Chapter 5: Description of Data

Figure 9: Cody (aged 4 years, 9 months): "Worms!"
Introduction

This chapter gives detailed descriptions and transcribed dialogue from the six events chosen from my recorded data to analyse in depth. I have included reproductions of the children’s drawings along with their conversations to allow the reader to make their own interpretations of the data. Some preliminary analysis is done of each event.

Collection of data

Over the study period of ten weeks, the children produced many drawings and I made video recordings of their collection and observation of creatures, interactions and discussions, and drawing events. Interviews with four parents and the staff at the centre were also included in the data collection. Consequently at the conclusion of the study, I had a considerable amount of data to deal with. I have chosen to focus on the events and drawings that gave the most insight into the children’s thinking processes.

What was immediately apparent from the collected data was the variety of different ways in which children used drawing during this study. Although I encouraged, modelled and suggested drawings that related to nature and the study of whatever creatures we were looking at that day, I allowed the children to draw whatever they chose. Some children chose to draw pictures of imaginary or other subjects, but most drawings related to nature in some way. However, very few drawings were directly observational, although many included details of the creatures from the garden that the children had observed. As each child
finished their drawing, I asked them about what they had drawn and scribed their comments onto the page of their book. In the following figures, the children’s actual comments have been transcribed in italics. Storytelling was an important part of many children’s drawings, and recording with the video camera allowed me to capture the language of their narratives, their gestures and actions, as well as the interactions with children around them. Revisiting the video recordings gave me the opportunity to analyse the children’s drawing events and conversations in depth.

Of the twenty children attending preschool on the study day, many children drew in their books every day and some created a number of drawings on a single day. The drawings that the children created often related to our observations of the day, many were of imaginary scenes incorporating natural elements, and some were totally unrelated to our nature study, for instance, Tia drew many pictures of her current interests in mermaids and Rapunzel.

**The informants**

As the study progressed, I realised that some of the children were producing drawings and conversations that were more likely to be useful for analysis than others. I then focused on how this group of children were interacting with each other and their drawing processes. In the latter part of the study, I asked four mothers of my five "key informants" (O’Reilly, 2009, p. 133) to participate in informal interviews about their children. The information they gave me forms part of this brief background, along with my own observations and information from staff gleaned in a group interview with them.
Shea (aged 5 years) was passionately interested in all kinds of small creatures. His family, in particular his mother, supported his interest and helped him to keep small creatures at home. Other members of his extended family were interested in nature and included two marine biologists. He watched nature documentaries at home and his mother helped him research living things in books. His knowledge of invertebrates and lizards was exceptional for a child of his age.

Katie (aged 4 years, 10 months) was an intelligent, thoughtful child. She enjoyed drawing and telling stories from her imagination both at home and at preschool. She was beginning to develop abstract thinking skills and often shared insightful ideas with the other children. Her family enjoyed the natural surroundings of their country home and grew a vegetable garden. Katie was encouraged by her parents to learn about "critters" and loved playing with all sorts of small creatures found around their garden.

Dwayne (aged 5 years, 1 month) had become interested in nature and outdoor play through his friendship with Shea. He was an imaginative storyteller and also very creative in the visual arts. Dwayne showed a sense of fun and humour in his stories. Within their relationship, Shea was the authority when it came to nature; Dwayne was the artistic and creative leader. Dwayne often deferred to Shea's greater knowledge about living things.

Sylvie (aged 4 years, 10 months) was a born storyteller and used drawing often as part of her narrative. Her drawings were usually interesting and complex,
developed as her narrative unfolded. Her mother informed me that she had learnt to talk very early and often incorporated drawings in her stories that she told at home. She and her siblings were encouraged in their imaginative play and conversations by their parents. Sylvie lived on a cattle property and was interested in nature, growing her own vegetables in her father’s garden.

**Cody** (aged 4 years, 9 months) was also a storyteller, drawing and telling imaginative stories that often included nature themes, adding a large amount of imagination. His thoughtful depiction of Katie with the magnifying glass and his insights into what happened showed that he was developing ideas about causal relationships.

In this chapter, I have selected six drawing and/or dialogue events from five children to describe in detail. I have included extensive transcripts of the children’s dialogue, taken from the video recordings, including, where possible, some indication of the children’s gestures, language emphasis and drawing actions. From careful study of my video recordings of the children in action, I have tried to create, as richly as possible in written form, some of the context in which these drawings were produced. In assessing the data after collection, I realised how crucial knowledge of the context was, to be able to fully comprehend the significance of the children’s drawings. Analysing the children’s drawings without any contextual detail would not give access to the children's deep thinking that was occurring, as is very evident in Shea and Dwayne's drawings of the worms.
After the transcript of each event is a short discussion of the children's involvement and learning. Further analysis and relation to theory will be dealt with in the next chapter.

**Description of selected drawing events**

1a: Katie, Dwayne and Shea observe a worm

Several children found some earthworms in the preschool garden and brought them back to the drawing table. Shea(S) was holding a worm, while Katie(K) and Dwayne(D) were watching it. I (AH) talked to them about the worm they found.

**AH:** Katie, did you find the worm?

**S:** Yeah, it was under a rock. It's a big fat one.

**AH:** Is that where it lives, under a rock?

**K:** Yeah, the rock was deep, deep down.

**AH:** Did it live in the rock?

**K:** No.

**S:** No- it lives under the ground.

(Shea bent and indicated under the table)

**AH:** Does it have a hole it lives in?

**S:** Yeah, it lives in a hole. But I plucked it out like a chicken.

**AH:** What can you tell me about worms?

**S:** Well, they're so wriggly. Some of them are earthworms that travel all round the world.

**AH:** Is it a live worm?
S: Yes.

AH: How do you know it's alive?

K: Because it's moving!

S: And we found a dead one got eaten by ants.

AH: Do worms have babies?

K: Yeah.

S: This one's not a baby - when they're babies, they're all white.

AH: Are they?

S: Yeah. Maybe we could put some dirt in here and put some worms in.

(Shea indicated a container. Katie got a container to put the worm in).

AH: Do you think the worm will get out?

K: No, the worm won't get out of this one!

AH: Do you think the worms will get out, Dwayne?

D: No - we'll just have to test it - if we're right.

S: Well, worms can't even climb.

D: No.

AH: Can't they?

S: Well, silkworms can. And under tin, I found some little lizards and kept them...

(The children continued with a dialogue about lizards.)

S: They only little skinks

AH: Do they live at your house?

S: Yeah, under bits of tin. And I normally find frogs under the tin as well. At the very bottom.

K: Guess how my brother says 'yellow'? 'Lellow'.

(A discussion followed about saying yellow.)
AH: What are we going to do with the worms?

S: It lives under ground so it must go in the dirt

AH: What can we find out about the worm by looking at it? Does it have any legs?

S & D: Um no

AH: Does it have a head?

D: Uh-huh

S: And it feels its way

AH: Does it have eyes?

D: We don’t see it has eyes but it does.

AH: How do we know it’s got eyes?

S: They just feel their way through the dirt. Yeah, like witchetty grubs.

AH: Do they have feelers like insects do? Shea, how do they feel their way through the dirt?

S: They just use their bits here. (Shea indicated his upper lip.)

AH: Do they have a mouth?

S: Yup, because they eat little skinny bits of dirt. They eat dirt!

AH: What do you think about that, Dwayne, do you think they have eyes or not?

D: Yep, they don’t.

AH: If they don’t have legs, how can they move?

S: Because they live in the dirt. And they move because only if you see them move they alive but if you see them not moving they dead.

D: ’Cos they wiggle (Dwayne made horizontal wiggling movements with his whole arm and hand.)

AH: Does that make them move along - just wiggling?

D: Uh-huh.
S: Like snakes.

AH: Do snakes move like that too?

D: Uh-huh, they just wiggle slowly (Dwayne moved his body from side to side)

Or they can wiggle fast (Dwayne wiggled his arm and hand horizontally again but faster than before.)

S: Yeah and snakes have eggs

AH: Do snakes have eggs??

S: Yeah and so do lizards!

In this relatively short conversation, Shea, Dwayne and Katie explored many different 'big ideas'. They talked about where worms live; how they move; whether they have eyes or, in the absence of eyes, how they feel their way; living and dead worms; what they eat; baby worms; whether worms can climb. As well as talking about worms, the dialogue sidetracked into Shea finding lizards at home; lizards and snakes producing eggs; and a discussion about how the word 'yellow' was pronounced by younger siblings.

My whole recording was a little over seven minutes long. What a wealth of knowledge was being explored here! Shea emerged, as he often does, as the most knowledgeable peer in this group, offering explanations for how worms move underground and whether they have eyes or not. Dwayne initially thought that worms have eyes that we can't see, but after Shea's explanation, he agreed that worms don't have eyes. Dwayne offered an explanation of how the worms move based on his observation. He appeared to have a sense of empirical testing when he said we would have to test our belief that the worm wouldn't climb out of the
container in which the children had put it. The children's knowledge about worms is a construction based on:

- observation (no legs, wriggling movement);
- prior knowledge (how they feel their way along);
- shared new knowledge (no eyes);
- experience (worms live underground);
- deduction (worm is alive because it's moving);
- comparison (worms wriggle like snakes);
- empirical testing (can worms climb?).

The children's knowledge is extensive and is being extended further through dialogue with their peers. The drawing episode that followed this conversation must be considered in the context of this prior exploration of the children's knowledge.

**1b: Shea and Dwayne draw worms**

Figure 10: Dwayne's drawings: (l) 'A worm, wriggling around in a knot; it's a dad worm'; (r) 'A mum worm'.

Figure 11: Shea's drawing of 'a worm wriggling'.
Shortly after the previous discussion, Dwayne was drawing in his book using brown pencil (figure 10, left) He completed some large roughly circular shapes that filled the page. As he drew the circular lines, he moved his body around following his line.

D: Look how humungous mine is!

AH: How come the worm’s so big?

Shea also commenced to draw a worm with a brown pencil (figure 11); his drawing was a series of looping lines in a tangled circular pattern.

S: Well, because it’s so long. Here's the head.

D: This is a daddy one.

Dwayne then drew more circular movements with an accompanying growling sound.

AH: How come your worm got to be so big?

D: Cos it’s a dad!

AH: It just grew big did it?

D: Uh-huh

S: Look how messed up it is

Dwayne continued circular drawing and growling noises.

S: Look how messed up my worm is - he's all in a knot.

AH: How did he get in a knot?

D: Mine’s in a knot too.

AH: How did he get in a knot? Did he wiggle so much he tied himself in a knot?

D: Yeah he just wiggled himself so much he got in a knot!

S: Mine did as well.
As Dwayne was completing the drawings shown above (figure 10, l & r), Shea was also drawing worms in an almost identical manner (Figure 11). The two boys were exploring more big ideas using both graphic and embodied forms. The boys wriggled their bodies, made ‘movement’ sounds as they drew energetic loops and circular lines to show how the worms wriggle. Previously they had put several worms into a container and observed their extreme wriggling movements. This is what the boys were expressing in their storytelling and drawing.

1c: Dwayne draws mum and baby worms

Dwayne continued drawing, starting on a new page opposite his 'dad' worm drawing (figure 10, right). It was another brown circular drawing similar to, but smaller than the first one. Dwayne told me it was a ‘mummy’ worm.

D: Here's the head sticking out

AH: Why did the mummy one curl into a knot?

D: Cos that's how they sleep.

AH: So that's how they sleep? They curl up?

D: Uh-huh - like curly bugs.

AH: Is the mummy one big like the daddy one?

D: (turned the page back to compare the pictures) Not much. See - they're both smaller (indicated both the drawings).

AH: Are there baby worms?

D: Uh-huh - there's hundreds of baby worms!

(Dwayne started to draw many circles on new page.)

AH: Can they curl up too?
D: Yeah

AH: How do they have babies?

D: 'Cos -um - 'cos they come out special ways.

AH: Do they grow in the mummy’s tummy like your baby?

[Dwayne's mother had recently had a baby].

D: Uh-huh

(Dwayne finished his drawing.)

D: Hey look! Those are all the baby ones.

AH: Have you ever seen baby worms?

D: Nah, I haven't seen any worms.

(Dwayne closed his book firmly, indicating he had finished.)

Dwayne appeared to have no scientific knowledge of how worms reproduce, so he assumed it is similar to how his mother had a baby. His drawings also showed a father, mother and 'hundreds' of baby worms. His concept about parent creatures is related to size - hence his 'dad' worm is 'humungous', his 'mum' worm is smaller and the baby worms are both numerous and much smaller. Understanding the relationship between 'dad', 'mum' and 'baby' creatures as based on relative size was a common idea, which permeated many of the discussions and drawings of other children as well (this is further explored in chapter 6, page 157).

Looking at the drawings done by Shea and Dwayne without the rich context of their discussions and dialogue would reveal none of the children's previous knowledge nor intelligent approach to discovering more about worms. These
drawings are not about realism, but about movement, ‘wrigginess’, and comparative size. Had I not been involved in the preceding dialogue with the children, I would not have had any understanding about the depth of their knowledge nor the extent of their thinking. Cox (2005) found a similar result in her study of young children’s drawings:

Paying attention to children’s drawing in progress, during my observations, revealed a far wider variety of intentions than could be imputed to the finished drawings themselves, when the information was restricted to what was available in what the child had produced and interpretations of it were questionable. It also went beyond the graphic strategies and skills which children used when they were drawing. (p. 115)

Awareness of the context in this instance is crucial to understanding the children’s meanings and without it the drawings can not stand alone to inform viewers of the children’s intent or thoughts. The drawing processes themselves may have been the inspiration to focus their attention and think more deeply about worms, their ‘wrigginess’ and their family relationships.

2: Dwayne draws snowman eggs

The following drawing event occurred one morning as the children were involved in drawing a variety of pictures in their books at the drawing table. Dwayne’s creation appeared to be a spontaneous idea, as no-one had been discussing snow prior to his drawing.

Dwayne drew lots of circles on the page (Figure 12, left).

D: I’m drawing eggs.
D: Eggs. On this page I'm going to draw a 'nowman.

AH: What did you draw Dwayne? What's this one over here?

D: This one is some eggs and this is a 'nowman. (Figure 12, right).

AH: What kind of eggs are they? Are they insect eggs?

D: (indicated with his hand the link between the snowman and the eggs) No, they're the snowman's eggs.

AH: Do snowmen have eggs?

D: Not really.

AH: Are snowmen alive? Are they living?

D: No-o-o

Shea was next to Dwayne looking at worms and joined the conversation.
S: They melt in the sun don’t they?

AH: Can they move?

D: No!

AH: Can they die?

D: No!

S: Yes they can. When it’s spring or winter... when it’s winter... then it’s spring, then they melt (Shea sat down in a wobbly fashion - like a snowman melting?) and be dead.

AH: Is melting the same as dying?

D: Uh-huh

AH: Are they alive before they melt?

D: Yeah.

AH: Are they alive?

(The boys responded in an uncertain way.)

S: Y...No.

D: No, not yet.

D: I have no snow at my house

S: Me neither.

D: Cos we don't live in snow.

AH: Have you seen a snowman?

D: Not me.

Dwayne was playing with ideas here - that of snowmen having eggs. His description of the egg drawing included the information that the eggs hatch out and that 'they’re about 2 big'. In discussion, Dwayne admitted that he knew...
snowmen do not have eggs but he playfully explored this idea of having 'baby' snowmen. Shea took a thoughtful approach to the discussion about whether snowmen are alive or dead - he knew that snowmen are not alive but he considered that melting is akin to dying. An interesting point is that Dwayne, when questioned, thought that snowmen are alive before they melt, even though earlier in the conversation he said emphatically that they were not alive. Once Shea said they are not alive, Dwayne changed his opinion. This occurrence of deferring to Shea's greater knowledge also occurred in the discussion about whether worms have eyes.

As in his drawing of worms, Dwayne was exploring ideas concerned with reproduction - eggs, babies and parents. This has been a big part of his own life in the recent past as he has a baby sister. The inspiration for his drawing was apparently all his own, as snowmen had not been discussed as part of our drawing session. Shea's idea that snowmen melting indicated that he has not yet developed a clear idea of what constitutes dying, and yet melting could be considered how snowmen 'die', and Shea knows that they are not alive. The 'big ideas' that children are constructing such as living/ non-living/ dead, reproduction, eggs/babies/parents are still in a formative stage where meanings are still fluid and have not yet been integrated as scientific concepts with clear boundaries and definitions. So snowmen can have eggs that hatch out as baby snowmen, and they 'die' as they melt in the spring sunshine.
3: Shea's tadpole 'loses' its tail

Shea had been very excited that his tadpoles, which he was keeping at home, were turning into frogs. He talked about it frequently - to me, to the preschool staff, to the other children- explaining that they are no longer tadpoles but now are 'froglets' because they have grown legs. Much of his scientific knowledge and vocabulary comes from his mother and also from watching nature documentaries on television.

Figure 13: Shea's drawing showing the tadpole after its tail has been 'sucked back into its body'. A faint line remains of its former tail.

His drawing (figure 13) showed a tadpole with a large oval body, human type smiling face, four stick-like legs and a stroke at the back to indicate a tail. Shea explained that it is now a 'froglet' because it has legs. How to make this metamorphosis happen with pencil and paper? Shea found an eraser and rubbed out the spindly line of a tail and carefully drew a rounded end to the froglet's body. There, his froglet has 'lost' its tail. Shea explained further for the
zoologically challenged: "It doesn't fall off - it gets sucked back into its body." On another occasion he explained: "[The tails] don't drop off, they just go right in - they go right little - they turn into their bum."

Shea’s drawing of a tadpole explores a scientific concept that Shea has observed and has knowledge about. He was clearly excited about this big idea - that his tadpoles were turning into frogs. He wanted to explain, to communicate to us how it was happening. In this age of visual communication, digital technology can make anything happen in a visual form. Shea found a way to show the change happening to his tadpole using paper and pencil - by erasing one part and substituting the new one. This drawing required planning, explanation and creativity to find a way to represent the metamorphosis of the tadpole. Again, without the context of explanation and knowledge of Shea’s sequence of drawing, erasing and redrawing, the completed drawing does not show the depth of Shea’s thinking and understanding.

4: Sylvie and the storm - a narrative in words and pictures The locality of the preschool had experienced a violent thunderstorm the day previous to my visit. The children came to my table and started to draw in their books. It was rather wet in the playground so the children were playing inside and we had not yet been collecting. Sylvie (S) started to draw pictures and talk about the previous night’s storm. Her first drawing (figure 14) had a border around the page and many vertical strokes. In the second picture (figure 15) she drew an enclosed spiky shape at the top and holding her pencil very firmly, rapidly drew a strong
zigzag down the page. This she told me was the lightning; the shapes at the top were where the thunder and lightning comes from.

Figure 14: Rain

Figure 15: Thunder and lightning

AH: Is that the lightning?

S: It went right down there. Really fast!

AH: What did the thunder sound like?

S: It went ‘boom’ really loud.

Shea was sitting across the table and joined in the conversation.

SHEA: Yeah, the thunder is the lightning hit. That what thunder is.

S: Yeah. Really. Did you hear it at your place?

SHEA: Yeah and it hit the ground!

S: I didn’t like it - it was really loud.

Sylvie was drawing as she talked, making energetic vertical strokes all over the page and on top of the lightning.

AH: What’s that bit, Sylvie?
S: That's all the rain.

AH: What's this bit up at the top?

S: That's where the thunder and the lightning come from and the rain.

AH: Is that the clouds up there?

S: Yeah, the rain clouds.

AH: Were you scared too or just your mum?

S: Mum and me.

AH: You were both scared?

S: And E. and daddy and D. (Sylvie's brothers).

AH: Everybody was scared? And did the rain come into your house?

(Sylvie turned to a new page)

S: No just from - right on the road. (Gestures towards the preschool road)

AH: Just on the road, did it?

S: And ? was driving on the road - driving and the thunder nearly hit him. (Started to draw car - figure 16)

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Figure 16: The friends' car driving in the storm.

Figure 17: Dad was driving mum's car into the shed.

Figure 18: "And Dad came inside getting Mum's keys".
**AH:** Is that their car?

**S:** Yeah, we were at the farm with the other people at the farm. (Turned page.)

**AH:** And did the thunder nearly get their car?

**AH:** What's that bit? What's this picture, Sylvie? (Figure 17)

**S:** This was where Mum's car was when it was getting wet. And Dad came inside getting Mum's keys.

(Sylvie completed the picture with a line that went down to the bottom of the page and then she started to draw a picture on left hand page - figure 18)

_Dad was getting Mum's keys to drive her car in the shed._ (Sylvie pointed to a circular shape in 'the shed' in Figure 17.)

(I could not hear some of her dialogue at this stage.)

**AH:** And did it get wet in the rain?

(Sylvie turned page and started to draw large rectangular shape - figure 19).

**S:** When Dad started the car in the shed ... (?)...

**AH:** So this is the shed?

**S:** Yes (Sylvie hesitated in her drawing for a few seconds.)

**AH:** And was the car inside?

Figure 19: 'This is the cow - right there.'
S: No.

AH: Not yet? Are you going to drive it in, in a minute?

S: And...um...this is the cow - right there. (Figure 19)

At this point, Sylvie suddenly started a new story. She added a head and legs to the rectangular shape and it 'became' a cow and the story shifted seamlessly to the cow story.

S: It was coming in our gate nearly and Mum closed the gate. So the cow can't get out. In our house, we don’t want cows!

AH: Is that the cow?

S: Yes.

AH: Why can’t the cow come in?

S: Because it's our house not the cow’s!

AH: Did the cow get wet when all the thunder and rain was happening?

S: There was one cow nearly got dead.

AH: Really?

S: Yes, a baby cow got dead.

(Sylvie turned page and started to draw a large oval shape-figure 20.)

AH: From the thunder?

S: Yes.

AH: So who’s this now, is this the baby cow?

S: No that’s a flower.

(Sylvie drew a flower head on top of a stem coming out of the top of a vase similar to a drawing which she had done several weeks previously. Again, her story changed in mid-stream without any hesitation. She turned the page to show her previous drawing of flowers in a vase.)
S: That's a yellow nice flower in my sunflower.

Figure 20: A baby cow? No, a flower in a vase.

In this drawing and storytelling sequence, Sylvie was exploring some 'big ideas' and also 'big feelings'. The previous day's storm had obviously made a deep impression on her, not just the physical aspects of thunder, lightning and rain but the actions and feelings of her family, friends and animals also caught in the storm. The whole sequence lasted about five minutes during which Sylvie drew seven pictures. The initial pictures of the rain and the lightning were drawn with some detail before I started recording. Sylvie used a black coloured pencil with firm grip and heavy deliberate strokes as if to emphasise her storytelling of the violent storm. Her rendition of the lightning flash was noticeably emphatic incorporating the power of the lightning. She revisited the lightning picture and started to draw heavy slashes of rain over the zigzag of lightning. When I asked her, she indicated the clouds at the top where "the thunder and the lightning come from and the rain".
These two pictures were the most detailed and took the longest to draw. Perhaps responding to my interest in her narrative, Sylvie elaborated on her story, telling about how some friends were driving in the rain and were nearly hit by 'thunder'. She continued telling about her mother and father, and how the car had to be driven into the shed, presumably to protect it from the storm. This was accompanied by pictures of a car, the shed, and Dad going inside to get the keys, all drawn rapidly as the story unfolded. Sylvie turned the pages of her book quickly and commenced drawing without hesitation. The drawing appeared to me to be unfolding as the story did, an integral part of the narrative, much as her hand gestures and body movements also lent emphasis and added meaning.

The drawing of the cow caught me unawares as Sylvie was still relating the part of the story about the moving the car into the shed and I assumed she was drawing the shed when she completed a large rectangular shape on a new page. Sylvie initially said it was the shed, and then changed her mind, perhaps as she remembered another part of the story. The shape became a cow with legs added and then a head. The story continued about the cow coming in the gate and having to be shut out by Sylvie's mother. Sylvie quickly turned to new page and started another shape and another idea - rather than the 'baby cow' she started to draw a flower in a vase.

Sylvie's narrative in words and drawings is described perfectly in Kolbe's (2005) description of another child's storytelling event: "(T)he very act of drawing seems to have set in train a stream of ideas in both words and visual images, the one complementing the other." (p. 37) When Sylvie started the second last drawing she was still engaged in telling about the car going in the shed and then
suddenly the shape became a cow, not a shed. Had she remembered another part of the story, or did the shape on the page suggest a cow’s body? Was her drawing leading the story at this stage? I later asked her mother about the cow incident and found that it was not part of the storm sequence but had happened earlier that day.

Sylvie’s drawings are also about events happening in time. Her rapid drawings are sometimes a way of communicating in ‘shorthand’ the complex action happening in the story - using a graphic language to communicate meaning. Wright (2003, p. 24) describes the interplay of different modes of communication and the importance for young children to use different ‘languages’ to express their understandings:

> Communicating via drawing and storytelling gives children the opportunity to create and share meaning using two modes - the non-verbal (i.e. graphic depiction stemming from imagery and visual memory) in collaboration with the verbal (i.e. creating a story that accompanies their artwork). Such a cross-over of modalities increases children’s capacity to use many forms of representational thinking. More importantly, it allows one symbolic domain to enrich and inform the other (Haas-Dyson, 1992, quoted by Wright, 2003).

This enrichment is certainly evident in many of the children’s narratives that are presented in both visual and verbal modes, which together allow children to present complex and meaningful stories.
5: Sylvie and the Emperor Gum moth - an observational drawing

One day, D. (a staff member) brought an Emperor Gum moth (Figure 21) in to preschool. The children were fascinated by its size and beauty even though her wings were a bit ragged. They observed that she had laid several eggs in the container. Sylvie started to draw the moth without any suggestion from me (Figure 22). She commenced with a jagged line denoting the edges of the wings and a dark area for the head. Sylvie looked at the moth continually as she drew.

Sylvie explained parts of her drawing:

*S: There is his legs and there is the hairy stuff on him and there is his 'nother part right next to his legs.*

Sylvie added some detail to the legs and hair. She drew the antennae and the dark bands along the edge of its wings.

*S: That’s his colours*
She drew two circles, the 'eye' markings on the wings.

S: *Here's his circle. He's got two circles around him.*

Sylvie started to colour the dark bands on the moth with black felt pen and I suggested she use the coloured pencils instead. At my suggestion, she chose a shade of brown that she thought was similar to the moth's colour. She suddenly asked:

S: *Scuse me, can you make a number of these - in your 'puter?*

AH: *Would you like me to make you a copy on my computer?* (Sylvie nodded.)

Sylvie continued with her drawing, adding colour and occasionally looking at the moth through the magnifying glass. When Katie joined the table, Sylvie showed her the moth through the glass. Sylvie took about fifteen minutes to complete her drawing.

Sylvie was focusing on observing the moth carefully as she drew and adding fine details that she noticed. She could relate parts of her drawing to the moth and explain it to me. Her description of the finished drawing was: "*It was a moth and it had little eggs coming out of it. And it had little baby moths coming out of it - hatching out.*" While Sylvie was drawing, there was a discussion happening at the table about what would come out of the eggs that the moth had laid and whether they would be 'little baby moths' or caterpillars like the silkworms that hatched out several months ago; hence Sylvie's addition of the eggs and explanation of the baby moths hatching.

An interesting comparison can be made between Sylvie's rich narrative of the storm produced in a dramatic way with words, gestures and multiple drawings,
and this relatively quiet period of drawing where she focused on the moth and drew one detailed drawing, which included no imaginative additions but many observed features. Sylvie was using drawing in quite a different way - to record her observations of the moth and perhaps make an aesthetically pleasing composition at the same time (note the symmetrical array of eggs which do not correspond to the actual eggs laid in the box).

6: Katie and Cody discover fire and light

Figure 23: Katie's drawing
Light from the sun (top right) makes a bright spot of light ("That's the fire") on the surface of the magnifying glass (black circle and handle) and "someone touching it" (yellow shape lower left)

Figure 24: Cody's drawing of Katie
Katie (figure on right) is holding the magnifying glass (bottom left) with rays of light from the sun (top middle) making a bright light on the glass surface (dark shading in circle).

As Katie and I were exploring the playground looking for bugs, I had a powerful magnifying glass in my hand. Without thinking, I focused the sunlight onto the
grass, which, after a few seconds, produced a small plume of smoke. I soon realised that this was not an appropriate skill to show young children in a bush-fire prone area so I quickly stopped what I was doing. Katie had seen what happened and she was fascinated. I explained that it could be very dangerous and could start a fire, and that children should never do it. Katie however was so interested in the phenomenon that she went to the drawing table and drew what she had seen. Cody was also very interested and drew Katie with the magnifying glass. As I discussed Katie’s drawing with her, Cody joined in and took over the discussion as Katie lost interest.

**AH:** What have you drawn there? Is that the magnifying glass?

**K:** And someone touching it.

**AH:** Right - is that their finger? And what’s the yellow in the middle?

**K:** That’s the fire

**AH:** Where does the fire come from?

**K:** Um...

Cody, sitting next to Katie, joined in the conversation.

**C:** When it’s sunny!

**AH:** Can you do that without the magnifying glass, Katie? Or do you need the magnifying glass to do it?

**C:** (showing his drawing) I did Katie with it.

**AH:** Is that Katie with the magnifying glass?

**C:** Yep.

**AH:** What’s she doing with the magnifying glass?

**C:** She’s looking at the fire.

**AH:** Where do you think the fire comes from Cody?
C: It comes from light - out of the magnifying glass.

AH: Does the magnifying glass make the light?

C: Yep

A: Does it?

C: And the light makes the fire.

AH: So could you do it inside?

C: Yep.

AH: Will it work inside?

C: No - only if the sun’s in - (C pointed out towards the sun) - only if the light of the sun’s in.

AH: So does the sun have to do something?

C: Yeah, the sun has to do it.

AH: Does the light in the magnifying glass come from the sun?

C: Yep.

AH: So how come the sun doesn’t make that light without the magnifying glass

C: I don’t know.

AH: Do you need the magnifying glass to make it happen?

C: Yep.

AH: What do you think the magnifying glass does?

C: I don’t know.

What happened with the magnifying glass and sunlight was both interesting and previously unknown by the children. Their drawings reflected what they observed - that the sunlight made a bright spot of light on the surface of the magnifying glass, and somehow made fire appear on the grass. Neither through
their drawings nor explanations were they able to account for the fire, but they knew there was a connection between the sun, the glass and the fire. Cody took up the discussion with me about what happened. He knew that the light came from the sun, and deduced that it could only occur inside if the light of the sun came inside. He realised that the magnifying glass was an essential part of the process, but did not know how it made the fire appear. The children are attempting to develop hypotheses based on their observations.

**Conclusion**

In these drawing events, the children concerned are demonstrating high levels of thinking, sometimes extensive prior knowledge, the ability to discuss concepts and learn from each other and the beginnings of scientific concepts from their observations and learning. However, without the context of their discussions and actions, the drawings alone would not give insights into the level of their thinking. In the following chapter I discuss the children’s drawings in the light of various theorists with a view to understanding how drawing functions as part of children’s thinking and learning.