in their study infants saw clear expressions of happiness and disgust in response to the different food items, thus allowing them specific information about her preferences and desires. Infants in the present research had to infer the object of E2's desire and interest based on more subtle pragmatic distinctions about which objects E2 had and had not played with (or seen in the case of the NE-A Condition of Experiment 1).

In Experiments 2 and 3, these distinctions were made even more complex by the addition of an object that was particularly interesting to the infant (i.e., the NB object) by virtue of it not having been available for play during the object presentation phase. In Experiment 2, this distraction was present in the tray during the final request procedure, tempting the infant and making it more challenging for even the oldest infants (i.e., the twenty-four-month-olds) to accurately choose the object of the experimenter's request. In

Experiment 3, this distraction was present only during the object presentation phase, but not during the final request procedure, such that any effects it may have had were confined to the infant's memory rather than being immediately present as a possible response choice. In this case, eighteen-month-olds, who had shown the most mature responding in Experiments 2 and 3, were reduced to apparently random responding or choices based on the colour of objects, while infants in the other two age groups (i.e., twelve- and twenty-four-month-olds showed only slight trends in the direction of the anticipated effect.

Aside from the disappointing results of Experiment 3, the findings reported in this dissertation fit quite nicely into the body of literature reviewed in the introduction, in showing that it is only around eighteen months of age that infants become capable of representing the intentional relations of others as distinct from their own (e.g., Bellagamba & Tomasello, 1999; Carpenter, Akhtar et al., 1998; Meltzoff, 1995; Olineck & Poulin-Dubois, 2005; Repacholi & Gopnik, 1997) and that up to that point their understanding of intentional relations is grounded in interactional contexts rather than being specific to people or objects (Moore, 1999). The tendencies of twelve-months to choose an object for which no shared interaction has occurred in the NE-P and NB Conditions of Experiment 1 and to choose the NB object when there are two objects for which no shared interaction occurred (i.e., Experiment 2) combined with the tendency of infants in this age group to choose the object for which no shared interaction occurred in both conditions of the first experiment by Tomasello and Haberl, support this conclusion.

Two exceptions to this pattern include the tendency of twelve-month-olds in Trial 1 of Experiment 1 in the present research to choose the first distracter object

preferentially and the tendency of twelve-month-olds in the Control Condition of Tomasello and Haberl's second experiment to choose both distracters preferentially over the object for which there had been no shared interaction with E2. This aspect of Tomasello and Haberl's results is their main basis for claiming that twelve-month-olds know what is new to others. However, as mentioned above, there was no significant difference between the two conditions in their second experiment, and it was only by combining those results with the ones from twelve-month-olds in their first experiment that they found significant evidence of "knowing what is new" in infants as young as twelve months. Overall, their results and the present ones suggest that the choices of twelve-month-olds have more to do with shared interaction than with a sophisticated understanding of the intentional relations of others.

Nevertheless, the research of Woodward and her colleagues (Guajardo & Woodward, 2004; Sommerville & Woodward, 2005; Sommerville et al., 2005; Woodward, 1998; 1999; 2003; Woodward & Sommerville, 2000) and Csibra, Gergely, and their colleagues (Csibra et al., 2003; Gergely & Csibra, 2003; Gergely et al., 1995) suggests that infants of this age and younger have some sensitivity at least to the intentional behaviour of others. Yet, distinguishing a change in goal from a change in path, or interpreting an agent's behaviour as rational and goal-directed does not necessarily entail an understanding that other people have independent intentional relations that may differ from one's own. Rather, these types of distinctions are precursors to the type of social understanding demonstrated in older infants. One way of pinpointing what (if anything) infants as young as twelve months *do* understand about the independence of intentional relations and, in particular, what is of interest to others would

be to adopt some type of habituation technique. Specifically, infants could be shown a series of events occurring inside of a puppet theatre in which one experimenter (E1) always brings two identical (and nameless) novel objects and places them on two of three available pedestals saying "I'll just put these here." E1 then exits the puppet theatre and E2 enters with a different (nameless) novel object of a very different colour and places it on the third pedestal saying "And this one can go here!" After E2 leaves, E1 returns and says "Oh, Wow!" and picks up the distinct object placed by E2. This sequence of events could be carried out repeatedly with E1 always placing the same two objects on pedestals (varying across trials), and E2 always bringing a completely novel object to place on the third pedestal. At the end of each trial, E1 would say "Oh, Wow!" and pick up the object placed by E2. Thus, infants would be habituated to a condition in which E1 always chooses the object that is new from her perspective.

Test trials for the experiment described above could include an event in which E1 chooses one of the familiar objects that she has seen and handled repeatedly (inconsistent test event) and one in which she chooses the novel object placed by E2 as she has done on every other trial. Alternatively, rather than using the same two familiar objects as distracters in the test phase as were used in the habituation phase, E1 could bring out two identical objects that were familiar from earlier in the experiment (in that one of them was an object that had been placed by E2 during the habituation phase), thus making the consistent test event distinct from the habituation events. In this experiment, looking longer on inconsistent test events would suggest that infants realized the propensity of E1 to choose the object that was new to the situation and different from the other two objects. Since infants' natural tendency would be to look at the object that was new from

their perspective, consistent test events in which attention was drawn to those objects would be expected unless infants had learned something about E1 from her behaviour during the habituation phase, thus making longer looking on inconsistent trials particularly impressive.

To control for the possibility that infants in the experiment described above would focus on the novel objects rather than the pragmatics of the task, they should be allowed to play with the objects prior to the habituation task, either with E2, a parent, or some other person (anyone but E1). This situation would require infants to recognize the target object on each trial as new from E1's perspective even though it was not new from their own perspective (just like the NE-A Condition of Experiment 1). Significant differences in looking time between consistent and inconsistent test events (with longer looking on inconsistent events) would indicate a rudimentary ability to "know what is new to other persons" (Tomasello & Haberl, 2003, p. 906) in infants twelve months of age and younger, by virtue of a less demanding task. As in Experiment 2, introducing an object during habituation that E1 got to see and touch but that was not included in the set provided to the infant (i.e., a NB object) would probably disrupt the infant's ability to notice whether or not she was choosing an object that was new to her at test.

While these particular results may or may not occur, the habituation experiment and variations described above would be a good test of the possibility of precursors to the understanding of intentional relations demonstrated in eighteen-month-olds in the present study and in the research of Tomasello and Haberl (2003). Indeed, while twelve-month-olds in the present research clearly did not represent the interests of E2 as independent of their own (and the claims of this effect by Tomasello and Haberl are tenuous at best), a

habituation technique may help to determine what kinds of knowledge twelve-month-olds do have about the intentional relations of others, and more specifically whether they are at all sensitive to what is of interest to others even if it is not of interest to the self.

In conclusion, the present research has challenged the claim of Tomasello and Haberl (2003) that infants as young as twelve months of age are capable of determining the object of a social partner's desire on the basis of novelty and expressions of excitement. Evidence of such understanding was found in eighteen-month-olds, as expected on the basis of previous research, but not in younger infants (and, paradoxically, not in older infants either). The twelve-month-olds' results are consistent with the proposal that these infants (and those of the same age in Tomasello and Haberl's research) were responding based on their recognition that there were one or more objects for which they had not shared an interaction with the experimenter and their desire to do so. The eighteen-month-olds' results are consistent with the idea that they represented the adult's intentional relations as independent and different from their own, and making choices based (at least in part) on their understanding that the object with which she had not had a chance to play was more interesting to her than those with which she had played already. The two-year-olds' behaviour is inconsistent with a mature understanding of the intentional relations of others, and there seems to be no clear explanation to account for their unusual response patterns in Experiments 2 and 3, aside from the possibility that they find the NB object itself (Experiment 2) or the memory of it (Experiment 3) so distracting that they are unable to discern the object of greatest interest to E2 in either of these experiments. Thus, whereas further research is needed to investigate the odd behaviour of two-year-olds, the younger groups' results, while

disagreeing somewhat with those of Tomasello and Haberl, fit nicely into the current literature.

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