
# Validation of the ToMas-child Scale for the Assessment of the Theory of Mind in a group of Spanish speaking Children aged 3 to 7 years from Spain



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Table 1.

Fit statistics, reliability and unidimensionality indices for the ToMas-child (N=252).

| Analysis number and items included | | Item-trait interaction $\chi^2$ (*p*) | Misfitting items | Ítem fit residual Mean (SD) | Person fit residual Mean (SD) | Person Separation Index PSI | Unidimensionality Independent t-test % with extremes (95% CI) |
|---|---|---|---|---|---|---|---|
| 1) | All: 8 | 78.178 (<.001) | #5 (p=.004) | -.707 (1.39) | -.218 (.79) | N/A | N/A |
| 2) | Seven: #5 deleted | 43.003 (.003) | #3 (correlation with #2) | -.397 (1.062) | -.267 (.672) | N/A | N/A |
| 3) | Six: 1 superitem (#2 + #3) and the remaining 5 items | 23.269 (.18) | | -.262 (.740) | -.225 (.618) | .70 | 2.22% (-.015 to .059) |

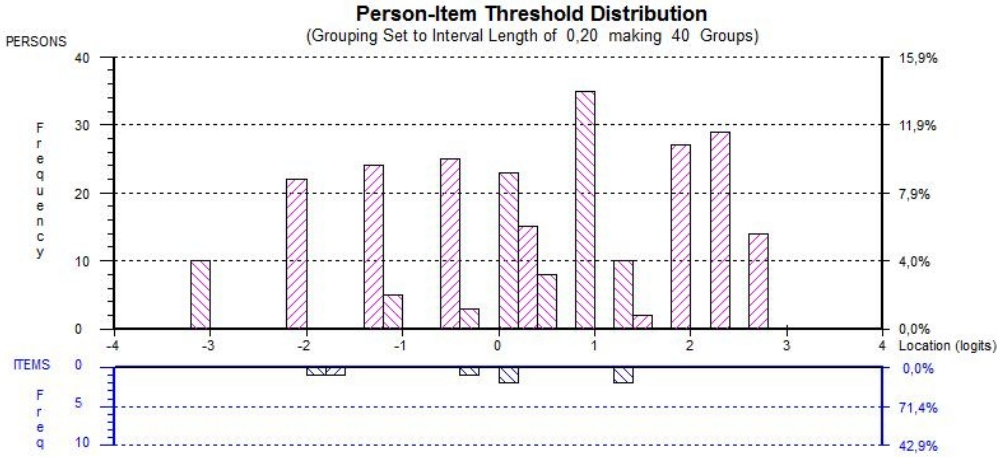


Figure 1. Distribution throughout the construct of the six items of the SaToM-child that fit to the Rasch model (bottom) and participants (top) (N=252).

207x105mm (96 x 96 DPI)

TITLE: Validation of the ToMas-child Scale for the Assessment of the Theory of Mind in a group of Spanish speaking Children aged 3 to 7 years from Spain.

ABSTRACT:

This study aimed to determine the psychometric properties of the Theory of Mind assessment scale in children (ToMas-child). 252 Spanish children from 3 to 7 years were assessed in school settings. Rasch analysis showed the ToMas-child is a unidimensional scale valid for the assessment of the main components of the ToM in children. Data of hierarchical distribution of six items (seven tasks) are discussed as milestones in the latent construct of ToM development in childhood, and construct validity of the scale is examined. A reliability index of PSI=0.7 indicated the usefulness of the scale as a screening tool.

**Keywords:** Theory of Mind, Theory of Mind assessment scale in children, ToMas-child, Rasch analysis, Validation

# Introduction

The Theory of Mind (ToM) is considered the central component of social cognition and, along with emotional perception and empathy, the most studied (Mcdonald & Cassel, 2017). The ToM is defined as the ability to understand others' mental states (interests, beliefs, emotions and intentions) that allows people to predict others' behavior and to contrast between those states and ones of oneself (Achim et al., 2013). Jackson, Boutin, & Monetta, 2013). The ToM is also called cognitive empathy or mentalization because it relates to understanding emotions and others' point of view but maintaining a clear distinction regarding oneself (Decety & Jackson, 2004). Lieberman (2007) proposed two main processes in the ToM: (a) recognizing that the minds of others have thoughts and feelings, and (b) development of a theory about how these minds operate and respond to environmental events. Based on these processes, some authors summarize the ToM as a prediction and explanation of behavior based on mental states (Repacholi & Slaughter, 2003, p. 3).

Many studies place the age of 3 years as the time when attention and social knowledge prerequisites culminate with the appearance of the most basic components of the ToM (Cassel et al., 2016). Between the ages of four and five, neurotypical children develop other increasingly complex components of the ToM such as the understanding of false beliefs (Walz et al., 2009). By far, the most studied milestone of the ToM is that ability to understand false beliefs (Wellman et al., 2001). Around the 4 years old many children are able to predict how a protagonist will behave based on a mistaken belief (Ebert, 2020).

Several factors are associated with ToM development. Language skills are closely related to the ToM (Milligan et al., 2007), In early childhood, pragmatics is the dimension of language most related to the ToM acquisition (Fernández, 2011; Matthews et al., 2018). Pragmatics includes the social, emotional, and communicative aspects of language (Adams et

al., 2016). Applying language in communicative exchanges boost achievement of relevant components of ToM such as awareness that people could have different points of view, and use of words referring to mental states (Astington & Baird, 2005). Environmental factors such as family size, peer relationship, and culture have been also related to ToM development (Hughes et al., 2018; Prime et al., 2016). Regarding family size, the number of siblings might influence ToM acquisition speed because ongoing interactions between them help understanding of connections between thoughts, feelings, and behaviors (Howe et al., 2011). For the same reasons, relationships between peers boost development of ToM in childhood (Vonk et al., 2020). Culture has also shown to be related to the order in which certain ToM milestones are acquired. Wellman et al. (2006) found that Chinese children first gained the ability to understand that other's beliefs may be different from their own, and later the perspective on what others know or ignore. In American children, the order of acquisition of these two components of the ToM was the opposite. Authors argued that this acquisition order was based on cultural features such as individualism versus collectivism.

A slow or inadequate development of ToM poses a risk to the social inclusion and academic performance of children (Amsterlaw et al., 2009). Negative effects of a protracted deficit in the acquisition of ToM extend to adolescence and adult life (Repacholi & Slaughter, 2003). The important role of the ToM along the life cycle has placed it into the focus of interest for developmental psychologists. There is a massive amount of studies about individual differences in ToM during childhood. A vast number of studies have examined individual differences in ToM using a wide range of experimental tasks (Aboulafia-Brakha et al., 2011; Molenberghs et al., 2016). However, many studies have focused on measuring just a single ToM component, the understanding of others' false beliefs (O'Connor & Evans, 2019). Beaudoin et al., (2020) found that the most widely used ToM task is the Baron-Cohen et al. (1985) adaptation of the Sally and Anne false belief task (Wimmer & Perner, 1983). In

terms of scales for the assessment of ToM, two recent reviews showed that from younger than six years to middle adolescents (Beaudoin et al., 2020; Hayward & Homer, 2017) the Strange Stories Test (Happé, 1994), the Faux Pas Test (Baron-Cohen et al., 1999), and the Hinting Task (Corcoran et al., 1995) were the most commonly applied. Each of these instruments purportedly assesses a single aspect of ToM. However, Zilber (2017) argues that a complete measure of the metacognitive, linguistic, emotional, and social aspects of the ToM is needed. In addition, there can be a lack of transference of the ToM evaluation tasks from research contexts to educational or health settings (Sprung, 2010). Professionals in charge of children in real-world contexts need a larger number of standardized and validated scales to assess the entire spectrum of ToM in children with and without typical development. For this reason, authors of the current study compiled eight widely applied research tasks to form a standardized scale called the Theory of Mind assessment scale in children (ToMas-child). These eight tasks were compiled trying to cover the entire continuum of the construct in the ToM in children from 3 to 7 years old inclusive (Wellman et al., 2011; Zilber, 2017). All tasks were linguistically and culturally adapted to Spanish speaking children in Spain. The purpose of the current study was to validate this new scale composed of established items previously used with Spanish children.

The Rasch measurement model is recommended over the traditional methods for evaluating scales (Cano & Hobart, 2011). Rasch analysis is becoming increasingly applied to validate assessment instruments (Aryadoust et al., 2019). This analysis addresses essential assumptions of test validity such as unidimensionality, invariance of measurement along the continuum of the construct, and stability of items across groups of respondents (Wright & Stone, 1979). Several Rasch analyses have been previously applied to some of the items compiled to form the ToMas-child scale. Data from different cultural samples of typical development children have been used: 75 Americans (Wellman & Liu, 2004), 92 Chinese

(Wellman et al., 2006), 68 British (Hiller et al., 2014), 77 Australians plus 58 Iranians (Shahaeian et al., 2011), and 62 Australians (Peterson et al., 2005). However, findings from those studies have some limitations: sample sizes too small to secure stable results, use of different versions of the items, and reported findings regarding the individual items but no information about overall fit of the scales. Therefore, we concluded that the eight classic items that have been compiled to form the ToMas-child scale must be tested in a new sample to validate them as a proper tool for assessment of the ToM.

The aim of the study was to determine the psychometric properties of the items on the Theory of Mind assessment scale in children (ToMas-child) using Rasch analysis in a sample of Spanish speaking children aged from 3 to 7 years old.

# Material and methods

## Participants

A sample of 252 children (52% males) was assessed in seven public schools of the city of Granada in Spain. Criteria to participate were: (a) children attending ordinary pre-school or primary school; (b) with absence of severe language comprehension problems informed by their school tutors and verified by a BLOC-S-R score above 3; (c) with absence of any neurological or developmental impairment diagnosis informed by their parents; and (d) age between 3 and 7 years. Age criterion of Wellman and Liu (2004) study (3 to 6.5 years) was extended to 7 years inclusive. There was scope to include older children because these authors reported that more than 50% of the oldest children did not pass all items.

Mean age was 5.43 ranging from 3 to 7.92 years. According to the Spanish educational system, percentage of participants in pre-school education was 9.5% in the first course, 12% in the second and 39.9% in the third. The remaining 38.6% were in the first course of primary education. 166 (65.9%) lived with siblings at home.

Children and their parents signed an informed consent. Parents completed a questionnaire about basic socio-demographic data: sex and age of the child, number of siblings living at home, medical problems, and outstanding medical and developmental aspects. The project had been approved by the Ethics Committee of the University of Granada (250/CEIH/2016).

## Instruments

### The Pragmatic Language subtest of the Battery of Objective and Criteria-Screening Language Revised (BLOC-S-R) (Puyuelo Sanclemente, 2007)

This subtest was applied to control a potential bias due to pragmatic language deficits. The BLOC-S-R consists of six items that evaluate the use of greetings, questions about why and how, farewells, action requirements, attention demands and comments of approval and disapproval. A drawing of the scene and the verbal description of two situations that take place in a veterinarian's office are used. The child is asked to imagine that he/she is one of the characters in the scene and to answer one question about each of the six pragmatic language elements. One point is awarded for each correct answer. Overall score ranges from 0 to 6.

### The ToM Assessment Scale in children (ToMas-child)

The ToMas-child aims to measure the achievement of the main milestones of the development ToM in childhood. The scale is made by arrangement of eight tasks widely used in previous research.

The ToMas-child includes the five items of *The ToM Scale (ToM-s)* (Wellman & Liu, 2004): *Diverse desires* (Repacholi & Gopnik, 1997; Wellman & Woolley, 1990), *Diverse beliefs* (Wellman et al., 1996; Wellman & Bartsch, 1988), *Knowledge access* (Pillow, 1989; Pratt & Bryant, 1990), *False contents belief* (Perner et al., 1987), and *Hidden emotion-long* (Harris et

al., 1986). To avoid item naming mistakes, in the first publication of that scale, but only there, the Hidden emotion task was entitled Real-apparent emotion (Wellman & Liu, 2004).

Three more tasks were used to form the ToMas-child scale: *Sally-Anne* (Baron-Cohen et al., 1985; Wimmer & Perner, 1983), *Belief-emotion* (Harris et al., 1989; Wellman & Liu, 2004), and a second *Hidden emotion-short task* (Wellman et al., 2006). As the Sally-Anne task has been applied in nearly 50% of the studies published to date (Beaudoin et al., 2020), this was included to make research results easily comparable. The belief-emotion task was included due to the essential role that emotion attribution plays in development of the ToM in young children (Rosnay et al., 2004). Finally, a second hidden emotion task was added to the scale for language comprehension purposes. The hidden emotion item already included in the *ToM-s* of Wellman and Liu (2004) seemed long to the youngest children. As age and language ability together explained 72% of emotion understanding variance (Pons et al., 2003), a shorter hidden emotion task from Wellman et al., (2006) was added to the scale. To easily differentiate between them, the words -short and -long was added after the title of the two Hidden emotion tasks.

Therefore, the ToMas-child scale is an extension of the *ToM-s* (Wellman & Liu, 2004) to which three new items were added. Ordering of the items was based on the a priori expected item difficulty according to the literature (Pons et al., 2004; Wellman et al., 2006; Wellman & Liu, 2004). Name of items in the ToMas-child referred to the specific ToM content to be measured by each of the eight tasks: Diverse desires (item #1) , Diverse beliefs (#2), Knowledge access (#3), False Contents belief (#4), Sally-Anne (#5), Belief-emotion (#6), Hidden emotion-short (#7), and Hidden emotion-long (#8).

The adaptation of the ToMas-child tasks for Spanish children was based on Wellman and cols. (Wellman et al., 2006; Wellman & Liu, 2004) and the Sally-Anne task of Baron-Cohen and cols. (1985). Instructions and materials were matched to the culture of Spain. A

pilot study was carried out in 15 children aged 3 to 7. It was verified that all children understood instructions and items demands. All materials were familiar to them and correctly recognized.

In all tasks, situations were described verbally and all characters were presented by drawings or dolls. Despite the apparent lack of ecological validity, it has been found that, at least for all false beliefs tasks children give the same answer when asked about real persons, videos, dolls, toys, or drawings (Wellman et al., 2001).

All but the Sally-Anne task had control/memory questions and the target question. One point is awarded when children get the correct answers to both the control and the target questions. Each item is marked with 0 point when the answer to any of the two questions is wrong. A correct response suggests the milestone is achieved.

In order to standardize the ToMas-child scale, detailed instructions have been provided, all materials have been carefully specified and showed in pictures, and a recording sheet has been designed to write down answers to all control/memory/target questions. The complete validated version of the ToMas-child scale in Spanish is available in the supplementary material. For informational purposes, a literal English translation of the Spanish version is also available.

## Procedure

The school tutors gave an information letter to the parents specifying the inclusion / exclusion criteria for the children. All 252 children whose parents agreed to participate met the study criteria and were included. Children were tested individually in a quiet room in their schools in a single session of about 25 minutes. After 5 minutes of introduction and habituation to the examiner, the Pragmatic Language subtest of the BLOC-S-R was administered. If the child had no problem in the pragmatic of the language, the items of the ToMas-child were applied.

## Analysis

Rasch analysis was conducted to determine unidimensionality and overall fit of the scale to the Rasch model, individual item fit, targeting to the participants, functioning of response categories and the presence of differential item functioning (DIF) by three dichotomic personal factors: sex (male, female); schooling level (pre-school, primary school) and presence of siblings (yes, no). Data from the ToMas-child were evaluated against the Rasch model expectations using the RUMM2020 software (Andrich et al., 2003). Extended information about the protocol for conducting and reporting Rasch analysis can be found elsewhere (Hagquist, Bruce, & Gustavsson, 2009; Tennant & Conaghan, 2007).

The Rasch Model (Rasch, 1980) is a probabilistic model of measurement within the Item Response Theory. Scores are transformed in an interval scale unit of measurement called *logit* (Tesio, 2003). Rasch analysis calibrated all items according to their difficulty to be achieved; and also the sample according to their level of ability on the latent construct. Construct validity of the scales is determined by examining the hierarchy of the items based on their difficulty as well as by evaluating the fit of each item to the latent construct (Linacre, 2002). The sample size of the study will guarantee at the 99% confidence the stability of item location estimation (Linacre, 1994).

## Results

A first Rasch analysis was performed for the whole scale. The unrestricted (partial-credit) model was adopted since a likelihood ratio test ($p<.001$) showed the rating scale model was less suitable, due to variable threshold distances across items.

Insert table 1 over here

**Fit statistics**

Results revealed a significant item-trait interaction (see first analysis in table 1) that meant the responses to the scale did not fit the Rasch model. Thereafter, item fit statistics were examined. These statistics assess the residual for each item. Residuals ranging within ±2.50 and non-significant chi squares are acceptable. We found that item 5 (*Sally-Anne*) showed misfit due to high negative residual (-3.28) and significant chi-square value ($p$=.002). This lack of the expected probabilistic relationship between the individual item and other items in the scale indicated that the item 5 does not contribute to the latent trait theory of mind. High negative residuals indicate redundancy of the item. For that reason, item 5 was deleted and a second analysis was run for the remaining seven items.

Secondly, Rasch analysis of the scale also indicated an overall misfit to the model (see second analysis in Table 1). On this occasion, all items showed fit residuals. However, there was a high correlation (>0.3) between residuals of items 2 (*Diverse beliefs*) and 3 (*Knowledge access*). Correlation above 0.3 is thought to indicate local dependence between answers that occurs when a person's response to one item is reflected in their response to another item (Elder et al., 2017). Local independence of items is an assumption in Rasch model. Local dependency should be avoided because it results in biased parameter estimation and affects the unidimensionality of the scale. The best option is to bundle the items into a polytomous super-item (Baghaei, 2008). Therefore, in the third analysis items 2 and 3 were combined into a super-item.

The last Rasch analysis was conducted using the remaining five items and a combination of items number 2 and 3 in a super-item. After those changes, the scale showed non-significant item-trait interaction that indicated satisfactory fit of the scale to the model (see analysis 3 in table 1). Threshold ordering of the superitem confirmed that category responses of the new item worked as intended.

**Differential Item Functioning (DIF)**

Rasch analysis uses DIF for checking the equivalence of items across groups of respondents with different categories of relevant factors that might affect the construct (Embretson & Reise, 2000). Analysis showed absence of DIF by sex, schooling level and presence of siblings at home. That implies invariance in latent trait manifestation across the three factors involved (Tennant et al., 2004).

**Unidimensionality**

Unidimensionality was checked using a Principal Component Analysis of the person residuals. This is the most exigent demonstration of unidimensionality of a test. This method could be consulted elsewhere (Caracuel et al., 2011). The percentage of t-tests outside the CI at 5% did exceed the criterion of 5% (Tennant & Conaghan, 2007). Therefore unidimensionality of the subscale and local independence of items can be assumed (Smith, 2000).

**Person Separation Index (PSI)**

PSI is an estimate of reliability similar to Cronbach's alpha coefficient (Bode et al., 2000). It is based on the number of strata that can be distinguished in the distribution of the sample. PSI value indicates the power of the scale to differentiate people on the measured construct. A value of 0.7 is the lowest acceptable PSI because it is not possible to distinguish between more than two strata of persons separated with 95% confidence (Fisher, 1992). The ToMas-child has sufficient power to classify children in two levels based on their development of ToM.

**Targeting**

This refers to the extent to which the items have adequately targeted the level of ToM of the children in the sample. As the mean of items is placed by the analysis at the 0.0 point

of the common logit scale, mean person location and standard deviation will indicate the targeting of the scale. Mean person location outcome was 0.271 (SD = 1.703) that indicated the average ToM level of the sample was slightly above the average of ToM reflected by the items. That value is close enough to the zero to state that the targeting was good. A visual inspection of the person-item distribution map (see Figure 1) also indicated the scale was well-targeted.

Insert figure 1 over here

**Item calibration**

Rasch analysis makes a calibration of items based on likelihood of correct response. The location order of each item in table 2 indicated its difficulty to be achieved by the children. Inspection of Item Location Order is a way to assess the construct validity of the scale (Table 2). A range of 3.4 logits between the location of the easier item (-1.997; *Diverse desires*) and the most difficult (+1.429; *Hidden emotion*) is considered wide enough.

Insert table 2 over here

# Discussion

The aim of the study was to determine the psychometric properties of the items on the Theory of Mind assessment scale in children (ToMas-child) using Rasch analysis in a sample of children aged 3 to 7 years. A satisfactory fit to the Rasch model was achieved after deleting misfit item 5 (*Sally-Anne*) and combining items 2 and 3 in a single item. The overall fit means that the ToMas-child is a unidimensional instrument. All items in the scale assess different components or parts of the continuum of a unique latent construct. Therefore, individual scores from each item can be added to sum a meaningful overall score. Furthermore, as the scale fits to the Rasch model, overall score represents an interval scale measure and can be properly used in parametric analysis (Wright & Masters, 1982).

The Rasch measurement model provides the strictest method to validate the items of an assessment tool (Cano & Hobart, 2011). Findings from the Rasch analysis propose a hierarchical order of achievements of components of the ToM. Calibration based on items difficulty is an evidence-based milestone map about how children of 3 to 7 years old acquire their ToM. Each task in the scale is a potential component of the ToM. Below, these findings are going to be contrasted with previous evidence in typical development to determine the construct validity of the 6-items ToMas-child scale.

The first item on the hierarchy based on the probabilistic difficulty to be achieved is related to diverse desires. This is a mental state about one's own and others' wishes and the notion that these desires will elicit a specific behavior. Analysis shows that this milestone is easy to achieve for most of the children at the age of 3. Just ten children (first left column at the top of figure 1) were far from the location of the first task (first left column at the bottom of the common scale), that means they did not give the correct answer. This finding is also supported by studies from authors that applied the same task (Wellman et al., 2006; Wellman & Liu, 2004), even for children with hearing impairment and autism (Peterson et al., 2005).

Findings indicate that the next milestone in the ToM latent construct is composed by two related components. Results have indicated that item 2 (diverse beliefs) and 3 (knowledge access) were interdependent, and then we joined them as two parts of a single super-item. Maybe this dependency is because they have exactly the same prerequisites or, at least, they share some underlying processes. The first component of this new proposed mental state is about one's own and others' beliefs in a specific context where beliefs are not based on evidence or facts. The second component is the understanding of the ignorance of other person when only the child has access to evidence. A common feature of these two interdependent tasks is that for passing them the child need awareness of other people's having lack of evidence. A series of studies found that for American and Australian children,

diverse beliefs (item 2) was the second easiest milestone, whereas knowledge access (item 3) was the third. However, for Chinese and Iranian children the order was exactly reverse (Shahaeian et al., 2011; Wellman et al., 2006; Wellman & Liu, 2004). Following our findings, we propose that both, beliefs and access to knowledge, are so interdependent that they are parts of a composite mental state or milestone. This lack of independency might be a contributing factor to the reversed and elusive order that some authors have been finding diverse beliefs and access to knowledge in culturally different samples.

Knowledge and beliefs can be right or wrong; in contrast to the first milestone that is related to desires which do not have a truth status and just could be fulfilled or not (Miller, 2012). Both tasks joined in the second milestone share some requirements (right status) and these processes seem to be more demanding than those connected with desires (fulfillment status). Then, there is evidence that support our findings that diverse beliefs and access to knowledge are hierarchical components of the ToM that are acquired after the awareness of the diversity between one's own and others' desires (item 1) (Shahaeian et at., 2011; Wellman et al., 2006; Wellman & Liu, 2004).

Following the location order of the items after the Rasch analysis, the third milestone in the hierarchy is called belief-emotion. An emotion arises after a belief (prediction of the content due to the familiarity with the container). But after seeing that the content is not expected, the emotion changes. Children have to predict the negative emotion resulting from the false belief. Our findings indicate this task is located on the middle of the continuum of the latent trait (location 0,144). Then, its difficulty is moderate. Unlike in our study, Wellman & Liu (2004) found that belief-emotion had similar difficulty in the hierarchy than false contents belief and explicit false belief. They considered that the three items represent similar constructs and just retained the false contents belief task in their scale. Then, as far as we know, this is the first time that this milestone has been placed in the central position of the

hierarchy of acquisition of the ToM in children. The mental status that represents this milestone requires that the child had achieved the understanding of others' beliefs (Rosnay, Pons, Harris, & Morrell, 2004), that is part of the previous item in our hierarchy. That intermediate position is also supported by Davis (2001) who demonstrated that understanding of what one person beliefs about another person's emotions is not a type of second-order belief. Some evidence also places the acquisition of the belief-emotion ability in a middle point of our sample range of age. Between the age of 4 and 6 years children start to understand that beliefs determine emotional reactions (Pons et al., 2004). Only 52% of children between 3 and 6.5 years passed this task (Wellman & Liu, 2004). However, 100% of children between 6 and 13 years showed a full achievement of this ability (Bakhshipour et al., 2012).

The fourth milestone is the contents false belief, a mental status that emerges to the fact that the contents of a container does not correspond to what it apparently should contain. Like in the Wellman and Liu (2004) study, Rasch analysis placed this item in the middle of the hierarchy but it is a bit more difficult than the previous one (location 0,236). Davis (2001) found that *false belief knowledge and representational change knowledge develop concurrently in the affective and physical domains*. Then, we consider that the previous milestone (belief-emotion) and this (contents false belief) are two aspects of the ToM that develop in parallel and that is why they occupy such a close position in the hierarchy. However, both tasks provide different information on the construct and both deserve to be kept on the scale. Although these two tasks have similar structure, the presence of an emotional component on the belief-emotion task is a relevant difference between them. Maybe the experience of children with their own emotional states gives them an advantage to understand belief-emotion tasks a bit easier and earlier than contents false belief tasks when the latter are free of emocional activation (Rosnay et al., 2004).

Short and long hidden emotion tasks placed the last locations of milestones on the developmental hierarchy. The fifth was the hidden emotion short task. This item is about understanding that to not hurting loved ones' feelings, it might be necessary to mask the real emotions (Wellman et al., 2006). The sixth milestone was hidden emotion long task. This task implied hiding emotions as a strategy to protect yourself in special situations (e.g. when a kind of leader offends you in such a way that is funny for the group) (Wellman and Liu, 2004). Achievement of the short hidden emotion task was a little easier to than the long one. However, location difference was much less than expected a priori. Previous results showed that the hidden emotion long task was the more difficult item in the Rasch analysis of the 5-items ToM-s scale: location at 7.21 on a scale whose mean was 4.46 (SD = 1.71) (Wellman and Liu, 2004). Wellman et al., (2006) changed the long hidden emotion task for the short version of the task. A Rasch analysis also indicated that the short version was the most difficult item in the 5-items scale: location at 6.36 on a scale whose mean was 3.71 (SD = 1.91). Current study was the first time that Rasch analysis was applied to data from both tasks. The location in the hierarchy of the short version as an easier task than the long version might be due to its lower comprehension requirements (Pons et al., 2003).

The whole ToMas-child scale was found to fit the Rasch model even with two tasks of hidden emotions. No statistics indicated that any of the tasks were redundant (fit residuals of both tasks were far from -2.5). Given the results, both tasks contribute to the latent trait of ToM. Specific contribution might be due to the type of emotion of each task (deception and fear). Emotion type in hidden emotion tasks played a role in the understanding of a sample of preschoolers (Banerjee, 1997).

Having two hidden tasks in the ToMas-child scale might also give the chance to capture individual differences in children's understanding of emotions in relation to cultural

factors. Molina et al. (2014) found that children between 3 and 5 years from different cultures (German and Italian) performed similarly in all components of the ToM related to understanding emotions, except for the items of hiding emotions (VII component of the Test of Emotion Comprehension of Pons and Harris, 2000). Cultural differences in development of understanding of hidden emotions were also found in transcultural studies with children from UK (Pons et al., 2004), Japan (Gardner et al., 1988), China (Tang et al., 2017), and India (Joshi & MacLean, 1994).

The Sally-Anne task is the only one that was removed from the scale due to misfit. Results about this items indicated that the Sally-Anne task was redundant. This means the item does not add any information about the construct that is not already added by the rest of items because there already is another false belief task. This is similar to in studies that applied two false belief tasks (Wellman et al., 2006; Wellman & Liu, 2004). This finding implies that if this item were not removed, the overall score would be artificially inflated as a result of a redundant item. This finding supports the assertion that Rasch analysis provides a method to make careful measurement (Grimby et al., 2012).

Some authors claim that research has focused too much into false beliefs neglecting others components (Burack et al., 2001; Miller, 2012). Therefore, we gathered all the items of the ToMas-child that had a unique contribution to the ToM construct in a Core scale and kept the Sally-Anne task as a separate item which score cannot be added to the rest. The Core scale measures mental states such as desires, knowledge, emotions, and emotional regulation strategies, along with false beliefs. Keeping Sally-Anne item into the ToMas-child scale allows comparison with many studies that still use it (Beaudoin et al., 2020).

Regarding the reliability of the scale, the Person Separation Index of 0.7 indicates that the ToMas-child could be applied as a screening test to detect which children have reached an appropriate level of ToM and which have not.

There are several avenues for future investigation following these findings. Some improvements can be made to increase the ability of the scale to measure the ToM more in detail. We found there are some gaps between locations of items in the continuum of the latent construct. New items could be tested to close these gaps and cover the whole spectrum of the ToM. There are gaps between the first and the second item (0.8 logits), the second and the third (1.3 logits), and the fourth and the fifth (1.15 logits). Furthermore, new items with a high degree of difficulty could be tested to enlarge the end of the continuum.

## Implications

Study findings pose some practical and theoretical implications. The ToMas-child is a brief, standardized, free, easy to apply and valid tool for screening development of ToM from an early age. That screening is suitable to be carried out massively in schooling contexts, where information about ToM development is essential to guarantee the social integration and further development of the individual. The ToMas-child will allow comparison of the acquisition process of the ToM in Spanish children with children from other cultures because five of its tasks are currently been used in multinational studies (e.g. Kuntoro et al., 2017)

From a theoretical point of view, Rasch analysis showed that the Sally-Anne task should not be added to those scales that already have one item about false beliefs assessment. The Core scale of the ToMas-child is a unidimensional measurement tool of the ToM that extend the 5-items ToM scale of Wellman and Liu to include abilities to (a) understand that

own and others' mind harbor different desires, thoughts (including content false beliefs) and emotions, and (b) hypothesizing how minds operate and respond to internal and external events (Lieberman, 2007).

### Limitations

Two main limitations emerged from this study. First, the validation process was focused only on construct validity and other strategies based on concurrent and divergent validity were not taken into account. However, each of the tasks in the ToMas-child scale has been validated in numerous previous research studies. Secondly, a convenience (not a random or cluster) sampling strategy was applied. Children were drawn from rural and urban population, but due to the sampling bias further studies should investigate whether the results can extrapolate to the general Spanish population.

### Conclusions

The ToMas-child is a unidimensional scale with adequate construct validity for the assessment of the Theory of Mind in children aged 3-7 years. It contains a Core scale of 6 items -one of them is double, about mental states of own and others' desires, knowledge, emotions, and strategies. Reliability of the ToMas-child guarantees its use as a screening tool. The Sally-Anne false belief task was kept into the scale as an extra item that cannot be added to the overall scale score but could be useful to make comparison between studies. Proposals for future improvements on the scale have been made after Rasch analysis. Spanish version of the validated ToMas-child scale and an English translation are available in the Supplementary files.

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# ESCALA DE EVALUACIÓN DE LA TEORÍA DE LA MENTE EN LA INFANCIA (ToMas-child)

**Objetivo:** evaluar el desarrollo logrado en el desarrollo de la Teoría de la Mente (ToM) en la infancia.

**Componentes:** siete ítems, uno de ellos con 2 partes.

**Aplicación**: individual.

**Edad:** de 3 a 7 años.

**Instrucciones:** Al principio, le explicamos al infante que vamos a jugar con algunos personajes. En cada ítem, tendremos que dar las instrucciones específicas que aparecen a continuación.

**Puntuación:** 1 punto por cada ítem correcto, excepto en el ítem número 2 que se puntúa con 0,5 a cada una de las dos partes de forma independiente.

## ESCALA PRINCIPAL (Ítems 1 a 6)

**Ítem 1: Deseos diversos**

Objetivo: evaluar si el infante comprende que sus deseos no son comunes a los de todo el mundo y que dos personas (el infante y otra persona) pueden tener deseos diferentes con respecto al mismo objeto (merienda).

Materiales: un dibujo de fruta, un dibujo de galletas y un dibujo de una persona adulta (Alonso).

Método: el infante ve el dibujo del adulto y luego el dibujo de la fruta y las galletas. Nosotros decimos:

- “Este es Alonso, es hora de la merienda y quiere comer algo. Tenemos dos cosas para comer, frutas y galletas, ¿qué prefieres? "(Pregunta sobre el deseo propio).

Si el infante elige la fruta, tenemos que decirle:

- "Bueno, es una buena opción, pero a Alonso realmente le gustan las galletas, no le gustan las frutas" (si elige la galleta, le decimos que a Alonso le gustan las frutas).

Aquí le hacemos al infante la pregunta objetivo:

- "Es hora de comer algo y Alonso sólo puede elegir uno de las dos opciones, ¿qué crees que elegirá? ¿Fruta o galletas?"

Corrección. Para que la respuesta sea correcta el infante debe de contestar la respuesta objetivo con la respuesta contraria a la pregunta sobre su propio deseo.

**Ítem 2:**

**Parte-A: Creencias diversas**

Objetivo: evaluar si el infante comprende que dos personas (el infante y otra persona) tienen creencias diferentes sobre el mismo objeto, cuando el infante NO sabe la respuesta correcta.

Materiales: un dibujo de una niña, un jardín y un garaje.

Método: el infante ve el dibujo de una niña, un jardín y un garaje. Nosotros decimos:

- "Esta es Bárbara. Bárbara quiere encontrar a su gato. El gato puede estar escondido en el jardín o en el garaje.
- ¿Dónde crees que puede estar el gato de Bárbara? ¿En el jardín o en el garaje? "(Pregunta sobre la creencia propia).

Si el infante elige el jardín, tenemos que decirle:

- "Buena elección, pero Bárbara piensa que está en el garaje" (si el infante dice que él / ella piensa que está en el garaje, le decimos que Bárbara piensa que su gato está en el jardín).

Luego hacemos la pregunta objetivo:

- “Entonces, ¿dónde buscará Bárbara a su gato?, ¿en el jardín o en el garaje?

Corrección. Para que la tarea sea correcta debe responder a la pregunta objetivo lo contrario que a la pregunta sobre su propia creencia.

**Parte-B: Acceso al conocimiento**

Objetivo: evaluar si el infante comprende la falta de conocimiento de otra persona sobre el contenido de un recipiente cuando el infante SI sabe lo que contiene.

Materiales: una caja, un juguete (perro / pato / oso) y un dibujo de una niña.

Método: el infante ve una caja cerrada, no puede ver lo que la caja tiene adentro. Decimos:

- "Mira esta caja, ¿qué crees que tiene la caja dentro?"

El infante dirá que contiene algo o que no sabe lo que hay dentro de la caja.

Después, el infante puede ver el contenido:

- "¡Veamos, hay un pato / perro / oso dentro!"

La caja está cerrada y preguntamos:

- "Ok, ¿qué hay en la caja?"

A continuación, se muestra la imagen de una niña:

- “Esta es Erika. Ella nunca ha visto lo que hay dentro de la caja. Entonces, ¿Erika sabe lo que hay dentro de la caja?” (Pregunta objetivo).
- “¿Erika ha visto el interior de la caja?” (Pregunta de memoria).

Corrección. Para que la respuesta al ítem sea correcta, las respuestas tanto a la pregunta objetivo como a la pregunta memoria debe ser “no”.

**Ítem 3: Creencia-Emoción**

Objetivo: evaluar si el infante comprende las emociones derivadas de las creencias y el cambio de emociones que se produce al contrastar con la realidad las creencias erróneas.

Material: un juguete representativo de un personaje, una caja con un dibujo claramente identificable de su contenido (por ejemplo, caja redonda de quesitos triangulares) y gomas de borrar.

Método: presentamos el personaje y la caja diciendo:

- “Esta es una caja de queso. Es la comida favorita de Minnie. ¿Qué crees que hay dentro de la caja?

Minnie dice:

- "¡Oh, ¡qué bien! Me encantan el queso, es mi merienda favorita. Ahora voy a jugar un rato". (Minnie desaparece de la escena).

A continuación, abrimos la caja de queso y le decimos al infante:

- "Miremos la caja ... ¡no tiene quesos, sólo tiene gomas de borrar! Sólo hay gomas de borrar, no hay quesos".

Cerramos la caja y preguntamos:

- “¿Cuál es la merienda favorita de Minnie?

Ahora, Minnie vuelve a la escena y le decimos:

- "Minnie nunca ha visto lo que hay dentro de la caja".
- "Minnie viene"
- “Ahora es la hora de la merienda. Démosle la caja."
- ¿Cómo crees que se siente Minnie antes de abrir la caja? ¿Está feliz o triste?” (Pregunta objetivo).

Abrimos la caja y escenificamos como Minnie mira dentro de la caja:

- “Y ahora, ¿cómo crees que se siente Minnie después de abrir la caja? ¿Está feliz o triste?” (Emociones de control de preguntas).

Corrección. Para que la respuesta sea correcta, debe responder "feliz" a la pregunta objetivo y "triste" a la pregunta sobre el cambio de emociones.

**Ítem 4: Falsa Creencia de Contenido**

Objetivo: Evaluar si el infante comprende el error en la creencia de otra persona sobre el contenido no esperable de un recipiente muy característico cuando el infante SÍ conoce lo que se ha introducido en el recipiente.

Materiales: una caja claramente característica de un tipo de comida (chips Príngales), algunos lápices para poner dentro de la caja, un dibujo de un infante.

Método: el infante verá la caja de patatas fritas y le preguntaremos:

- "Esta es una caja de papas fritas, ¿qué crees que tiene dentro?"

Luego, abrimos la caja y decimos:

- "¡Veamos, realmente lo que hay dentro son lápices!"

Cerramos la caja nuevamente y preguntamos:

- "Entonces, ¿qué hay en la caja?"

Entonces el infante ve el dibujo:

- “Este es Iker. Nunca ha visto lo que hay dentro de la caja. Entonces, ¿qué crees que Iker pensará que tiene la caja? ¿Fichas o lápices?” (Cuestión objetivo).
- "¿Ha visto Iker lo que hay dentro de la caja de chips?" (Pregunte de memoria).

Corrección. Para que la respuesta al ítem sea correcta, la respuesta a la pregunta objetivo debe ser "lápices" y la respuesta de la pregunta de memoria debe de ser "no".

**Ítem 5: Emoción Oculta (corto)**

Objetivo: Evaluar si el infante comprende que en contextos sociales una persona puede experimentar una emoción, pero no manifestarla y expresar otra diferente (en la forma A el objetivo es no ofender a otra persona).

Materiales. Dos dibujos, uno de cara feliz y otro de cara triste.

Método. Primero, el infante ve los dibujos para verificar que conoce estas expresiones emocionales. Preguntaremos:

- "Mira estas 2 caras, ¿cuál de ellas es feliz? Además, ¿cuál está triste?

Luego se retiran los dos dibujos y le contamos la siguiente historia:

- "Hoy es el cumpleaños de Sofía. Ella realmente quiere que su tío le regale una bicicleta. Cuando llega a su casa después de la escuela, Sofía ve que su tío le ha regalado una pelota".

Después de la breve historia, le pedimos al infante:

- "¿Cómo crees que Sofía se siente cuando ve el regalo?, ¿feliz o triste?" (pregunta Control de la emoción sentida).

Se les mostrarán las dos láminas, pidiéndole que señale la que indique cómo se sentirá Sofía.

Entonces, preguntamos:

- ¿Cómo crees que actuará Sofía cuando vea a su tío, si su tío compró la pelota con mucha ilusión?, ¿se mostrará feliz o triste? (pregunta control de la emoción sentida).

Corrección. Para que la respuesta sea correcta debe decir o indicar que Sofía se sentirá triste (pregunta objetivo sobre la emoción sentida) pero que se mostrará contenta (pregunta objetivo de la emoción expresada).

**Ítem 6: Emoción Oculta (largo)**

Objetivo: evaluar si el infante comprende que en contextos sociales una persona puede experimentar una emoción y ocultarla, expresando otra diferente (en la forma B el objetivo es protegerse a sí mismo).

Materiales: un dibujo de un infante de espaldas y tres dibujos de tres expresiones faciales diferentes (felicidad, tristeza y "neutral").

Método: Primero, le mostramos las tres caras al infante. Le pedimos:

- “Mira estas 3 caras, ¿cuál es feliz? ¿Cuál es triste? Además, ¿qué es normal? ".

Mostramos el dibujo las tres caras y mostramos el dibujo donde hay un infante de espaldas:

- “Este niño es Raúl. Hoy, él y sus amigos han estado jugando y bromeando. Rosa, que era de las mayores, contó un chiste de mal gusto sobre Raúl y todos se rieron. Todos pensaban que era divertido, excepto Raúl, él no creía que fuera una broma graciosa. Sin embargo, Raúl no quería que los otros supieran cómo se sentía con la broma, porque entonces le dirían que es un bebé. Por lo tanto, Raúl trató de ocultar cómo se sentía ".

Después de la historia, le preguntamos al infante:

- ¿Qué hicieron los otros cuando Rosa bromeó con Raúl? (Pregunta control de memoria 1)
- ¿Qué dirían los demás sobre Raúl si supieran cómo se sentía? (Pregunta control de memoria 2).

Luego muestra las tres caras nuevamente:

- “Entonces, ¿cómo se sintió Raúl cuando todos se rieron? ¿Se sintió feliz, triste o normal?” (Marca la respuesta en la pregunta de la emoción sentida).
- “¿Qué rostro intentó tener Raúl cuando todos se rieron? ¿Puso cara feliz, triste o normal?" (Marca la respuesta en la pregunta objetivo de la emoción expresada).

Corrección. Para que la respuesta sea correcta la respuesta a la pregunta objetivo de emoción sentida debe ser más negativa que la respuesta a la pregunta objetivo de emoción expresada. Por ejemplo: “triste” a la emoción sentida y “feliz o normal” a la emoción expresada, o “normal” a la emoción sentida y “feliz” a la emoción expresada.

## TAREA DE FALSA CREENCIA

**Ítem 7: Sally y Ana**

Objetivo: evaluar si el infante comprende que la creencia de otra persona sobre el lugar en el que se encuentra un objeto debe ser errónea cuando se ha manipulado su localización mientras no estaba presente esa persona.

Materiales. Dos dibujos de dos chicas, dos cajas diferentes y una pelota pequeña.

Método: el infante ve los dos dibujos de las dos niñas, las dos cajas y la pelota:

- "Estas son Sally y Ana, que están jugando con una pelota".
- "Y aquí hay dos cajas, una de Sally y otra de Ana".
- "Ahora, Sally guarda la pelota en su caja".
- "... y Sally se va".

En este momento, Sally ha dejado la escena y le contamos al infante y representamos como:

- "Ahora, Ana saca la pelota y la cambia de caja".
- "Ahora, Sally regresa, ¿dónde crees que buscará Sally la pelota?

Corrección. Para puntuar la respuesta como correcta debe responder (o señalar) la caja de Sally.

**MATERIALES**

**1.** Deseos diversos



**2.** **A**. Creencias Diversas



**2.** **B.** Acceso al conocimiento

**3.** Creencia-Emoción



**4.** Falsa Creencia de Contenido



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**5.** Emoción Oculta (corto)

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**6.** Emotion Oculta (largo)




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**7.** Sally y Ana



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ToMas-child

**HOJA DE RESPUESTAS: 1 punto por cada ítem correcto (ítem número 2: 0,5 puntos por cada parte*)**

Código (ID): _____ Fecha: _____

| ESCALA PRINCIPAL | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Ítem** | | | **Preguntas Requisito** | **Preguntas Control/Memoria** | | | **Preguntas Objetivo** | | | **Puntuación** |
| **1** | | Deseos Diversos | -- | Deseo Propio | Fruta<br>Galletas | | Deseo de Alonso | Fruta<br>Galletas | | |
| **2** | **A** | Creencias Diversas | -- | Creencia Propia | Jardín<br>Cochera | | Creencia de Bárbara | Jardín<br>Cochera | | * |
| | **B** | Acceso al Conocimiento | ¿Qué hay dentro? | ¿Erika ha mirado dentro? | Sí<br>No | | ¿Erika sabe lo que hay dentro? | Sí<br>No | | * |
| **3** | | Creencia-Emoción | ¿Qué crees que hay dentro? | ¿Cómo crees que se siente Minnie después de haber mirado dentro? | Feliz<br>Triste | | ¿Cómo crees que se siente Minnie antes de mirar dentro? | Feliz<br>Triste | | |
| **4** | | Falsa Creencia de Contenido | ¿Qué hay dentro? | ¿Iker ha visto dentro? | Sí<br>No | | ¿Qué piensa Iker que hay en la caja? | Patatas<br>Lápices | | |
| **5** | | Emoción Oculta (corto) | -- | ¿Cómo crees que se siente cuando ve el regalo? | Feliz<br>Triste | | ¿Cómo crees que se comportará delante de su tío? | Feliz<br>Triste | | |
| **6** | | Emoción Oculta (largo) | ¿Qué hicieron los otros niños cuando Rosa bromeó con Raúl?<br>¿Qué dirían los demás sobre Raúl si supieran cómo se sentía? | ¿Cómo se sentía Raúl cuando todos rieron? | Feliz<br>Neutral<br>Triste | | ¿Qué cara trató de Raúl cuando todos rieron? | Feliz<br>Neutral<br>Triste | | |
| | | | | | | | | | **PUNTUACIÓN TOTAL (Suma ítems 1 a 6)** | |

| TAREA DE FALSA CREENCIA | | | | | |
|---|---|---|---|---|---|
| **7** | Sally y Ana | ¿Dónde cree Sally que está la pelota? | Caja Sally<br>Caja Ana | | |

# THE THEORY OF MIND ASSESSMENT SCALE IN CHILDREN (ToMas-child)

**Aim:** to assess the development achieved in the Theory of Mind (ToM) in childhood.

**Application:** individual.

**Components:** seven items, one of them with 2 parts.

**Age:** children from 3 to 7 years.

**Instructions:** At the beginning, explain to the child that you are going to play with some characters. In each item, give the specific instructions that appear in the descriptions below.

**Score:** 1 point for each correct item, except for item number 2 that is scored with 0.5 to each of the two independent parts.

## CORE SCALE

### Item 1: Diverse Desires

Aim: to assess whether the child understands that his/her wishes are not common to all and that two people (the child and another person) have different wishes regarding the same object (snack).

Materials: a drawing of fruit, a drawing of cookies and a drawing of an adult person (Alonso).

Method: the child sees the drawing of the adult and then the drawing of the fruit and cookies. We tell him/her:

- “This is Alonso, it's time for a snack and he wants to eat something. We have two things to eat, fruits and cookies, what do you prefer?" (Question about own desire).

If the child chooses the fruit, we have to tell:

- "Well, it's a good option, but Alonso really likes cookies, he doesn't like fruits" (if he chooses the cookie, we tell him Alonso likes fruit).

Here we ask to child the target question:

- "It's time to eat something and Alonso can only choose one of the two, what do you think that he will choose? Choose fruit or cookies?"

Scoring. For the answer to be correct, the child must answer the opposite to the question about his own desire.

**Item 2.**

**Part-A: Diverse Beliefs**

Aim: to assess whether the child understands that two people (the child and another person) have different beliefs about the same object, when the child does NOT know the correct answer.

Materials: a drawing of a girl, a garden and a garage.

Method: the child see the drawing of a girl, a garden and a garage. We tell:

• "This is Barbara. Barbara wants to find her cat. The cat could be hidden in the garden or it could be hidden in the garage.

• Where do you think Barbara's cat could be? In the garden or in the garage? "(Question about self-confidence).

If the child chooses the garden, we have to tell:

• "Good choice, but Barbara thinks it is in the garage" (if the child says that he/she thinks it is in the garage, we tell that Barbara thinks her cat is in the garden).

Then we ask the target question:

• “So where will Barbara look for her cat? In the garden or in the garage?

Scoring. For the task to be correct, you must answer the target question instead of the question about your own belief.

**Part-B: Knowledge Access**

Aim: to assess whether the child understands the lack of knowledge of another person about the contents of a container when the child DOES know what it contains.

Materials: one box, one toy figure (dog / duck / bear) and a drawing of a child.

Method: the child see a box closed, he/she cannot see that the box has inside. We tell:

- "See this box, what do you think that the box has inside?"

The child will say that it contains anything or does not know what is inside the box.

After, the child can see the content:

- "Let's see, there is a duck / dog / bear inside!"

The box is closed and we ask:

- "Ok, what's in the box?"

Below is the image of a girl:

- “This is Erika. She has never seen what is inside the box. So, does Erika know what is inside the box? ” (Target question).
- “Has Erika seen the inside of the box?” (Memory question).

Scoring. For the answer to the item to be correct, the answers to both the Target question and the memory question must be "no."

**Item 3: Belief-Emotion**

Aim: to assess whether the child understands the emotions and beliefs derived when the belief is wrong.

Material: a toy representative of a character, a box with a drawing clearly identifiable of its contents and erasers.

Method: we present the character and the box saying:

- “This is a cheese box. It is the favourite food of Minnie. What do you think is inside the box?

Minnie tells:

- "Oh, how good! I love chees, it’s my favourite snack".
- “Now I'm going to play for a while.” (Minnie disappears from the scene).

Next, we open the cheese box and we tell to child:

- “Let’s look the box ...”
- “It do not have cheeses, it only has erasers!”
- "There are only erasers, no cheeses."

We close the box and ask:

- “What is Minnie’s favourite snack?

Now, Minnie come back to the scene and we tell:

- “Minnie has never seen what's inside the box.”

"Minnie is coming”

- “Now is the snack time. Let us give him the box. ”
- “How do you think that Minnie feels before to open the box? Is she happy or sad?” (Target question).

We open the box and staged as Minnie looked at inside the box:

- “And now, how do you think that Minnie feels after to open the box? Is she happy or sad?” (Question Control emotions).

Scoring. For the answer to be correct, you must answer “happy” to the target question and “sad” to the question about changing emotions.

**Item 4: False Contents Belief**

Aim: to assess whether the child understands the error of thinking of another person when another person looks at a box characteristic of something. The child knows what the box really contains.

Materials: a box clearly characteristic of a type of food (Pringles chips), some pencils to put inside the box, a drawing of a child.

Method: the child will see the chip box and we will ask:

- "This is a box of chips, what do you think is inside?"

Then, we open the box and say:

- "Let's see, really what's inside are pencils!"

We close the box again and ask:

- "So what's in the box?"

Then the child see the drawing:

- “This is Iker. He has never seen what is inside the box. So, what do you think that Iker will thing that the box has? Chips or pencils? ” (Question of the objective).
- “Has Iker seen what is inside the box of chips?" (Ask a little memory).

Scoring. For the answer to the item to be correct, the answer to the Objective question must be "pencils" and the answer to the memory question must be "no."

**Item 5: Hidden Emotion-short**

Aim: to assess whether the child understands that in social contexts a person can experience an emotion but not manifest it and express a different one.

Materials. Two drawings, one of a happy face and another of a sad face.

Method. First, the child see the drawings to verify that the child knows these emotional expressions. We will ask:

- “Look at these 2 faces, which one of them is happy? In addition, which one is sad?”

Then the two drawings are deleted and we tell the next story:

- "Today is Sofia's birthday. She really wants her uncle to give her a bike. When she arrives home after school, Sofia realises her uncle has given her a ball”.

After the brief history, we ask to child:

- “How do you think that Sofia feels when she sees the gift? Is she happy or sad? “(Question Control of emotion felt).

The child sees two drawing and we ask how does he/she think Sofia feels?

Then, we ask:

- How do you think Sofia will act when she meet her uncle if her uncle bought the ball with very emotion? Happy or sad? (Target question of expressed emotion).

Scoring. For the answer to be correct, you must say or indicate that Sofia will feel sad (Target question about the felt emotion) but that she will be happy (Target question of the expressed emotion).

**Item 6: Hidden Emotion-long**

Aim: to assess whether the child understands that in social contexts a person can experience an emotion and hide it, expressing a different emotion.

Materials: a drawing of a child's back and three drawings of three different facial expressions (happiness, sadness and "neutral").

Method: First, we show the three faces to the child. We ask:

- “Look at these 3 faces, which one is happy?, which one is sad?, which one is neutral? ".

We show the drawing of the three faces and show the drawing where there is a child who does not show his face:

- “This child is Raul. Today, he and his friends have been playing and joking. Rosa, one of the oldest children, told a mean joke about Raul and everyone laughed. Everyone thought it was fun, except Raul, he did not think it was a funny joke. However, Raul did not want the other

children to know how he felt about the joke, because then they would tell him that he is a baby. Therefore, Raul tried to hide how he felt."

After the story, we ask the boy / girl:

- What did the other children do when Rosa joked Raul? (Question memory control 1)
- What would the others say about Raul if they knew how he was feeling? (Question memory control 2).

Then show the three faces again:

- “So how did Raul feel when everyone laughed? Did he feel happy, sad or normal? ” (Point to the issue of felt emotion).
- “What face did Raul try to have when everyone laughed? Did he make a happy, sad or normal face? "(Objective issue of expressed emotion).

Scoring. For the answer to be correct, the answer to the objective question of the felt emotion must be more negative than the answer to the objective question of the expressed emotion. For example, "sad" to the felt emotion and "happy or normal" to the expressed emotion, or "normal" to the felt emotion and "happy" to the expressed emotion.

## FALSE BELIEF TASK

### Item 7: Sally and Anne

Aim: to assess whether the child understands that another person's belief about the place where an object must be will be wrong when the object was move when the person was not present.

Materials. Two drawings of two girls, two different boxes and a small ball.

Method: the child sees the two drawings of the two girls, the two boxes and the ball:

- “These are Sally and Anne, who are playing with a ball."
- "And here there are two boxes, one is from Sally and the other from Anne".
- "Now, Sally keeps the ball in her box."
- “...and Sally leaves.”

In this moment, Sally left the scene and we tell the child:

- “Now, Anne picks up the ball and changes it."
- "Now, Sally come back, where do you think that Sally will look for the ball?

Scoring. It is correct to respond (or point to) the box of Sally.

**MATERIALS**

**1.** Item 1: Diverse Desires



**2.** **A**. Diverse Beliefs



**2.** **B.** Knowledge Access

**3.** Belief-Emotion



**4.** False Contents Belief



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**5.** Hidden Emotion-short

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**6.** Hidden Emotion-long

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**7.** Sally and Anne

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**ANSWER SHEET: 1 point each correct item (item #2: 0.5 point each part*)**

Code (ID): _____ Date: _____

| CORE SCALE | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| **Item** | | | **Requirements** | **Control/Memory Questions** | | | **Target Questions** | | | **Score** |
| **1** | | Diverse Desires | | Own Desire | Fruit<br>Cookies | ☐<br>☐ | Alonso's desire | Fruit<br>Cookies | ☐<br>☐ | |
| **2** | **A** | Diverse Beliefs | | Own Beliefs | Garden<br>Garage | ☐<br>☐ | Barbara's beliefs | Garden<br>Garage | ☐<br>☐ | * |
| | **B** | Knowledge Access | What is inside the box? | Has Erika seen the inside of the box? | Yes<br>No | ☐<br>☐ | Does Erika know what is inside the box? | Yes<br>No | ☐<br>☐ | * |
| **3** | | Belief-Emotion | What do you think is inside the box? | How do you think that Minnie fells after to open the box? | Happy<br>Sad | ☐<br>☐ | How do you think that Minnie fells before to open the box? | Happy<br>Sad | ☐<br>☐ | |
| **4** | | False Contents Belief | What is inside the box? | Has Iker seen what is inside the box of chips? | Yes<br>No | ☐<br>☐ | What do you think that Iker will think that the box has? | Chips<br>Pencils | ☐<br>☐ | |
| **5** | | Hidden Emotion-short | | How do you think that Sofia fells when she see the gift? | Happy<br>Sad | ☐<br>☐ | How do you think that Sofia will act when she see her uncle? | Happy<br>Sad | ☐<br>☐ | |
| **6** | | Hidden Emotion-long | What did the other children do when Rosa joke Raul?<br>What would the others say about Raul if they knew how was he feeling? | How did Raul feel when everyone laughed? | Happy<br>Neutral<br>Sad | ☐<br>☐<br>☐ | What face did Raul try to have when everyone laughed? | Happy<br>Neutral<br>Sad | ☐<br>☐<br>☐ | |
| | | | | | | | | **TOTAL SCORE (Sum of items 1 to 6)** | | |

| FALSE BELIEF TASK | | | | | |
|---|---|---|---|---|---|
| **7** | Sally- Anne | Where do you think that Sally will look for the ball? | Sally box<br>Anne box | ☐<br>☐ | |