From Mind to Picture: A Systematic Review on Children’s and Adolescents’ Understanding of the Link between Artists and Pictures

Painting is self-discovery. Every good artist paints what he is

-Jackson Pollock, 1956

From early in their lives, children begin to understand and use a large array of symbols to convey information about objects, events and ideas. A symbol is something that a person uses with the intention to denote something other than itself. A key element of this definition is the human intention to represent one entity with another (Allen & Armitage, 2017; DeLoache, 2004; Freeman, 1995, 2008). Consequently, to become symbol users, children and adolescents must go beyond the perceptual and cognitive abilities that enable them to interact with the physical world and develop the ability to infer and to adopt the mental states of others (Tomasello, 1999).

In the pictorial domain this ability to infer and to adopt the mental states of others is also required. Pictures are symbolic representations and, therefore, have a *dual representation* (DeLoache, 1987, 1995). Therefore, children must understand simultaneously that they are marks on a flat surface and also refer to some other reality. Since pictures have the potential to communicate something beyond their concrete nature, it is critical for children to develop an understanding of the artists’ mental state to successfully interpret the message they intended to convey (Allen & Armitage, 2017; Bloom & Markson, 1998; Freeman, 1995, 2008; Preissler & Bloom, 2008).

Children’s and adolescents’ understanding of the nature of pictures has been associated with their evolving ability to infer their own and other’s mental states: their theory of mind (see for example, Callaghan & Rochat, 2008). This social-cognitive skill in pictorial understanding could be explained due to both developing an understanding of the intention of the artist behind a picture and developing an understanding that actions are intentional products of human’s minds.

**Freeman’s intentional network theory**

Norman Freeman (1995, 2008) captures the complexity of pictorial understanding by arguing that a complete theory of pictures rests on an understanding of the intentional network between four factors: the picture (P), the artist (A), the world (W) and the beholder (B). Pictures can represent referents of the real world in the immediate present or past experiences of the artist who creates them, and even illustrate imaginative worlds. However, Freeman stresses that, on their own, pictures are just inanimate objects. The artists are the ones who create pictures to convey meaning and express their attributes (e.g. skill) through them, while the beholders are the ones who make inferences about the artists behind them.

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Even though pictures, the world, the artist and the beholder are interdependent elements, if we focus solely on the Picture-World link (P-W), we would concentrate on recognizing the subject matter a picture represents based on perceptual similarity (e.g., a circular shape as a representation of a ball). Meanwhile, by reflecting about pictures in terms of the Artist-Picture (A-P) relationship, we acknowledge how intention and other attributes of the artist affect the pictorial outcome (e.g., whether a circular shape can represent a ball, an orange or the planet Earth depends on the artist's intention). Furthermore, by considering the Picture-Beholder relationship (P-B), we can reason about the multiple interpretations the audience can make about a single picture (e.g., a beholder can interpret that the artist meant to depict a ball while another one could argue it is an orange).

Altogether, Freeman’s model claims pictures are intentional representations of a mind that produces them and the mind that interprets them. Consequently, the pictorial competence is a mentalistic competence and any functional account of pictures should put the artist rather than the drawing at centre of the analysis. In addition, the complexity of the pictorial competence presents substantial challenges to the eye of the beholder which explain why the pictorial competence is also a developmental process. The current systematic review examines existing evidence on children’s and adolescents’ understanding of the relation between artists and pictures (A-P link).

It is worth noting that pictures are not only evidence of the artist’s intention but also of their attributes such as their age, cultural background, mood, knowledge and style. Indeed, we argue that as children’s pictures are used to test their cognitive abilities (e.g. Goodenough, 1926; Harris, 1963; Imuta, Scarf, Pharo, & Hayne, 2013; Naglieri, 1988; Reynolds & Hickman, 2004), personality (e.g., Hammer, 1958,1997; Kato & Suzuki, 2016; Machover, 1949), their knowledge and ideas about a certain topic (e.g., Brechet, 2015; Christidou, Bonoti, & Kontopoulou, 2016; Jolley & Vulić-Prtorić, 2001) and to examine cultural influences (e.g., Aronsson & Junge, 2000; Cox, 2000; Jolley & Zhang, 2012; Kellogg, 1969; Pariser & van den Berg, 2001; Wilson, 1997, 2000), children and adolescents could also use drawings to make inferences about these and other attributes of the mind behind them.

Although children’s understanding of the artist’s attributes is positively correlated with their performance in Theory of Mind tasks (Callaghan & Rochat, 2003), and Freeman’s intentional net theory (Freeman, 1995, 2008; Freeman & Sanger, 1995) has been cited 132 times worldwide¹, most research in the pictorial domain has merely focused on children’s and adolescents’ understanding of the P-W link. Such research has either examined children's ability to map a picture to its referent on the basis of resemblance (see for example, DeLoache, 1987, 1995, 2002; DeLoache & Burns, 1994; Ganea, Allen, Butler, Carey, & DeLoache, 2009; Ganea, Bloom Pickard, & DeLoache, 2008; Jolley, 2010; Peralta & Salsa, 2009; Preissler & Carey, 2004), or to understand that pictures do not have all the attributes of what they represent (e.g., a picture of an ice cream is not itself cold) (Beilin & Pearlman, 1991; Flavell, Flavell, Green, & Korfmacher, 1990; Robinson, Nye, & Thomas, 1994; Zaitchik, 1990). In sum, even though children’s developmental milestones in pictorial understanding have been widely researched, the intentional aspects of pictorial understanding have often been neglected (but see Allen & Armitage, 2017; Callaghan & Rochat, 2008; Cox, 2005).

**Foundations of children and adolescents’ understanding of the A-P link**

Children develop an awareness of the A-P link with age. A small number of theories of pictorial development have acknowledged the role of the artist in the understanding of drawings and paintings. For instance, Gardner and Winner (1982) claim that children’s pictorial understanding follows a three-stage developmental pattern. Four and 5-year-old children are in a transition to understanding the P-W relation but have no consideration of the role of the artist in the picture making process. Around age 10, children continue to focus on P-W by judging pictures based solely on realism but can also sort pictures by the artist's style. By adolescence, they start to acknowledge attributes that are linked to skilled artists - talent and imagination - and they recognise the role of the beholder by acknowledging the relativity of pictorial interpretation.

In contrast, Parsons (1987) documented a five-stage model of children’s understanding of art. The stages are not rigidly associated with age and they are influenced by children’s art education. While being in stage one (preschool age), children tend to judge pictures based on their formal properties (e.g. ‘I like it because of the colours’) – neglecting both what they stand for and the artist behind them. When children shift to stage two (primary school children up to 9 years of age), they start to judge art based on the referent they depict. Children also start considering the artists by appreciating their skill and effort to depict a specific referent using representational realism. In stage three (from about 10 to 14 years old), children start relying on expressiveness when interpreting pictorial symbols. They put a focus on the artist’s originality and emotional expression. In stage four adolescents can reason about the style of pictures and how a work relates to its artistic tradition. Finally, in stage five (from 15 years of age) they develop an awareness of the role of the social and historical context in pictorial production and interpretation. Although both Gardner and Winner’s (1982) and Parsons’ (1987) theories of picture interpretation refer to a developing acknowledgement of the artist, they did not provide empirical evidence for their assertions. Another common aspect of both traditional views is that despite considering the role of the artist, unlike Freeman’s theoretical approach, they place the picture rather than the artistat the centre of the analysis.

Concerning *how* children develop an understanding of the mentalistic aspects of pictures, Callaghan and Rochat (2008) theorise that children’s interactions with others who use pictures to communicate meaning to them, enhance their understanding of the mind behind a drawing. The social-cognitive abilities of learning through others where pictures are used in joint attention settings not only include the ability to reproduce the actions of others but also the ability to infer and adopt another’s mental stance. As they gain experience in communicative exchanges with the pictures others have created or used, they generate a theory of what pictures are for and become able to produce pictorial symbols of their own for communicative purposes. Therefore, in Callaghan’s and Rochat’s view, children’s theory of pictures develops initially as inferences of the intentions of others who produce pictures. Once children understand the intentional dimension of these symbols, they build a more refined theory of pictures and their symbolic communication becomes self-initiated. Callaghan and her collaborators tested some aspects of their theory on children’s understanding of the A-P in their research (see for example, Callaghan & MacFarlane, 1998; Callaghan & Rochat, 2003). Nevertheless, their research was limited to the influence of different factors such as Theory of Mind skills and subject matter cues on children’s understanding of the A-P relationship, and was not a systematic review.

Understanding the A-P link is a fundamental step for achieving a mature understanding of pictures as these symbols do not merely stand for the referent they represent; they may also be used to make inferences about mind of the person who produced them. Therefore, to fully understand pictures, children need to be able to construe the identity of the artists by making inferences about their mental state and attributes (Callaghan & Rochat, 2003; Freeman, 2004; Rochat & Callaghan, 2005). By collating empirical research on children’s and adolescents’ understanding of the role artists play in their pictorial outcomes, we will gain a comprehensive understanding of the variety of artist attributes that contribute to the A-P relationship. Finally, as mental reasoning is fundamental to the A-P link when judging a picture, our research could provide insight on children’s and adolescents’ Theory of Mind skills (Callaghan & Rochat, 2003), and their reflective and critical thinking skills (Hetland, Winner, Veenema, & Sheridan, 2007).

**The present study**

There are no systematic reviews on children’s and/or adolescents’ understanding of the link between artists and their pictures. All previous literature reviews, even though they have made promising remarks on the importance of this line of enquiry (see, for example, Allen & Armitage, 2017; Callaghan & Rochat, 2008; Freeman, 2004; Winner, 2006), were not derived from systematic reviews that follow established search strategy and data extraction protocols. Furthermore, previous reviews represent only a piecemeal coverage of artists’ attributes such as intention (Allen & Armitage, 2017; Callaghan & Rochat, 2008; Cox, 2005; Winner, 2006), knowledge and originality (Allen & Armitage, 2017), age and skill (Callaghan & Rochat, 2008; Cox, 2005; Trautner, 2008), mood (Callaghan & Rochat, 2008; Cox, 2005; Trautner, 2008; Winner, 2006), style (Trautner, 2008; Winner, 2006) and sentience (Callaghan & Rochat, 2008; Cox, 2005). Moreover, except for Allen’s and Armitage’s (2017) review, it has been over 10 years since the literature reviews were published.

The aim of this article is to conduct a systematic literature review of the empirical papers that address children’s and adolescents’ understanding of the relationship between the attributes of the artists and their pictures. The objective was not only to thoroughly examine the evidence of children’s and adolescents’ insights into the artist’s intention, knowledge and originality, age and skill, mood, style and sentience but to consider whether there are further characteristics of the artist that they could infer from the content of their graphic productions. For example, the gender, intelligence, personality, ethnicity, religion, socio-economic and cultural background of artists. Our examination of the literature was particularly aimed on which attributes of the artists were explored in the literature and what are the developmental milestones in this area. Finally, we focused on children’s and adolescents’ understanding of the A-P link both when the artist was another person and when the children or adolescents had produced the drawings themselves.

**Method**

The systematic review was conducted and reported in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher, Liberati, Tetzlaff, Altman, & PRISMA Group, 2009). Research questions, search strategy, inclusion criteria and method of analysis were specified in advance and documented in a protocol (see Supplementary Material 1).

**Study Inclusion Criteria**

The review aimed to identify all original quantitative and qualitative studies that examined children’s and adolescents’ (from 2- to 18-years-old) understanding of the relationship between artists and their pictures. The age range was selected after conducting a scoping review which revealed there is evidence of children’s understanding of the role of the artist in the picture making process since the age of 2 years (Egyed & Szalai, 2016; Preissler & Bloom, 2008; Salsa & Vivaldi, 2016). Moreover, by extending it up to 18 years of age - the chronological time point often considered to represent the threshold between adolescence and young adulthood - we were able to make a thorough exploration of the developmental milestones of children's and adolescents` understanding of the A-P link. In studies that specified the school level of participants rather than the age, the standard age range for that grade level in the country where the study was conducted was used. Studies with samples ranging from adolescents to adults were only included if data on the adolescents’ performance were provided separately.

For the article to be considered pictures in the form of drawings or paintings made by a human were required to have been shown or referred to with participants as part of the procedure. Studies were included if the understanding of the relationship between the attributes of the artists and their pictures was measured, regardless of whether that was the primary aim of the article or not. Therefore, P-W link studies were included if children’s understanding of the referent and picture represented was facilitated by highlighting the role of the artists (e.g. their intention) in the picture production process. P-W link studies were also considered when children and adolescents spontaneously acknowledged the role of the artist in pictures even though this was not explicitly triggered by the researchers (e.g., while justifying aesthetic preferences).

To avoid a publication bias, grey literature (i.e. conference presentations and thesis) were reviewed. Finally, to prevent the introduction of an English-language bias, we also considered articles written in foreign languages spoken by at least one of the authors. As consequence, studies written in Spanish, Portuguese, Italian and German were also reviewed for their inclusion.

**Study exclusion Criteria**

Studies were excluded if they focused on the relationship between pictures and referents exclusively, without data on children’s understanding of the artist’s role. For instance, research that merely informed on children’s understanding of the style or mood in pictures was excluded if it did not provide data on children’s inferences of the artist’s potential influence on the style or mood perceived. Studies with entire adult samples were also excluded. Moreover, studies which examined the role of the artist behind photographs, maps and any other pictorial symbols were not considered. It was decided not to include photographs as unlike drawing producers, photographers are restricted on their intention because of the casual-mechanical nature of cameras (Allen & Armitage, 2017; Cavedon-Taylor, 2014; Gooskens, 2012; Ross, 1982; Scruton, 1981). Therefore, without the use of additional technology (such as Photoshop and computer-generated picture software), a photograph’s referent will always be limited to the physical present world. On the contrary, drawings can be a product of an artist’s imagination; hence, they can be either realistic, abstract or ambiguous (i.e., with more than one interpretation). Beyond using the referent of a drawing or painting as a cue to the artist’s intention, we can infer an artist’s attributes by the formal properties of their graphic productions such as colour choices, execution of line and compositional decisions. In contrast, the photographer’s mental state would only be evident in their use of angles, lighting and shutter speed, which are very sophisticated qualities for children to understand (Allen & Armitage, 2017). Maps were not included as they are restricted to the representation of visual-spatial relationships among subject matter.

Grey literature was only excluded when insufficient information was available to decide if the inclusion criteria were met even after the authors had been contacted. Finally, since the aim of this systematic review was to examine the empirical data on children’s and adolescents’ understanding of the A-P link, non-empirical articles, such as theoretical papers, book chapters (in which no primary data was presented) and opinion pieces were not considered.

**Search strategy**

The children’s and adolescents’ understanding of the A-P link electronic search strategy was co-created by all three authors and conducted in Web of Science (1970- September 2017) and PsycInfo (1783- September 2017). To search for gray literature, Open Grey and Open DOAR databases were used (1975 - September 2017).

The electronic search was constructed as three separate topic-specific lists of search terms, each of which addressed one of the three main concepts in our systematic review: *artist*, *child*/*adolescent*, and *pictures*. The artist string included the terms *artist*, *drawer*, *craftsman*, *producer* and *creator*. The child/adolescent string incorporated the following terms: *child*, *teenager* and *adolescent*. The picture-specific terms were: *picture*, *drawing*, *painting* and *art*. Each of these three topic search strings were pilot-tested separately before incorporated into a final strategy to ensure that the selected terms produced the desired results. Specific attributes of the artist (e.g., ‘age’) were not included as key words as we did not wish to restrict the results to any list of specific attributes. Additional details on the search strategies are given in Supplementary Material 1.

In addition to the electronic search, the following additional searches for further evidence were completed. Citation searchers were conducted for all papers included in the review and other key papers and book chapters. Google Scholar searches were conducted for eligible journals, thesis or conference papers. Key content experts were contacted and asked to identify relevant papers in the topic to ensure no key relevant articles were missed by the search.

**Data extraction**

References were imported into a Citation Manager Software (Mendeley) where duplicate references were removed (first author). All titles and abstracts were screened by the first author and either the second or third author. Only those agreed on for inclusion by at least two of the authors were included in the next stage. This resulted in 74 full-text articles being screened by the first author and either the second or third author; the second author was the second examiner for half of the articles and the third author for the other half. Cohen’s Kappa were calculated to determine the agreement on 100% of the reviewers’ decisions. These indicated very high agreement between the reviewers on both phases of the citation screening (titles and abstracts: 98% agreement, *k* = .86; full text: 96% agreement, *k* = .80). The discrepancies were resolved by discussion and consensus obtained between the reviewers. Data extraction was completed by the first author and checked by the second and third author.

**Analysis**

We conducted a narrative synthesis rather than a meta-analysis. The systematic search revealed considerable methodological variations in the selected studies (quantitative, qualitative and mixed methods), and the lack of statistical data reported in qualitative research would have led to a number of important contributions to being excluded from a meta-analysis systematic review. Indeed, the Cochrane Handbook for Systematic Reviews suggests that meta-analyses are problematic for wide-scope reviews with high study variability (Higgins, & Green, 2008). Furthermore, metanalysis is most appropriate when assessing the effectivity of interventions or diagnostic tests in addressing a condition or phenomena, or when examining the relationship between two or more conditions (Piggot, 2012). In contrast to this, our review embraced a wide range of contributions from the literature to investigate which attributes of the artist children and adolescents infer from their pictures, and what are the developmental milestones in this line of enquiry.

**Results**

The PRISMA flow diagram for study inclusion and exclusion is included in Figure 2. All the studies included in the review are summarized in the Appendix. After screening 74 eligible articles, the final sample included 42 articles (64 studies) from 14 different countries with a cumulative sample of 3688 participants. The majority of the research included was from North American and Western Europe countries (33; 79%) and used representational pictures (15; 36%). In addition, in most cases the artist was someone else (31; 74%); very few studies included children’s reflections about their own role as artists (6; 14%) or both (5; 12%). Twenty-four articles (57%) explored the understanding of an artist’s intention while the impact of age and skill has been addressed in eight each (19%). The role of style and mood were explored in five (12%) articles each and the artist’s originality and knowledge were investigated in four (10%) and three (7%) articles, respectably. Only two articles (5%) investigated children’s and adolescents’ understanding of an artist’s sentience and just one (2%) was focused on the role of the artist’s gender. Lastly, no studies examined children’s and adolescents’ understanding of the link between pictures and an artist’s personality, intelligence, SES, religion or cultural background. Therefore, these attributes will not be discussed further. The artist’s attributes addressed in the literature have been used to group the findings of the studies (e.g., intention, age and emotion).

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**Intention**

Over half of the articles (24), 20 experimental and four interview-based studies, included in this systematic review addressed the understanding of the artist’s intention. A total of six of the studies included have demonstrated that children from age 2 are able to match a pictorial symbol with its correspondent referent successfully if the relationship between artists and pictures is highlighted (Allen, 2009; Callaghan & Anton, 2004; Egyed & Szalai, 2016; Preissler & Bloom, 2008; Salsa & Vivaldi, 2016; Vivaldi & Salsa, 2014). For instance, Preissler and Bloom (2008) showed 2.5-year-old children can label ambiguous pictures according to information given about the referent based on which object the adult artist looked at whilst drawing. Nevertheless, this early developing ability may not be available in atypical populations: using a similar procedure, Allen (2009) found children with autism spectrum disorder (ASD) do not take into account the information regarding the artist’s intention when mapping another person’s symbols to their referents.

In addition, two studies have demonstrated that the information regarding the relationship between an artist and pictures enhance 2-year-old children’s performance in object retrieval tasks (Egyed & Szalai, 2016) and match-to-symbol tasks (Salsa & Vivaldi, 2016). Egyed and Szalai (2016) revealed 2-year-olds can use pictorial information to find a toy hidden in a room after highlighting that pictures are the result of human intention by drawing in front of children. In addition, verbal descriptions about how a drawing was created were found beneficial for 2-year-olds when matching an array of objects with their correspondent drawings (Salsa & Vivaldi, 2016). However, in both studies children were not able to match pictures with their referents when no cues to the artist’s intention were provided, suggesting understanding the intentional nature of pictures at this early developmental point requires some level of support.

A total of six studies investigated whether children name pictures made by other people based on their appearance or the artist’s intention. Generally, it was found that children name pictures based on the artist’s intention when there is no conflict between appearance and intention, that is, when the image bore resemblance with what the artist meant to depict (Armitage & Allen, 2015; Browne & Woolley, 2001; Hartley & Allen, 2014). Furthermore, most of the studies suggested children favour intentionality over shape information when asked to label ambiguous drawings. For instance, Gelman and Ebeling (1998) reported 2- to 4-year-olds name ambiguous pictures differently depending on whether the instructions stated that they were intentionally created (e.g., “John was at art class, he decided to make something for his teacher”) or the outcome of an accident (e.g., “John accidentally spilled some paint on the floor”). Children were significantly more likely to name a picture according to its shape (e.g., ‘a man’) when told it was intentionally produced, while this response was reduced in the accidental condition where many children provided material-based names (e.g., ‘paint’). Using a replication of this task, Hartley and Allen (2015) found that unlike TD children, those with ASD do not rely on what the artist intended to represent.

Bloom and Markson (1998) also demonstrated that 3- and 4-year-old children could name an array of ambiguous pictures based on the artist’s intention rather than on what they looked like. For instance, when the children were shown two scribbles, distinctive only in their size, and were told they represented a mouse and an elephant, children labelled the small shape as a mouse and the large one as an elephant. However, Browne and Woolley (2001) demonstrated that typically developing children will disregard the artist’s intentionality when the drawing’s appearance clearly depicts a different subject matter. When they showed 4- and 7-years-olds a drawing made by an artist who intended to draw a bear but looked unequivocally like a rabbit, children tended to name the picture according to what it looked like (Browne & Woolley, 2001). As to atypical populations’ performance, Hartley and Allen (2014) used a similar procedure to Bloom and Markson’s (1998) and found that, unlike typically developing children, children with ASD have a tendency to match pictures with referents based exclusively on resemblance (e.g., if the elephant and the mouse were depicted as squares varying in size, children with ASD would match the drawings with matching-size cubes instead of the animals the artist intended to represent). Not only can typically developing children grasp the intention behind ambiguous drawings, the literature also shows they are flexible in their interpretation of pictures. Allen, Nurmsoo and Freeman (2016) found that 4- and 6-year-old children accept an additional label for ambiguous pictures intentionally created to represent a specific referent (e.g., a lollipop drawing could also represent a balloon). Therefore, even though children consider the artist’s intention, they also show representational flexibility by acknowledging pictures can represent more than what the artist’s intended.

It is worth noting that it is unlikely that an artist would produce a drawing with an unequivocal resemblance to a specific referent without having the intention to represent it. To vary the level of conflict between appearance and intention, children aged 3- to 6-years-old witnessed an artist stating her intention to depict one specific referent (e.g. ‘blue duck’) out of three (e.g., blue duck, pink duck or a teddy bear) (Armitage & Allen, 2015). Once the complete picture was revealed, the referent was of a different (e.g. pink) or ambiguous (grey-scale duck) colour. When the colour of the picture was ambiguous (grey-scale duck), children favour the artist’s intention (blue duck). When the final picture resembled a different referent from what the artist meant to portray (pink duck), children named the image based on appearance. However, Armitage and Allen reported children tended to protest about the final picture not being faithful to the artist’s intention. Therefore, they concluded children’s inclination to name pictures according to their shape does not mean they disregard the information regarding what the producer meant to portray.

The literature also showed that when asked to rate drawings made by other people based on their aesthetic preferences, children increasingly referred to the artist’s intention between ages 4 and 6 and between ages 6 and 8 (Rodway , Kirkham, Schepman, Lambert, & Locke, 2016). Some children also relied on the artist’s intention when justifying their answers in expressive pictures labeling tasks (Jolley & Thomas, 1994) or in interview-based studies where they are asked to discuss art pieces or talk about art in general (Gilli, Ruggi, Gatti, & Freeman, 2016; Guruzhapov, 2006).

With regards to children’s understanding of their own symbols, three experimental studies have shown children are able to recognize the intention behind their own drawings from early in their development. Bloom and Markson (1998) reported that 3- and 4-year-old children could name their pictures according to intention even when shape cannot cue intention (e.g. children correctly labelled their identical-shaped drawings of balloons and lollipops). When shape can cue intention, 3- to 4-year-olds can recognise their own drawings of events from other children’s drawings of similar events, and describe their intentions as artists, even after a 3-month delay from when they were produced (Gross & Hayne, 1999). Allen (2009) replicated Bloom’s and Markson’s study with children with ASD and found that even though they do not use the artist’s intention while naming somebody else’s pictures, children with ASD do take their own intentions into account when naming their graphic productions.

Apart from naming tasks, children’s understanding of the intention behind their own drawings has been investigated in two interview-based studies where children were asked to describe their artistic motivations (Malin, 2013; Rostan, 1998). These studies showed children from 6 years of age acknowledged that storytelling, representing their identity, emotions and experiences, making their subject matter look realistic, and experimenting with multiple drawing mediums are among their main artistic intentions. Later in development, adolescents claim that pictures are a proficient medium to express their intentions and identity as artists (Rantala, 1997).

 **Age and skill**

A total of 14 studies, five interview-based and nine experimental, explored children’s understanding of the artist’s age (6), skill (6) or both (2) attributes. As reported with intention, 3- to 16-year-old children acknowledge the role of the artist’s skill when justifying aesthetics judgments or when they discussed their views on visual arts and what it means to be an artist (Gardner, Winner, & Kircher, 1975; Hart & Goldin-Meadow, 1984; Rodway et al., 2016; Rostan, 1998). In a further interview study, Gilli et al. (2016) reported that some 8- and 10-year-olds acknowledged implicitly the skill of an artist by arguing that forging art undermines the forger’s own artistic skill.

Unlike adults, who acknowledge that the artist’s age is not always transparent in their work, it has been reported that 14-year-olds, but only a minority of 11-year-olds, believe this attribute can be inferred from their pictures (Freeman & Sanger, 1995). Nevertheless, a series of experimental studies reported that between the ages of 4 and 7, children make inferences on the artist’s age when looking at representational pictures made by others (Callaghan & Rochat, 2003; Cox & Hodsoll, 2000; Goodnow, Wilkins, & Dawes, 1986; Trautner, Lohaus, Sahm, & Helbing, 1989; Tryphon & Montangero, 1992).

When presented with pairs of simple-line drawings of familiar subject matter (e.g. a bear, a tree, a house) (Callaghan & Rochat, 2003) or human figures (Goodnow et al., 1986), each one made by either an adult, older child or a younger child, children from age 4 to 7 can tell which of the pictures was created by an older rather than a younger artist. When asked to sort series of a wider set of human figure pictures according to age of the artist, accuracy improves from age 5 to 7 (Cox & Hodsoll, 2000; Trautner et al., 1989; Tryphon & Montangero, 1992).

Applying the knowledge of developmental changes to their own drawings seems to be more challenging (Cox & Hodsoll, 2000; Scheuer, de la Cruz, Pozo, Echenique, & Márquez, 2010; Tryphon & Montangero, 1992). For instance, Tryphon and Montangero (1992) asked 6- to 12-year-olds have they always drawn the same way, and only children from 10 years of age started to explicitly acknowledge they had not. When asked to make human figure drawings illustrating how they used to draw in the past and how they will in the future, only quantitative changes (e.g. to size and detail) were made by the children up to 10 years of age. Older children additionally showed some evidence of qualitative changes (e.g. to structure and perspective). Using a similar task on 5- and 7-year-olds, Cox and Hodsoll (2000) findings were broadly consistent with those of Tryphon and Montangero, although their sample showed that a minority could make qualitative changes to drawings from their ‘younger self’. In addition, it was noticeable that the changes children made were not necessarily an accurate reflection of the changes we see in children’s drawings. Children may be less able to reflect on the developmental sequence of drawing in their own drawings than they are in choosing and seriating presented drawings. Nevertheless, 6-, 8- and 10-year-old children demonstrated awareness of their drawing development by discussing relevant sources to become skillful as artists: drawing from a live model, a photograph, another drawing or from imagination (Echenique, Márquez, & Scheuer, 2014). The answer distribution was relatively even and no significant age differences were found, imagination was the most popular source to develop skill among participants. Altogether, even though children may not explicitly acknowledge the role of the artist’s age and skill until adolescence, their ability to sort pictures according to these attributes suggests an implicit understanding of the influence of these attributes to the pictorial outcome.

Finally, Jolley, Knox, and Foster (2000) investigated how children’s understanding of the link between the artists’ age and their pictures is related to children’s production skills. The authors found that children who are able to draw conventional human figure forms are significantly better at inferring the age of an artist than scribblers and pre-conventional drawers. Crucially, their findings could not be explained by the age of the children.

**Originality and knowledge**

A total of seven studies, six experimental and one interview-based, explored children’s understanding of either the artist’s originality (3), knowledge (2) or both (1). Two studies have tested children’s reasoning when artists draw a specific referent without having any knowledge of it (Browne & Woolley, 2001; Richert & Lillard, 2002). In Browne and Woolley’s (2001) study, 4- and 7-year-olds were told that an artist (i.e. a puppet) wanted to draw a bear but his picture looked like a rabbit. Children were also told the artist did not know the difference between bears and rabbits. When naming the picture, both age groups tended to devalue the artist’s intention because of his lack of knowledge and named the picture according to what it looked like (a rabbit). However, only 7-year-old children recognised an artist could not draw a bear without knowledge of this particular referent when presented with ambiguous pictures (i.e. pictures that looked equally like a bear and a rabbit). Therefore, this study suggested a developmental shift in acknowledging an artist’s knowledge when naming a picture’s content. This was confirmed in Richert and Lillard’s (2002) study that asked 4- to 8-year-olds to identify what an artist (Luna) was trying to draw, considering: a) the artist lived in a land without animals and had no understanding of what animals look like, and b) Luna’s picture looked unequivocally like a fish. When asked “Does Luna think she is drawing a fish?”, only 8-years-olds’ responses considered Luna’s lack of animal knowledge. On the contrary, younger children tended to interpret her graphic actions on the basis of appearance (i.e., stating she was drawing a fish), rather than on Luna’s mental state.

As to children’s consideration of the artist’s originality, four studies provided evidence of children’s negative views on pictures made by artists who deliberately copy somebody else’s ideas (Gilli et al., 2016; Li., Shaw, & Olson, 2013; Olson & Shaw, 2011; Yang, Shaw, Garduno, & Olson, 2014). For instance, Olson and Shaw (2011) showed 7- and 9-year-olds videos of situations where one artist produced an original picture and a second artist deliberately, or accidentally, drew the same as the first artist. Children preferred the picture made by the original artist to the ones who produced identical images. In addition, unknowingly identical pictures were ranked better than the deliberate copies. In a second study with 3- to 6-year-olds, the authors reported negative evaluations of forgery from age 5. Similar results were found in an interview-based study where most children (5-, 8- and 10-year-olds) justified their negative views on forgery by stating that it represents cheating. Furthermore, some 8- and 10-year-olds commented that plagiarizers disadvantage themselves by not being able to display their artistic originality in their own skill unique ideas (Gilli et al., 2016).

Additionally, children’s sensitivity to the artist’s originality has been tested cross-culturally. Five- and 6-year-olds from United States, Mexico and China all evaluated plagiarized pictures more negatively than original pictures (Yang et al., 2014). Finally, regarding children’s conceptions of their own originality when producing pictures, it has been shown that children from 6 years of age prefer pictures in which they contributed with ideas rather than with mere physical labour only (Li et al., 2013).

**Mood**

Only five studies, two experimental and three interview-based, have explored children’s understanding of the link between the artists’ mood and their pictures.Freeman and Sanger (1995) asked 11- and 14-year-old children whether the artist’s mood or feelings towards a scene determine picture quality and whether these can be inferred from a picture. All the older children, and the majority of the younger children, agreed upon the possibility of inferring how the artist was feeling whilst making a picture. In addition, all but one child believed that the artist’s feelings towards an event could have an effect in the outcome (e.g., an artist who hates dogs is more likely to depict them in a more negative manner than an artist who loves dogs). Still, the 11-year-old children believed that a happy artist would make a better picture than a sad one, claiming only happy pictures are beautiful; a view much less prevalent among that 14-year-olds.

Consistently with the findings for intentionality, age and skill, experimental studies demonstrated the onset of children’s understanding of the link between mood and the picture earlier in development. Callaghan and Rochat (2003) reported younger children, 5 years old, were able to infer whether a calm or an agitated person produced a certain picture after seeing videos of the artist drawing. The authors also found at that age children pair emotions displayed in pictures of target artists (happiness vs. sadness) with abstract paintings of the same emotional tone. In subsequent interviews with the children the authors reported that 5- and 7-year-olds believed that artists paint pictures expressing the mood that the artists feel themselves. However, when pressed further by the interviewer as to whether artists could paint a mood opposite to the mood they were feeling, around two thirds of the children acknowledged that it might be possible. Therefore, it seems that the early developmental mindset is that artists express emotions in pictures that reflect the artist's own mood, and that a more flexible interpretation of the artist’s intention to express mood is initially tentative and not spontaneously considered.

While discussing their own artworks, children from 8 years of age acknowledge pictures as a medium for emotional expression (Rantala, 1997; Rostan, 1998). Nevertheless, preadolescent children may not spontaneously make the link between the artist’s mood and their pictures in tasks that do not explicitly refer to expression in the task instructions. For instance, when children and adolescents were asked to choose line drawings of particular content to complete a scene expressing either happiness or sadness, Jolley and Thomas (1995) reported that most verbal justifications given by 4- to 11-year-olds for their choices referred only to perceived similarities in subject matter. Few comments referred to the mood compatibility of their selections, even though they recognised the mood in the pictures when asked directly.

**Style**

Just as children’s understanding of mood behind pictures shows, four experimental-based and one interview-based study revealed sensitivity to style seems to develop later than other attributes of the artist (Callaghan & MacFarlane, 1998; Carothers & Gardner, 1979; Gardner et al., 1975; O’Hare & Cook, 1983; Silverman, Winner, & Gardner, 1976).In the interview study based on 4- to 16-year-olds’ responses to paintings, only the 14- to 16-year-old adolescents demonstrated a firmly grounded definition of style as the manner in which the artist depicts subject matter (Gardner et al., 1975). Nevertheless, experimental based research showed an understanding of the artist’s style in pre-adolescents. An early study (Silverman et al., 1976) demonstrated that after receiving training of style sensitivity for seven weeks, children can discriminate paintings based on the artist’s style by age 10. Nevertheless, when the paintings differed in subject matter, children continued to prioritise content over style when sorting pictures by their creator. It is also worth noting that the stimuli used varied in multiple dimensions such as texture, shading and light. On the contrary, when a single dimension of the picture was manipulated, other studies suggested that untrained children between 10 and 12 years of age show sensitivity to the artist’s style (Carothers & Gardner, 1979; O’Hare & Cook, 1983). Ten-year-olds are successful at choosing a drawing from a set to complete a picture based on the similar use of line (Carothers & Gardner, 1979), or colour organization (O’Hare & Cook, 1983) which looked as if it was made by the creator of a series of unfinished pictures. Nevertheless, Callaghan and MacFarlane (1998) reported that when the levels of discriminability of style and subject matter were varied, children from age 6 were able to infer which picture looks like it was made by a target artist when their work was paired with a highly discriminable distractor (e.g., a Van Gogh *vs.* a Magritte painting).

**Sentience**

Two studies, one experimental and one interview-based, explored children’s understanding of the sentience behind a picture (Callaghan & Rochat, 2003; Gardner et al., 1975). Using an open-ended interview approach, Gardner et al. (1975) explored 4- to 16-year-old children’s understanding of this attribute by asking them ‘Where do pictures come from?’ Young children (4- to 7-year-olds) answered they were made in factories, by machines. While most children in an intermediate age group (8- to 12-year-olds) acknowledge spontaneously the human source of pictures, it was not until adolescence (14- to 16-year-olds) that pictures were seen as both a human and cognitive endeavour. Nevertheless, the authors reported that young children did concede that pictures are a human creation when prompted further by the interviewer. This early developmental understanding was confirmed in an experimental study (Callaghan & Rochat, 2003) that directly asked young children to distinguish between pictures created by humans (i.e., an adult, an older child and a younger child) and computer-generated images (computer printer). Five-year-olds, but not 2- to 4-year-olds, were able to distinguish drawings produced by machines from children’s drawings. However, the 5-year-olds did not succeed when they had to discriminate an adult picture from a machine picture. The authors suggest that a possible explanation of these results could be that children find adults and machines equally skilful at producing pictures, which may be a challenging distinction to make for even adults.

**Gender**

Only one unpublished experimental study has investigated adolescents’ understanding of the relationship between an artist’s gender and pictures. Bloomfield (2015) presented 14- to 18-year-olds with an array of paintings selected for how they conveyed gender-roles, this is, whether it included subject matter typically associated with male or females (e.g., war for males and maternity for females) and whether it included a conflict between male and female symbolism (e.g. a painting of a pink gun). The author reported that gender stereotypes affect the adolescents’ interpretations of paintings as made by either a male or a female artist. They relied mostly on the stereotyped gender colours and themes portrayed, and on the gender of human figures depicted to make their inferences about the artist’s gender.

**Discussion**

Our systematic review of 42 articles on children’s and adolescents’ understanding of the link between artists and pictures has found that most research concentrated on the artist’s intention, with much less attention on other attributes of the artist. Making inferences about the intention of the artist not only is the most traditional approach to the artist-picture relationship, it enables us to test the understanding of the mind behind a picture with young children. Several studies have shown that typically developing children become aware of the artist’s intention when interpreting pictures from 2 years of age, particularly if cues are provided to consider the artist’s intention (Allen, 2009; Callaghan & Anton, 2004; Egyed & Szalai, 2016; Preissler & Bloom, 2008; Salsa & Vivaldi, 2016; Vivaldi & Salsa, 2014). Research has also shown similar results for other pictorial symbols: they can use photographs (Salsa & Peralta, 2007) or maps of a room (Myers & Liben, 2008) to locate a hidden object in the real room when taught about the intentional symbolic relationship between the symbol and its referent. Furthermore, cues to the artist’s intention have been demonstrated to scaffold drawing (Callaghan, 1999; Salsa & Vivaldi, 2017) and map production (Myers & Liben, 2008). Although these findings contradict traditional pictorial development theories which state children begin considering the role of the artist by around 10 years of age (Gardner & Winner, 1982; Parsons, 1987), there is an agreement that young children’s acknowledgement of the artist’s intention is still relatively late compared to their understanding the relationship between pictures and their referents (Cox, 2005; Gardner & Winner, 1982; see also Freeman & Sanger, 1995). As a matter of fact, the first step towards an understanding of the P-W link nature can be linked back to young infants’ precocious recognition and discrimination of depicted objects, faces and patterns from their three-dimensional counterparts (Barrera & Maurer, 1981; DeLoache, Strauss, & Maynard, 1979; Dirks & Gibson, 1977; Rose, 1977). Meanwhile, no evidence of an awareness of the A-P link was found before the second year of life.

Furthermore, evidence of 3- to 7-year-old children naming pictures according to appearance when pitted against intention (Armitage & Allen, 2015; Browne & Woolley, 2001; Hartley & Allen, 2014) supports not only that children’s awareness of intention is still emerging from the age of two, but that the relation between the P-W link and the A-P link is hierarchical: participants tend to use the artist’s intention information only when appearance cues are insufficient to interpret the pictorial symbol. Children’s tendency to take a realist approach (Freeman & Sanger, 1995) when interpreting pictures is consistent with a possible lack of experience being prompted to use intentional information to interpret pictorial symbols. Traditional joint picture-book reading sessions involve parents asking children to recognise the content of a picture by naming them (Fletcher & Reese, 2005) or pointing out the referent’s features or functions (e.g., "people live in houses") (DeLoache & DeMendoza, 1987; Gelman, Chesnick, & Waxman, 2005). As young children have a difficulty holding in mind two representations about the same object (see Jolley, 2010), this may explain further their perceptual bias over intention in interpreting pictures. Nevertheless, in regard to recognising the intentions behind their own drawings even 3- to 4-year-olds can distinguish their drawings of similarly-shaped topics (Bloom & Markson, 1998), and can do so after a 3-month delay when appearance is distinguishable in shape between the participant and another child’s pictures of a similar event (Gross & Hayne, 1999).

Our systematic review also identified a small number of studies (Allen, 2009; Hartley & Allen, 2014, 2015) testing children’s understanding of the artist’s intention in children with ASD. This small body of work revealed a differential route to pictorial understanding than typically developing children as children with ASD show a perceptual bias when matching pictorial symbols to referents, disregarding the artist’s intention. A possible explanation of this is that children with ASD tend to have impairments in understanding their own and others’ mental states (Baron-Cohen, Leslie, & Frith, 1985; Baron-Cohen, 1995; Wellman, 2010, 2017) and symbolic understanding (Preissler, 2006, 2008; Sigman & Mundy, 1987). Nevertheless, one study has reported that children with autism understand intentional actions equally well with typically developing mental age controls, but unlike their typical counterparts lacked the social interest to share these intentions (Broekhof, Ketelaar, Stockmann, van Zijp, Bos & Rieffe, 2015). It is interesting to note further that in case studies on autistic savants gifted in drawing their drawings often show remarkable visual realism, but at the same time these autistic artists rarely show awareness of others’ interest in their work nor do they seek it (see Cox, 2005; Jolley, 2010). Therefore, the perceptual bias towards matching pictorial symbols to referents may be contributed by an inclination towards the visual iconicity of the pictorial-world link that is relatively unaffected by an ability or desire to consider the intentional underpinnings of that link.

While the artist’s intention is rarely acknowledged in autistic samples, the literature shows that typically developing children’s understanding of intention in the A-P relationship progresses to an appreciation of other artist’s attributes (e.g. age, skill, originality and knowledge, mood, style, and sentience) from around 4 to 14 years of age. The ‘unpacking’ of these attributes from intention resonates with theory of mind research where a consistent pattern of order of acquisition has been established. An understanding of intentions develops first (Meltzoff, 1995; Camaioni et al., 2004), then an understanding of desires develops, followed by understanding beliefs (Wellman & Liu, 2004). It makes logical sense that one acknowledges first the mind behind a behavioural product (e.g., an action or picture), and then over time one unveils further attributes from the intentional mind.

In respect of the developmental unpacking of the A-P relationship our systematic review shows that children’s understanding of the link between an artist’s age and skill with their picture seems to be the first to develop. In experimental studies the link has been shown reliably between the ages of 4 and 7 (Callaghan & Rochat, 2003; Cox & Hodsoll, 2000; Goodnow et al., 1986; Trautner et al., 1989; Tryphon & Montangero, 1992), with further developments up to the age of 16 in interview-based studies (Freeman & Sanger, 1995; Gardner, Winner, & Kircher, 1975; Gillie et al., 2016; Hart & Goldin-Meadow, 1984; Rodway et al., 2016; Rostan, 1998).

Children’s understanding of originality and knowledge seems to develop in mid-childhood. It is not until around 7 to 8 years of age that children consistently take into consideration the artist knowledge (or lack of) in naming the picture, with younger children’s deferring to the picture’s appearance (Browne & Woolley, 2001; Richert & Lillard, 2002). Nevertheless, younger children seem sensitive to artist’s borrowing ideas from other artists (Li et al., 2013; Olson & Shaw, 2011; Yang et al., 2014). From 5 years of age, cross-cultural studies suggest that children have negative views on artists copying other people's pictures, and from age 6, they are more likely to value pictures they have produced themselves if they included their ideas. This is consistent with the wider literature suggesting that from the age of approximately 6-years children apply rules about ownership not only to objects but to ideas as well (Shaw, Li, & Olson, 2012). Therefore, it seems that children may develop the concepts of originality of an artist's ideas earlier than acknowledging what the artist is able to draw based on their knowledge. The one interview study examining children’s understanding of the benefits of originality over plagiarism (Gilli et al., 2016) found that some 8- and 10-year-olds’ understanding of this includes the artist expression of their own ideas. This suggests that interview studies carried out with older children who have more developed linguistic expression can provide richer information to underpin developmentally earlier experimental findings.

With regards to mood, although experimental studies have shown children as young as 5 years can match the mood of an artist to that shown in a picture (Callaghan & Rochat, 2003), children up until the age of 11 will still prefer to match pictures on subject matter rather than mood (Jolley & Thomas, 1995). Furthermore, even though by preadolescence children do acknowledge potential link between their artists’ mood and their pictures, they express a bias against pictures showing a negative mood (Freeman & Sanger, 1995). The development from younger children’s focus on the subject matter of pictures (and the bias towards ‘positive’ content) to a primary interest in artists’ expression in pictures is consistent with Parsons’ (1987) findings from semi-structured interviews, where children, adolescents and adults were asked to respond to a variety of paintings. Style and sentience showed a similar developmental pattern: children can sort pictures according to the artist’s style from age 6 (Callaghan & MacFarlane, 1998) and distinguish human from non-human creations from age 5 (Callaghan & Rochat, 2003), but only begin to demonstrate their understanding of sentience and style through interviews from 8 to 12 and from 14 to 16 years old, respectably (Gardner et al., 1975). Finally, only one unpublished study investigated children’s understanding of the link between the artist’s gender and pictures, suggesting this has developed by the age of 14 years (Bloomfield, 2015).

Altogether, our systematic review suggests that once the child has a rudimentary understanding of the role of an artist’s intention in the outcome of a picture, shown around 2 years of age with appropriate experimenter and procedural support, there seems to be a consistent developmental pattern to how other artist’s attributes are expressed through intention. In the period from 4 to 8 years children show an understanding of the artist’s age, skill, originality and knowledge and how this can impact a picture. This is consistent with Walker and Gopnik’s (2013) summary of the evidence on children’s understanding of causality: by 2 years of age children begin to provide causal explanations for physical phenomena and the actions of others, which develops increasingly through middle childhood to include abstract properties of causal influence. However, from our review it seems that it is not until preadolescence and throughout adolescence that children spontaneously consider artists’ mood, style and sentience, although experimental studies focusing on these aspects do show developmentally earlier rudimentary evidence of these attributes. A plausible explanation for this is that experimental studies are directly designed to reveal and even enhance both explicit and implicit knowledge of aspects of pictorial understanding to the child, while interview studies only disclose children’s explicit knowledge on the factors which affect the pictorial outcome (Callaghan & Rochat, 2003, 2008). While interview studies might show an apparent delay in understanding many aspects of the artist-picture relationship compared to experimental studies, they do indicate that it is not until preadolescence that children begin to spontaneously consider how pictures might be affected by attributes of the artist beyond mere intention. As the traditional pictorial development theories (e.g., Gardner & Winner, 1982; Parsons, 1987) were based on semi-structured interviews, it is not surprising that interview-based findings are more aligned with their assertions than experimental-based data.

In line with Freeman’s (1995, 2008) assertions on the interdependency between all four elements of his intentional net (i.e., the picture, the world, the artist and the beholder), knowledge of children’s and adolescents’ understanding of the A-P relationship is likely to have implications for their comprehension of the P-W and the P-B links. As our review has shown, children’s developing understanding of the artist’s intention helps them move beyond naming a picture simply on its P-W relationship based on appearance, but to what the artist intended it to be. Furthermore, developing an understanding of the artist’s mind behind a picture enables an opportunity to analyse the communicative characteristics beyond merely their relationship to real-world referents, but to include the mental state of the beholder. This is likely to facilitate children’s understanding and use of pictures as symbols (Allen, 2009; Callaghan & Anton, 2004; Egyed & Szalai, 2016; Preissler & Bloom, 2008; Salsa & Vivaldi, 2016; Vivaldi & Salsa, 2014), but also to acknowledge that other beholders will interpret the same picture differently because of their own apprehension of the mentalistic aspects of artists.

 We now turn our attention to the limitations of the literature, followed by suggestions for future research directions. The design of the studies included was heterogeneous, and, consequently, comparison between studies was challenging. This was particularly true for the data on children’s understanding of the A-P link that were derived from studies designed primarily with an alternative purpose, but which none the less included relevant data. In addition, studies not only varied in methodology and data analysis but were derived from samples mostly based in North American and Western Europe settings (33; 79%). For instance, only one cross-cultural study was found (Yang et al., 2014), and therefore there is still scarce evidence to suggest to what extent the development of the reported findings is universal.

Further research on cultures and other environments with limited exposure to pictures is likely to demonstrate a developmental delay in an initial understanding of pictures as intentional products created by artists. There is cross-cultural evidence of a potential developmental delay in infants understanding the picture-world (P-W) distinction if they live in a community with limited exposure to pictures (Callaghan, Moll, Rakoczy, Warneken, Lizkowski, Behne & Tomasello, 2011; DeLoache, Pierroutsakos, Uttal, Rosengren & Gottlieb, 1998; Walker, Walker & Ganea, 2013). Furthermore, very young children in lower SES homes where there are fewer pictures and mother-child interactions with pictures show poorer understanding of drawing-referent relations compared to similar aged children from middle SES homes (Salsa & Gariboldi, 2018; Salsa & Vivaldi, 2017). It would not be surprising, therefore, that in sparse or poor pictorial environments - whether culturally or economically determined – that understanding the artist’s intentional mind and attributes that underpin pictures is similarly delayed.

The literature also shows an age bias as the majority of the artist’s attributes have not been tested in a wide range of age groups, with the majority of studies testing preschool and preadolescent children. Consequently, there is still not enough evidence regarding the developmental patterns of those abilities, particularly through the adolescent years. Similarly, only four studies investigated children’s and adolescents’ inferences on both themselves and another person as artists, with a lack of consistency within this small body of work as to whether it is easier for children to infer their own mental states as artists than others as artists. Future research examining this question would also usefully investigate whether children come to understand their own versus other artist’s intentional relationship with pictures in different ways. Indeed, a similar suggestion has been made to apply to children’s developing understanding of their own and others’ false beliefs (Brandt, Buttelmann, Lieven & Tomasello, 2016).

Not only is research on children’s understanding of attributes of the artist other than intention scarce, there is no previous literature on their understanding of the possible link between an artist’s personality, SES, intelligence, religious and cultural background. Yet, there is a general agreement among researchers about the impact of cultural background, personality and intelligence makes on an artist’s drawing (for a review, see Jolley, 2010), and how drawings are influenced by religious affiliation and education (Brandt, Kagata Spitteler, & Gillièron Paléologue, 2009; Dandarova et al., 2016). A significant body of work has been published informing us of children’s developing understanding of the artist-picture relationship both before and since the original publication of Freeman’s pictorial understanding theory (1995, see also Freeman, 2008) over 20 years ago. Nevertheless, further research needs to go beyond studying the artist’s intention as an overarching construct to examining the particular intrinsic and extrinsic attributes of artists that influence the artist’s intention, and hence their pictorial outputs. Methodological studies that target children’s understanding of these intrinsic (e.g. age, skill, knowledge, originality, mood, style, sentience) and extrinsic (e.g., SES, culture and religiosity) attributes would produce an integrative framework of children’s understanding of the artist-picture relationship. Although it is expected that cross-sectional designs would provide the bulk of the research, longitudinal studies on the more fundamental attributes of artists could provide essential data of children’s developmental understanding of these attributes and their corresponding relationships.

Experimental studies which show what children are able to understand, particularly when scaffolded, would inform us on children’s understanding of artist’s attributes and their influence on pictures under optimum conditions. Nevertheless, it is clear from the research reported in this systematic review that there is an unambiguous developmental difference between children’s understanding when primed in tasks requiring simple pointing and verbal naming responses, compared to more unconstrained conditions where the child is required to provide more self-initiated and complex verbal responses. In their review of mixed methods research in developmental psychology, Yoshikawa, Weisner, Kalil and Way (2008) argue that this approach is particularly useful where apparently incongruent findings are being reported from the two different approaches. The lack of a mixed methods approach has no doubt restricted a more coherent account on children’s developing understanding of the artist-picture relationship. In particular, we recommend that future research includes a mixed-methods approach, where we expect that quantitative data would inform on developmental milestones, their prevalence, direction and size of effect, while qualitative data could explain the nature, quality and causal mechanisms of the development of understanding.

Any analysis of children’s understanding of the A-P relationship needs to investigate further its influence from and to other developmental milestones in the child’s psychological development. Those which are most likely to be relevant are the development of a Theory of Mind (e.g., Browne & Woolley, 2001; Callaghan & Rochat, 2003; Richert & Lillard, 2002) and the child’s own drawing developmental level (e.g., Jolley et al., 2000). In respect of the potential role of drawing production, Jolley and Rose (2008) reported data showing a significant association between the children’s own drawing level and an understanding of developmental change in drawing, even with age partialled out. This understanding of developmental change included acknowledging intrinsic factors of the artist (e.g. maturation, application and enjoyment). Therefore, children’s critical reflection on their own drawing development may promote an understanding of how artists convey their intentions and other attributes (e.g. through developing age and skill) to their picture making.

Further investigation into the roles of training (e.g., Silverman et al., 1976) and adult scaffolding (Allen, 2009; Callaghan & Anton, 2004; Egyed & Szalai, 2016; Gardner et al., 1975; Preissler & Bloom, 2008; Salsa & Vivaldi, 2016; Vivaldi & Salsa, 2014) would provide a social context of how understanding the A-P relationship develops within psychological milestones in childhood. Art education provides an optimum setting in which children’s understanding of the artist-picture relationship can be facilitated. For instance, as the mentalistic aspects of pictures affects intuitive art judgments in lay adults (Jucker & Barrett, 2011), critical discussions with children about the mind behind pictures could promote art appreciation from early in development as well.

As important as the artist-picture relationship is to the framework of pictorial understanding it nevertheless has to be seen within the wider context of the other relationships within the framework, particularly in connection with the world and the beholder. We are unaware of any systematic reviews of any of the other relationships between the elements of the framework, and conducting such reviews would be a good starting point before a model of children’s framework theory of pictures can be envisaged. Furthermore, research that took a broader conception of pictures than considered in this review, which would include photographs and maps, would illuminate both the similarities and differences in children’s understanding of pictures between different formats and purposes. The paucity of research in this area on only one atypical population (autistic spectrum disorder) suggests a widening focus on different atypical populations.

Such research could be driven by the qualitative difference versus developmental delay debate, and findings related potentially to the characteristics of the disorder or syndrome. For instance, one might expect that children with specific and non-specific learning difficulties perform similarly to typically developing younger (mental age) controls - indicating a developmental delay commensurate with mental age - but that children with autism have an additional impairment due to their deficit in inferring mental states (a qualitative difference). Earlier in our discussion we commented that the developmental progression of understanding intentions-desires-beliefs in typically developing children in theory of mind research has similar connotations to the unpacking of understanding artist’s attributes from intention in pictorial understanding. It would be interesting to see whether this developmental progression from understanding intention to artist’s attributes is found in atypical populations generally. Autism in particular may display atypical variations, as has been reported in their developmental understanding of theory of mind (Peterson, Wellman & Liu, 2005).

In conclusion, this systematic review of 42 articles revealed an interesting developmental pattern in pre-adults’ understanding of the A-P link: that children first acknowledge intention and only later become more aware of how artist’s attributes are communicated through intention. The underrepresentation of research on the development of understanding how artist attributes, beyond intention, influence a picture needs to be addressed. Further specific lines of enquiry have been offered as future directions, that once carried out will form a foundation for a theoretical model of children's understanding of the artist-picture relationship. Furthermore, this model needs to coordinate with research on other relationships in the intentional network, and with other relevant milestones (e.g. theory of mind, drawing production) that children and adolescents reach.

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Footnotes

1 Google Scholar (1995 – November 2019)

Figures

*Figure 1*. Freeman’s intentional network theory.

 *Figure 2*. PRISMA flow diagram.

**Appendix**

Characteristics of studies included.

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| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
| Allen, 2009 | United Kingdom | English | To examine ASD children's understanding of the intention behind abstract drawings | 6 to 11 | Child participant and other | Intention | Quantitative | Cross-sectional study; Special population | 2 | Drawing | Mixed | ASD children are unable to use the eye gaze of an artist as a cue to their intention but they can name their own pictures according to what they meant to represent |
| Allen *et al*., 2016 | United Kingdom | English | To examine to what extent children, commit to the artist's intention when naming ambiguous pictures | 4 and 6 | Other | Intention | Quantitative | Cross-sectional study | 3 | Drawing | Ambiguous | Both age groups showed evidence of flexibility in considering a picture could represent two alternative perceptually similar referents, while thinking the picture is still consistent with the artist’s intention.  |
| Armitage and Allen (2015) | United Kingdom | English | To examine if children favour appearance or intention when they interpret pictures | 3 to 4 and 5 to 6 | Other | Intention | Quantitative | Cross-sectional study | 3 | Drawing | Mixed | Children name pictures according to the artist’s intention only with perceptually ambiguous pictures |
| Bloom and Markson (1998) | United States | English | To examine whether children name pictures based on intention and analogy | 3 and 4 | Child participant and other | Intention | Quantitative | Cross-sectional study | 1 | Drawing | Mixed | Children can name identical-shape pictures based on their intention as artists. They can also use size and oddity  |

**Appendix** (Continued)

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
|  |  |  |  |  |  |  |  |  |  |  |  | as cues to another artist's intention |
| Bloomfield, 2015 | United States | English | To examine whether gender stereotypes affects adolescents’ understanding of pictures as made by a male or a female | 14 to 18 | Other | Gender | Mixed | Cross-sectional | 1 | Painting | Mixed | Gender stereotypes affects the way adolescents interpret artworks |
| Browne and Woolley, 2001  | United States | English | To examine to what extent children name pictures on the basis of the artist's intention and knowledge | 4 and 7 | Other | Intention and knowledge | Quantitative | Cross-sectional study | 2 | Drawing | Mixed | Children name pictures according to appearance when pitted against intention. Older children use the artist's knowledge when naming pictures. |
| Callaghan and MacFarlane*,* 1998 | Canada | English | To examine whether children can reason about the artist's style | 6 and 9 | Other | Style | Quantitative | Cross-sectional study | 1 | Painting | Mixed | Children from age 6 are able to match pictures with other ones that looked they were made by the same artist. |
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**Appendix** (Continued)

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| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Callaghan and Rochat, 2003 | Canada | English | To examine whether children can infer the age, sentience, affective style and emotion of the artists from their pictures. | 2 to 7 | Other | Age; Mood; Sentience | Quantitative | Cross-sectional study | 3 | Drawing | Mixed | Children from age 4 can infer the artist’s age; children from age 5 can discriminate a picture made by a human from another one made by a machine and judge the impact of artist's emotions in pictures. Their performance correlated with ToM skills. |
| Callaghan and Anton, 2004 | Canada  | English | To examine the effects of modelling referential intentions in children’s production and use of drawings | 3,5 and 7 | Child participant | Intention | Quantitative | Cross-sectional study | 1 | Drawing | Representational | All children produced and used functional pictures when an adult modelled referential intention directly. |
| Carothers and Gardner,1979 | United States | English | To examine whether children can infer how an artist would complete their drawings. | 7, 10 and 12 | Other | Style | Quantitative | Cross-sectional study | 1 | Drawing | Representational | By age 10, children are able to choose a drawing to complete an unfinished version of a drawing based on the artist’s style. |

**Appendix** (Continued)

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| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
| Coxand Hodsoll., 2000  | United Kingdom | English | To examine whether children can seriate HF drawings of increasing complexity according to the artist’s age, and whether they can vary their own drawings for how they drew when they were younger and how they would draw in the future | 5 and 7 | Other | Age | Quantitative | Cross-sectional study | 1 | Drawing | Representational | Seven-year olds, but not five years olds, were able to successfully match pictures with the artist's age. While both 5- and 7-year-olds made quantitative changes to their ‘present’ and ‘future’ drawings, only 7-year-olds made qualitative changes as well. |
| Echeniqueet al., 2014  | Argentina | English and Spanish | To examine which aids children consider helpful to become skilful at drawing a human figure | 6, 8 and 10 | Child participant | Skill | Quantitative | Cross-sectional study | 1 | Drawing | Representational | Children considered drawing from another drawing, a photograph, a live model or from imagination equally helpful to become better artists |
| Egyed and Szalai, 2016 | Hungary | English | To examine whether children can use picture to solve an object-retrieval task when the intentional  | 2 | Other | Intention | Quantitative | Cross-sectional study | 2 | Drawing | Representational | Two years old children were able to use pictures to solve the object-retrieval task when the intentional dimension of  |

**Appendix** (Continued)

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| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
|  |  |  | dimension of pictures is highlighted. |  |  |  |  |  |  |  |  | pictures was highlighted. |
| Freeman and Sanger, 1995 | United Kingdom | English | To examine children's understanding of the role of the artist and the viewer in pictorial symbols. | 11 and 14 | Other | Mood; age; skill | Quantitative | Cross-sectional study | 1 | Not Applicable | Unspecified | Only 14 years old were able to grasp the link between the artists’ skill, age and mood and their picture. |
| Gardner *et al*., 1975  | United States | English | To examine children's views of where art comes from and how art is evaluated. | 4 to 16 | Other | Sentience, skill, style | Mixed | Cross-sectional study | 1 | Painting | Unspecified | Only adolescents demonstrated a mature understanding of the human source of pictures and that artists have individual style.  |
| Gelmanand Ebeling, 1998 | United States | English | To examine whether children were more likely to label ambiguous shapes as representations if told they were intentionally rather than accidentally produced. | 2 to 4 | Other | Intention | Quantitative | Cross-sectional study | 2 | Drawing | Ambiguous | Two and 4-year-old children were more likely to name ambiguous shapes if told they had been intentionally produced.  |
| Gilli, *et al*., 2016  | Italy | English | To examine whether children consider the artist's intention to display  | 5 to 10 | Other | Intention; originality; skill | Quantitative | Cross-sectional study | 3 | Painting | Representational | Children from age 5 children demonstrated negative views on forgery |

**Appendix** (Continued)

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| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
|  |  |  | pictures to others, how art should be judged, and whether they judge an original picture better than a fake one |  |  |  |  |  |  |  |  |  |
| Goodnow et al., 1986 | Australia | English | To examine whether children can discriminate drawings according to the artist's age | 4,5,7,9 and 11 | Other | Age | Quantitative | Cross-sectional study | 1 | Drawing | Representational | Children from age 7 attribute which picture from pairs of drawings was made by an older child  |
| Gross and Hayne, 1999 | New Zealand | English | To examine whether children can recognize and describe the intention behind their drawings after a delay | 3 to 5 | Child participant and other | Intention | Quantitative | Longitudinal | 2 | Drawing | Mixed | Children from age 3 can recognise the intention behind their drawings after a delay. |
| Guruzhapov*,* 2006 | Russia | English | To examine whether children's art interpretation corresponds to cultural norms for art appreciation | 7 to 7.5 | Other | Intention | Qualitative | Cross-sectional study | 1 | Painting | Representational | Seven-year-old children elaborated on what artists might have felt about their work. |
| Hart andGoldin-Meadow, 1984 | United States | English | To examine children's evaluations of drawings for  | 3, 5 and 7 | Other | Skill | Quantitative | Cross-sectional study | 1 | Drawing | Mixed | Both 5- and 7-years old children tended to justify their answers on the quality of the artist's work |

**Appendix** (Continued)

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| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
|  |  |  | their own personal likes and for somebody else's likes |  |  |  |  |  |  |  |  |  |
| Hartley and Allen,2014 | United Kingdom | English | To examine whether TD children and ASD children interpret abstract pictures on the basis of the artist's intention. | 2 to 5 (TD); 5 to 13 (ASD) | Other | Intention | Quantitative | Cross-sectional study; Special population | 3 | Drawing | Abstract | TD children name abstract pictures on the basis of referential intentions while ASD children name them on the basis of shape. |
| Hartleyand Allen, 2015 | United Kingdom | English | To examine whether TD children and ASD children interpret pictures differently when presented as intentional symbols through naming and drawing tasks. | 2 to 5 (TD); 4 to 16 (ASD) | Other | Intention | Quantitative | Cross-sectional study; Special population | 1 | Drawing | Ambiguous | Referential intention only affected TD children performance; ASD tended to produce drawing consistent with their verbal responses. |
| Jolley and Thomas, 1994 | United Kingdom | English | To examine children's understanding of the emotion portrayed in abstract paintings. | 4, 5, 7, 8, 11 | Other | Intention | Quantitative | Cross-sectional study | 1 | Painting | Abstract | Some children relied on the artist's intentions to justify their answers. |
| Jolleyand Thomas,1995 | United Kingdom | English | To examine children’s sensitivity to  | 5 to 17 | Other | Mood | Quantitative | Cross-sectional study | 1 | Drawing | Representational | Although all participants recognised mood, only adults used mood to justify their  |

**Appendix** (Continued)

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
|  |  |  | metaphorical expression of mood in drawings |  |  |  |  |  |  |  |  | selection of drawings in a matching task. Children tended to use subject matter. |
| Jolleyet al., 2000 | United Kingdom | English | To examine if children can identify a drawing made by an artist who draws like him/her and to examine whether they can sort an array of pictures according to the artist's age | 2 to 14 | Other | Age | Quantitative | Cross-sectional study | 2 | Drawing | Mixed | Performance was related to production skills. Conventional artists were able to identify a picture of their own production level and sort pictures according to developmental sequence. Selection was in advance of own production level and ability to sequence drawings related to own production level. |
| Li et al., 2013 | United States | English | To examine whether children value ideas over labour when interpreting an artist's picture | 4 and 6 | Other | Originality | Quantitative | Cross-sectional study | 1 | Drawing | Unspecified | Six years old children favour ideas over labour when judging pictures |
| Malin, 2013 | United States | English | To examine children's perceptions of their own art making | 1st to 5th grade students | Child participant | Intention | Qualitative | Ethnographic | 1 | Unspecified | Unspecified | By talking about the intentions behind their drawings, children connect with inner lives with their social and cultural context |
| O’Hareand Cook, 1983 | United Kingdom | English | To examine children's  | 6 to 11 | Other | Style | Quantitative | Cross-sectional study | 1 | Drawing | Representational |  |

**Appendix** (Continued)

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| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
|  |  |  | awareness of the artist's different uses of colour. |  |  |  |  |  |  |  |  | Children showed awareness to an artist's different uses of colour from age 9. |
| Olson and Shaw,2011 | United States | English | To examine children's responses to plagiarism in pictures | 3 to 11 | Other | Originality; Knowledge | Quantitative | Cross-sectional study | 3 | Drawing | Unspecified | By age 5, children favour originality over copying ideas when judging pictures. |
| Preissler and Bloom, 2008 | United Kingdom | English | To examine whether children can use a non-linguistic cue to the artist's intention (eye gaze) to match a symbol with its referent. | 2.5 | Other | Intention | Quantitative | Cross-sectional study | 2 | Drawing | Ambiguous | Two and half years old children are sensitive to the artist's eye gaze when interpreting pictures. |
| Rantala, 1997 | Finland | English | To examine adolescents' narrative identity through their own graphic productions. | 13 to 18 | Adolescent participant | Intention; Mood | Qualitative | NA | 1 | Drawings and Paintings | Unspecified | Adolescent demonstrated art is a means to retrieve and produce knowledge about themselves and the world. |
| Richert and Lillard, 2002 | United States | English | To examine whether children take into account the artist's knowledge and intention when naming pictures. | 3 to 8 | Other | Knowledge | Quantitative | Cross-sectional study | 2 | Drawings and Paintings | Representational | Children's understanding of the relationship between the artists’ knowledge and their pictures develops from age 4 and increased gradually to age 8. |
| Rodwayet al., 2016 | United Kingdom | English | To examine children aesthetic judgments of  | 4, 6, 8 and 10 | Other | Intention; Skill | Quantitative | Cross-sectional study | 1 | Painting | Mixed | Children from age 8 referred to the artist's  |

**Appendix** (Continued)

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| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
|  |  |  | abstract and representational drawing. |  |  |  |  |  |  |  |  | intention and skill when justifying aesthetic preferences. |
| Rostan, 1998 | United States | English | To examine children's emerging artistic and creative identity through discussing their own paintings. | 8 to 11 | Child participant | Intention; Skill; Mood | Mixed | Cross-sectional study | 1 | Painting | Unspecified | Children's conceptions of what it means to be an artist and to be creative reflected their artistic focus which in turn reflected their artistic development. |
| Salsa and Vivaldi, 2016  | Argentina | English | To examine the differential impact of linguistic (verbal scripts) and non-linguistic (graphic demonstration) cues to the artist's intention when children interpret pictures. | 2 and 2.5 | Other | Intention | Quantitative | Cross-sectional study | 2 | Drawing | Representational | Two years old children are sensitive to linguistic cues to the artist's intention when matching a symbol with its referent. Two-and-a-half-year-old children can do it in the absence of cues. |
| Scheuer et al., 2010 | Argentina | Spanish | To examine children's perceptions of the own trajectory as drawers by asking them to draw a human figure as they  | 6, 9 and 12 | Child participant | Age; Skill | Quantitative | Cross-sectional study | 1 | Drawing | Mixed | Children demonstrate an awareness of their development as drawers by depicting simple figures in their drawings of the past and incorporating  |

**Appendix** (Continued)

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| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
|  |  |  | used to in the past and to do it and they think. they would in the future. |  |  |  |  |  |  |  |  | new and more complex elements. in the drawings of the future |
| Silverman et al.,1976 | United States | English | To examine whether children can discriminate paintings based on artistic style after training. | 10 | Other | Style | Quantitative | Cross-sectional study | 1 | Painting | Mixed | Ten-year-old children can discriminate based on artistic style after 7 weeks of training. |
| Trautner et al., 1989 | Germany | English | To examine whether children can infer the artists’ age from their pictures. | 5 to 10 | Other | Age | Quantitative | Cross-sectional study | 1 | Drawing | Mixed | Even 5-year-old children can classify drawings based on the artist's age. |
| Tryphon and Montangero, 1992 | Switzerland | English | To examine whether children can infer the artists’ age from their picture and their perceptions of the own trajectory as drawers by asking them to draw a human figure as they used to in the past and to do it and they think they would in the future | 6 to 11 | Child participant and other | Age | Quantitative | Cross-sectional study | 1 | Drawing | Representational | While 6- and-7-year-olds made quantitative changes to their ‘past’, ‘present’ and ‘future’ drawings, children aged 10-11 made qualitative changes to their depictions. Even 6-7 were able to seriate pictures to the age of their artists. |
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**Appendix** (Continued)

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| First author, Year | Country | Language | Aim of study | Age of participants(in years) | Artist | Artist's attribute | Methodology | Study design | Number of relevant studies | Picture type | Picture style | Findings |
| Vivaldi and Salsa, 2014 | Argentina | Spanish | To examine whether children use both non-linguistic cues (graphic demonstration) and linguistic cues (verbal scripts) to the artist's intention when matching a symbol with its referent. | 2 and 2.5 | Other | Intention | Quantitative | Cross-sectional study | 2 | Drawing | Representational | Two-year-olds can match a picture with a symbol when provided with cues to the artist's intention. |
|  |  |  |  |  |  |  |  |  |  |  |  |  |
| Yang et al., 2014 | United States; Mexico; China | English | To examine the effect of cultural background in children's responses to plagiarism when watching other people draw | 3 to 6 | Another person | Originality | Quantitative | Cross-sectional study | 1 | Drawing | Representational | Children from all three cultural backgrounds are sensible to the artist's originality when judging pictures by age 5. |