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Drawing production, drawing re-experience and drawing re-cognition

The maxim 'Children draw what they know, rather than what they see' is a formative and recurring topic in the study of children's art. This characteristic, implying a communicative or expressive function for children's drawings, has led many to reason that early artwork can be used to study cognitive development. Study of the psychology of children's drawings is now in its second century (key works include; Ricci, 1887; Kerschensteiner, 1905; Luquet, 1913; Eng, 1931; Harris, 1963; Kellogg, 1970; Goodnow, 1977; Freeman, 1980; Cox, 1992; Lange-Küttner and Thomas, 1995). A substantial body of work has concerned the expression - or 'projection'- of emotions in children's art (for a summary see Burkitt, Barrett & Davis, 2003). The intellectual correlates of drawing ability have also been repeatedly examined (Harris, 1963; Bensur, Eliot and Hedge, 1997). However, the bulk of literature regarding children's drawings has focused on the ontogenetic development of drawings as graphic representations.

Common to the developmental accounts of drawing advanced by modern theorists (Kellog, 1970; Goodnow, 1977; Freeman, 1980; Cox 1992) and their predecessors (Kerschensteiner, 1905; Luquet, 1913; Eng 1931) is the proposal that children's drawings develop in a conventional way, building toward the representation of perceptual reality. Kerschensteiner (1905) offered the first detailed stage theory of drawing based on a massive sample of almost 300, 000 drawings produced by school children. The schematic development of drawing was further

qualified by Luquet (1913) and Eng (1931) following the longitudinal study of individual children. Each of these theorists emphasise the child's path to attainment of conventional drawing skills, advancing graphic expression from an exercise in motor skill to a representative product. Later, Kellogg (1970) proposed that young children's drawings begin with pre-representational graphic elements, reflecting a common perceptual experience of reality (i.e. geometric shapes), which are gradually modified until representational drawings are produced (e.g. circles for heads). Freeman (1980), focuses on children's acquisition of specific techniques used to plan drawing performance and overcome misleading perceptual cues (e.g. the representation of occluded objects). Similarly, Goodnow (1977) and Cox (1992) give comprehensive descriptions of the sequence of veridical errors (e.g. missing or misassembled features) and achievements (e.g. the grasp of proportion and perspective) which typify children's drawings at each developmental stage.

As noted, the developmental psychologist's focus on perceptual reality may be motivated by the view that representations of reality express knowledge, i.e. what the child knows about the world. However, although considerable consensus has been reached regarding the ontogenetic development of objective reality (the outside world) in terms of its appearance on paper, qualification of what this appearance means in terms of the child's subjective reality (the inside world) has been less explicit. Drawing topics (e.g. family drawings) and devices (e.g. relative size, colour) have historically been considered expressive of emotional state (Burkitt, Barret & Davis, 2003). However, less attention has been given to the idea that drawing schemes may be expressive of children's cognition regarding the drawing topic. Perhaps the most striking evidence in support of this statement is the observation that

only a handful of experiments in the history of children's drawings research have employed children, as opposed to adults, in the evaluation of their own and/or other children's drawings.

An early study consulting children about their drawings was carried out by White and Johnson (1930). They reported that children under the age of five were more successful in naming the subject matter of drawings produced by their peers than interpreting the paintings of masters such as Monet and Picasso. Stacey and Ross (1975) later extended this result, demonstrating that young children are capable of making cognitive evaluations of drawing ownership. In this study, five- to seven-year-old children were asked to recognise their own drawing from a set of twenty similar drawings produced by their peers. 73% of the sample were able to recognise a drawing that they had produced one week earlier, and 60% were able to recognise a drawing produced five weeks before. This rate of success is notably high given the high number of matched topic distracter drawings present at the recognition stage.

Nolan, Kagan and colleagues (1980a; 1980b; 1981) ran a series of studies which confirm that children are capable of recognising their own products under challenging conditions. In their studies, young children were asked to identify four drawings that they had made a week earlier of a bird, flower, man and tree. During the test phase, each drawing was presented to the child together with three foils produced from the original and altered to vary from it in small aspects of size, detail and perspective. Despite high levels of similarity between distracter drawings and their original product, children as young as four and a half years of age were typically able to identify over a third of their own drawings (Nolan, Adams and Kagan, 1980a).

Nolan and Kagan (1980b, 1981) reported equivalent success rates for children aged between two and a half and three and a half years. These success rates are marginally higher than the quarter of correct identifications predicted by chance.

Interestingly, Nolan and Kagan (1981) found children's memories for others' drawings to be similarly impressive. When children were asked to recognise peers' drawings which they had been shown, encouraged to label and memorise one week earlier, they were again successful on over a third of occasions. However, Nolan and Kagan (1981) found no correlation between the recognition tasks for own versus others' drawings. Further, the correlations between recognition success and age, and recognition success and cognitive ability (as measured by the 1975 Winett Preschool Inventory) that were present for own drawings, were not apparent for performance regarding others' drawings. The authors took this to suggest that recognition of own and others' products may rely on cognitively different processes.

Gross and Hayne (1999) have provided the most recent evidence concerning children's memory for drawings, reporting that children are capable of recalling drawing episodes following substantial delays. They asked three- to six-year-old children to draw and describe three pictures depicting what happens during a birthday party, a trip to the park, and visit to the supermarket. Later, the children were asked to recognise their birthday party drawing when placed alongside two similar drawings produced by their peers. Using this paradigm, Gross and Hayne (1999, Experiment 1A) found that 60% of three- to four-year-olds were able to recognise and correctly interpret aspects of their drawing up to three months after drawing production. Five- to six-year old children performed at ceiling in recognising their birthday party

drawings up to six months following production. Moreover, Gross and Hayne (1999, Experiment 1B) subsequently demonstrated that the vast majority (90%) of five- to six-year-old children were capable of correctly identifying a drawing of a class-outing when presented with two similar distracters made one year before.

In an effort to determine the importance of drawing production for later recognition, Gross and Hayne (1999, Experiment 2) ran a further experiment comparing children's memory for their own versus a peer's drawing of an emotional event (a time when they were happy, sad, or scared). After making their own drawing, children were shown and asked to listen to a description of another child's drawing. To test for recognition, these drawings were presented separately after a delay of three months alongside two similar 'distracter' drawings. Interestingly, although the majority (70%) of three- to six-year-old children were capable of identifying and qualifying their peers' drawing, children were significantly more accurate in identifying their own drawings (90% recognition rate).

As implied by the motivation of Gross and Hayne' s (1999) second experiment, the finding that recognition of others' drawings differs from recognition of own drawings is intuitively viable. When asking children to recognise their own drawings one is asking them to recognise a self-production. Freeman (1972) notes that when producing representative drawings children are required to hold in mind conceptual and perceptual components of the chosen topic, and to physically translate perceptual parts into coordinated graphic schema. By this account drawing production requires cognitive reasoning (in terms of drawing topic, and in terms of the placement of constituent parts relative to other drawing features on the page) in addition to visual

input and motor coordination. Freeman's (1972) analysis makes clear that drawing production implies a level of self-engagement – both physical and cognitive - unparalleled by relatively passive engagement with another's finished product.

In addition to the high level of self-involvement inherent in producing a drawing, it is possible that the finished product is self-reflective in terms of style. Van Sommers (1984) offers extensive documentation of idiosyncrasy and conservatism (or originality and consistency) in the artwork of young children. The presence of style in children's art work has also been demonstrated empirically; adult judges are apparently able to sort sets of drawings provided by children between the ages of three and five years according to artist (Hartley *et al*, 1982; Campbell and Harris, unpublished manuscript). Nolan, Adams and Kagan (1980a) note that appreciation of style would suggest a well articulated conception of subtle aspects of an artist's products. When applied to one's own products, this would entail holding a relatively high order conceptualisation of the self. In support of this mechanism of recognition Nolan and colleagues (1980a, 1980b, 1981) data suggest that young children are sensitive to small changes in the way particular topics are represented.

What recognition studies make clear is that drawings are open to claims of ownership. Whether claims of ownership are based on recognition of style or on memory of the drawing's creation, they are ultimately based on a link between the drawing and the self. For this reason, drawing recognition studies have the potential to reveal recursive self-awareness. Moreover, it seems reasonable that certain drawing episodes are in themselves capable of revealing aspects of self-awareness. For example, the link between drawing production and the self is particularly clear on

occasions where the child is both the producer and topic of the drawing. Self-portraits may be regarded as advanced forms of the mirror test of self-recognition, involving both the recognition of one's external self and the internal maintenance of that image. Although successful graphic representation of the self-image may vary depending on motor ability, a necessary requirement for embarking on such a task is a concept of the self. This reasoning suggests that certain features of self-drawings - for example, levels of differentiation and detail - are likely to reveal the content and/or extent of self-knowledge. In support of this argument, there is evidence for a self-referent bias in figure drawing. Research suggests that between five and seven years of age children consistently include more body features in self-drawings than in drawings of other, presumably less familiar, people (Gellert, 1968).

Empirical substantiation of a link between self-drawings, drawing recognition, and self-awareness may add weight to the historical assumption that drawings offer a route to the child's conceptual (as opposed to perceptual) reality. Following this reasoning, I carried out two studies designed to investigate the impact of the self in the production and recognition of drawings. The methodology and results of each study are described below.

The impact of the self in the production and recognition of drawings

Study One: Exploring the relationship between self-drawings and self-awareness.

The first study aimed to test the hypothesised link between children's self-drawings and their developing self-awareness. Children ranging in age from 3 to 9

years produced a self-drawing, and, to allow comparison between representations of self and other, a drawing of a same sex peer. Drawings were scored for quality according to established guidelines provided by the Goodenough-Harris Drawing test manual (Harris, 1963). This manual describes how drawings accumulate credit based on levels of feature inclusion, realism and motor skill. To provide empirical support for a relationship between the quality of self-representation and self-awareness, two additional measures of 'self-recognition' were included. Firstly, children were required to discriminate their own figure drawings from four distracter figure drawings after a delay of two weeks. Secondly, children's reactions to the introduction of a mirror following completion of a verbal task were observed. Mirror self-recognition is currently the only implicit developmental measure of self-awareness routinely employed (see Bard, this volume). By the age of two children are able to recognise their image, as evidenced by their reaching toward a surreptitiously introduced head-mark on the introduction of a mirror (Amsterdam, 1972). However, behavioural reactions to the self-reflective properties of the mirror also have the potential to elucidate self-awareness later in development.

An intriguing tool for formalising the antecedents and consequents of self-reflection is provided by Duval and Wicklund's (1972) theory of self-awareness. Duval and Wicklund (1972) dichotomise self-awareness according to attentional focus. Attentiveness to feedback from the environment is regarded as "subjective" self-awareness, whilst attentiveness to one's self as an object in that environment is categorised as "objective" self-awareness (OSA). Objective focus upon the self can be induced by stimuli highlighting the self, such as a salient audience or mirror image. The major consequence (and evolutionary advantage) of objective self-reflection is

thought to be self-evaluation, which leads to appropriate behavioural regulation. Dependent on situational factors, Duval and Wicklund (1972) predict that self-evaluation will usually result in a) behavioural adjustment to become consistent with internalised or externalised standards, and/or b) withdrawal from the evaluation-inducing situation. In this way, cognitive and affective equilibrium regarding the self is maintained. Crucially, Duval and Wicklund's (1972) behavioural predictions can be used to develop implicit measurement of self-awareness beyond that indexed by early mirror self-recognition.

Originally it was assumed that OSA would be a negative state, to be avoided. However later work showed that where evaluation of the self meets one's standards, OSA can result in positive affect and may be actively sought (Greenberg and Musham, 1981). In the first study, this positive aspect of OSA was used to create a situation allowing implicit observation of self-aware behaviour. Children were given the opportunity to view themselves in a mirror following a verbal description task with an undefined outcome. Immediately before the introduction of the mirror half of the children were given high levels of praise, and half offered no feedback. All children were then asked to look in the mirror 'to see how well they had done'. It was expected that children given praise would evaluate their performance relatively positively, and therefore spend longer looking in the mirror (remaining comfortable in a mirror-induced state of OSA) than children who received no positive feedback.

Although Duval and Wicklund's (1972) theory has received continued interest and empirical support in the adult literature (see Silvia & Duval, 2001 for a review), their methods have rarely been applied in early developmental research. For this

reason, a supplementary aim of the first study was to elucidate the age at which children behave as though actively self-evaluative. Where mirror behaviour is not systematically affected by feedback, it seems reasonable to assume that OSA is absent.

The results of the first study supported a link between self-representation and self-knowledge. Consistent with Gellert's (1968) finding that children are more adept at representing themselves graphically than representing others, there was a small, but consistent, self-referent bias in figure drawing quality for all age-groups (see Figure 1). Although the quality of self and other figure drawings were positively correlated at 0.90, self-drawings consistently scored more highly than drawings of others on the Goodenough-Harris (1963) drawing scale. The observation that young children employ qualitatively different drawing schemes to represent themselves versus similar others implies that self-drawings are inherently linked to the ability to self-differentiate.

[insert Figure 1 about here]

Moreover, the quality scores for self-drawings, but not other-drawings, were related to self-aware behaviour as indexed by mirror recognition. Even the youngest age-group systematically altered their mirror behaviour as a function of feedback, suggesting they held the sophisticated level of self-awareness described in Duval and Wicklund's (1972) model. Figure 2 shows that children of all ages spent significantly longer in front of the mirror when given praise. However, the more advanced children are developmentally, the less their mirror reactions appear to depend on external

feedback. As shown in Figure 2, the magnitude of the effect of the experimenter's praise decreases with age. These findings suggest that evaluation of the self may first rely on external input before becoming internalised. For this reason, the observation of a child's dependence on external versus internal sources of self-evaluation may provide a relatively fine measure of developing self-awareness.

[insert Figure 2 about here]

Interestingly, the time spent in front of the mirror following praise was significantly *negatively* correlated with self-drawing quality at -0.4. A possible interpretation of this negative relationship is to assume that the waiting times of those with a higher level of self-awareness (as reflected by higher quality self-drawings) were tempered by their own opinion. One's own performance evaluation was likely to be less positive than the experimenter's randomly distributed, over-inflated, praise. As a result, spontaneous self-evaluation would likely encourage relatively early withdrawal from the OSA inducing situation.

In addition to being related to self-drawing quality and ontogenetic development, self-aware mirror behaviours can also be linked to the ability to recognise one's own drawing products. Two thirds of the sample – with representatives from all age-groups - successfully identified both of their own drawings when viewed with distracters after a delay. When considered as a group, these children showed the expected effect of feedback; waiting significantly longer in self-reflective conditions following praise. By contrast, the remaining third of the sample – those who did not recognise their own products – showed no significant

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evidence of self-evaluation as measured by systematic responses to experimenter feedback. The finding that those who fail to show self-evaluative behaviour in classic OSA inducing conditions also fail to successfully evaluate their own products in terms of ownership suggests that the two capabilities may be related.

Study two: Exploring the relationship between drawing ownership and self-awareness

The first study offered some empirical support for the proposal that own drawing recognition is likely to be related to self-awareness. The aim of the second study was to further elucidate this association by investigating whether drawing recognition not only relates but *relies* on self-awareness, i.e. constitutes an act of self-recognition. By increasing sample size and the number of recognition episodes we hoped to provide a more thorough assessment of the development of successful drawing recognition.

3- to 7-year-old children were asked to discriminate their own drawings (including a cup, crocodile, and self-portrait) from five matched-topic distracter drawings after delays of up to four weeks. To further assess the impact of self involvement on drawing recognition, around a third of the children were also asked to identify a peer's cup, crocodile and self-drawing with which they had previous contact. Peers' drawings cannot be considered equivalent to own drawings in terms of planning (choosing how to represent the topic) or implementation (demonstrating one's own drawing style). However, the extent to which one physically engages with others' drawings is easily alterable. To vary this factor children either traced their

peer's drawing with a pencil (active visual and motor input), or viewed the drawing while it was described to them (no motor input or visual mark-making). By separating the physical and cognitive components of drawing production in this way we hoped to compare recognition rates for drawings which had required ascending levels of self-involvement, and thus involved ascending levels of self-recognition.

We also observed the impact of variations in drawing skill on drawing recognition. To provide a global measure of each child's drawing skill we classified self-drawings in reference to Luquet's (1913) popular account of drawing development. Luquet (1913) suggested that children's drawing development proceeds sequentially from non-representational scribbles, to failed or 'pre-conventional' attempts at realism in which a poorly coordinated selection of the constituent parts of the topic is represented, to a schematic and more accurate 'conventional' representation of the topic. These developmental stages imply cognitive and motor advances in representation in terms of the level of realism aimed for and achieved, and can be easily distinguished when viewing human figure drawings provided by children ranging in age from three to seven years (see Figure 3).

[insert Figure 3 about here]

To provide a finer measure of the impact of drawing quality, drawings of all topics were also scored according to a scale inspired by the Goodenough-Harris (1963) draw-a-man test manual. Firstly, drawings attracted credit for the number of features included, for depicting all basic features of the drawing model, and for placing features in the correct place relative to the other features included. Drawings

were also credited for motor skill in reference to a component included in the Goodenough-Harris (1963) manual specifying firm and well-controlled pencil lines (Harris, 1963: 262). Finally, a global judgement of whether or not the finished drawing was clearly representative of the drawing model was made. As the model was no longer present for the case of self-drawings, this post hoc judgement referred to the drawings which clearly depicted a human figure with 'characteristic' features of hairstyle, dress, or other physical appearance. Figure 4 gives examples of high, intermediate and low scoring drawings of each topic. Measurement of the level of drawing skill exhibited in individual products, and by the artist globally, allowed thorough investigation of the proposal that successful representation of a topic may be related to its subsequent recognition.

[insert Figure 4 about here]

The results of the second study allow further qualification of the development of successful drawing recognition. Given the number of distracter drawings present, children had a one in six chance of correctly selecting their own drawing in each recognition episode. Averaged over three episodes, this gives a chance hit rate of 1.5 drawings per individual. Figure 5 shows that although the majority of children performed above chance, recognised two or more of the three drawings they had provided, only a minority of three- and four-year olds achieved this level of success. This effect is in keeping with the age-related improvement in drawing recognition observed by Gross and Hayne, 1999.

[insert Figure 5 about here]

Figure 6 shows that traced drawings were also likely to be recognised after sizeable delays, with the majority of children over the age of 5 years recognising two or more of the three drawings they had previously traced. By contrast, recognition performance for drawings previously only viewed (shown in Figure 7) was very poor. The majority of children recognised one or less of the drawings that they had simply seen, and even by the age of 7 only half of the children achieved recognition success.

[insert Figure 6 about here]

[insert Figure 7 about here]

Direct comparison of recognition rates for drawings encountered in different conditions confirms that the drawing recognition is affected by the level of self-involvement at the production stage (see Figure 8). Children who simply had visual contact with others' drawings were less able to recognise them as successfully as their own productions. However, on average, when children traced others' drawings they later recognised them just as successfully as they recognised their own. Further, those who traced others' drawings appeared to have depressed own drawing recognition rates relative to those who viewed others' drawings. This result can be interpreted as resulting from interference due to an increase in the number of competing *production* episodes.

[Insert Figure 8 about here]

The finding that recognition rates for tracings and original productions were statistically equivalent implies that at this age the conceptual aspects of drawing production are less important for recognition than physical aspects. The observed effect of personal physical input is reminiscent of a self-referent bias found in verbal recall; there is an established mnemonic advantage for action statements that one has performed relative to those one has described verbally, imagined, or witnessed being performed by another person (Engelkamp and Zimmer, 1997). The implication is that the depth of processing involved in physically producing a drawing is enough to secure its subsequent recall, or to interfere with recall of other drawings.

The results discussed so far challenge the hypothesis that drawing recognition relies on recognition of cognitive input, emphasising instead the physical trace of the drawing episode. However, close observation of individual recognition profiles revealed that proportionately more children performed at ceiling when recognising their own drawings (38%) than when identifying previous tracings (17%). This implies that the 'full' drawing experience provides optimal conditions for recognition.

Further, analysis of the relationship between drawing quality and recognition confirms that representative aspects of the drawing process do impact on recognition, showing a correlation of 0.6. There was a significant difference in the number of drawings recognised by scribblers, pre-conventional drawers and conventional drawers, even when controlling for age. Figure 9 shows that children who drew themselves non-representatively - whose mark-making appeared to be purely an exercise in motor skill - were never successful in recognising their own products above the level expected by chance. Around half of children who drew pre-

conventionally were successful, while an impressive majority of conventional drawers recognised two or more of their own drawings. This result confirmed that the *content* of motor input – which is dictated by cognitive engagement during the drawing process – is crucial for subsequent recognition (for further discussion see Riggs, Campbell, this volume).

[insert Figure 9 about here]

The quality scores of individual drawings also had a significant effect on drawing recognition, again, even when controlling for age. Those recognising one or less drawings had significantly lower quality scores (mean 4.3) than those recognising two or three drawings (mean 8.9). Moreover, each individual component of the quality scale was strong enough to predict drawing recognition independently of overall scores. This result confirms that the more articulated and successfully representative the drawing product – as dictated by cognitive-behavioural input - the more likely it is to be recognised.

As may be anticipated, self-drawings were again found to be of consistently higher quality than drawings of other topics. The superior quality of self-drawings is likely to be in part due to children's familiarity with the subject matter. Figure drawings are a popular topic choice relative to crocodile and cup drawings, meaning that a suitable drawing scheme is likely to be readily available. Besides, Study 1 demonstrated that self-drawings are likely to be advanced even relative to other figure drawings. As predicted by the observed relationship between drawing quality and recognition, self-drawings were also recognised more frequently than drawings of

other topic. Despite the confound between drawing topic and drawing quality, it is worth noting that in this study self-drawings had an added advantage at the recognition stage. Distracter 'self' drawings were produced by children of the same age and sex, however, they ultimately referred to different models. As a result, children who successfully represented themselves should have had the opportunity to identify their own drawing via recognition of their own likeness.

In anecdotal support of self-image recognition, several of the children in both the first and second studies pointed out their own characteristic features in self-drawings during the recognition process (see Figure 10). Figure 11 shows an accurate portrait of the author drawn by a six-year-old child and supports the suggestion that young children are capable of capturing likeness in drawings. In empirical support of this strategy, there was some evidence to suggest that recognition of self-portraits relied on qualitatively different processes. In an interesting reflection of the importance of physical self-involvement, linear regression (stepwise) suggested that the component motor-coordination: lines – indicating confident mark-making - was the single most influential quality factor in drawing recognition for both cup and crocodile drawings. For these topics, this factor was more predictive of recognition than the number and accuracy of drawing features included, and the extent to which the drawing was successfully representative. However, for self-portraits being credited as successfully representative of the model was the most influential factor for later recognition.

[insert Figure 10 about here]

[insert Figure 11 about here]

The impact of the self in the production and recognition of drawings

This research offers clear support for the proposal that drawings can be usefully employed to investigate developing self-awareness. In the first study, the quality of self-drawings predicted reactions to self-reflexive media. Those who produced higher quality graphic self-representations were more likely to index self-recognition via mirror behaviours. This result supports the hypothesis that self-drawings are indicative of self-knowledge. Moreover, drawing recognition could also be independently linked to self-awareness; those who failed to index self-recognition in front of the mirror also failed to recognise their own drawings. This finding supports the proposal that the ability to recognise one's own drawing products may be considered an act of self-recognition.

There was some anecdotal and empirical evidence to suggest that children refer to cognitive self-representation not only to produce but also to identify self-drawings. This suggests that self-drawing recognition may be considered a 'specialised' act of self-recognition. However, the second study, which emphasised the importance of drawing production (a self-referent event), confirmed that the link between drawing recognition and self-awareness is not limited to recognition of self-drawings. The level of physical self-involvement in drawing production was shown to affect subsequent drawing recognition rates. Own drawing recognition improved considerably with age, and it appeared that this relationship was mediated by cognitive-behavioural input at the production stage. Drawings which were better

planned and implemented, particularly in terms of topic representation and purposeful mark-making, were recognised more frequently. Most strikingly, children who produced unrepresentative drawings – requiring only minimal levels of cognition – were unsuccessful in claiming ownership of their own products.

Conclusions

This chapter presents and supports the argument that children's drawings have the capacity to reflect conceptual knowledge (what children know) in addition to perceptual knowledge (what they see). In particular, it is suggested that the cognitive and physical demands of drawing production make all drawing episodes self-referent. For this reason, children's retrospective analysis of their own drawings has the potential to reveal their self-awareness. At least in the case of self-drawings, objective analysis of drawing content can also be indicative of self-knowledge.   In the past, content based analysis of children's drawings has allowed valuable comment on the problem-solving processes involved in representing one's 3D reality in 2D. However, by exploring children's drawings in a context based manner, drawing recognition studies make clear that it should also be possible to make the converse journey; inferring children's 3D reality from their 2D productions. Specifically, by exploring graphic self-representation via both self-drawings and retrospective claims of drawing ownership, it may be possible to track the problem solving processes involved in representing oneself cognitively.

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