

Family Context and Theory of Mind Development

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The aim of this study was to analyse the influence of diverse variables on theory of mind development in a group of 114 pre-school children aged between 3 years 1 month and 4 years 2 months. Development levels in diverse areas were assessed, along with the quality of family interaction, quality of attachment and the children's performance when faced with a staggered series of theory of mind tasks ranging from simple desire situations to a false belief task. The percentage of children classified as securely attached who responded correctly to the false belief task proved significant, whereas no significant relationship was found between a correct response to this task and number of siblings or number of older siblings. We propose the development of a multi-causal model in order to continue our research into the optimum family environment for theory of mind development.

Key words: Attachment, siblings, family environment, theory of mind

INTRODUCTION

Within the current contextually-oriented framework of developmental psychology, a number of researchers have recently begun to investigate the possible relationship between family context and the process of human psychological development (Bornstein (1995), Kindermann and Valsiner (1995) Socha and Stamp (1995), Harkness and Super (1995), Kagitcibasi (1996), Rodrigo and Palacios (1998) and Palacios (1999)). One of the areas that has been the subject of most attention is the analysis of the influence of family context on cognitive development. A study by Meadows (1996) includes some of the most important contributions made in this field. As a result of these contributions, we can confirm that the quality of the *scaffolding* established by parents in their interaction with their children is directly related to those children's performance in diverse areas of cognitive development. Similarly, studies by Gonzalez (1996, 1997) evaluate the impact of parents' use of distancing strategies during the completion of tasks with their children. The results of this evaluation show that children's cognitive development is improved when distancing or decontextualisation strategies are employed in the *proximal development zone*.

This current approach, that analyses the influence of family context on cognitive development, is based on the Vigotsky tendency to consider social interactions as a key element of cognitive development. This is made evident by Dunn (1996a), when she asserts that a solid

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bridge has been built between cognitive and social development. Indeed, the thesis is supported by all investigations that relate family and social interaction to cognitive ability, and in particular by those that relate intrafamily interactions to a child's *theory of mind* development. Dunn and Munn (1985) found a relationship between everyday conflicts in the home and 2-years olds' awareness of the emotions and desires of other members of the family. In a subsequent longitudinal study Dunn *et al.* (1991) discovered a significant relationship between family conversations about emotions at the age of 3, and later competence in emotional perspective taking tasks at the age of 6.

Along the same lines we could mention the studies carried out by Dunn (1996b, c), the first of which analyses the relationship between arguments with siblings, friends and mothers and the development of social awareness; while the second identifies certain developmental changes that occur within intrafamily interaction. The studies show that, from the age of 3 onwards, child-mother interactions tend to decrease and sibling-sibling interactions increase.

One component of the interactions that occur within the family system is that of interaction between siblings of the same family. Indeed, a substantial number of studies attest to the influence of sibling interactions on cognitive development. However, before outlining the results of these studies, it is advisable to place them in their corresponding theoretical context. In a previous paper, Arranz and Olabarrieta (1998) underlined the distinction between *structural theory* and *interactive theory* in relation to the study of the impact of sibling relationships on psychological development. Structural theory claims a relationship between cognitive development and the structural variables of sibling status: Birth Order, Age Gap between Siblings, Size of the Family and Gender. This type of research involves correlational analyses of large subject samples. Interactive theory focuses on the detailed analysis of sibling interactions and investigates the relationship between these interactions and psychological development variables. The preferred methodology in studies of this kind is the observation of small samples.

Contradiction is a characteristic element of the results obtained using structural theory. Its principal hypothesis is based on Zajonc and Markus' *confluence model* (1975), which asserts that children's intellectual capacity decreases in direct proportion to their birth order and increases in the size of their families. This decrease is caused by the fact that the larger the family, the more parents are obliged to divide their resources between various recipients, thus diminishing both the quantity and the quality of the attention dedicated to each individual child. One example of the contradictory nature of this theory is the study carried out by Alaphillipe *et al.* (1995), which failed to find any significant relationship between intelligence, birth order and family size in a sample of 893 students aged between 15 and 18. The complete lack of any connection between these variables was further documented by Lian and Sugawara (1996) in a study of 76 pre-school children and by Arranz *et al.* (2001) in a study of 903 school children. Nevertheless, the results of a study by Jiao *et al.* (1996) of school children aged between 8 and 12, showed only children to have a higher level of intellectual development.

The *interactive theory* mentioned above uses a completely different approach from structural theory. Rather than focusing on the possible effect of so-called structural variables, it concentrates instead on analysing the everyday interactions that take place within the family group: conversations, arguments, imitations, etc., and studies the relationship between these and certain aspects of children's psychological development. A large number of studies carried out within the field of cognitive development analyse the relationship between sibling interactions and children's capacity to identify other people's emotional states, to adopt a perspective different from their own and to resolve *false belief* tasks, in short, abilities related to theory of mind development. This approach constitutes a departure from the search for quantitative differences with regard to intelligence, focusing instead on the more qualitative aspects of intellectual development.

A large number of studies have been published from many different perspectives regarding children's *theory of mind* development. Excellent papers by Nuñez and Riviere (1994) and Riviere *et al.* (1994) illustrate the profound adaptive significance of this ability throughout children's phylogenetic and ontogenetic development, and the observation of deceptive behaviour in non-human primates constitutes a clear example of these roots in our species' evolutionary history. The age at which the ability to construct a theory of mind and its developmental precursors appear during the course of a child's ontogenetic development has been the subject of much investigation over recent years. Studies by some of the most renowned researchers in this field, such as Perner (1991), Wellman (1995), Martí (1997) and Astington (1998), point to the conclusion that children do not develop the ability to resolve false belief tasks until their fourth year. It is not until this age that they begin to resolve stories such as Max and Chocolate, that was used in this current study.

However, the resolution of false belief tasks is the culmination of a gradual development process that is marked by many other more basic abilities that children demonstrate at an earlier age, such as the ability to identify and predict other people's emotional states and the capacity to predict behaviour that conflicts with their own desires. These abilities were labelled *belief-desire psychology* by Wellmann (1995), Wellman and Phillips (2000) and are acquired around the age of 3. Moses (1993) and Cassidy (1998) also identified the ability to recognise frustrated intentions in others as a prelude to the capacity to resolve false belief tasks. This current study aims to analyse children's responses to a scale of increasingly complicated tasks ranging from belief-desire psychology to false belief tasks.

Research into theory of mind development becomes even more complex when its relationship with the development of metacognitive abilities is analysed. A study by Wimmer and Hartl (1991) illustrates how children of between 3 and 5 years of age are able to develop a theory of mind despite being as yet unable to understand their own, thus contradicting the Cartesian maxim that the human mind is transparent to itself. The preliminary results obtained by other researchers such as Riggs *et al.* (1998), support the hypothesis that difficulties experienced by 3 and 4-year-olds during false belief tasks are symptomatic of a broader difficulty with counterfactuality. These results become even more significant when considered in conjunction with data that suggest a significant relationship, in children of the same age, between simulation games (pretend play) with other children and the ability to distinguish between reality and fiction and to complete tasks that require representational skills, such as theory of mind tasks, for example (Schwebel *et al.*, 1999)

Other studies in this field have focused on issues such as the importance of verbal mediation when assessing children's responses to false belief tasks. Clements and Perner (1994) detected an implicit understanding of false belief in children aged between 2 and a half and 4 and 5 months by analysing their visual responses to tasks that did not require a verbal response. The data presented by Jenkins and Astington (1996) also support this discovery. The relationship between the ability to cope with false belief tasks and other more basic cognitive abilities has also been the subject of considerable research. Hughes (1998) demonstrates the positive relationship between active memory, attentional flexibility and inhibitory control and the ability to cope with false belief tasks. Finally, we should underline that the type of task and procedure used can also affect children's performance in false belief tasks. The results of a study of 3, 4 and 5-year-olds by Holmes *et al.* (1996) support the hypothesis that children perform better at localisation tasks than at content tasks.

As regards the theoretical basis that underpins research into *theory of mind*, there are two approaches that Astington and Olson (1995) have labelled *naturalistic and meaning-making*. The former focuses on laboratory tests involving false belief tasks and acts on the conviction that children construct a causal theory that enables them to explain and predict human responses and actions. The latter is based on natural observation of children in their different

interactive contexts and believes that the quality of these interactions is directly linked to the acquisition of the skills required for *theory of mind* development, such as representational capacity, ability to distinguish between fiction and reality and attribution of intentions and beliefs (among others). This approach subscribes to the guidelines established by Bruner (1986, 1990) regarding the social construction of cognitive abilities. Astington and Olson (1995) propose a combination of both approaches, analysing children's performance in theory of mind tasks in relation to diverse interactive experiences.

This proposal leads us back to our initial point of departure and enables us to turn our attention to the studies that, within the field of *interactive theory*, have furthered research into the relationship between sibling interactions and *theory of mind* development. In an earlier paper, Arranz (1989) offered the first data linking *dethronement*, the birth of a brother or sister, with an acceleration of the cognitive decentring process by firstborn children. All the messages that a firstborn child receives about the other's existence, desires, states and intentions seem to have an accelerating effect on his/her ability to assume a point of view different from his/her own. One of the key studies carried out during this initial stage was that of Stewart and Marvin (1984), which, while analysing the ability of 4-year-old older siblings to act as *subsidiary attachment figures*, discovered a highly significant relationship between this ability and the capacity to make non egocentric judgements. The use of the terms *cognitive decentring*, *egocentrism* and *another's point of view* inevitably serve to remind us of the Piagetian roots of *theory of mind* research.

Howe and Ross (1990) found that firstborn children aged between 3 and 5 that made verbal references to the feelings and abilities of their younger siblings were also better able to cope with a laboratory task designed to assess their perspective taking abilities. Subsequently, Brown *et al.* (1996) demonstrated how 4-year-olds that use terms to describe mental states during conversations with their friends and siblings are more able to cope with false belief tasks. The relationship established between siblings during shared symbolic play also seems to affect *theory of mind* development. A study by Youngblade and Dunn (1995) demonstrated that children who engaged in more symbolic play with their siblings at 33 months performed better at false belief and perspective taking tasks at 40 months. Furthermore, Farver and Wimbarti (1995) confirmed that elder children are major elicitors of symbolic play in their younger siblings, who engage in more symbolic play with them than with their own mothers.

Data have also been published that link interaction with friends and peers with the development of social awareness of the feelings and beliefs of others (Maguire and Dunn (1996), Slomkowski and Dunn (1996)). This discovery was followed by studies designed to analyse the degree to which children are influenced by their siblings and peers. One of the first investigations into this area was that carried out by Azmitia and Hesser (1993), who found that children imitate and consult their siblings more than their peers when performing cognitive tasks. However, the task used in this study did not require *theory of mind* abilities. Other researchers (Perez, Granados and Callanan (1997)) found that older children help their younger siblings resolve tasks by indicating the correct solution, whereas mothers will try to help them reach the conclusion on their own. Despite being different amongst themselves, all social interactions in which children participate, whether with their parents, siblings or friends, all seem to contribute to cognitive development.

Returning to the analysis of the influence of sibling interactions on psychological development, we should make special reference to recent studies by Perner *et al.* (1994) and Ruffman, *et al.* (1998). The former found that, in a sample of 3 and 4-year-olds, those from large families performed better at the Max and Chocolate false belief task, a finding confirmed by Jenkins and Astington (1996) in a sample of children aged between 3 and 5. The latter narrows down the relationship between family size and the ability to resolve false belief tasks, demonstrating that it is the presence of older, and not younger siblings that facilitates

theory of mind development. However, this relationship is not confirmed by the papers published by Cole and Mitchell (1998, 2000). This shows that the relationship between the number of siblings and performance in false belief tasks must be researched more thoroughly.

These findings are particularly significant from a theoretical point of view for two reasons. The first is linked to the easily understood idea that younger siblings, unable to compete directly with their elders, especially on a physical basis, are obliged to be constantly aware of others' perspectives in order to successfully compete with them and adapt to the context into which they have been born. As early as 1927, A. Adler pointed out that younger siblings, who always lose at physical contests, are obliged to elaborate more sophisticated means of competing with and prevailing over their siblings. In short, precocious *theory of mind* development can be seen as an adaptive response to the specific interactive demands placed on younger, but not older siblings, who exist within a different interactive context despite being part of the same family. The concept of a *non-shared environment*, a concept coined by behavioural genetics theorists (Dunn and Plomin (1990), Dunn (1992)) in order to explain the differences between siblings within the same family, becomes especially significant when observing interactive differences between children with and without older siblings. We should also remember that while *theory of mind* development has clear adaptive advantages as regards phylogenetic development (Nuñez and Riviere (1994)), it also favours ontogenetic development.

The second reason why the findings outlined above are particularly significant is that the data published by Perner *et al.* (1994) and Ruffman *et al.* (1998) are, in principle, absolutely contrary to the aforementioned resource dissolution theory developed by Zajonc and Markus (1975). It is strange that data should be found that support the existence of a greater intellectual capacity in children from large families, while at the same time other results indicate the intellectual superiority of only children and children from small families. One possible solution to this conundrum may be the fact that theoretical definitions of intelligence and techniques used for measuring it are extremely diverse—intelligence quotient measurements are clearly not the same as observation of performance in false belief tasks. The contradictions may also be explained by the use of extremely simple designs (such as that of considering the number of siblings in a family solely as an independent variable) that do not reflect the systemic complexity of intrafamily interactions.

Given the systemic complexity of family interactions, we should perhaps ask ourselves whether, in addition to those already mentioned, there are yet more family structure variables that may affect children's ability to cope with false belief tasks. Studies by Meins (1997) offer a decisive answer to this question. In one of the studies included in her book *Security of Attachment and the Social Development of Cognition*, the author confirms that in a sample of children aged between 3 years 11 months and 4 years 2 months, 83% of those belonging to the securely attached group performed the theory of mind task correctly, as opposed to only 33% of insecurely attached children. The relationship was also confirmed in the results obtained by Fonagy *et al.* (1997) and Meins *et al.* (1998).

As far as security of attachment is a basic characteristic of initial family interactions, it may be considered a precursor to the subsequent development of *theory of mind* abilities. This is the basis which underpins the hypothesis that children who are securely attached, and therefore more likely to be aware of and explore their surroundings, will later be more capable of making the most of the interactive advantages offered by living with other siblings in the same family. One of the consequences of this ability to take advantage of interaction opportunities is precocious *theory of mind* development.

On the basis of the above review of available data, the fundamental objective of this research project is to use an approach that includes, along with variables such as family size, gender and age, an evaluation of the quality of attachment. The aim is to conduct an in-

vestigation that combines the process used by Perner *et al.* (1994), Ruffman *et al.* (1998) and Cole and Mitchell (1998, 2000), with that used by Meins (1997), Fonagy *et al.* (1997) and Meins *et al.* (1998). Our basic hypothesis is the belief that, in children aged between 3 years 2 months and 4 years 2 months, quality of attachment may be significantly related to the ability to cope with a false belief task (Hypothesis 1). The secondary objective of the investigation is to offer descriptive data regarding age, and to analyse possible associations between sibling-group variables and other variables measured; especially the association between the number of siblings and the false believe task competence (Hypothesis 2).

METHOD

Sample

The sample used in this study was made up of 114 subjects (60 girls and 54 boys) from two year one groups at Ikastola Begoñazpi in Bilbao (Vizcaya) and Colegio Ia Salle Ikastetxea in Zarauz (Guipuzcoa). *Age*: 24.5% of the subjects were under 3½ years old, 58.8% were aged between 3½ and 4 and 16.7% were over 4 y old at the time of the study ($n = 114$; Range: 38.4 months – 50.2 months; $X = 44.6$; Standard deviation: 3.2). *Parent's educational level*: 30% of the subjects' mothers had received a basic level education, 53% a middle level education and 17% a higher level education. Nineteen percent of the subjects' fathers had received a basic level education, 61% a middle level education and 20% a higher level education. *Number of siblings*: 40.2% of subjects were only children, 45.5% had one sibling, 13.4% had two siblings and 0.9% three siblings. *Number of older siblings*: 35.1% had one older sibling, 8.8% two older siblings and 0.9% three older siblings. *Birth Order*: 40.2% were only children, 14.3% were firstborn children, 3.6% were middle children and 42% were youngest children. *Nursery before school*: 40.1% of the sample had attended nursery school at some stage while the remaining 59.78% had stayed at home with their mother, father or other caregiver until starting school. *Linguistic model*: Both sample groups belong to language model D (i.e. they receive their education exclusively in Basque).

Instruments

- The “Haizea-Llevant” Scale: the only one with scales in both Spanish and Basque for detecting development difficulties in children under the age of 6. It measures the following areas: General, Socialisation, Mathematical Logic and Language, Manipulation and Posture. It was included in the study in order to detect cases of severe development difficulties.
- Teachers' report: teachers were asked to assess the sample children using a “Lickert” scale which measures the following areas: Social, Adaptive, Motor, Language, Cognitive and General Development. They were also asked to use the same type of scale to assess each child's level of insecurity/security and dependence/independence. Written criteria were provided as guidelines for each of these evaluations.
- Quality of attachment test: the test developed by Bretherton *et al.* (1990) was used in the study (Spanish version by A. Eceiza). This test assesses whether the subject is securely or insecurely attached, and has been thoroughly contrasted with other attachment quality assessment instruments in order to guarantee reliable results with children aged between 3 and 4 (Solomon and George, (1999)). Five stories are dramatised with puppets in front of the children, and their replies to a series of questions are then classified as being indicative of secure or insecure attachment according to a set of pre-established criteria.
- False belief tasks: a series of tasks of gradually increasing difficulty, ranging from the most simple examples of Wellman's belief-desire psychology (1995) to the “Max and

Chocolate” task (Wimmer and Perner (1983)), which was also used in the studies conducted by Perner *et al.* referred to in the theoretical introduction. The tasks are dramatised with puppets in the following order:

1. “Search-Find” situation: Amaia/Mikel wants to find a piece of chocolate that is hidden in her/his house either here (indicate cupboard A) or here (indicate cupboard B). Amaia/Mikel looks for it here (cupboard A) and finds it. Prediction question: What will she/he do now? (Correct answer: eat it). Question about emotional state: Is she/he happy or sad? (Correct answer: happy).
 2. “Search-Do Not Find” situation: now Amaia/Mikel wants to find a drawing that is hidden in her/his house either here (indicate cupboard A) or here (indicate cupboard B). Amaia/Mikel looks for it here (cupboard A) but does not find it. Question about emotional state: Is she/he happy or sad? (Correct answer: sad). Prediction question: What will she/he do now? (Correct answer: look in the other cupboard).
 3. “Search-Substitute” situation: now Amaia/Mikel wants to find a ball that is hidden in her/his house either here (indicate cupboard A) or here (indicate cupboard B). Amaia/Mikel looks for it here (cupboard A) and finds a sweet. Question about emotional state: Is she/he happy or sad? Why? (Correct answer: happy). Prediction question: What will she/he do now? (Correct answer: look in the other cupboard).
 4. “Other person’s desire” situation: “Look, here’s Amaia/Mikel. She/he can either go and play with her/his friends or play in the caravan. What would you like to do, go and play with your friends or play with the caravan?” Once the subject has stated his/her preference, the interviewer says: “but Amaia/Mikel doesn’t want to do that (the subject’s preference). Prediction question: what do you think Amaia/Mikel will do? (Correct answer: Amaia/Mikel will do what she/he wants to do, not what the subject says she/he would rather do).
 5. Phase 2: “False belief” task, adapted by Perner, Ruffman and Leekan (1994). “Look, I’m going to tell you another story about Amaia/Mikel (Amaia is used for girls and Mikel for boys). One day she/he came home with her/his mother after going shopping at the supermarket (show the mother and child puppets arriving at the two cupboards and explain that they represent the kitchen). Amaia/Mikel puts the chocolate here (put the chocolate in drawer A) and goes to play in her/his daddy’s car (take the child puppet to the caravan and leave it there for a few seconds). But mummy wants to eat a piece of chocolate so she takes it out of the drawer, eats a little piece and then puts it here (leave the chocolate in drawer B, located 50 cm from drawer A, forming a vertex with the caravan). But Amaia/Mikel feels hungry and decides to go back to the kitchen and eat a piece of chocolate”. The child is then asked the following comprehension questions: 1. Does Amaia/Mikel know where the chocolate is? 2. Do you remember the beginning of the story? Where did Amaia/Mikel put the chocolate? 3. Do you remember when mummy put the chocolate in a different place? Where did she put it? 4. Did Amaia/Mikel see her/his mummy put it there? Prediction question: **Where will Amaia/Mikel look for the chocolate?** (Correct answer: in drawer A. The answer is considered correct as long as the subject clearly points to drawer A, even if he/she does not give a verbal reply.)
- H.O.M.E. Scale (Caldwell and Bradley (1984)). The version designed for pre-school children by Dr. M. Carmen Moreno of the University of Seville was used during the study. It consists of a personal interview with the mother in the presence of the subject, during which data on the following aspects of the family environment are obtained: Learning Materials, Language Stimulation, Physical Environment, Kindness and Affection, Academic Stimulation, Social Behaviour Model, Diversity of Experiences, Acceptance, Overall Score. This instrument was included in order to obtain data about the quality of subjects’ family environment and to rule out subjects from high risk homes.

Procedure

Data was collected during February and March 1998 by an interviewer in each centre. The interviewer sat with the class for two weeks before the collection period in order to get to know the children. She then saw each child individually on two occasions. On the first occasion the development evaluation test was carried out, and on the second, the quality of attachment test and the series of false belief tasks were conducted. All evaluations were carried out in the child's native language. Mothers were interviewed at the school in the presence of their children. Two experienced researchers conducted the interview in the language chosen by the mother. A number of circumstances beyond our control prevented the interviews being carried out in the children's homes. The data matrix was compiled and completed in the Psychology Faculty developmental psychology laboratory at the University of the Basque Country.

RESULTS

Quality of Attachment: 64 subjects were classified as securely attached, (56.1%); 37 were classified as insecurely attached (32.5%) and 13 were missed cases (11.4%).

Developmental Scale, Teacher's reports and Quality of home environment: Table I show the descriptive statistics of Haizea (developmental scale), Teacher's reports and HOME scale (quality of home environment).

False believe task: Table II shows the frequencies of correct/incorrect answers to the false believe task:

Analysis

A binary logistical regression analysis was carried out using the proposed model which included age, gender, number of older siblings, number of younger siblings, quality of attachment evaluation and performance during the false belief task. In this analysis, age, family size and comprehension questions were considered interval variables. A significant relationship was found between secure attachment and a correct response to the prediction question ($n = 90$, 0.0369 , $P < 0.05$). The contingency analysis confirmed this significant relationship $\chi^2(1, n = 90) = 4.891$; $P = 0.028$, and Pearson correlation analysis also showed a significant positive result: 0.225 , $P < 0.05$.

In order to analyse the possible relationship between family size, number of older siblings and number of younger siblings, a binary logistical regression analysis (SPSS 9.0) was carried out according to the model used by Perner *et al.* (1994), which includes age, gender, family size, comprehension questions from the "Max and Chocolate" story and responses to the false belief question. In this analysis, age, family size and responses to comprehension questions were considered interval variables. In a second analysis, family size was replaced by number of older siblings and number of younger siblings, according to the modification introduced by Ruffnam *et al.* (1998). No significant results were found in relation to family size, number of older siblings or number of younger siblings. Nor was any significant relationship found between birth order and response to the prediction question in the false belief task. Table III shows the percentage of correct answers to the prediction question in the false belief task, the subjects in the sample being grouped according to date of birth, number of siblings, number of older siblings, youngest child/not youngest child and with/without older siblings.

Complementary analyses were also conducted in order to explore the relationship between the sibling group and intelligence assessment variables. Consistent significant results were found that indicated an inverse correlation between the total number of siblings and devel-

Table I Descriptive Statistics.

	<i>N</i>	<i>Min.</i>	<i>Max.</i>	<i>x</i>	<i>s.d.</i>
Haizea: General development	114	36	56	46.3	5.6
Haizea: Social development	114	36	47	41.8	4.4
Haizea: Language & mathematical dev.	114	35	60	46.3	5.7
Haizea: Manipulation development	114	36	56	47.8	7.2
Haizea: Postural development	114	36	54	44.9	5.2
Teacher's report: Social development	114	1	5	3.5	0.89
Teacher's report: Adaptive development	114	1	5	3.1	0.95
Teacher's report: Motor development	114	1	5	3.4	0.96
Teacher's report: Language development	114	1	5	3.7	1.0
Teacher's report: Cognitive development	114	2	5	3.9	1.0
Teacher's report: General development	114	2	5	3.4	0.9
Teacher's report: Security/independence	114	1	5	3.4	1.1
Home: Learning materials.	114	6	11	8.0	1.3
Home: Language stimulation	114	4	7	6.1	0.79
Home: Physical environment	114	4	7	6.0	0.65
Home: Affection	114	1	7	4.5	1.4
Home: Academic stimulation	114	2	6	3.9	0.71
Home: Social behaviour modelling	114	1	5	3.0	0.94
Home: Diversity of experiences	114	4	9	7.2	1.1
Home: Acceptance	114	5	4	3.7	0.41
Home: Overall score	114	35	52	43.4	3.4

Table II False Belief Task. Frequencies.

<i>Situation</i>	<i>Correct</i>	<i>Incorrect</i>	<i>Missed</i>
Search find, prediction question	92 (80.7%)	5 (4.4%)	17 (14.9%)
Search find, emotional question	79 (69.3%)	20 (17.5%)	15 (13.2%)
Search do not find, prediction question	57 (50.0%)	35 (30.7%)	22 (19.3%)
Search do not find, emotional question	84 (73.7%)	15 (13.2%)	15 (13.2%)
Search substitute, prediction question	24 (21.1%)	59 (51.8%)	31 (27.2%)
Search substitute, emotional question	41 (36.0%)	57 (50.0%)	16 (14.0%)
Other person's desire, prediction question	56 (49.1%)	38 (33.3%)	20 (17.5%)
Comprehension question 1	32 (28.1%)	66 (57.9%)	16 (14.0%)
Comprehension question 2	64 (56.1%)	34 (29.8%)	16 (14.0%)
Comprehension question 3	87 (76.3%)	11 (9.6%)	16 (14.0%)
Comprehension question 4	58 (50.9%)	40 (35.1%)	16 (14.0%)
False belief, prediction question	23 (20.1%)	72 (63.1%)	19 (16.6%)

opment in months on the Manipulation and Posture Scales (-0.399 and -0.348 respectively, $P < 0.01$, Pearson). Similarly, an inverse correlation was found between birth order and development in months on the Manipulation and Posture Scales (-0.317 and -0.261 respectively $P < 0.01$, Pearson). A positive correlation was found between Secure Attachment and development in months on the Language-Mathematics Scale (0.208 , $P < 0.05$, Pearson) and development in months on the Manipulation Scale (0.198 , $P < 0.05$, Pearson).

As regards age-related analyses, Table IV shows the percentages of correct responses in the prediction question of false belief task (Max and Chocolate):

A multinomial regression analysis was carried out, dividing the age variable into three fractions: younger than $3\frac{1}{2}$, between $3\frac{1}{2}$ and 4 and older than 4, in order to check for a significant relationship between age and performance in the series of tasks. A significant relationship was found between age and response to the 2nd comprehension question ($P = 0.019$). If we analyse the contingency table, we see that the percentage of correct replies in the under $3\frac{1}{2}$ s was 37.5%, as opposed to 93.3% in the over 4s: $\chi^2(1, n = 114) = 14.838$; $P = 0.001$.

Other analyses were carried out to check for a possible relationship between performance in the "Mikel/Amaia and Chocolate" task and other variables such as having had previous

Table III Sibling Variable and “Max & Chocolate”, Prediction Question. Frequencies.

<i>Sibling variables</i>	<i>Correct</i>	<i>Incorrect</i>	<i>Missed</i>
Only children	7 (15.5%)	32 (71.1%)	6 (13.3%)
Oldest children	3 (17.6%)	12 (70.5%)	2 (11.7%)
Middle children	1 (25.0%)	1 (25.0%)	2 (50.0%)
Youngest children	12 (25.0%)	27 (56.2%)	9 (18.7%)
Total	23 (20.1%)	72 (63.1%)	19 (16.6%)
Children from one-sibling families	7 (15.5%)	32 (71.1%)	6 (13.3%)
Children from two-sibling families	12 (23.07%)	30 (57.6%)	10 (19.2%)
Children from three or more-sibling families	4 (23.5%)	10 (58.8%)	3 (17.6%)
Total	23 (20.1%)	72 (63.1%)	19 (16.6%)
Children with one older sibling	10 (25.0%)	20 (50.0%)	10 (25.0%)
Children with two or more older siblings	3 (25.0%)	8 (66.6%)	1 (8.33%)
Total	13 (25.0%)	28 (53.84%)	11 (21.15%)
Youngest children	12 (25.0%)	27 (56.2%)	9 (18.7%)
Not youngest children	11 (17.74%)	45 (68.18%)	10 (15.15%)
Total	23 (20.1%)	72 (63.1%)	19 (16.6%)
Only children	7 (15.5%)	32 (71.1%)	6 (13.3%)
Children with siblings	16 (23.18%)	40 (57.97%)	13 (18.84%)
Total	23 (20.1%)	72 (63.1%)	19 (16.6%)
Children with older siblings	12 (23.07%)	27 (51.92%)	13 (25.0%)
Children without older siblings	11 (17.74%)	45 (72.58%)	6 (9.67%)
Total	23 (20.1%)	72 (63.1%)	19 (16.6%)

educational experience, the HOME scale factors and the development scale scores, among others. No significant relationship was found other than that related to the quality of attachment described above.

The results of the HOME and Haizea Scales eliminate the possibility of high risk families and children with serious developmental difficulties being included in the sample.

DISCUSSION

The data collected in this study may be considered as supporting those obtained by Meins (1997), Fonagy *et al.* (1997) and Meins *et al.* (1998), which are representative of a wide range of investigations that serve to highlight the importance of emotional factors in cognitive development. The results of the study support the idea that, in relation to a lower age range than other studies, quality of attachment may be a precursor for sibling group variables in children's *theory of mind* development. However, under no circumstances can we conclude that cognitive development is unaffected by the adaptive demands faced by all human beings in the course of their development. The authors of this paper regard the circumstance of having an older or younger sibling as an adaptive demand that children are obliged to cope with and that has a profound impact on their cognitive development.

No significant relationship was found between the number of siblings and the number of older siblings. These results contradict those obtained by Perner *et al.* (1994), Ruffman *et al.* (1998) and support those obtained by Cole and Mitchell (1998, 2000). When analysing this

Table IV Age and “Max & Chocolate”, Prediction Question. Frequencies.

<i>Age</i>	<i>Correct</i>	<i>Incorrect</i>	<i>Missed</i>
Younger than 3 years 6 months	3 (10.7%)	19 (67.85%)	6 (21.42%)
Between 3 years 6 months and 4 years	15 (22.38%)	43 (22.38%)	9 (13.43%)
Older than 4 years	5 (26.31%)	10 (52.63%)	4 (21.05%)
Total	23 (20.1%)	72 (63.1%)	19 (16.6%)

contradiction, we should bear in mind that the only difference between the procedure used by the aforementioned researchers and those used in this current study was that the former used the “Max and Chocolate” task in conjunction with a variation that included the protagonist being given incorrect information by a third party. In this current study, the task was used in its original form, as described in the instruments section. There is also a slight difference in the ages of the sample, which range from 3 years 2 months to 4 years 2 months in this study and from 3 years 1 month to 4 years 9 months in the two studies carried out by Perner *et al.* Apart from this, identical analyses were used and the sample was only slightly larger: 114 as opposed to 78. The difference in age range may be the determining factor, given that older children have had more time to take advantage of the accelerating effect that the presence of an older sibling has on the development of false belief abilities.

The percentages of correct responses to the false belief task shown in Table IV may be interpreted as supporting the hypothesis of Perner *et al.* These results indicate how the percentage of correct responses for children with siblings, from large families, with older siblings and with only older siblings (youngest children) was higher than that of only children, children from small families and those with no older siblings.

We cannot assert that the results obtained differ from those published by other researchers, but rather that a multicausal and developmental approach may be a more effective way of describing the optimum interactive environment for *theory of mind* development. For this reason, the study also focused on other variables included in previous scientific papers that chart their significant association with pre-school children’s theory of mind development. This is the case for quality of attachment, which has proved to be a predictor of cognitive theory of mind ability. This should not be considered as a contradiction of the proposal’s theoretical solidity, as outlined in the introduction, whose fundamental hypothesis is that children with older siblings are “obliged” to develop theory of mind skills at an earlier stage in order to cope with the adaptive and competitive demands they face as younger children. Furthermore, the aforementioned data obtained by Perner *et al.* lend these theoretical stances an empirical weight.

The significant results obtained from correlational analyses should be considered with the characteristic reservations corresponding to this type of procedure. In principle, the inverse correlation between the number of siblings and the development in months on the manipulation and posture scales supports the resource dissolution theory expounded by Zajonc and Marcus (1975) that was outlined in the introduction. The same can be said of the inverse relationship between birth order and the development in months on the manipulation and posture scales. As we have already mentioned, this type of association is more often found when quantitative intelligence measurements and correlational data analyses are used. Analyses that show a positive correlation between secure attachment and the development in months on the manipulation and language-mathematics scales should be interpreted as supporting the relationship between quality of attachment and cognitive development that is described earlier in this paper.

As regards data relating to the age at which children develop the ability to cope with theory of mind tasks, we should mention that in this study, with the exception of the second comprehension question, age was not found to have any significant bearing on the subjects’ performance of the series of tasks set. Other studies (Perner *et al.* (1994), Ruffman *et al.* (1998)) have found significant associations between an increase in age and an improved performance of the false belief tasks. The difference in the age range of the samples used in these two studies and that of the sample used in this current study may explain these contradictory results. The sample used in this study had a narrower age range because the effect of this particular variable was not one of its priority objectives. Furthermore, the model used in the study required a younger sample in order to analyse quality of attachment as a precursor to children’s *theory of mind* development.

Nevertheless, the results have been shown because of the low percentage of correct responses to the false belief task. In all probability, if the upper limit of our sample's age range had been extended to 4 years 9 months, age would have been found to be a significant variable. The significant result obtained may be interpreted as an indication of a firmly established fact, *i.e.* that it is at the age of 4 that children begin to consolidate the cognitive abilities required for *theory of mind* development.

Another aspect worth considering was the higher percentage of correct responses to emotional questions than to prediction questions. These results support Dunn's idea (1995) that it is essential to differentiate between emotional and cognitive components when researching the development of children's social awareness. The results show a high level of comprehension of emotional aspects and a lower level of comprehension of others' minds, as demonstrated in the subjects' responses to the prediction question in the "Max and Chocolate" task. This seems to coincide with that expounded by Wellman (1995) regarding the existence of a belief-desire psychology. The above comments should be considered while bearing in mind that age was not found to have a significant and generalised effect, although they do acquire a certain value as a panoramic description of the minds of the subjects included in the sample.

The most relevant conclusion that can be drawn from this study is that of proposing the use of a multicausal and developmental model to explain the influence of family context in *theory of mind* development. In addition to factors such as number of older siblings or family size, it is advisable to include other family interaction variables such as quality of attachment, which in this study was shown to have a significant effect from an early age. The results also suggest that studies involving under 4s may yield highly relevant data. As regards sibling group variables, it may be interesting to include the age gap between siblings in the analysis model, since some age gaps may be more conducive to theory of mind development than others.

It seems clear that the methodological design should take into account the systemic complexity of family interactions. In order to do this, it should encompass an evaluation of the quality of parent-child interaction. From this perspective, it is also worth remembering that some parents make a special effort to focus on the desires, states and needs of other siblings in their everyday interactions with their children. These parents would be facilitators of *theory of mind* development, but not all parents behave in the same way. Therefore, appropriate hypotheses and instruments should be developed to investigate the differences resulting from diverse parental interactive patterns.

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