Cognitive Cues Are More Compelling than Facial Cues in Determining Adults’ Reactions towards Young Children

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Abstract: Previous research has demonstrated the significant influence that both children’s facial features (Lorenz, 1943) and children’s cognitive expressions (Bjorklund, Hernández Blasi, and Periss, 2010) have on adults’ perception of young children. However, until now, these two types of cues have been studied independently. The present study contrasted these two types of cues simultaneously in a group of college students. To this purpose, we designed five experimental conditions (Consistent, Inconsistent, Mature-Face, Immature-Face, and Faces-Only) in which we varied the presentation of a series of mature and immature vignettes (including two previously studied types of thinking: natural thinking and supernatural thinking) associated with a series of more mature and less mature children’s faces. Performance in these conditions was contrasted with data from a Vignettes-Only condition taken from Bjorklund et al. (2010). Results indicated that cognitive cues were more powerful than facial cues in determining adults’ perceptions of young children. From an evolutionary developmental perspective, we suggest that facial cues are more relevant to adults during infancy than during the preschool period, when, with the development of spoken language, the verbalized expressions of children’s thoughts become the principal cues influencing adults’ perceptions, with facial cues playing a more secondary role.

Keywords: cognitive babyness, cognitive immaturity, supernatural thinking, evolutionary developmental psychology

Introduction

A distinctive feature of humans is the prolonged period of immaturity compared with other mammals and primates. Some authors (e.g., Bogin, 2006; Nielsen, 2012) have
Adults’ reactions towards young children

stressed the significance of childhood, ranging from the time of weaning until the eruption of the first permanent tooth, between approximately 3 and 6–7 years of age, as a critical stage in the evolution of human intellect. A number of scholars have proposed that humans’ extended period of immaturity provided fitness advantages in terms of social learning, which greatly facilitated tool use and construction, hunting/foraging skills, cultural learning, and social functioning (see e.g., Alexander, 1989; Bjorklund, 1997; Kaplan and Gangestad, 2005). This extended period of immaturity has its costs, however, increasing significantly an offspring’s dependence on other members of the social group and the risk of dying before reaching reproductive maturity. Historical records indicate, for example, that the probability of a hunter-gatherer child dying before his or her first birthday or before young adulthood was 25% and 50%, respectfully (Volk and Atkinson, 2008, 2013). This trade-off between benefits and costs has made infancy and childhood intense periods of natural selection, with caregiving playing a key role in influencing child mortality (see Hrdy, 2009; Salmon and Shackelford, 2011).

Caregiving has been proposed to be a primate adaptation (de Waal, 1996; Warneken and Tomasello, 2006). In humans, the pressure to care for vulnerable infants and children has been related to the evolution of several more specific adaptations, including strong responses to neonatal cues and distress vocalizations, skin-to-skin contact, attachment-related behaviors, and compassionate emotion (e.g., Bowlby, 1969). A fundamental factor in eliciting caregiving behaviors from adults is indicators of children’s maturational status. In this vein, Lorenz (1943) proposed that adult humans possess a Kindchenschema, or baby schema—a cognitive system that processes and reacts specifically to infantile features, including large, rounded cheeks, a flat nose, rounded head, large head relative to body size, and adult-sized eyes—which serves to promote caretaking in adults and acts as a “social releaser” of caretaking behavior in adults.

Research subsequently showed that adults tend to perceive immature faces as being more endearing than more mature faces and also attribute other qualities to immature faces, such as being more friendly, less powerful, less active, and more in need of help compared to more mature faces (e.g., Alley, 1981; Glocke et al., 2009; Gross, 1997; Senese et al., 2013), provoking a powerful, positive, and brain-grounded attentional bias (see e.g., Brosch, Sander, and Scherer, 2007; Leibenluft, Gobbini, Harrison, and Haxby, 2004). Immature facial features may provide adults cues regarding a child’s health and overall maturity level that in turn may influence the amount of time and resources devoted to a child. In support of this, perceptions of cuteness and attractiveness (which are associated with a greater display of immature features) are the single best predictors of the likelihood of people making hypothetical adoption decisions (e.g., Volk, Lukjanczuk, and Quinsey 2007; Waller, Volk, and Quinsey, 2004). Other researchers have reported a link between cuteness, as derived from neonatal facial features, and adults’ motivation for caretaking (Glocker et al., 2009). Such positive regards for “baby-like” faces extends beyond infancy to about the age of 4.5 years, after which adults’ judgments of attractiveness and likeability do not differ from their judgments of adult faces (Luo, Li, and Lee, 2011).

Young children are typically immature in a number of ways, physical appearance being only one indicator of a child’s maturity status. Behavioral, verbal, and cognitive indicators, especially for children past infancy, can also be effective means of estimating a child’s maturity. Adults’ judgments of positive and negative affect as a function of expressions of cognitive immaturity were explored in two recent studies (Bjorklund,
Adults’ reactions towards young children

Hernández Blasi, and Periss, 2010; Periss, Hernández Blasi, and Bjorklund, 2012), in which adults in the United States and Spain, parents and nonparents, and men and women attributed more positive qualities (e.g., cute, friendly, feel like helping) and fewer negative qualities (e.g., sneaky, likely to lie, feel more angry with) to children who expressed some forms of immature cognition. In these studies, participants read two brief vignettes attributed to two hypothetical children and selected which of the two children better reflected a series of 14 adjectives or brief statements, organized into four categories: positive affect (e.g., cute, friendly), negative affect (e.g., sneaky, likely to lie), helpless, and intelligence. One of the vignettes always expressed “immature” cognition (e.g., “I can remember the 20 words!” overestimating the hypothetical child’s ability to remember), whereas the other always expressed “mature” cognition of the same phenomena (e.g., “I’ll probably remember seven of the words,” depicting a more realistic estimation of memory skills). Half of these pairs of vignettes focused on a type of cognition we called “supernatural thinking” (e.g., animism: “The sun’s not out today because it’s mad”), whereas the other half focused on a type of cognition we called “natural thinking” (e.g., the overestimation vignettes mentioned earlier). Adults and older adolescents, but not younger adolescents, selected the hypothetical child expressing immature thinking significantly more often than the hypothetical child expressing mature thinking for the item “helpless” and for the positive-affect items (e.g., cute, friendly), but only for the supernatural vignettes. In contrast, for the natural vignettes, participants selected the child expressing immature thinking more often for the negative-affect items (e.g., sneaky, feel angry with). We have called this positive effect of children’s immature supernatural thinking on adults’ judgments “cognitive babyness,” analogous to Lorenz’s “baby schema” for the physical realm.

The intuitive, and sometimes anthropomorphic or teleological, way of thinking reflected in the supernatural vignettes is typical of young children (e.g., Kelemen, 1999; Piaget, 1929). However, supernatural thinking does not end with childhood; there is evidence indicating that it might well constitute a “default” mode to explain some “natural” phenomena in adulthood as well. Supernatural thinking has been reported as being typical in most adults in traditional societies (Guthrie, 1993; Woolley, 1997), for most educated adults in pre-Renaissance Europe (see Brainerd, 1978), as well as in both nonschooled and educated adults today (e.g., Casler and Kelemen, 2008; Goldberg and Thompson-Schill, 2009; Kelemen and Rosset, 2009). Bjorklund et al. (2010) suggested that it is precisely adults’ tendencies to sometimes think “intuitively” about events and objects that provoke a positive bias to immature supernatural thinking as expressed by young children. In contrast, the expression of different types of immature natural thinking by children, as exemplified by phenomena such as overestimating of one’s abilities, failure to inhibit a behavior, or understanding some aspects of theory of mind, would be simply perceived by adults as “poor thinking” and would elicit a negative rather than a positive reaction. Periss et al. (2012) also suggested that the finding that older adolescents, but not younger adolescents, displayed the same pattern of responding as adults is consistent with the idea that “cognitive babyness” may reflect an adaptation for people anticipating the possible role of parenthood.

The current study

Research has identified two specific indicators of young children’s immaturity
status that produce positive affect in adults: one physical—Lorenz’s “baby schema,” whose positive effects have often been demonstrated; and one cognitive—related to the positive effect of immature supernatural thinking. However, to our knowledge, no study has yet examined these two indicators simultaneously, which was the purpose of the current research.

To this purpose, we generated five experimental conditions: Consistent condition—the mature face of a child associated with a mature vignette was compared with the immature face of the same child associated with an immature vignette; Inconsistent condition—the maturity of faces and maturity of vignettes were mismatched (i.e., a mature face associated with an immature vignette was compared with an immature face with a mature vignette); Mature-Face condition—the mature face of child associated with a mature vignette was compared to the mature face of the same child associated with an immature vignette; Immature-Face condition—the immature face of a child associated with a mature vignette was compared to the immature face of the same child associated with a mature vignette; and Faces-Only condition—only mature vs. immature faces of the same child were compared. Performance in these conditions was contrasted with data from a Vignettes-Only condition from Bjorklund et al. (2010) (see Material and Methods section for more details).

For the Faces-Only condition, we predicted that the immature-faced child would be selected more frequently than the mature-faced child for the positive-affect and helpless trait dimensions, consistent with the existing literature indicating that adults associate both cuteness (positive affect) and helplessness with facial immaturity (e.g., Gross, 1997). We were less certain about how adults viewing only faces would respond for the negative-affect and intelligence dimensions. One possibility is that, in the absence of any additional information, the generally positive view of immature-looking children will extend to the negative trait dimension (and possibly intelligence), so that immature-looking children are rated lower on negative affect and higher on intelligence than the mature-looking children. Alternately, participants may not have enough information from faces alone to decide confidently on these features and believe that both the mature- and the immature-looking children can be both “intelligent.smart” and/or “troublesome” in a number or ways. Participants may also consistently rate the more mature child as more intelligent, reflecting a belief that older children are smarter than younger children.

For the Consistent condition, we hypothesized that the pattern of results would be similar (and perhaps even exaggerated) to the pattern found for the Vignettes-Only condition in previous research (Bjorklund et al., 2010; Periss et al., 2012). That is, we predicted that for the supernatural vignettes, participants would select the immature-looking child expressing immature cognition more frequently than the mature-looking child expressing mature cognition for the positive-affect and helpless traits. In contrast, for the natural vignettes, the immature-looking child expressing immature cognition would be selected more frequently than the mature-looking child expressing mature cognition for the negative-affect dimension. We also predicted that the mature-looking children expressing mature cognition would be selected more frequently for both the natural and supernatural vignettes for the intelligence dimension. We should also note that this condition is the most ecologically realistic in the present study, with both mature- and immature-faced children expressing respectively mature and immature types of thinking, as typically occurs in everyday life.
Given the inconsistent matching of faces and vignettes (i.e., a mature-faced child depicting immature thinking, and the vice versa), we made no specific predictions for performance for the Inconsistent condition. This condition provides a head-to-head contrast between features of facial and cognitive immaturity in adults’ decision on the dimensions under study here. If the maturity of a child’s face is more influential in affecting adults’ judgments, patterns should be exactly opposite those found in the Vignettes-Only condition and those predicted for the Consistent condition. In contrast, if the maturity of the vignettes (both supernatural and natural) is more influential in affecting adults’ decisions, the patterns should be similar to those found in the Vignettes-Only condition and predicted for the Consistent condition.

For the Mature-Face and Immature-Face conditions, we predicted that the patterns would be similar to those of participants given only vignettes (Bjorklund et al., 2010; Periss et al., 2012) and to those proposed for participants in the Consistent condition, although possibly not as strong.

**Materials and Methods**

**Participants**

The sample consisted of 292 college students (239 female; \(M_{\text{age}} = 23.6\) years, \(SD_{\text{age}} = 5.6\) years) attending a public urban university in Castellón, a province of eastern Spain. The majority of participants \((n = 197; 67\%)\) completed paper-and-pencil versions of the questionnaire, were tested in classroom groups (ranging from 15 to 50 students), and did not receive any compensation for their participation in the study. The remaining 95 participants (33%) completed the questionnaire using a computer in the researchers’ laboratory, were tested individually, and received a small monetary compensation (3 Euros). The socioeconomic status of participants was mainly middle class, reflecting the typical profile of college students in Spain.

**Design**

The general methodology followed that of Bjorklund et al. (2010) and Periss et al. (2012). Participants were presented with pairs of photographs of children’s faces paired with vignettes attributed to children (one group received faces only, without the vignettes). The photos varied in depicting a younger child (approximately 4–7 years old) or an older child (approximately 8–10 years old), and the vignettes varied in depicting either mature (characteristic of an older child) or immature (characteristic of a younger child) cognition. Further, half of the vignettes reflected “natural” cognition (e.g., a child overestimating his or her abilities) and half reflected “supernatural” cognition (e.g., a child attributing animate characteristics to an inanimate object). Participants were asked to select which of the two hypothetical children (as depicted in the photos, or the vignettes and the photos) best reflected a series of traits (e.g., cute, friendly, likely to lie, smart).

Participants were assigned to one of five between-subject conditions in which they evaluated four different stimuli pairs (two for natural vignettes and two for supernatural vignettes). In the Consistent condition \((n = 60)\), each pair comparison consisted of a mature child’s face always associated with a mature vignette, and an immature child’s face always associated with an immature vignette. In the Inconsistent condition \((n = 55)\), an immature child’s face was always paired with a mature vignette, and a mature child’s face was
always paired with an immature vignette. In these conditions, the photograph of the same child was used, manipulated to look either older/more mature or younger/less mature. In the Mature-Face condition \( (n = 56) \), photographs of the same mature children’s faces were paired with versions of both mature and immature vignettes, and in the Immature-Face condition \( (n = 55) \), photographs of the same immature children’s faces were paired with versions of both mature and immature vignettes. Finally, in the Faces-Only condition \( (n = 66) \), participants received no vignettes but selected which of two versions of the same child (one manipulated to look older/more mature and the other manipulated to look younger/less mature) was best reflected by each trait. Participants in this condition made judgments on four different pairs of faces. In each condition, half the faces/vignettes were attributed to boys and half to girls.

Thirty-six versions of the questionnaires were created (combining 32 photos and vignettes—eight versions for each of the four faces + vignettes conditions and four composed only of photos in the Faces-Only condition), such that each face was associated with both the natural and supernatural vignettes equally often. The photographs of four boys and four girls were used as face stimuli.

For the four faces + vignettes conditions, a series of paired vignettes described the hypothetical thinking of the photographed child. One vignette in each pair expressed a child’s immature thinking, whereas the other expressed a child’s mature thinking (the terms “mature” or “immature” were not included in the texts or any instructions). In two of the four pair comparisons, the immature cognition reflected different forms of supernatural thinking (animism and finalism), whereas in the other two pairs the immature cognition reflected different forms of natural thinking (overestimation and inhibition). Appendix A presents examples of the immature and mature versions of each vignette type used in the current research (cf., Bjorklund et al., 2010; Periss et al., 2012). To replicate across materials, we constructed two versions for each vignette type (i.e., animism, finalism, overestimation, and inhibition) that were used with approximately equal frequency. The order of presentation of the four vignette types, as well as the association of the different vignettes with the eight different photo pairs, was counterbalanced.

*Photograph stimuli creation and selection procedure*

A professional photographer took portraits of 26 children (11 boys and 15 girls; \( M \) age = 7.08 years, \( SD \) age = 0.64 years) attending 1\(^{st}\) and 2\(^{nd}\) grades at a Spanish primary school in Castellón, Spain. Portraits were taken at school, indoors, against a white background. Children were told to show an emotionally neutral expression. Signed parental permission was obtained for all the children.

The 26 pictures were then manipulated by using the face-morphing software *Face Filter Studio 2* (Reallusion Inc, http://www.reallusion.com). The objective was to generate two versions of each photo: an immature one, resembling the face of an approximately 4- to 7-year-old child, and a mature one, resembling the face of an approximately 8- to 10-year-old child. For the immature versions, the faces were morphed to produce smaller noses and mouths, larger eyes, with the central facial features (eyes, nose, mouth) closer together, as well as wider face contours. For the mature versions, the nose and face contours were lengthened, the mouth enlarged, and the eyes made smaller (see Table 1 for the specific modifications and Figure 1 for two examples of the morphed faces, one boy and one girl).
Table 1. Overview of the photo manipulation procedure

|                     | Face Contour Width | Mouth Width | Mouth position (Y-axis) | Nose Width | Nose Length | Nose Position (Y-axis) | Eyes Width | Eyes Height |
|---------------------|--------------------|-------------|-------------------------|------------|-------------|------------------------|------------|-------------|
| Immature Faces      | +100               | -50         | +50                     | +50        | -50         | +50                    | ---        | +50         |
| Mature Faces        | -100               | +50         | ---                     | -50        | +50         | ---                    | -50        | ---         |

Note: Modifications on the original photos were made using the “Reshape/Modify Face Features” option of the software Face Filter Studio 2 (Reallusion Inc., http://www.reallusion.com). Eight parameters were modified for both the immature and the mature faces, in a scale of -100 to +100 from the starting position, according to the template above.

Figure 1. Examples of immature (far left) and mature (far right) versions of the photos used in this study

Note: Original photos are in the middle (Reproduced with parental permission).
We did not follow any particular face-modification procedure used in earlier research, but took as a reference both general guidelines provided by Lorenz (1943) and some classical studies in the field (e.g., Hildebrandt and Fitzgerald, 1979; Glocke et al., 2009) that had considered a range of 6 to 14 different facial features to generate a more vs. less “babyish” schema in infants. On this basis, we elaborated a specific template on the eight facial features mentioned above that we applied systematically to all the pictures.

In order to select the eight pairs of photos (4 boys and 4 girls), we presented 80 college freshmen attending the School of Education in Castellón, Spain (44 females and 36 males) the 52 modified versions of the photos (26 immature and 26 mature photos). Each participant was shown 26 modified photos (half immature and half mature) and asked to guess the age of each child (from 3 to 12 years). From these ratings we selected the four boys and four girls whose difference in average age ratings for the mature and immature versions were the greatest (mean estimated age, immature versions = 6.99 years; mean estimated age, mature versions = 9.14 years).

**Procedure**

Participants completing the paper-and-pencil version were tested in college classrooms (15 to 50 students), whereas participants completing the computer version were tested individually at a university lab. After viewing the mature and immature versions of each photo pair (in the Faces-Only condition), or viewing and reading the different combinations of faces + vignettes pairs, participants read a series of 14 adjectives or brief statements and decided which of the two children in the pair would reflect better each adjective or statement (cf., Bjorklund et al., 2010; Periss et al., 2012).

We selected adjectives and statements we believed represented a wide range of characteristics that potentially might play an important role in how individuals interact with young children (see Table 2). Based on previous studies (Bjorklund et al., 2010; Periss et al., 2012), where these adjectives and statements were also used with Spanish samples, and a series of principal component factor analyses of participants’ responses, 13 of these 14 descriptors were classified into four factors (Positive Affect, Negative Affect, Intelligence, and Helpless). One item (“Curious”) did not load highly on any factors and will not be further discussed.

When participants selected the immature faces in the Faces-Only condition or the immature vignettes in the faces + vignettes conditions we coded their responses as 1, and when they selected the mature faces in the Faces-Only condition or the mature vignettes in the faces + vignettes conditions their responses were coded as 0. Consequently, mean values greater than 0.5 indicate that participants selected more often the immature faces (in the Faces-Only condition) or the immature vignettes (in the faces + vignettes conditions), whereas values less than 0.5 indicate just the opposite: participants selected more often the mature faces (in the Faces-Only condition) or the mature vignettes (in the faces + vignettes conditions).
Table 2. A list of the traits and brief statements used by participants to rate children, organized by trait dimensions determined through factor analyses

| Positive Affect \( (n = 4) \) | Negative Affect \( (n = 4) \) | Intelligence \( (n = 2) \) | Helpless \( (n = 3) \) | Items Not Loading Highly on Any Factor |
|--------------------------------|-----------------------------|---------------------------|----------------------|--------------------------------------|
| Cute                          | Sneaky                      | Smart                     | Helpless             | Curious                              |
| Friendly                      | Likely to lie               | Intelligent               | Feel more protective towards |                                   |
| Nice                          | Feel more angry with        |                           | Feel more protective towards |                                   |
| Likeable                      | Feel more irritated with    |                           | Feel like helping     |                                     |

Note: Participants selected either the immature child (scored 1) or the mature child (scored 0) as best reflecting each item.

Results

Preliminary analyses indicated no differences in performance between participants completing the questionnaires via computer versus the paper-and-pencil versions, and thus we collapsed analyses across this factor. Table 3 presents mean scores by condition (Consistent, Inconsistent, Mature-Face, Immature-Face, and Faces-Only) and trait dimensions (Positive Affect, Negative Affect, Intelligence, Helpless), separately for the supernatural and natural vignettes (in the case of the four faces + vignettes conditions). For comparative purposes, mean values corresponding to the Vignettes-Only condition for the Spanish sample from Bjorklund et al.’s (2010) study are also presented in this table.¹

Selection of immature and mature children relative to chance

Initial analyses \( (t \) tests, \( p < .001 \) to adjust for multiple contrasts) assessed whether the immature or the mature child was selected significantly different than expected by chance (.50) for each condition x trait dimension x vignette type (supernatural, natural) cell. Note that selecting the immature child in all conditions involving vignettes means selecting the child associated with the immature vignettes, not the child with the immature face, and vice versa for selecting the mature child.

¹ The factor analysis of the current data resulted in slightly different classifications than in Bjorklund et al. (2010), such that some of the items previously classified with Positive Affect in Bjorklund et al. (2010) were classified with the Helpless factor here. Thus, means reported for the Positive Affect and Helpless traits by Bjorklund et al. (2010, Experiment 2) differ slightly from those reported here. Means based on the factor analysis reported in Bjorklund et al. (2010):

- Positive Affect: Supernatural = .72; Natural = .27
- Helpless: Supernatural = .84; Natural = .41

Means for Bjorklund et al. (2010) based on current factor analysis, which were used in the analyses in the current study:

- Positive Affect: Supernatural = .68; Natural = .27
- Helpless: Supernatural = .77; Natural = .28
Table 3. Proportion of participants selecting the child expressing immature cognition or selecting the immature face (Faces-Only condition) by trait group, experimental condition, and vignette type

| Vignette Type | Positive Affect (n = 4) | Negative Affect (n = 4) | Intelligence (n = 2) | Helpless (n = 3) |
|---------------|------------------------|------------------------|---------------------|-----------------|
|               | Supernatural | Natural | Supernatural | Natural | Supernatural | Natural | Supernatural | Natural |
| Consistent (n = 60) | .72 \( ^a \) | .43 | .56 | .76 \( ^a \) | .17 \( ^b \) | .38 | .76 \( ^a \) | .45 |
| Inconsistent (n = 55) | .59 | .31 \( ^b \) | .48 | .72 \( ^a \) | .17 \( ^b \) | .29 \( ^b \) | .79 \( ^a \) | .53 |
| Mature-Face (n = 56) | .72 \( ^a \) | .29 \( ^b \) | .51 | .81 \( ^a \) | .08 \( ^b \) | .24 \( ^b \) | .87 \( ^a \) | .56 |
| Immature-Face (n = 55) | .71 \( ^a \) | .31 \( ^b \) | .51 | .78 \( ^a \) | .09 \( ^b \) | .35 \( ^b \) | .85 \( ^a \) | .48 |
| Vignettes-Only (n = 151) | .68 \( ^a \) | .28 \( ^b \) | .53 | .81 \( ^a \) | .11 \( ^b \) | .36 \( ^b \) | .77 \( ^a \) | .28 \( ^b \) |
| Faces-Only (n = 66) | .68 \( ^a \) | .21 | .57 | .26 | .51 | .26 | .47 | .29 |

Note: Vignettes-Only are means for the Spanish sample from Bjorklund et al. (2010) and are presented for comparison purposes. Standard deviations are in parentheses. \(^a\) selecting an immature child significantly greater than expected by chance; \(^b\) selecting a mature child significantly greater than expected by chance; chance values determined by \(t\)-tests. Significance set at \(p < 0.001\)

As can be seen in the table, participants in the Faces-Only condition selected the photograph of the immature child significantly greater than chance for the Positive Affect trait dimension (\(M = .68\)), and showed no bias toward either the immature or mature child for the other three trait dimensions (\(M_s = .57, .51, \) and .47 for the Negative Affect, Intelligence, and Helpless traits, respectively).

Participants in the four faces + vignettes conditions exhibited a consistent pattern across the four conditions, with a different profile for the supernatural and the natural vignettes, similar to that shown by participants in the Bjorklund et al. (2010) study, who received vignettes only. For the supernatural vignettes, participants showed (a) a significant bias toward selecting the child associated with the immature vignettes for both the Positive Affect and the Helpless trait dimensions, i.e., mean scores significantly greater than .5; (b) a bias toward the mature child for the Intelligence trait dimension, i.e., mean scores significantly less than .5; and (c) no bias toward either the immature or mature child for the Negative Affect trait dimension. There was only one exception to this pattern: The bias toward selecting the immature child for the Positive Affect dimension for participants in the Inconsistent condition did not reach our conservative level of significance (\(p = .001\)), although the effect was in the predicted direction (\(M = .59, p = .02\)).
For the natural vignettes, participants exhibited a significant bias toward (a) selecting the mature child for both the Positive Affect and the Intelligence trait dimensions, i.e., mean scores significantly less than .5; (b) a significant bias toward selecting the immature child for the Negative Affect trait dimension, i.e., mean scores significantly greater than .5; and (c) no bias toward selecting either the immature or mature child for the Helpless trait dimension. There were two exceptions to this pattern: The bias toward selecting the mature child for the Positive Affect (M = .43, p = .024) and Intelligence (M = .38, p = .006) dimensions for participants for the natural vignettes in the Consistent condition did not reach significance, although both means were in the same direction as for the other conditions.

Differences among conditions, trait dimensions, and vignette-types

To assess differences in patterns of performance for the various experimental conditions and trait dimensions, we conducted two sets of analyses: (1) a 2 (sex: female vs. male) x 2 (photo gender: boys vs. girls) x 4 (traits dimension: Positive Affect vs. Negative Affect vs. Intelligence vs. Helpless) ANOVA for the Faces-Only condition, with repeated measures on the photo gender and traits dimension, and (2) a 2 (sex: female vs. male) x 2 (vignette type: Supernatural vs. Natural) x 5 (condition: Consistent vs. Inconsistent vs. Mature vs. Immature vs. Vignettes-Only) x 4 (trait dimension: Positive Affect vs. Negative Affect vs. Intelligence vs. Helpless) ANOVA for the four faces + vignettes conditions and the Vignettes-Only condition (with data from Bjorklund et al., 2010, Study 2), with repeated measures on the vignette-type and traits dimension.

For the Faces-Only condition, the analysis produced a significant main effect for trait dimension, F(3, 64) = 15.41, p < .001, partial η² = .19 (Positive Affect, M = .68 > Negative Affect, M = .57 = Intelligence, M = .51 = Helpless, M = .47), and photo gender, F(1, 64) = 6.81, p < .05, partial η² = .10 (Boys, M = .57 > Girls, M = .53). No other effects were significant.

Analyses for the faces + vignettes and the Vignettes-Only conditions produced a number of significant main and interactive effects, which are described in Appendix B. However, rather than describing various statistical effects in detail, we instead present patterns of data pertinent to our specific hypotheses for each condition. Because sex differences were small in magnitude and because there was a disproportionate number of females than males in our sample, subsequent analyses were collapsed across sex.

Consistent condition. For the Consistent condition, we predicted that patterns would be similar to that shown for the Vignettes-Only condition, although perhaps in an exaggerated form. A 2 (vignette type: Supernatural vs. Natural) x 2 (condition: Consistent vs. Vignettes-Only) x 4 (trait dimension: Positive Affect vs. Negative Affect vs. Intelligence vs. Helpless) ANOVA, including data only from the Consistent and Vignettes-Only conditions, produced a significant effect of condition, F(1, 197) = 24.44, p < .001, partial η² = .11, (Consistent, M = .53 > Vignettes-Only, M = .49). Also significant was the condition x vignette-type interaction, F(1, 197) = 7.26, p < .008, partial η² = .04, with post-hoc tests revealing that the magnitude of the difference between the supernatural and natural vignettes was smaller, although significant and in the same direction, in the Consistent condition (supernatural, M = .55; natural, M = .50) than in the Vignettes-Only condition (supernatural, M = .53; natural, M = .43). All other effects involving the condition factor were nonsignificant, ps > .05.
Inconsistent condition. Although we made no specific prediction for the Inconsistent condition, patterns were also similar to those found for the Vignettes-Only condition. A 2 (vignette type: Supernatural vs. Natural) x 2 (condition: Inconsistent vs. Vignettes-Only) x 4 (trait dimension: Positive Affect vs. Negative Affect vs. Intelligence vs. Helpless), including data only for the Inconsistent and Vignettes-Only conditions, produced a significant condition x trait dimension interaction, $F(1, 192) = 29.41, p < .001$, partial $\eta^2 = .13$. Subsequent tests indicated comparable scores between the Inconsistent and Vignettes-Only conditions for the Positive Affect ($Ms = .45$ vs. .49), Negative Affect ($Ms = .60$ vs. .67), and Intelligence ($Ms = .23$ vs. .23) dimensions; differences between the conditions were significant for the Helpless trait, with participants in the Inconsistent condition ($M = .66$) having higher scores (i.e., selecting the child expressing immature cognition more often) than participants in the Vignettes-Only condition ($M = .53$).

Mature-Face and Immature-Face conditions. For Mature- and Immature-Face conditions, we predicted that patterns would be similar to those found in the Vignettes-Only conditions. A 2 (vignette type: Supernatural vs. Natural) x 3 (condition: Mature-Face vs. Immature-Face vs. Vignettes-Only) x 4 (trait dimension: Positive Affect vs. Negative Affect vs. Intelligence vs. Helpless) ANOVA, including data only for the Mature-Face, Immature-Face, and Vignettes-Only conditions, produced a significant main significant effect of condition, $F(2, 246) = 6.36, p < .002$, partial $\eta^2 = .05$ (Mature-Face, $M = .51$ vs. Immature-Face, $M = .51$ > Vignettes-Only, $M = .48$), a significant condition x trait dimension, $F(2, 246) = 10.89, p < .001$, partial $\eta^2 = .08$, and condition x trait dimension x vignettes-type interactions, $F(2, 246) = 6.10, p < .003$, partial $\eta^2 = .05$. Subsequent inspection of the triple interaction revealed no significant differences among the Mature-Face, Immature-Face, and Vignettes-Only conditions for the Positive Affect ($Ms = .51$ vs. .51 vs. .49) and Negative Affect ($Ms = .66$ vs. .65 vs. .67) trait dimensions. For the Intelligence dimension, participants in the Mature-Face condition had lower scores ($M = .16$) than participants in the Immature-Face ($M = .22$) and Vignettes-Only conditions ($M = .23$), which did not differ. For the Helpless dimension, scores were comparable between the Mature-Face and Immature-Face conditions, both of which were significantly greater than scores for participants in the Vignettes-Only condition (Mature-Face, $M = .71$ = Immature-Face, $M = .66$ > Vignettes-Only, $M = .53$). Further inspection of the significant triple interaction indicated that patterns among the three conditions for the supernatural and natural vignettes were similar for the Positive Affect, Negative Affect, and Intelligence trait dimensions; the patterns varied for the Helpless dimension among the three conditions, especially for the natural vignettes, with participants in the Vignettes-Only condition having significantly lower scores ($M = .28$) than participants in the Immature ($M = .48$) and Mature ($M = .56$) conditions (see Table 3).

Discussion

The aim of this study was to contrast adults’ reactions towards two specific indicators of maturity status in children: physical maturity, reflected by faces with different degrees of maturity, and cognitive maturity, reflected by vignettes attributed to children expressing different degrees of intellectual maturity. To this purpose we created five conditions combining a series of mature and immature faces with a series of mature and immature vignettes (Faces-Only, Consistent, Inconsistent, Mature-Face, and Immature-
Face), and contrasted performance in these conditions with that in a Vignettes-Only condition (from Bjorklund et al., 2010). Overall, results clearly showed that, for children of the ages depicted here, cues of cognitive immaturity played a more potent role in influencing adults’ judgments than cues of physical immaturity.

As we mentioned in the Introduction, Bjorklund, Hernández Blasi, and Periss (2010; Periss et al., 2012) reported a “cognitive babyness” effect associated with the immature supernatural vignettes. We suggested that the intuitive and sometimes anthropomorphic thinking reflected by the supernatural vignettes is not limited to childhood but continues into adulthood, accounting for adults’ generally positive perception of hypothetical children uttering such statements. In contrast, adults view expressions of different types of immature natural thinking, such as overestimating one’s abilities or failing to inhibit inappropriate responses, as examples of “poor thinking,” producing negative reactions.

For the four combined (faces + vignettes) conditions, similar patterns of responses emerged, which were similar to those reported using vignettes only (i.e., from Bjorklund et al., 2010). For the supernatural vignettes, participants attributed greater positive affect and greater helplessness for children expressing immature thinking, regardless of whether the vignettes were paired with a mature or immature face. They also showed no bias to choose either the mature or immature child for the Negative Affect items for the supernatural vignettes, again independent of the maturity of the face that was paired with the vignettes. Also similar to the earlier findings using vignettes only, for the natural vignettes, participants rated children expressing mature cognition higher for positive affect and rated the child expressing immature cognition higher for negative affect, again regardless of the maturity of the face paired with the vignettes. Patterns were similar among the four conditions and with data from participants receiving vignettes only for the Intelligence dimension, with participants rating immature children as less intelligent for both the supernatural and natural vignettes. Patterns were similar across conditions for the Helpless trait, although participants receiving vignettes only (from Bjorklund et al., 2010) provided lower ratings for the Helpless dimension for the natural vignettes (.28 vs. an average of .50 for the four faces + vignettes conditions).

This pattern of results indicates that the presence of physical information pertinent to a child’s level of maturity (i.e., their face) did not substantially influence young adults’ ratings for a variety of attributions beyond the information provided by the vignettes. Yet, participants did use the physical information in evaluating the faces when the faces were not accompanied by the vignettes. Participants in the Faces-Only condition rated photographs of immature children higher on the Positive Affect items than photographs of mature children, but showed no differentiation between the mature and immature faces for the other three dimensions (Negative Affect, Intelligence, Helpless). This is consistent with previous research indicating greater feelings of positive affect toward immature-looking children (e.g., Alley, 1981; Gross, 1997). Our results suggest that although adults can use the maturity of children’s faces to make attributions related to positive affect, they require more information to make attributions of negative affect, intelligence, and helplessness. Generally, these differences were found for both male and female participants and male and female faces. Although sex of participant was significant in several interactions (see Appendix B), the absolute magnitude of these differences was small and patterns of responses were similar for both men and women in all conditions. Overall these results
Adults’ reactions towards young children

reflect the significance of cognitive over physical information for understanding adults’ evaluations of young children. Stated another way, adding faces to the cognitive vignettes added little information that influenced adults’ assessment of psychological features of children, whereas adding vignettes to faces modified adults’ judgments substantially, consistent with the information provided in the vignettes.

In the introduction we hypothesized that the results in the Consistent condition would be similar if not more exaggerated than those obtained in the Vignettes-Only condition, given that this was the most representative condition in our study for what happens in ordinary life. As we noted earlier, patterns for the Consistent condition were similar to those of the Vignettes-Only condition (see Table 3). Differences between the Consistent and Vignettes-Only conditions were greatest for the natural vignettes for the Positive Affect trait ($M_s = .43$ vs. .28) and the Helpless trait ($M_s = .45$ vs. .28), although again means for both traits were in the same direction as in the Vignettes-Only condition (i.e., selecting the mature children more frequently).

The Inconsistent condition provided a head-to-head contrast between the role of maturity in faces and in vignettes in adults’ perception of children on the dimensions examined in this experiment. Participants in the Inconsistent condition displayed the same pattern as participants in the other combined conditions and as participants in the Vignettes-Only condition, although the difference was somewhat muted for the Positive Affect trait. Participants in the Inconsistent condition provided the lowest rating for the Positive Affect items for the supernatural vignettes (.59, compared to .72, .71, .72, and .68 for the Consistent, Mature-Face, Immature-Face, and Vignettes-Only conditions). Thus, having a photograph of a mature child paired with an immature supernatural vignette (and vice-versa) did have an influence on participants’ decisions for Positive Affect items, although the effect was small and did not reverse the direction of participants’ decisions (i.e., did not result in selecting the mature child more frequently for the Positive Affect items for the supernatural vignettes).

Finally, we predicted that the results for the Mature-Face and the Immature-Face conditions would be similar and analogous to those obtained in the Vignettes-Only condition. We hypothesized that, given that the two children’s photos were the same in these two conditions, participants would make their decisions on the basis of the information provided by the vignettes. Overall, patterns of responses for participants in both the Mature-Face and Immature-Face conditions were similar to the other face + vignettes conditions and to the Vignettes-Only condition, again with exception that ratings for the Helpless dimension for the natural items were higher than in the Vignettes-Only condition.

As we have noted, the only trait dimension in which participants in the four faces + vignettes conditions varied substantially from the participants in the Vignettes-Only condition was the Helpless trait, and here only for the natural vignettes. Whereas ratings for the natural items for the Helpless dimension for each of the four faces + vignettes conditions did not differ from chance (ranging from .45 to .56), this value was .28 in the Vignettes-Only condition, with participants selecting the mature child significantly greater than expected by chance. As we explained in Footnote 1, the factor analysis in the Bjorklund et al. (2010) study resulted in a slightly different classification of the Positive Affect and Helpless items than here, and if the mean Helpless value for the natural vignettes from the original factor analysis is used, that value was .41, more in line with the
current values for the four faces + vignettes conditions. Moreover, the mean values for the natural vignettes for the Helpless trait for other samples (American participants, Bjorklund et al., 2010: \(M = .64\); American participants, Periss et al., 2012: \(M = .64\); Spanish participants, Periss et al., 2012: \(M = .41\)) display greater variation than the other traits, suggesting that this vignette-type-by-trait combination is less reliable than the others. We suggest that the differences between the four combined conditions and the Vignettes-Only condition in the present study might be an artifact of applying “old” data (Bjorklund et al., 2010, Study 2, Spanish sample, Vignettes-Only condition) using a different factor analysis than the one originally applied, although one that fits better with the “new” data of the four combined conditions presented here.

It could be argued that the physical information about the children provided in this study may not have been enough to properly measure its potential role in adults’ reactions toward them. In this sense, perhaps a more global view of the children’s body structures and functioning would be more informative to adults about their maturity status, further modifying adults’ reactions. It is also possible that adults would have depended more on facial features had age difference in the faces been greater (in this study, the estimated difference between the mature and immature photos by an independent sample of adults was about only 2 years). However, we selected the facial features we did to be associated with children who adults would think would be credibly verbal at the youngest age (we can't envision most 2-year-old children having the language skills to make the statements attributed to them) and who may reasonably be expected to express some of the immature statements at the later age (we can’t envision attributing statements such as “The sun’s not out because it’s mad” to 12-year olds). Thus, within these constraints of making the task credible to adults, our results clearly indicate the greater influence of cognitive factors over the physical factor of face maturity in adults’ judgments of children.

We propose that the role of children’s physical appearance in adults’ reactions towards them might be different depending on the children’s developmental stage in life. For the pre-verbal infant, children’s physical appearance, namely in the terms of the “baby scheme” described by Lorenz (1943), provides valuable information about an infants’ maturational state. However, as children enter the preschool years, additional cues become available to assess a child’s maturational status, among them language and the type of cognitive abilities that children express via language. It is during this time, we suggest, that children’s verbalized thinking becomes the most reliable source of information for adults about children’s psychological characteristics, with physical appearance assuming a more secondary or complementary role. Both the immature faces and the immature vignettes used here were typical of preschool children, whereas both the more mature faces and vignettes were typical of children in middle childhood. Our results indicate that children’s thinking is the more important cue to their maturational status and attributions of positive and negative affect than facial appearance.

There is a widely known saying that “a picture is worth a thousand words.” However the results of the current study suggest that, at least with respect to adults’ reactions towards young children, this is not the case: A picture of a child’s face is not worth even a handful of a child’s words. Adults seem to make their decisions about young children’s maturational status and traits on the basis of their verbalized thinking rather than on the basis of their physical appearance. The impact of children’s appearance over children’s thoughts seems to wane with the onset of productive language, which makes it
possible to convey to adults the state-of-the-art of children’s minds. From that moment on, physical appearance seems to play a secondary role in adults’ perceptions of children, with some types of statements—those expressing immature supernatural cognition—resulting in feelings of positive affect, whereas others—those expressing immature natural cognition—resulting in feelings of negative affect. These results bolster earlier findings that some aspects of children’s immature cognition evoke positive evaluations by adults and seem to minimize negative evaluations, consistent with the proposal that some aspects of cognitive immaturity are adaptive in young children (Bjorklund, 1997; Bjorklund, Periss, and Causey, 2009; Bruner, 1972).

Acknowledgements: This work was supported by a research grant from the Ministerio de Ciencia e Innovación (PS12009-13724), Spain. We would like to thank Gregory Gorelik, Karin Machluf, Patrick Douglas Sellers II, Sigrid Gallego and Guiomar Jiménez for their useful comments, technical assistance, and contribution on data collection, and to Francisca Castellano and the parents and teachers of “Grans i Menuts” school in Castellón for their support in taking children’s photos.

Received 08 January 2015; Revision submitted 18 March 2015; Accepted 09 April 2015

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Appendix A

Examples of immature and mature versions of vignettes used in this study (A list of all the vignettes used can be obtained by writing the authors)

Supernatural Vignette-types

Animism
At breakfast on a cloudy day, this boy (A)’s mother asked him, “Why do you think the sun’s not out today?” He replied, “Because it’s mad.” (immature)
At breakfast on a cloudy day, this boy (B)’s mother asked him, “Why do you think the sun’s not out today?” He replied, “Because the clouds are blocking it.” (mature)

Finalism
This girl (A) came home from school and told her mother, “Mommy, today at school, we went on a field trip to the park. María (a friend) pointed to the mountains and said, ‘Why does that mountain have a big peak AND a small peak?’ I said, ‘the big one is for long walks, the small one is for short walks.’” (immature)
This girl (B) came home from school and told her mother, “Mommy, today at school, we went on a field trip to the park. María (a friend) pointed to the mountains and said, ‘Why does that mountain have a big peak AND a small peak?’ I said, ‘That’s just the way that it got built up over a really long time.’” (mature)

Natural Vignette-types

Inhibition
This girl (A) came home from school and told her father, “Daddy, today at school we played the ‘don’t peek’ game. The teacher gave me a box and said if I didn’t peek for 2 whole minutes, I could keep the prize! I had to peek, and the teacher said even though I peeked REALLY early, I could still get the prize. It was a cookie.” (immature)
This girl (B) came home from school and told her father, “Daddy, today at school we played the ‘don’t peek’ game. The teacher gave me a box and said if I didn’t peek for 2 whole minutes, I could keep the prize! I did it, I didn’t peek the whole time, and I got to eat the cookie in the box!” (mature)

Overestimation
This boy (A) was playing a video game with his friend. He needed 1000 points to win. He told his friend, “I’ve never played this game before, but I’m sure I can get the 1000 points!” (immature)
This boy (B) was playing a video game with his friend. He needed 1000 points to win. He told his friend, “I’ve never played this game before, so it may take me a while, but I think I can get the 1000 points.” (mature)
Appendix B

Results of the ANOVA for the faces + vignettes and the Vignettes-Only conditions

For the faces + vignettes and the Vignettes-Only conditions, the analysis produced significant main effects for trait dimension, $F(2.59, 351) = 152.98, p < .001$, partial $\eta^2 = .30$ (Helpless, $M = .66 =$ Negative Affect, $M = .64 >$ Positive Affect, $M = .52 >$ Intelligence, $M = .22$), vignette-type, $F(1, 351) = 41.33, p < .001$, partial $\eta^2 = .11$ (Supernatural, $M = .54 >$ Natural, $M = .48$), condition, $F(4, 351) = 5.73, p < .001$, partial $\eta^2 = .06$ (Consistent, $M = .54 =$ Immature, $M = .52 >$ Vignettes-Only, $M = .48$; and Consistent, $M = .54 >$ Inconsistent, $M = .49$), and sex, $F(1, 351) = 4.96, p < .05$, partial $\eta^2 = .01$ (Males, $M = .52 >$ Females, $M = .50$), and the following significant interactions: trait dimension x vignette type, $F(2.65, 351) = 124.04, p < .001$, partial $\eta^2 = .26$; trait dimension x condition, $F(4, 351) = 5.05, p = .001$, partial $\eta^2 = .05$; vignette type x condition, $F(4, 351) = 2.56, p < .05$, partial $\eta^2 = .03$; and trait dimension x vignette type x sex, $F(1, 351) = 5.12, p < .05$, partial $\eta^2 = .01$

Inspection of the significant triple interaction revealed only slight differences between men and women. For both sexes we found significant differences between responses to supernatural and natural vignettes for each of the four trait dimensions, although the magnitude of the difference was greater for women ($M_s$ supernatural = Positive Affect, $M = .68$, Negative Affect, $M = .52$, Intelligence, $M = .13$, Helpless, $M = .80$; $M_s$ natural = Positive Affect, $M = .31$, Negative Affect, $M = .79$, Intelligence, $M = .34$, Helpless, $M = .40$, $ts \geq 10.11$) than for men ($M_s$ supernatural = Positive Affect, $M = .73$, Negative Affect, $M = .53$, Intelligence, $M = .11$, Helpless, $M = .81$; $M_s$ natural = Positive Affect, $M = .35$, Negative Affect, $M = .77$, Intelligence, $M = .28$, Helpless, $M = .52$, $ts \geq 4.83$).