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*Continuing the Copperhead : Bronze Casting Processes and
Elapid Snakes of the Canberra District*

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Declaration of Originality

I, Steven Mark Holland hereby declare that the exegesis here presented is the outcome of the research project undertaken during my candidacy, that I am the sole author unless otherwise indicated, and that I have fully documented the source of ideas, references, quotations or paraphrases attributable to other authors.

Date:

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Abstract

This PhD inquiry is a sculptural study of some of the elapid snakes from the districts surrounding Canberra. As a practice-led research it examines the Eastern Brown Snake, the Red-bellied Black Snake, the Death Adder and the Tiger Snake as biological and socially constructed animals through the material of bronze. The project investigates the properties of bronze and the processes of bronze lost wax casting to see if these material agents can somehow reveal the lives of snakes. It resulted in a series of bronze Serpent sculptures which aimed to affirm the life of venomous snakes and create a greater acceptance of their existence. Some of these sculptures were exhibited in different cultural venues including the ACT Herpetological Association exhibition *Snakes Alive* where they were seen by large audiences. The sculptural inquiry locates elapid snakes from the regions around Canberra in the field of bronze Serpent sculpture within the broader sphere of snakes in Art, Biology and human culture.

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Preface

This PhD research into bronze and snakes is an extension of a broader artistic investigation concerned with interrelationships between humans and animals. For over 30 years I have been creating artwork in the form of sculpture, performance and drawing that explores human understanding of the lives of animals. The focus of this work is on types of language that we use to construct an understanding of animals. To communicate this anthropocentric view I have developed a way of working that explores language that is projected onto animals through the non-verbal language of sculptural materials. I see this as an illustration of animals created through a poetic synthesis of sculpture and natural history.

This approach has sometimes involved living animals where birds, ants and dogs were offered food, which was made into sculptures or laid out as words. By eating the food the animals were seen to undo or question certain preconceptions about them. Other more formal sculptures include: a litter of rabbits made from wire and plastic shopping bags, ravens constructed from wire and black plastic bin liners, and recently Serpent sculptures cast in wax and bronze. Through creating works of art about a range of animals and through thinking about the way animals are linguistically portrayed, I came to the realization that the relationship between humans and snakes was special. It occurred to me that perhaps we have more words and stories for snakes than any other animal.

Introduction

Real snakes

As creatures that have shared our planet since prehistoric times, snakes occupy a unique place in human thought and visual culture. When early hominids encountered them over two million years ago snakes were fully evolved as effective reptilian predators and from the beginning were seen as mysterious, deadly creatures that embody the essence of life.¹ With their ability to strike with lightning speed and inflict a painful or lethal bite, snakes are instinctively feared and many of their refined biological characteristics mystify human perception.² The liquid way they seem to move, the dazzling veneer of their scales, the way they engulf their prey, the way they slough their skin leaving behind a paper-thin presence, and the way they remain hidden has a profound effect on human consciousness and imagination. A sighting of a snake incites our senses. The single word “SNAKE!” yelled-out in excited alarm unites people in the Australian bush and suburbs. Heard amid the heat of summer months, the word exclaims more than the immediate presence of a threat to our survival and the need for vigilance. It is recognition of an evolutionary relationship between snakes and humans that connects us to our primate ancestors in distant times and diverse places.³

Imagined Serpents

Based on fear and a sense of wonder passed down over generations, snakes are seen to be a combination of both real and imagined creatures. With all the highly refined and deadly characteristics of snakes, imaginary Serpents live only in the human mind where they are deeply sensed. Glimpsed through a lampblack fog of terror, awe and revulsion, the mind shines a cinematic light on the Serpent’s shifting, jewel-like coils, flicking tongue and fiery eyes. This illusory reptilian phenomenon is identified as being fundamental to human psychology in different ways. Balaji Mundkur asserts that “fascination” with supernatural Serpents is the result of profound fear which became the basis of religion.⁴ Joseph Campbell characterizes the Serpent as a “threshold figure” that transcends consciousness.⁵ He aligns Serpentine energy with the Hindu and Buddhist tantric concept of the *Kundalini* coiled snake which, through yoga and

¹ Lynne A. Isbell, *The Fruit, the Tree, and the Serpent : Why We See So Well* (Cambridge: Harvard University Press, 2009).

² Balaji Mundkur, *The Cult of the Serpent : An Interdisciplinary Survey of Its Manifestations and Origins* (Albany: State University of New York Press, 1983), 1.

³ Isbell, *The Fruit, the Tree, and the Serpent : Why We See So Well*, 3.

⁴ Mundkur, *The Cult of the Serpent : An Interdisciplinary Survey of Its Manifestations and Origins* 1. ; "Human Animality, the Mental Imagery of Fear, and Religiosity," in *What Is an Animal?*, ed. Tim Ingold (London: Unwin Hyman, 1998), 141.

⁵ Joseph Campbell, *The Inner Reaches of Outer Space* (New York: Harper & Row, 1986), 74.

meditation, is progressively channelled up the spine into the brain and out the top of the head. Freud formulates the Serpent into psychoanalytic sexual fears and desires. Jung identifies the universal quality of the Serpent that arises from the depths of the human consciousness. He interprets the snake as a symbol which acts as a chthonic message from Mother Earth.⁶ Jungian analyst Craig San Roque believes that the Serpent is a symbol of something hidden. He maintains that because different species of snakes are widespread across the Earth they inhabit our imagination though their ability to remain unseen. Scientists like Carl Sagan and Lynne Anne Isbell explain the “pervasiveness” of myths as a cerebral inheritance from a time when our human ancestors evolved to live alongside reptilian predators.⁷

Biologist Edward O. Wilson, who grew up catching snakes in the swamps of Florida, understands how the human mind is “primed” to weave Serpents into stories.⁸ As a force of nature they slip between polyvalent meanings as myths, symbols and allegories in many aspects of human concern.⁹ Serpent signs are powerful and yet subtle. They appear as important motifs in visual art, religion, psychology, advertising, film, music, dance, fashion, jewellery, tattoos, war, medicine and popular culture. Within these cultural domains Serpents convey both widely shared and specific societal meanings. The depiction of a snake entwined around a vertical rod for example, is universally identified as the symbol of medicine. Less well understood is the Serpent draped over the Christian crucifix. This symbol is believed to be a Serpent personification of Jesus Christ and an allegory for the battle between good and evil.¹⁰ Wickedness and cunning was one of several categories of Serpent iconography in an exhibition of Serpent art at the Sammlung Hoffmann gallery in Berlin in 2014.¹¹ Writing in response to the exhibition Jennifer Allen equated the contemporary phenomenon of computer network surveillance practised by governments and corporations as an electronic form of Serpent evil.¹²

In visual art, snakes and Serpents are portrayed in different genres. They are shown as both, snake subjects in natural history illustration and as imaginative Serpent creations which make up a vast archive of visual and conceptual ophidian images.¹³ Throughout history, artists have been drawn to Serpents for the ease in which they embody narrative

⁶ Carl G. Jung, *Man and His Symbols* (London: Aldus 1964).

⁷ Carl Sagan, *The Dragons of Eden* (New York: Random House, 1977), 140. Isbell, *The Fruit, the Tree, and the Serpent : Why We See So Well*, 1.

⁸ Edward O. Wilson, *Biophilia* (Cambridge: Harvard University Press, 1984), 86.

⁹ Jennifer Allen, "The Resistance to Symbols," *Mousse Contemporary Art Magazine*, no. 40 (2013): 15.

¹⁰ Jan Schouten, *The Rod and Serpent of Asklepios* (Amsterdam: Elsevier 1967), 101.

¹¹ “Snake” art from the Sammlung Hoffmann private collection was curated by Erika Hoffmann-Koenige at the Sammlung Hoffmann gallery from September 2013 to June 2014.

¹² Allen, "The Resistance to Symbols.", 12.

¹³ The Oxford English Dictionary describes “ophidian” as relating to the Biological suborder Ophidia (or Serpentes) which comprises the snakes. It is also used to describe a snakelike quality.

and convey power. The curvilinear, tapering body of a snake intrigues and excites our eyes and implies visual movement over time. Drake Stutesman identifies this effect as the “Serpentine line” or “S line”, which was a term originally described by William Hogarth as a “Line of Beauty” in 1753.¹⁴ The swirls and curlicues of the S-line can be sensed as an icon in art and architecture from Palaeolith bone carvings to the recent Serpentine Sackler Gallery building in London.¹⁵ Serpents are so widespread in art history that it is possible to enter a major art gallery in the guise of a cultural herpetologist and go on a Serpent-hunt. Visitors to the National Gallery of Australia in Canberra for instance, can find Serpents made in a variety of forms and materials. Here it is possible to view them painted in natural earth pigments, carved in wood and stone, woven into tapestries and inscribed onto palm leaf manuscripts. The national collection also features Serpents fashioned into a brass processional standard, shaped in gold and precious stones and cast in bronze.

Bronze Serpent sculpture

Arising out of different cultures and historical contexts, the sculptural form of the bronze Serpent is central to this research. As a concept the bronze Serpent resonates with symbolic meanings relating to both bronze and Serpents that are fused together through the lost-wax casting process. My study has made it possible to identify key examples of bronze Serpent sculpture. I was able to research some of the sculptures during a field trip to India, Turkey, Greece and Israel in 2012. The field trip allowed me to visit a bronze foundry to study Hindu *Nāg* sculpture in India, to draw *The Serpent Column* in Istanbul, visit museums in Greece and to research a small copper snake that is housed in the Eretz Israel Museum in Tel Aviv. Within the Israeli museum context this votive snake was positioned in relation to the Old Testament story of the *Bronze Serpent* or the *Nehushtan*.¹⁶ This Judaic text tells of God’s instruction to the Hebrew prophet Moses to make a bronze “seraph” (or fiery serpent) “and mount it on a standard”.¹⁷ In this way; “if the serpent had bitten a person and he looked toward the bronze serpent he lived”.¹⁸ The episode that is believed to have occurred during the Exodus of the Israelites out of Egypt is set in a Biblical landscape characterized by mining and smelting of copper and the existence of several species of venomous snakes. Against this background the story references a synthetic relationship between bronze and Serpents through language and material associations. *Nehushtan* is a Hebrew term

¹⁴ Drake Stutesman, *Snake* (London: Reaktion 2005), 14, 59, 168. William Hogarth, *The Analysis of Beauty* (London: William Hogarth, 1753), 38.

¹⁵ Stutesman, *Snake*, 14. : Zaha Hadid Architects, "Serpentine Sackler Gallery," <http://www.zaha-hadid.com/architecture/serpentine-sackler-gallery/>.

¹⁶ 1 Numbers 21:4-9 Hebrew Bible

¹⁷ Karen Randolph Joines, *Serpent Symbolism in the Old Testament : A Linguistic, Archaeological, and Literary Study* (Haddonfield NJ: Haddonfield House, 1974), 7.

¹⁸ Amy Birkan, "The Bronze Serpent, a Perplexing Remedy: An Analysis of Num. 21:4-9 in Light of near Eastern Serpent Emblems, Archaeological and Inner Biblical Exegesis" (McGill University, 2005), ix.

derived from a combination of the words for bronze or brass נחשת (nachoshet) and serpent נחש (nachash).¹⁹ The term *Nehushtan* is used in a pejorative sense later in the Old Testament when King Hezekiah orders images of bronze Serpents to be destroyed in an act of iconoclasm.²⁰ As an example of sympathetic medicine however, the *Nehushtan* story is interesting in the way it anticipates the invention of modern antivenoms by looking “toward” venomous snakes as a cure for their bite. It also hints at a sense of ophidian wonder that ancient copper smelters and foundry workers may have experienced when they refined native ore into purified copper and observed it flow on the ground in a dangerous metallic stream.²¹

Bronze lost wax casting

To create a bronze Serpent the sculptor is required to follow ancient foundry procedures facilitating the transformation of materials dating back 7000 years to Chalcolithic metalworkers. The stages of this ancient lost wax casting process remain much the same today. At the Australian National University, Hot Metal Casting Research Facility which is run by Nick Stranks in the Sculpture Workshop, the process begins by making the sculpture in wax. With all its fine details in place the wax is encased in a block of plaster and then placed into a kiln to burn the wax out. With the wax melted out, it is “lost” and what is left is a solid plaster investment with a centrally placed internal cavity which is a mould for the bronze. On the day of casting the investment is buried in the foundry sand pit and molten bronze, which is a copper based alloy, is carefully poured into the cavity effectively taking the shape of the wax. Once the bronze has cooled it is broken out of the plaster mould and metalworking techniques are employed to refine the surface and the colour of the sculpture. As a way of working and as a finished artwork, bronze is a sculptural tradition that encompasses a vast history across many geographic regions and philosophies.²² It is a discursive entity with unique physical and metaphorical properties which as a foundry artist I proposed to explore for their ability to reveal the life of snakes. Based in the ANU foundry my investigation followed an artistic hunch. It pursued an intuition that some substances have metaphorical “animal properties” and that perhaps I could find the essence of a highly evolved reptile lying dormant in an ancient sculptural process.²³ The formal research came about after completing a series of bronze Serpent sculptures in my practice over the previous five years.

¹⁹ Joines, *Serpent Symbolism in the Old Testament : A Linguistic, Archaeological, and Literary Study*, 7.

²⁰ 2 Kings 18:4 Hebrew Bible

²¹ Nissim Amzallag, "Yahweh, the Canaanite God of Metallurgy?," *Journal for the Study of the Old Testament* 33, no. 4 (2009): 400.

²² David Ekserdijan, ed. *Bronze* (London: Royal Academy of Arts, 2012).

²³ Eliade Mircea, *The Forge and the Crucible* (Chicago: The University of Chicago Press, 1956), 54.

Research question

To realize this proposal I contained my investigation within the parameters of the research question:

Can the life of elapid snakes from the districts around Canberra be revealed through the material of bronze and the processes of bronze lost wax casting?

The question provided a practical way of working where I could progressively gain an understanding of elapid snakes and make attempts to reveal a sense of their life through bronze sculpture and foundry processes. To do this, I interpreted the “life” of a snake through a combination of biological and semiotic understandings and as a concept that is essentially known to the snake. By employing these trans-disciplinary approaches the study acknowledged snakes from a scientific and a cultural perspective, as being real and symbolic animals. With an emphasis on the lives of snakes, one of the aims of the sculptural research was to facilitate a greater understanding and wider tolerance of elapid snakes which through fear and ignorance are often misunderstood and needlessly persecuted.

Snakes from the districts around Canberra

Each year Canberra newspapers report on the emergence of snakes following their winter brumation²⁴ (for example, figs 1 & 2). Readers are alerted to reports of “reptiles roaming the bush capital” along with information about what to do if they should happen to come across a snake and medical advice for the treatment of snake bite.²⁵ Although very few people get bitten by snakes in Australia they are a potential danger if they are accidentally stepped on, or intentionally interfered with in some way. The types of snakes that live in Canberra and surrounding areas of New South Wales in South Eastern Australia are mostly from the family of snakes known as *Elapidae*. Elapid snakes are proteroglyphous which means that they have two fixed hollow or grooved fangs at the front of their upper jaw through which they inject venom.²⁶ The name *Elapidae* is derived from the Greek word *élops* which is defined as a “kind of fish regarded as a rare delicacy” and “a kind of snake”.²⁷ Researchers studying the geographic distribution of snakes speculate that Australian elapids evolved from Asian terrestrial species like the Indian Cobra. It is thought that they evolved into sea snakes and further evolved to inhabit a wide range of ecological niches across most of the

²⁴ Brumation is an adaptation that allows cold-blooded reptiles to survive in cold climates. Reptile brumation is a term that loosely refers to hibernation in mammals.

²⁵ Naomi Fallon, "Vigilance Needed in Slithery Season," *The Chronicle*, 23 October 2012, 3.

²⁶ Harold G. Cogger, *Reptiles and Amphibians of Australia* (Melbourne: Reed Books, 1996), 629.

²⁷ , in *Oxford Latin Dictionary* (Oxford: Clarendon Press, 1968), 790.

Australian continent.²⁸ Their acclimatisation to Australian habitats occurred over a relatively short period of geological time in the last 10 to 20 million years.²⁹ Egg-laying elapids were the first species to adjust to Australia's unpredictable environment. Following these, two different lineages of live-bearing species evolved in response to colder global conditions caused by glacial events in the last 5 million years.³⁰ While the identification of Australian elapid snakes is constantly under review, currently around 90 terrestrial species are recognized; 37 of these are found in New South Wales and 8 species are reported to live in the Australian Capital Territory.³¹



Fig. 1: *Seasonal slippery customers don't want to bother you*, Tamara Glumac, *The Canberra Times* Wednesday 19 October, 2005.



Fig. 2: *Vigilance needed in slithery season*, Naomi Fallon, *The Chronicle*, Tuesday 23 October, 2012.

Like all reptiles, snakes that live in and around the ACT are precisely adapted to living with changing ecological conditions. Canberra's bioregion is situated between the Southeast Highlands and the Australian Alps where the geography and climate determine a range of localized ecosystems.³² This diverse landscape extends across lowland temperate grasslands, box-gum woodlands, eucalyptus bushlands, nature reserves, riverine corridors and wetlands, as well as agricultural and urban environments. Living in these habitats, amongst the leaves and grasses, on and below the ground near a supply of water is where different species of elapid snakes occupy

²⁸ J. Scott Keogh, "Molecular Phylogeny of Elapid Snakes and a Consideration of Their Biogeographic History," *Biological Journal of the Linnean Society* 63, no. 2 (1998).

²⁹ Kate L. Sanders et al., "Molecular Phylogeny and Divergence Dates for Australasian Elapids and Sea Snakes (Hydrophiinae): Evidence from Seven Genes for Rapid Evolutionary Radiations," *Journal of Evolutionary Biology* 21, no. 3 (2008).

³⁰ Richard Shine, *Australian Snakes: A Natural History* (Sydney: Reed New Holland, 2009), 48.

³¹ Steve Wilson and Gerry Swan, *A Complete Guide to Reptiles of Australia* (Sydney: Reed New Holland, 2003), 392. ; Glenn Shea and Ross Sadlier Gerry Swan, *A Field Guide to Reptiles of New South Wales* (Sydney: Reed New Holland, 1990), 219. ; Richard Longmore, "Elapid Snakes of Canberra," *Newsletter of the ACT Herpetological Association* Oct-Nov 2014, 2.

³² Environment and Sustainable Development Directorate, "Australian Capital Territory Nature Conservation Strategy 2013-23," (Canberra2013), 7.

unique biological positions as both predators and prey.³³ They live their lives in response to Canberra's continental climate.³⁴ Being ectothermic they absorb heat from the Sun as a source of energy to become active during hot summers. Throughout the cold winters they metabolize at a much slower rate to maintain a state of torpidity in brumation. As a way of retaining a constant body temperature and as a survival strategy, instead of roaming most of the time they are elusive and remain hidden in underground dens. In regard to this cycle it is curious to note the degree of human awareness to the presence of local snakes at particular times of the year. In Canberra, I have observed that people are highly attuned to the existence of snakes during spring and summer, and forget about them once winter sets in.

The seasons and other environmental factors became significant aspects of my inquiry that sought to link snakes from around this broad region to the process of bronze lost wax casting. My research focused on three elapid species commonly encountered in the ACT and the one species found in coastal regions of neighbouring NSW. Set out as four sequential projects, the investigation concentrated on the Eastern Brown Snake, *Pseudonaga textilis*, the Red-bellied Blacksnake, *Pseudechis porphyriacus*, the Tiger Snake, *Notechis scutatus* and the Death Adder, *Acanthophis antarcticus*. A notable single occurrence of a Death Adder that was reported to be killed at the Cotter Reserve in the ACT is an exception to their typical distribution throughout Eastern Australia and along the southern coast.³⁵ In the process of creating a series of sculptures about *Acanthophis antarcticus* however, I referred to several Death Adder species including the desert dwelling *Acanthophis pyrrhus*.

Situated within the academic framework of the ANU College of Arts and Social Sciences where an artist's working methods are recognized as a source of knowledge, my research is practice-led. This means that the investigation was progressively informed by discoveries made through creating "works of art" as a sculptor working in the studio-foundry and through exhibiting finished "artworks". In her assessment of practice-led research as qualitative knowledge, artist and theorist Barbara Bolt reframes the ideas of Martin Heidegger to make the distinction between the work of art and the artwork that emerge as signifiers in the physical world in different ways.³⁶ In my investigation the work of art became an active physical engagement with materials, tools and processes. This approach was informed by research into biology, metallurgy, art history, philosophy and past experience. At times my working methods were logical and conformed to the sequential steps of bronze casting and on other occasions the work

³³ ACT Government; Territory and Municipal Services, "Snakes," http://www.tams.act.gov.au/parks-recreation/plants_and_animals/urban_wildlife/local_wildlife/snakes.

³⁴ Australian Government Bureau of Meteorology, "Climate of Canberra Area," <http://www.bom.gov.au/nsw/canberra/climate.shtml>.

³⁵ "Death Adder Identified at Cotter Reserve," *The Canberra Times*, 29 December 1951, 2.

³⁶ Barbara Bolt, *Art Beyond Representation : The Performative Power of the Image* (London: I.B. Tauris, 2004), 8.

would take on a life of its own, especially when working with wax. My research question was further addressed by exhibiting several finished bronze Serpent artworks at herpetological events and art galleries. These public displays became an important way to gather anecdotal information about local snakes and to determine responses to my sculptural inquiry. As a whole this methodology naturally advanced my quest to discover if the life of elapid snakes could be revealed through the material and processes of bronze over four separate projects.

Projects

The first project was called *being*.³⁷ It used language as a literal device as an attempt to articulate the life of Eastern Brown Snakes. It aimed to do this in several ways. The first way was to make bronze Eastern Brown Snake sculptures in the shape of letters of the alphabet to literally communicate a state of existence. The second line of inquiry was to examine in detail the transformative processes of lost wax casting to find out if my physical engagement in foundry practices could metaphysically reveal the lives of local snakes. The outcome of this project was seven pairs of bronze Eastern Brown Snake sculptures that were displayed in different configurations in two separate exhibitions. In 2012, the first exhibition was at *Snakes Alive* which is an event hosted annually by the ACT Herpetological Association at the Australian Botanic Gardens in Canberra. In the context of a display of live reptiles and amphibians my sculptures were called “fake snakes” by many children visiting the event. When first installed outside the entrance to *Snakes Alive* the sculptures also attracted the attention of, and created great concern to, birds that live in the gardens. These responses alerted me to the visual codes that snakes denote to humans and birds to signal potential danger. In a subsequent exhibition in 2013-2014 I created an installation out of pages of the local newspaper as an environment for the sculptures at Canberra Museum and Gallery. Also called *being*, the installation was highly visible to the general public over two months and was accompanied by several public programme events.

The working title for the second project was *Moon over the Murrumbidgee*. It focused on Red-bellied Black Snakes. With my research question centrally in mind, the project was advanced by: what I had recently learned in the bronze foundry, research into the thermoregulatory behaviour of Red-bellied Black Snakes and cyclical symbols of Serpents. To refine my working methods I used a shed skin from a Red-Bellied Blacksnake as a template to create a model of the snake. This led to new ways of forming snake sculptures in wax that was performative of Red-bellied Black Snakes “shuttling” into and out of the sun to maintain their body temperature.³⁸ It was an

³⁷ The title *being* evolved though the process of making the sculptures in the first project. The term is used broadly to explore snake and human existence without any specific reference to the philosophical discourse of Ontology.

³⁸ Shine, *Australian Snakes: A Natural History*, 82.

imaginative and poetic sculptural enquiry that resulted in a series of six lifelike bronze Red-bellied Black Snake sculptures. One of these bronzes was exhibited at the *Waterhouse Natural Science Art Prize* at the South Australian Museum and later at the National Archives in Canberra in 2013.³⁹ The outcome of this project raised numerous questions about the limitation of mimetic sculpture to communicate the lives of snakes.

In 2012 a field trip to locate key examples of bronze Serpent sculpture was conducted in four countries overseas. This primary research is outlined in the Appendix. My specific survey of bronze Serpent sculpture overlapped with visits to several sites of importance in the history of bronze in countries where different species of venomous snakes live. I gained insights into bronze Serpent sculpture through drawing and photographing artefacts in museums and through discussions with curators. Upon my return, these experiences were absorbed into my practice and would influence my sculptural and theoretical findings. As a result, the third project made direct reference to aspects of the history of bronze which became a metaphor for the distinctive hunting behaviour of the Death Adder and the defence strategies of the Tiger Snake. Working with Nick Stranks I was able to adopt an experimental approach to foundry procedures and the waste products of the casting process. I explored the use of slag scraped from the top of the molten bronze, the plaster investment, old crucibles and the foundry sand pit in the works of art. The impetus underlying this approach was to invoke the life of the snake through symbolic, historical and material associations and through allegory.

The final project to complete my sculptural investigation into Canberra's elapid snakes and bronze casting processes was titled *Snake picnic*. It took the form of an arrangement of bronze picnic objects on a bronze picnic blanket which was designed to potentially attract live snakes. The still-life sculpture was placed outside in a fenced-off location near a dam on the farm where I live. An outdoor motion sensor camera was set up to record snake movement on and around the sculpture. The design of the sculpture was based on the potential for snakes to be attracted to the heat conducting properties of bronze during the cooler months. In creating the *Snake picnic* my intention was to invite snakes to interact with the sculpture. The purpose of this was to reveal the life of the snake through a combination of biological and socially constructed meanings.

Issues of representation: what is the life of the snake?

This research asks the question: can the life of a snake be revealed through the material of bronze? In attempting to find answers, the inquiry brings to light broad philosophical and biological questions relating to the perception of an individual snake's life and the

³⁹ *The Waterhouse Natural Science Art Prize* is an annual competition and exhibition run by the South Australian Museum in Adelaide. The National Archives of Australia hosts a travelling exhibition of selected artworks from the prize.

communication of snake existence through signs. At the heart of the matter are different perceptions of the life of a snake. If we could speak with snakes like Harry Potter and other *Parselmouths* in J. K. Rowling's magic stories we could ask a snake about its life.⁴⁰ Another way of considering the life of a snake is through a Darwinian analysis of its ongoing evolution and the external pressures that give shape to its functioning anatomy. This biological understanding of a snake's life makes sense of how it survives and reproduces within an ecosystem. A related way of deciphering the life of a snake is through the sum of the semiotic processes that go to make up its *Umwelt* or its self-centred world which is a concept first developed by Jakob von Uexküll.⁴¹ This understanding of a snake's life is its unique animal perception of, and response to signals in its habitat. It is also an understanding of the life of a snake at a cellular level where its bodily functions are understood as a biosemiotic exchange of chemical and electrical information as codes and signals along autopoietic pathways.⁴² A snake's *Umwelt* is its particular sensory sphere which overlaps and interacts with other organisms, including humans, in a combined semiosphere.⁴³

To stand quietly and observe a snake, undetected beyond its visual and olfactory perceptual field, is to see it translate sensations of smell, temperature, movement, light, and vibration as a series of sign relations within its particular environment. Visualizing the snake in this way involves a reflective human process of translating the snake and its actions into a matrix of interrelated iconic, indexical and symbolic signs. Because of the real and imagined danger they present, snakes exert an immediate and profound presence on the human automatic nervous system which is often felt as intense fear. Lynn Isbell puts forward a theory that the need to detect snakes camouflaged in a shared environment has led to advanced vision as a function of the human brain. She suggests that rapid detection of snakes which occurs simultaneously in several visual systems in the brain allows mammals to facilitate a flight/fright/freeze response and the ability to determine instantly whether "that scaly thing in the grass is really a snake or just the head of a dead lizard".⁴⁴ Her research expands the implications of coexistence with venomous snakes to include: the extreme fear of snakes in all anthropoids (including humans), declarative pointing as a gesture leading to language, and the capacity for the brain to selectively respond to complex visual stimuli such as the diamond shaped pattern of snake scales.⁴⁵ As I discovered in this sculptural research, human vision that is highly attuned to the perception of living snakes was a significant aspect that influenced the potential to reveal the actual and symbolic life of snakes through bronze artworks.

⁴⁰ J. K. Rowling, *The Chamber of Secrets* (New York: Scholastic, 1999).

⁴¹ Jakob von Uexküll, "An Introduction to Umwelt," *Semiotica* 134, no. 1/4 (2001). ; "The New Concept of Umwelt; a Link between Science and the Humanities," *ibid.*

⁴² In Biology the term autopoietic refers to the self-regulating and reproducing chemistry of cells.

⁴³ Kalevi Kull, "On Semiosis, Umwelt and Semiosphere," *Semiotica* 120, no. 3/4 (1998).

⁴⁴ Isbell, *The Fruit, the Tree, and the Serpent : Why We See So Well*, 146.

⁴⁵ *Ibid.*, 80.

The life of copper and mineral substances

The nature of this trans-disciplinary project required that I divide my time equally between researching elapid snakes and copper-based bronze, in the foundry. The inquiry led me ask not only “what is the life of a snake” but also “what is the life of copper”? Through this aspect of my research I scrutinized copper at a microscopic level. I was looking for signs of snakes and signs of life in many of its coppery states. To come across a piece of bright green native copper when walking through the places where it naturally occurs is a curious event. There is something innately compelling about copper. It is easy to imagine how early metallurgists were lured to explore its properties. Malachite, blue azurite and dark red cuprite are mineral compositions and sedimentary veins in the Earth’s crust that were a source of metallurgical interest to our Neolithic ancestors.⁴⁶ With the subsequent discovery of bellows and alloys, ancient metalworkers believed that metal had spirit and could be made to move, transform and embody life.⁴⁷ This idea was developed by the Alchemists who sought to understand the “passion”, “death” and “marriage” of mineral substances.⁴⁸ Similarly, in Europe during the 16th to 18th centuries small animals and sections of plants were directly cast in various metals and were highly prized as specimens in cabinets of curiosities. Among the life-cast animals were bronze lizards and snakes that were believed to be made from “juices of the earth” and demonstrated transformation from mineral ore into “life”.⁴⁹ Notions that metals can live and breathe remain with us today. It can be seen in the philosophical investigations of Object Oriented Ontology that include “vibrant materiality” and scientific experiments to create the characteristics of cell membranes by chemically modifying metal oxides.⁵⁰ In my experiments to reveal the life of snakes through the transformative processes of bronze, I was assisted by a symbolic understanding that, snakes are the essence of life.

Snakes are life

My initial experiments to cast Serpents in bronze prior to this study indicated several creative connections between bronze and snakes. The polished surface of bronze with its ability to act as an iconic sign for the lustrous scales of a snake was an obvious example. So was sculpture of a snake made from wax. It not only signalled the appearance of a snake but could also be made to move. Snakes are defined by their

⁴⁶ R. F. Tylecote, *The Early History of Metallurgy in Europe* (London: Longman, 1987), 22.

⁴⁷ Mircea, *The Forge and the Crucible*, 7.

⁴⁸ *Ibid.*, 11.

⁴⁹ Pamela H. Smith and Tonny Beentjes, "Nature and Art, Making and Knowing: Reconstructing Sixteenth-Century Life-Casting Techniques," *Renaissance Quarterly* 63, no. 1 (2010): 141.

⁵⁰ Jane Bennett, *Vibrant Matter; a Political Ecology of Things* (London: Duke University Press, 2010). ; Katharine Sanderson, "Life-Like Cells Are Made of Metal," *New Scientist* 211, no. 2830 (2011).

movement. On my field trip to India I remember the spellbinding sight of an Indian Cobra being tipped out of a clay pot onto the floor of a village sitting room at Battis Shirala during *Nāg Pamchami*. Standing with bare feet amongst the gleeful room of Hindu worshippers, I watched as the cobra simultaneously slid its twisting tail forward towards the crowd as it reared up, flattened its neck into a startling hood and angled back ready to strike. With such effective defence strategies the concept of a snake is an assertion of its life. Notwithstanding the snake's ability to kill, symbolically it stands for life. Drake Stutesman's far-reaching summary on the *Living Snake* is a list of ways that snakes are interpreted and celebrated as "the symbol most quintessentially suited to the human imagination".⁵¹ Amongst her inventory of snake attributes that serve as a source of inspiration to humans she sees the snake as "the action of process" and "the current in artistic energy"⁵² As an artist and researcher my study acknowledges this. It set out to discover if the actions of bronze casting and the resulting metal sculptures could be made to reveal not just the external appearance of snakes but the ongoing lives of the distinctive snakes from the broad region around Canberra.

⁵¹ Stutesman, *Snake*, 12.

⁵² *Ibid.*

1 Eastern Brown Snakes: *language*

The first project set out to discover if the material and processes of bronze lost wax casting could reveal the life of Eastern Brown Snakes. To explore a hunch that it possibly could, I embarked upon a sculptural programme that addressed this question in several ways. The first approach was to make bronze Eastern Brown Snakes sculptures in the shape of letters which explored the life of snakes through language. The second inquiry was conducted in the bronze foundry and workshop where I examined lost wax casting to find out if this transformative sculptural process could reveal any aspects of snakes. When the bronze sculptures were complete they came together to form an installation called *being* which was displayed at the ACT Herpetological Association's exhibition *Snakes Alive*,⁵³ and later at Gallery 4 in the Canberra Museum and Gallery.⁵⁴ By showing the sculptures in these exhibition contexts I was able to raise awareness of Eastern Brown Snakes as unique reptiles adapted to live in the Canberra region and to engage with audiences about their encounters with snakes and their reactions to my sculptural project.

Eastern Brown Snakes

Eastern Brown Snakes live in and around Canberra and are distributed throughout much of eastern Australia and to a limited extent; eastern Papua New Guinea.⁵⁵ Within this wide geographic range they prefer to live in dry, secluded suburban and rural environments where they prey upon small mammals and reptiles including rodents and lizards. Due to the toxicity of their venom and the frequency of encounters with humans, this species of snake has gained a reputation as being fearsome, aggressive and dangerous.⁵⁶ Eastern Brown Snakes are responsible for the majority of snake bite deaths in Australia where an average of two or three people die from venomous snake bite each year.⁵⁷ While Eastern Brown Snakes will strike out in self-defence if they are stepped on or if they are under attack, in reality the threat that the snakes pose is disproportionate to their perceived danger. Research has shown that Eastern Brown Snakes tend to avoid contact with humans by retreating or remaining hidden.⁵⁸ It also shows that people are more likely to attack elapid snakes and in attempting to kill

⁵³ *Snakes Alive* was held at the Crosbie Morison Building in the Australian Botanic Gardens, Canberra, ACT from 23 to 29 January 2012. This was the 20th anniversary of the event.

⁵⁴ The second exhibition of *being* was shown at Canberra Museum and Gallery, Canberra, ACT from 15 December 2013 until 16 February 2014.

⁵⁵ Harold G. Cogger, *Reptiles and Amphibians of Australia* (Melbourne: Reed 1996), 675.

⁵⁶ Eric Worrell, *Dangerous Snakes of Australia and New Guinea* (Sydney: Angus and Robertson, 1961), 46.

⁵⁷ Straun K. Sutherland, "Deaths from Snake Bite in Australia 1981-1991," *Medical Journal of Australia*, no. 157 (1992).

⁵⁸ Patrick B. Whitaker and Richard Shine, "Responses of Free-Ranging Brownsnakes (*Pseudonaja Textilis* : Elapidae) to Encounters with Humans," *Wildlife Research* 26(1999).

snakes people become more vulnerable to being bitten.⁵⁹ However with the general availability of antivenins and the efficiency of Australian emergency services, it is increasingly likely that someone bitten by an Eastern Brown Snake will survive.

As I sometimes come across Eastern Brown Snakes when walking about the farm where I live, (fig. 3), this study provided an opportunity to learn more about the biology of the snake beyond snake bite statistics. Through a range of research about Eastern Brown Snake behaviour and anatomy I was able to build a picture of the snake in my mind to inform a sculptural initiative. These snakes are understood to be swift-moving active searchers with long slender, streamlined bodies that can grow to a maximum length of about 2.5 metres.⁶⁰ In 1869 Gerald Kreft described the shape of the Eastern Brown Snake's as "elongate and rounded" with its head "not very distinct from neck, high and quadrangular".⁶¹ Their pupils are round.⁶² When fully grown the colour of Eastern Brown Snakes vary. They can be grey, brown, orange, russet, or nearly black, sometimes with faint, narrow cross-bands.⁶³ Female Eastern Brown Snakes are oviparous and average 16 eggs in their clutch.⁶⁴ They are active by day but in some places young snakes are encountered at night.⁶⁵ Newly hatched snakelings set out to search for small mammals and reptiles. After injecting venom into their prey they coil tightly around it causing it to suffocate. This prevents the prey from biting the snake while it struggles to escape.⁶⁶ They have 17 rows of smooth scales around their mid-body and between 185-235 belly scales.⁶⁷ These and other Eastern Brown Snakes observations were useful. So was the opportunity to watch a live snake at a local reptile sanctuary (fig. 4) and to draw a preserved specimen from the ANU Research School of Biology (fig. 5). This inquiry led me to examine the names for Eastern Brown Snakes that resulted in a decision to make snake sculptures in the form of letters to be made into words.

⁵⁹ "Sources of Mortality of Large Elapid Snakes in an Agricultural Landscape," *Journal of Herpetology* 34, no. 1 (2000).

⁶⁰ Richard Shine, *Australian Snakes: A Natural History* (Sydney: Reed New Holland, 2009), 189.; Cogger, *Reptiles and Amphibians of Australia*, 647.; Graeme Gow, *Graeme Gow's Complete Guide to Australian Snakes* (Auckland: Angus and Robertson, 1989), 128.

⁶¹ Gerald Kreft, *The Snakes of Australia* (Sydney: Thomas Richards, 1869), 41.

⁶² Worrell, *Dangerous Snakes of Australia and New Guinea*, 54.

⁶³ Belinda Edwards, *Australian Snakes: A Pictorial Guide* (Scoresby: Five Mile, 2009), 64.

⁶⁴ Shine, *Australian Snakes: A Natural History*, 210.

⁶⁵ Queensland Museum, "Eastern Brown Snake,"

<http://www.qm.qld.gov.au/find+out+about/animals+of+queensland/reptiles/snakes/common+and+dangerous+species/eastern+brown+snake>.

⁶⁶ Peter Mirtschin and Richard Davis, *Dangerous Snakes of Australia* (London: New Holland, 1982), 98.

⁶⁷ Cogger, *Reptiles and Amphibians of Australia*, 647.



Fig. 3: The farm hay shed at Michelago where I saw an Eastern Brown Snake.



Fig. 4: An Eastern Brown Snake that was displayed at the *Australian Reptile Sanctuary* in Canberra in 2011.

Snake words spell be

Collectively Eastern Brown Snakes are referred to as Common Brown Snakes. Since they live over a wide geographic area and their habitat and appearance varies, they are also known by numerous colloquial names. Local Ngambri Aboriginal people call them *murralang* or *warraleng* or *wurungul*.⁶⁸ In science the name for Eastern Brown Snakes has progressively changed as more became known about the snake's evolutionary relationships. As it exists today the name *Pseudonaja textilis* is a taxonomical identity given to it by French herpetologists Duméril, Bibron and Duméril in 1854. This binomial classification places the elapid snake into the genus *Pseudonaja* and the species *textilis*. Linguistically the name *Pseudonaja* is made-up of Greek and Sanskrit words meaning “fake” or “false cobra”. *Textilis* is Latin; it is used as an adjective to describe the Eastern Brown Snake as either “woven, wrought” or “textiles” and possibly, “plaited”.⁶⁹ Perhaps as the naturalist David Fleay suggests, the synonym could imply the “plaited rope grapple” of intertwined rival males during breeding season.⁷⁰ It interested me however that encapsulated inside the name *textilis* is the word text. This word connection directed a literal way to explore my research question.

Communication about the existence and identity of venomous snakes has always been crucial for human survival. Throughout history phonic and graphic signs for snakes evolved over time and continue today as symbols to communicate danger and vitality. The etymology of the English word *snake* stems from Indian and European language origins, denoting “crawling” movement.⁷¹ Drake Stutesman also reminds us of the impact of the short sharp sound; *psssst...* Sounding like a warning hiss of an adder or viper, the onomatopoeia is used to demand immediate attention and is an example of language forming a direct relationship between the signifier and what is being signified.⁷² Corresponding in a similar way is the visual and aural action of the Serpentine line in the saying *S is for snake* which is a familiar learning tool for students of the English alphabet. To a greater or lesser extent these examples of snakes as speech, words and symbols act as referents to actual living snakes. This vast vocabulary of snakes as text served as a broader context for my research. I decided to create two bronze Eastern Brown Snake sculptures in the shape of the letters *b* and *e*. Together they would spell the snaky word *be*. Making snake sculptures in the form of text indicated a possible way to reveal the life of Eastern Brown Snakes through language in combination with the material properties of bronze. The choice of the word *be* was affirmative; it carried with it a message of acceptance that allowed me to adopt an open-ended approach to the sculptural investigation in the foundry that lay ahead.

⁶⁸ These names were provided through personal correspondence with Paul House from the Ngambri Local Land Council in July 2013.

⁶⁹ , in *Cassell's New Latin-English English-Latin Dictionary* (London: Cassell, 1959).

⁷⁰ David Fleay, "The Brown Snake - Dangerous Fellow," *Victorian Naturalist* 59(1943): 149.

⁷¹ , in *The Concise Oxford Dictionary of English Etymology* (Oxford: Oxford University Press, 1986).

⁷² Drake Stutesman, *Snake* (London: Reaktion, 2005), 139.

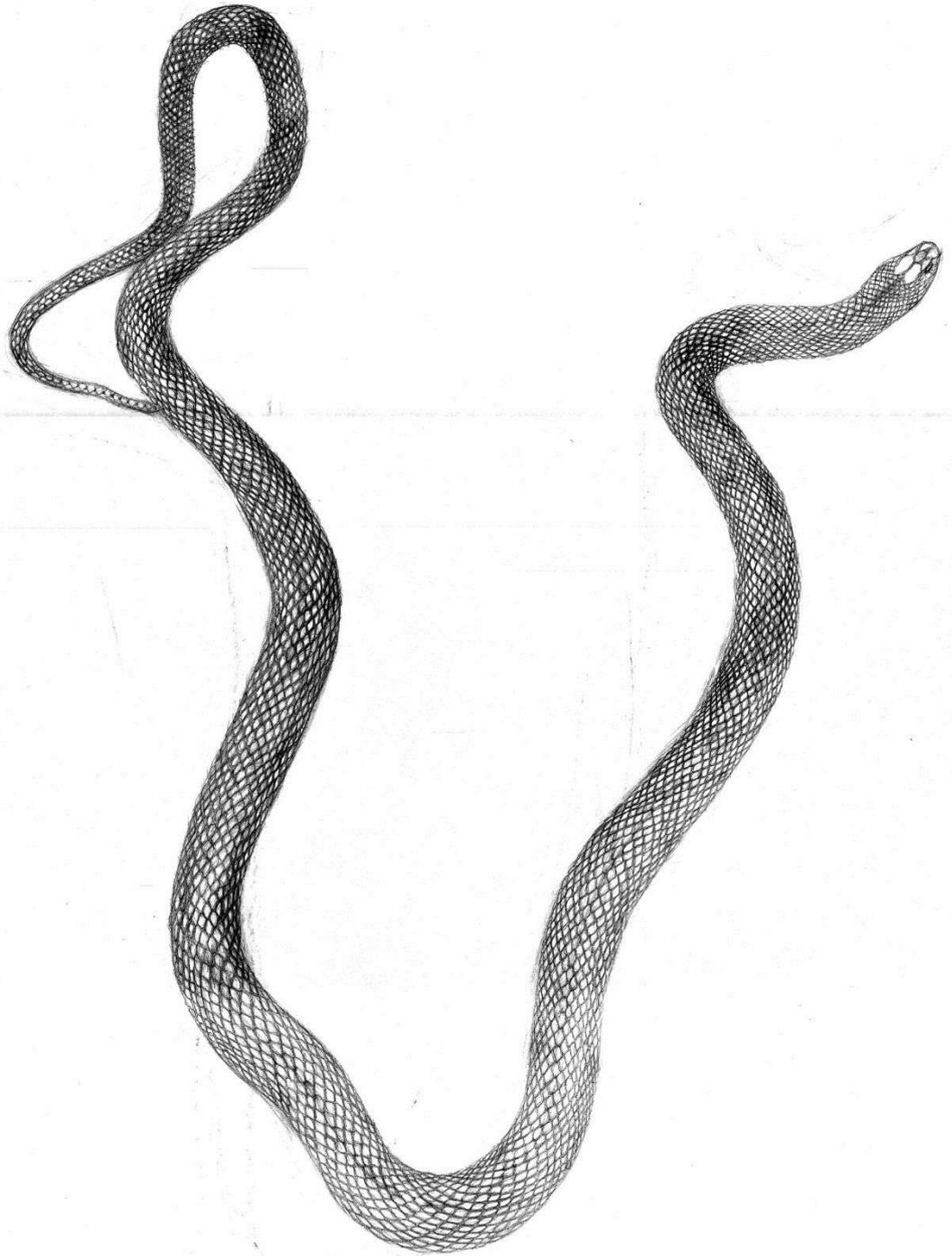


Fig. 5: A drawing of an Eastern Brown Snake in the shape of the letter *v* is from a series of snake letter drawings using HB and 2B pencil on cartridge paper.

Making the sculptures

In early 2011 I began modelling two sculptures by pressing lengths of fishnet stocking material into plasticine that was formed into the snake letters *b* and *e* (fig. 6). These Eastern Brown Snake models were destined to be cast firstly in wax then in bronze. As I was making the sculptures I was keen to find out if there were any physical or metaphysical links between the transformative processes of bronze lost wax casting and the life of snakes. Could a connection to a real snake be found in the process of: modelling snake sculptures in plasticine; taking a mould from these plasticine snakes; casting liquid wax into the snake moulds; sculpting fine details of scales into the wax snakes; attaching a gating system⁷³ made from wax rods and a pouring cup to the wax snakes; setting these wax snakes and gating systems into plaster and ludo⁷⁴ investment moulds; burning the wax snakes out of the investment moulds in a gas fired kiln; pouring molten bronze into the hollow investment moulds while they were buried in the foundry sandpit; breaking the investments open to reveal the newly cast bronze snakes; cleaning the bronze snake sculptures with a water blaster; angle grinding the bronze gating system off the sculpture; welding holes caused by heat shrinkage; refining the bronze snakes with metalworking tools; and patinating their surface with chemicals and a blow torch? In an attempt to answer this question I assumed the role of a sculptor/metaphysician with an awareness of snakes as biological and mythological creatures.



Fig. 6: Modelling scales on the sculpture by pressing elasticised fishnet stocking into a plasticine model of the snake letter *e*.

⁷³ The term *gating system* refers to the technique of attaching a network of wax rods to the sculpture to create a series of channels to allow molten bronze to flow through the mould when it is cast in bronze (figs 10 & 14).

⁷⁴ *Ludo* is a colloquial name for recycled grog that is mixed with plaster to make the investment mould. It is made in the foundry by grinding down investment moulds after the bronze has been broken out (figs 11 to 15).

Operating inside the framework of the Sculpture Workshop and bronze foundry, I completed the tasks of modelling and casting Eastern Brown Snake letter sculptures whilst keeping my senses attuned for the presence of snakes. To do this I monitored the stages of casting where materials are transformed, forms are sequentially revealed and concealed, by-products are created, temperatures fluctuate and time elapses. It entailed sensitivity to movements, sounds, smells, touch, humidity and light over days, nights and seasons. As I progressed my mind reached out into university grounds where snakes are sometimes seen. At the same time I was reading about elapid snakes, Serpent symbolism, bronze Serpent sculpture and the history of bronze. When this project was complete I had created seven pairs of bronze Eastern Brown Snake letter sculptures and during the course of making the sculptures, I sensed the life of snakes in three ways: in casting wax and bronze into moulds; through the material qualities of wax; and in the atmosphere of the foundry during the bronze pour.

To create the snake letter sculptures in wax and then in bronze, moulds were used on two occasions. Snake movement was initially hinted at when liquid wax was poured into the first mould which was made from polyurethane rubber supported by a two-piece plaster mother mould (fig. 7). As the wax flowed into the hole at the top of the mould it disappeared into a snake shaped void. The fluid and lustrous stream was evocative of times when I glimpsed a snake slip from view into a crevice under a rock or down a drain. In addition to this snake vision, the act of prising the mould open and freeing the solid wax snake sculpture from the rubber suggested a snake sloughing out of its skin (figs 8a & 8b). Starting at the head, the rubber mould rolled off the newly cast wax snake, turning inside out as it came away at the tail. The rubber moulds were capable of generating multiple snake casts. With a sense of rhythmic production I poured seven pairs of snake letters spelling the snake word *be*. This resulted in fourteen Eastern Brown Snake sculptures to be handled and stored. They naturally evolved into a sculptural group that I called *being*.



Fig. 7: The mould for the snake letter *b* is shown clamped together before wax was poured into a hole at the top.



Figs 8a & 8b: Wax snake letters *b* and *e* inside the rubber mould shortly after the plaster mother mould was opened.

The snake sculptures that made up *being* passed through several stages where they changed material state three times over a period of about six months. The separate stages involved in this process are explained in a series of images in figures 7 to 28. Through the agency of two different moulds they were transformed from plasticine into wax and from wax into bronze. To facilitate this transformation of materials the procedure demanded that the solid state of the snake sculptures be replaced by a hollow space inside a mould in two instances. Throughout this process the snake sculptures were seen to disappear inside plaster encasings then reappear some time later. During the investment stage the wax sculptures were hidden from view for months and reappeared as bronze. As I was making the sculptures I became aware of how snakes fade from our consciousness during winter months. I was also mindful that the time it took me to create the snake sculptures was analogous to the Eastern Brown Snake's annual passage through winter brumation and emergence in spring.

A connection to a reptilian way of being in the world was also found in the properties of *Brown Wax*.⁷⁵ With its fine crystalline structure and a relatively high melting point *Brown Wax* has transient qualities relating to the colour, surface appearance and movement of Eastern Brown Snakes. When the days were warm the wax snake sculptures became pliable making it possible to subtly shift their shape. Working with the properties of wax at this stage I found a way to refine the detail of the snake with a combination of tools including custom made scale-shaped branding tools (fig. 9). Sitting outside in the sun, the task of outlining individual scales and their imbricate arrangement took several days to complete. The process of handling the wax snakes over an extended period of time induced a creative meditation on Eastern Brown Snakes when I was able to empathise with their reliance on warmth from the Sun as an ectothermic way of existing in the world.

⁷⁵ *Brown Wax* is the name of a commercially available microcrystalline wax used for bronze lost wax casting.



Fig. 9: Working in the sun, details were melted into the wax snake sculptures with custom made tools.



Fig. 10: Nick Stranks attached the gating system onto one of the *b* shaped snake sculptures.



Fig. 11: The *b* shaped snake sculpture was flooded with a solution of plaster and ludo.



Fig. 12: The wax snake sculptures were encased inside plaster investments.



Fig. 13: The investments were joined into one.

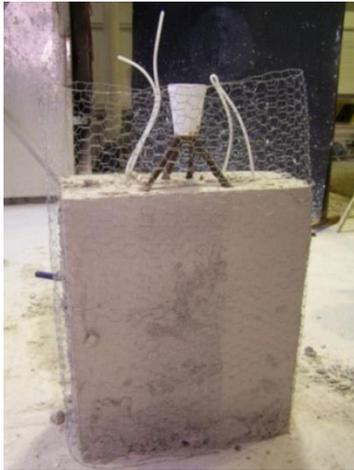


Fig. 14: A pouring cup was added to the gating system and wire mesh was stretched around the outside.



Fig. 15: The investment was built up with a thick layer of plaster and ludo.



Fig. 16: The moulds were placed upside down in a gas fired kiln for several days to burn the wax out. At this stage the wax is “lost”. They were removed from the kiln while still hot.



Fig. 17: The moulds were buried in the foundry sandpit to absorb the extreme heat from the molten bronze and to safeguard against any leakage.



Fig. 18: A crucible was placed in the furnace before the furnace was ignited.



Fig. 19: Flames burst from the furnace as the flow of gas was regulated.



Fig. 20: Recycled bronze and bronze ingots were heated on top of the furnace before it was added to the crucible.



Fig. 21: The heated bronze was lowered into the crucible inside the furnace. It took about two hours to melt at a temperature of approximately 1260°C.



Fig. 22: When the bronze was melted a crucible lifting bail was used to lift the crucible out of the furnace.



Fig. 23: The crucible was placed into a yoke.



Fig. 24: Slag was lifted from the top of the molten bronze.



Fig. 25: At a temperature over 1100°C , the molten bronze was left to cool slightly.

The final way that I sensed an essence of snakes and Serpents in the lost wax casting process was in the foundry on the day of the bronze pour. As significant amounts of time, material and energy had led to the moment of casting the snake sculptures in bronze, this day was filled with much expectation and reverence. Diffuse in the atmosphere of the foundry was a sense that an ancient ritual was being enacted. It was an occasion when extreme heat and noise, combined with the sight of brilliant and dangerous molten metal, created a deep connection to the past when cultic bronze Serpents were associated with gods of metallurgy.⁷⁶ This was when smelters, smiths and alchemists were revered for their ability to collaborate with nature during the pour to transform matter into life.⁷⁷ On the day of the pour at the ANU foundry the spectacle of molten metal streaming through the air created a perception of a living Serpent (figs 26 & 27). Conjuring pain and certain death associated with snakebite, the Serpent appeared: lightning fast, blinding and bronze.



Fig. 26: Two foundry workers move into place above the snake letter investment mould. While one person steadied the yoke the other tilted the handle to angle the crucible.



Fig. 27: A mythological Serpent was conjured as molten metal streamed into the mould's pouring cup and spilled out of gating system air vents.

⁷⁶ Nissim Amzallag, "Yahweh, the Canaanite God of Metallurgy?," *Journal for the Study of the Old Testament* 33, no. 4 (2009): 398.

⁷⁷ *Ibid.*, 8; Mircea Eliade, *The Forge and the Crucible* (Chicago: University of Chicago Press, 1956).



Fig. 28: The bronze snakes were revealed when the investment mould was broken open.



Fig. 29: A high pressure water blaster was used to wash the ludo off the bronze snakes.



Fig. 30: A range of metal working tools were used to cut the gating system from the sculpture.



Fig. 31: Repairs to the sculptures were made with a MIG welder. The surface of the sculpture was refined in a process known as chasing.



Fig. 32: A blow torch was used to heat the snake sculptures whilst they were sprayed with a *Ferric Nitrate* solution. This gave the bronze snakes a light brown colour.



Fig. 33: The Eastern Brown Snake bronze snake letters *b* and *e*.



Fig. 34: An experimental arrangement of seven pairs of snake letters *b* and *e*.

Installation being at Snakes Alive in 2012

After the pour the bronze snakes were cleaned and the surface of the metal was refined and patinated to bring them together into an installation called *being*. Before they were exhibited I experimented with different arrangements of the group of snake letters to see how my ideas for the project might be read by other people. I tried placing the snake letters *b* and *e* close together so the sculptures could be seen as one. This unified configuration spoke to me about a mating pair and the potential for snakes to continue.

When I spread the snake sculptures out on the ground and moved the letters around, the snake calligraphy became illegible. To counter this I hoped that the material of bronze and the twisting energy of the sculptures would convey a visual sense of Eastern Brown Snake life.

Shortly before exhibiting the sculptures at *Snakes Alive* I made a sign to stand amongst the installation to explain some of its less obvious concepts (fig. 35). The sign contained the following statement:

Snakes are inspiring animals. They often appear as characters in stories and art and have a special place in the human imagination. This exhibition of snake sculptures by local artist Steven Holland is called *being*. It shows several pairs of Eastern Brown snakes. Each pair of snakes is made in the shape of the letters b and e. Together they spell the word be. The sculptures carry the idea of being in our busy world alongside of snakes; to let them be.

As a mark of respect for Canberra's snakes the artist has made them in the material of bronze. Bronze is a metal commonly used to make sculptures of important people and noble animals. These bronze snakes add to a growing interest in snakes in the Canberra region. Along with *Snakes Alive* the artist hopes to create a greater understanding and wider acceptance of snakes. They are beautifully adapted animals that live amongst us and are sometimes seen here in the Botanic Gardens.

Snakes Alive
Canberra's Snakes in Art

Each year *Snakes Alive* is presented by the ACT Herpetological Association with the aim of educating people about reptiles and amphibians and promoting research. In 2012 *Snakes Alive* attracted more than 2000 visitors. They were able to touch pythons and lizards, witness animals being fed and learn about the biology of many Australian reptiles and amphibians including endangered Northern Corroboree Frogs and threatened Olive Pythons that were on display. It was also an opportunity for people to share herpetological stories and to inform children about living alongside venomous snakes in Australia. Working with the organizing committee I decided to place my installation outside the entrance to the exhibition building. Through my display I hoped to test the various ways that the concept of the life of Eastern Brown Snakes was formed in the minds of audiences, both human and nonhuman, through the sculptures. By the end of *Snakes Alive* my display was notable for two distinct reactions: firstly from the birds in the gardens and then from children. Another remarkable moment happened when an Eastern Brown Snake living in the gardens was spotted several meters from the installation.

Shortly after setting up the sculptures on the day before *Snakes Alive* opened to the public, a family of White Winged Choughs who frequent the Botanic Gardens flew in for a closer look. What happened next was reminiscent of the famous story recounted by Pliny the Elder in his *Naturalis Historia* about the painting contest between Zeuxis and Parrhasius.⁷⁸ Zeuxis's painting of grapes was so realistic that hungry birds were "fooled" into thinking they were food. Instead of being attracted to painted grapes in 5th century BCE Greece, birds in the Australian Botanic Gardens were greatly concerned by the sudden appearance of the fourteen bronze Eastern Brown Snakes. Ten or more choughs gathered in a nearby tree and called out in alarm. Shrieking loudly, several of the braver choughs came nearer. The commotion drew the attention of other birds. Mud Larks flapped above the sculptures threatening to peck at them, Ravens cawed from a branch high above the scene, Currawongs, Magpies and Wattle Birds joined in the uproar and a Bower Bird was seen. In due course the birds flew off. This was when a number of Fairy Wrens appeared and took their turn protesting at the presence of the sculptures. To release the tiny wrens from further apprehension I decided to pack the display away and return the following day for the opening.

After the birds, the next reaction to the installation of sculptures was from children. The first thing they would see when arriving at *Snakes Alive* was something that appeared to be a group of metallic snake objects lying on the pavement at the base of a free standing blue sign. As such, it was common for excited children of differing ages to break away from their parents and run at full speed toward the sculptures from a distance of a hundred meters. When they arrived at the artwork it was their natural reaction to reach out with their feet and hands to explore the material quality of the bronze then to stand on them, dance amongst them, pick them up and carry the snake sculptures about. The display presented a dilemma which was making people nervous. It was an outdoor artwork which invited interaction. It looked tactile, precious and very vulnerable to crowds of people arriving on the first day. A 'Do Not Touch' sign was suggested and after limited debate two notices reading 'FOR LOOKING ONLY / SNAKES MIGHT BITE' were taped to the bricks as a temporary solution. I welcomed this practical remedy which was put forward by Kay Hick, one of the *Snakes Alive* volunteers. By making and placing the notices in front of the sculptures Kay had creatively integrated the artwork into the *Snakes Alive* event (fig. 35). The boundaries of reality had become blurred between what the notices said and what the eye could see. "Snakes Might Bite", but how? They are static objects. This need for distinction effectively halted the children and their wary parents.

⁷⁸ Pliny the Elder, *Natural History*, vol. 35.64-6.



Fig. 35: ACT Herpetological Association volunteer, Kay Hick explains the ideas underlying the installation to children at *Snakes Alive*.

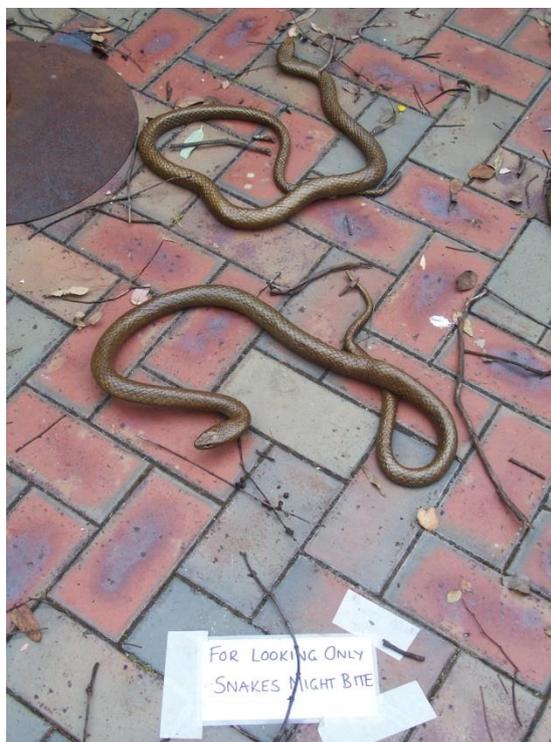


Fig. 36: A pair of bronze Eastern Brown Snakes with signs taped to the brick paving.

Upon seeing the sculptures with the notices in place visitors arriving at *Snakes Alive* would engage with issues of representation. Some people would declare statements like: “they are not real”; “they are just pretend”; “they are fake snakes”. Alternatively, without being so sure others would ask: “Are they real?”, “Are they toys?”, “Will they bite?”, “Why does it say they will bite?”, “How can they bite?” These questions allowed for positive interaction with people. It was a way to explain that inside the *Snakes Alive* building it was possible to touch some pythons and lizards but outside in the bush it was inadvisable. It then became a way to ask people about their experiences with snakes in the wild and to exchange observations and stories. People genuinely welcomed these sometimes lengthy conversations and often expressed awe and reverence for Australian snakes. It seemed that with the notices, the installation was acting as an experiential connection between audiences and live snakes. As I set up the installation each day I would try out different configurations of the sculptures along with a scattering of leaves and sticks taken from the nearby gardens. This act of integrating the snake sculptures into the gardens would bring the artworks closer to where Eastern Brown Snakes range freely.



Fig. 37: A view of the installation at the entrance to *Snakes Alive* with leaf litter connecting the installation into the Botanic Gardens.

About midday on Thursday, Jo McAuliffe, the Conservation Officer for the ACT Herpetological Association and representative of the Australian National Botanic Gardens, quietly called me from down the hill at the side of the building. Jo had discovered an Eastern Brown Snake hiding in a pipe inside a stormwater culvert a short distance from my display. We stood observing it move slowly from the pipe and out through the metal grill covering the drain. I was amazed at how close we were to the venomous snake and how easily it glided through the bars on the grill. Jo was concerned about people having picnics on the lawn nearby. He pointed out a Jackie Lizard sitting on a retaining wall above the drain. By moving its head rapidly up and down the lizard signalled with the light colour of its throat, indicating that it too had seen the snake. The Brown Snake slipped out of the drain and headed into a tangle of bark at the base of a tree. Extending its body out in a smooth undulating line it moved through the bark out into the open. Suddenly a boy from the picnic grounds ran down the hill, he grabbed his ball and ran back again. The snake stopped and rapidly made its way into another drain a few meters away. We watched it disappear into the drain and come back out heading across an access road towards the safety of long grass on the other side of the perimeter fence. When it was almost across the road a bird let out an alarm call. At the same time people could be seen walking across the road some way off. Unaware of our presence, again the snake stopped, it looked around momentarily before vanishing through the fence.

In its natural environment this Eastern Brown Snake could be seen to respond to the vibrations and movements of other animals. The subtle visual relationship between its light brown colour and the filtered light falling onto the leaf litter was a breathtaking spectacle. This was *Snakes Alive* and I was thrilled to have observed a wild snake so close to my installation of Eastern Brown Snake sculptures. According to Jo the Botanic Gardens are home to several species of snakes and lizards including the Eastern Brown Snake which favours a medium sized Jackie Lizard as its prey. Following this palpable incident I returned to watch over the *fake snake* sculptures and to listen to visitors' snake stories. Through the opportunity to exhibit *being* at *Snakes Alive* my sculptural research into elapid snakes was advanced. It provided an appropriate forum where I could share the aims of my research with herpetologists, further refine issues of representation and display, and search for ways to integrate scientific understanding of elapid snakes into a bronze sculpture enquiry.

Installation *being* at Canberra Museum and Gallery 2013-2014



Fig. 38: Installation *being* at Gallery 4, Canberra Museum and Gallery, Canberra ACT.

A year later I presented a different version of the installation *being* in the outside exhibition space known as Gallery 4 at Canberra Museum and Gallery in Civic Square (fig. 38). This installation was on display from December 2013 until February 2014 and was seen by many people who congregate in Civic Square for summer festivals. The installation featured a suspended newspaper hanging made from sheets of *The Canberra Times* that were perforated with leaf shaped holes. This was designed to respond to the gallery's natural and artificial light and provided a creative context for the bronze snake letters *b* and *e*. Newspaper leaves cut from the sheets littered the gallery floor around the bronze Eastern Brown Snakes. The installation brought together a layering of symbolic elements that reflected on the life of Eastern Brown Snakes through material and language. I created the newspaper hanging to represent a socially constructed chronical of human events. By cutting holes into the news stories my intention was to expose openings through which another creature's existence could be contemplated on its own terms. This idea was reinforced by the way that fragments of text written on the newspaper leaves became an indecipherable background for the snake sculptures (fig. 39).

The installation in Gallery 4 invited viewers to consider the life of Eastern Brown Snakes beyond an awareness of being human. By creating several artworks called *being* I had the opportunity to explore what this might mean. The concept of *being* is natural; it is a state intrinsic to all life. It is so basic that we are seldom aware of it. Always in the middle of being is our ongoing present, being simultaneously propels us forward and creates a sense of past. Perhaps we get the greatest appreciation of being when we are outside or on the edge of being, when a life is

born or dies. Any philosophical understanding of being is vast and encompasses both individual and cosmic perspectives. The sudden appearance of a venomous snake brings our being into acute focus. Perhaps this is one reason why Serpents feature in creation stories? While my sculptural installation *being* at Canberra Museum and Gallery was broad ranging in its meanings, at its core was an endeavour to communicate the ongoing life of Eastern Brown Snakes through bronze and a backdrop of Canberra times and seasons (fig. 40).



Fig. 39: A detail of the installation *being* showing the Eastern Brown Snake letter *b* amongst leaves cut from newspaper sheets.



Fig. 40: A detail of the newspaper sheets showing the location of the installation in Canberra's Civic Square.

Summary

By making seven pairs of bronze Eastern Brown Snake letter sculptures that came together as an installation called *being* my research set out to discover if the material of bronze could somehow reveal the life of snakes. The project evolved through different kinds of research and through making and exhibiting bronze snake sculptures. A decision to make a pair of Eastern Brown Snakes sculptures into the word *be* led to a literal way to address the research question. In the studio and foundry my focus was on metaphysical properties of bronze processes to see if they could bring to light a relationship with snakes. This resulted in identifying the sequential use of moulds, the manipulation of the thermal properties microcrystalline wax and the bronze pour as stages in the lost wax casting process that had esoteric links to Serpents and the life of snakes.

To test audience reactions to my work the installation *being* was presented in two separate exhibitions. While both exhibitions placed Eastern Brown Snakes in the public domain, *Snakes Alive* provided the best opportunity to observe audiences, speak with them about my research project and to learn about their experiences with snakes. At *Snakes Alive* children often referred to my sculptures as “fake snakes” which was an ironic reflection of the genus name for the Eastern Brown Snake *Pseudonaja* meaning “fake” or “false cobra”. While the installation *being* embodied visual movement it was essentially a static exhibit situated within the framework of a live snake event. Audiences both human and avian were initially intrigued by the sculptures but once they worked out that the metal forms posed no danger the level of attention to the snake sculptures diminished. As the installation was located in close proximity to live snakes it acted as a locus for people to share their stories about encounters with elapid snakes and in recounting their experiences, snakes became alive in language.

2 Red-bellied Black Snakes: *likeness*

Red-bellied Black Snakes were the focus of my practice-led investigation in 2012. Working under the title *Moon over the Murrumbidgee* I developed a multi-layered poetic and biological interpretation of Red-bellied Black Snakes that utilized the capacity of bronze to accurately record the snake's appearance. The project was also an attempt to make a creative connection between Red-bellied Black Snakes and the Universe, the Moon, and the Murrumbidgee River. It resulted in a series of six bronze sculptures. These sculptures aimed to speak about the life of Red-bellied Black Snakes through detailed observation of their external form, serpentine movement and the snake's affiliation with water and seasonal cycles. To achieve this I adopted an experimental process to use a large slough or shed snake skin as a template to model the tapering body of the snake and its distinctive scales. I also developed a way to cast wax into a mould and bend the wax snake sculptures in a manner that referenced the thermoregulatory behaviour of Red-bellied Black Snakes. While this approach allowed me to make lifelike representations of Red-bellied Black Snakes the sculptures' meticulous realism reduced the project's creative impact. With a deep appreciation of the colourful characteristics of the Red-bellied Black Snakes and their status as an icon of Australian fauna, the venture to model, cast and patina the bronze sculptures took over a year to complete.

Red-bellied Black Snakes

Red-bellied Black Snakes are considered to be shy, unaggressive animals with "happy-go-lucky" natures.⁷⁹ As their name implies they have scales that are mainly black with bellies that can be different hues of red, orange, salmon pink and pale yellow. This scale pigmentation is used to aid Red-bellied Black Snakes in survival. Research has shown that snakes tilt their heat-absorbing black scales in relation to the Sun to help regulate their body temperature.⁸⁰ While it is not known if red scales serve as an aposematic strategy used to warn other animals of potential danger, their vivid markings are both alarming and appealing to humans. Male Red-bellied Black Snakes grow to be longer than females and can reach between 1.5 to 2 metres in length.⁸¹ They occupy a geographic range of habitats, often but not always close to water, throughout the South Eastern and Eastern states of Australia.⁸² Within their home ranges they seek out

⁷⁹ Richard Shine, "Not as Black as It's Painted," *Australian Geographic* 1997, 77.

⁸⁰ Harold Heatwole and Clifford Ray Johnson, "Thermoregulation in the Red-Bellied Blacksnake, *Pseudechis Porphyriacus* (Elapidae)," *Zoological Journal of the Linnean Society* 65(1979): 99.

⁸¹ Cecilie Beatson, "Red-Bellied Black Snake," Australian Museum Website, <http://australianmuseum.net.au/Red-bellied-Black-Snake/>.

⁸² Harold G. Cogger, *Reptiles and Amphibians of Australia* (Melbourne: Reed 1996), 668.

mostly frogs and also small mammals, reptiles, fish and tadpoles.⁸³ Venom from their two short fangs can be used to subdue their prey. The toxic effect of this venom is also potentially lethal to children.⁸⁴ Due to the moderate temperament of Red-bellied Black Snakes however, instances of human death from envenomation are rare.

With a preference to live near water and a widespread dispersal throughout much of Eastern Australia, Red-bellied Black Snakes are frequently encountered and recorded by humans. They were well known to the Aboriginal people of the Canberra region who refer to Blacksnakes as *dyrriabity* or *kullendyulin*.⁸⁵ After colonial settlement of Australia this snake became the first elapid species to be scientifically catalogued by George Shaw, a naturalist who was working at the British Museum in 1794.⁸⁶ He called it the *Crimson-Sided Snake*, *Coluber porphyriacus* and a hand coloured engraving by James Sowerby that accompanied its description remains an archetype of early Australian natural history illustration (fig. 41). Some years later in 1869, a depiction of a Red-bellied Black Snake by Helena Scott titled *Pseudechis porphyriacus* appeared in Gerald Krefft's publication *The Snakes of Australia* (fig. 42).⁸⁷ Both these illustrations are detailed drawings of snake specimens that were probably kept coiled in bottles of preserving alcohol. As contextual precedents for my research they remain luminous records of Red-bellied Black Snake anatomy and convey the artists' desire to communicate the life and beauty of the animal.

⁸³ Ibid.

⁸⁴ John Pearn et al., "The Envenomation Syndrome Caused by Australian Red-Bellied Black Snake *Pseudechis Porphyriacus*," *Toxicon : Official Journal of the International Society on Toxinology*, no. 38 (2000): 1723.

⁸⁵ These names for Red-bellied Black Snakes were provided through personal correspondence with Paul House from the Ngambri Local Land Council. In other correspondence with Aunty Jannette Phillips who is an artist and an elder from the local Ngunnawal people I learned that the Red-bellied Black Snake is considered to be "a kind of guardian that serves to warn of an enemy". She told me; "never to touch it". Aunty Jannette knew of a word for Red-bellied Black Snakes that her Great Grandmother Cecelia Walker recorded on a wax cylinder. While I was asked not to repeat the word, it exists amongst the vast symbolic and practical understandings that Aboriginal people have for snakes as they have encountered them over 50,000 years or more.

⁸⁶ George Shaw, *Zoology and Botany of New Holland and the Isles Adjacent, Zoological Part* (London: J. Sowerby, 1794), 26, 27.

⁸⁷ Gerald Krefft, *The Snakes of Australia* (Sydney: Richard Thomas, 1869), Plate V111.

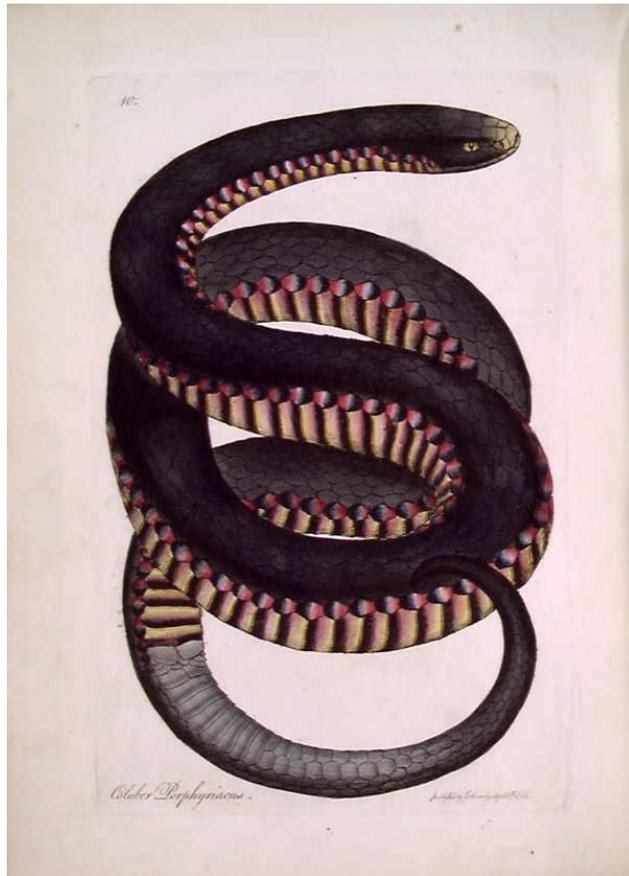


Fig. 41: *Crimson-Sided Snake (Coluber porphyriacus)*, hand coloured engraving by James Sowerby, 1794.

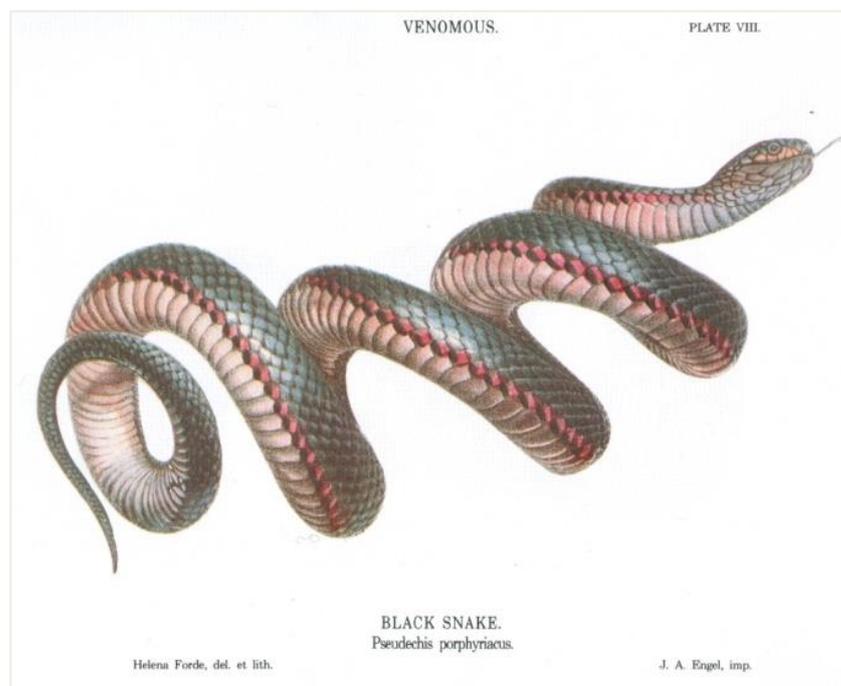


Fig. 42: *Black Snake. Pseudechis porphyriacus*, hand coloured lithograph by Helena Scott, in Gerard Krefft's, *The Snakes of Australia*, 1869.

A photograph taken by Julian Green of two Red-bellied Black Snakes that was printed in *The Canberra Times* newspaper served as a further reference to my research (fig. 43).⁸⁸ Bringing elapid snakes into contemporary consciousness the photo showed two male snakes engaged in a vicious combat at Tidbinbilla Nature Reserve close to Canberra. In an attempt to obtain dominance and gain access to breeding females, the snakes rear up and clearly expose their ventral scales. They energetically thrash about in a writhing wrestle, hiss and strike at each other's head until one is vanquished from the area. This dramatic spectacle has been observed by herpetologists studying snakes in captivity and in the field.⁸⁹ It occurs at a particular time of year when the Australian landscape begins to get warmer and snakes commence their annual cycle of species renewal. In early October 2012, Green's photograph appeared as a seasonal reminder of reptilian life just outside of Canberra's urban areas and provided a pictorial guide to the external anatomy of Red-bellied Black Snakes that I would closely study.



Fig. 43: Two Red-bellied Black Snakes photographed fighting for females at Tidbinbilla Nature Reserve.

As biologists search for evolutionary interrelationships between snakes and all living things Red-bellied Black Snakes continue to be the subjects of behavioural, morphological and phylogenetic research. Placed in the genus *Pseudechis*, Red-bellied Black Snakes form a part of a group of elapid snakes known as the Black Snakes. This genus includes snakes such as the King Brown Snake, Spotted Mulga Snake, Blue-bellied Black Snake, Papuan Black Snake and several taxonomically unconfirmed species including the Pygmy Mulga Snake and the Dwarf King Brown. Not including Tasmania snakes of the genus *Pseudechis* live in most regions of Australia and in some places in Papua New Guinea. Red-bellied Black Snakes are unique amongst the Black Snakes in the way that some pregnant females gather in nursery groups to give birth to

⁸⁸ John Thistleton, "Red-Bellied Black Fury in the Snake Pit.," *The Canberra Times*, <http://www.canberratimes.com.au/act-news/redbellied-black-fury-in-the-snake-pit-20121015-27n8s.html#ixzz2XYRLxeEK>.

⁸⁹ David Fleay, "Savage Battles between Snakes," *Walkabout* 1951; Richard Shine et al., "Mating and Male Combat in Australian Blacksnakes *Pseudechis Porphytiacus*," *Journal of Herpetology* 15, no. 1 (1981).

their young fully-formed in fluid filled protective sacs.⁹⁰ Other research has pointed to the habitation of cold climates as a possible reason for Red-bellied Black Snake viviparity.⁹¹

Biologists have also studied Red-bellied Black Snake to explain how snakes control their body temperature through external heat sources. By flattening out their bodies to expose a large surface area to the Sun, snakes can quickly heat up. Then by shuttling into and out of direct sunlight they maintain their temperature in a range of about 28-31°C.⁹² At the end of the day they retreat to dens underground or hollow logs and shift their form into an enclosed gathering of coils to reduce heat loss throughout the night. As a foundry artist I was keen to explore what I perceived to be a correlation between the Red-bellied Black Snake thermoregulation and the thermal properties of microcrystalline wax. It became one of several lines of inquiry that motivated this sculptural project. Other ideas drew upon geological knowledge of the Earth and the Solar System and the snake as a symbol of the cosmos (fig. 44). Finding a way to bring these thoughts together presented a sculptural challenge that would both evolve over, and directly reference, time.



Fig. 44: One of the bronze sculptures called *all things known-all things sensed from the Moon over the Murrumbidgee* series that makes reference the snake as the Ouroboros symbol of the cosmos.

⁹⁰ Shine, "Not as Black as It's Painted," 84, 85.

⁹¹ "The Evolution of Viviparity: Ecological Correlates of Reproductive Mode within a Genus of Australian Snakes (*Pseudechis*, Elapidae)," *Copeia* (1987).

⁹² Heatwole and Johnson, "Thermoregulation in the Red-Bellied Blacksnake, *Pseudechis Porphyriacus* (Elapidae)," 96; Richard Shine, *Australian Snakes: A Natural History* (Sydney: Reed, 2009).

The Ouroboros and the Cosmic Serpent

The concept of time had the potential to unify the separate threads of my investigation. In serpent mythology the phenomenon of the Cosmic Serpent is generated by a consciousness of perpetual time.⁹³ This cyclical symbol of the snake is commonly expressed as the Ouroboros. The idea for this symbol originates in Palaeolithic art and is subsequently represented as a mystical and religious emblem in many cultures.⁹⁴ The Ouroboros depicts a snake arced into a circle where its head marks a starting point that endlessly envelops its tail. Visually active, the Ouroboros is an iconic graphic symbol of eternity that has taken on different meanings throughout history. It is generally recognized as a reference to an eternal passage from the past to the future, from nothing into consciousness, from one thing into everything. Full of energy, it refers to universal forces and continuing time. An example of this is the annual return of seasons. During the Earth's continual orbit around the Sun, gravitational forces cause it to tilt on its axis. This results in summer and winter in the Earth's hemispheres. These seasonal intervals govern most life forms on the Earth, especially ectothermic animals like snakes that rely on the Sun in order to metabolize. In the Southern Hemisphere the return of summer is an abiding sign of elapid snake activity.

The Murrumbidgee, the Moon and Red-bellied Black Snakes

Near Canberra, Red-bellied Black Snakes often bask in the Sun on rocks and logs along the banks of the Murrumbidgee River. This upper section of the Murrumbidgee is close to my home and runs along the northern part of the farm where it has etched a deep gorge into the land. The river is old. It may have originally started to flow when the mountainous landscape of the region was formed, sometime in the early Miocene approximately 20 million years ago.⁹⁵ Set in geological time the Murrumbidgee River can be understood in terms of Earth and planetary sciences. Beyond human experience this is a notion of physical time extending back to the origin of our Solar System some 4.6 billion years ago. It is a time when astrophysicists believe the Sun and its orbiting planets were created following the collapse of a giant molecular cloud.⁹⁶ Living in a rural location I often look out into the night sky to ponder the occurrence of universal events that allowed life to flourish on Earth. As I look into space I immediately focus on the Moon as it rotates around the Earth (fig. 45).

⁹³ Drake Stutesman, *Snake* (London: Reaktion, 2005), 36.

⁹⁴ *Ibid.*

⁹⁵ Robert Young and Ian McDonald, "Long-Term Landscape Evolution: Early Miocene and Modern Rivers in Southern New South Wales, Australia," *The Journal of Geology* 101(1993): 1.

⁹⁶ Brian J. Skinner, Stephen C. Porter, and Jeffery Park, *Dynamic Earth* (USA: John Wiley & Sons, 2004).

Reflecting rays from the Sun, the Moon appears in the sky as a constant marker of celestial time. It exerts a subtle presence on this Murrumbidgee landscape, an ancient place where Red-bellied Black Snakes live.



Fig. 45: The full moon as it appeared rising over the farm in early 2012.

While this project makes a connection between Red-bellied Black Snakes and the Moon in reality they are primarily diurnal-basking snakes that retreat into their protected dens at dusk. There are however, reports that in some places they move about on warm summer evenings.⁹⁷ I imagine these snakes flicking the damp air with their tongues to detect scent particles as they navigate through this nocturnal world. At night, life cycles of many plants and animals respond to changing phases of the Moon.⁹⁸ Fragrances from certain flowers are released during particular lunar events to attract insects and nectar feeders. These in turn attract predators such as spiders and owls. Amid the danger posed by predatory animals, alien sounds and subtle olfactory sensations, this is a world little known to humans. Whether Red-bellied Black Snakes stay hidden in their dens or venture out on summer nights, their relationship to the Moon is one of mystery.

⁹⁷ Beatson, "Red-Bellied Black Snake".

⁹⁸ Erwin Bünning and Ilse Moser, "Interference of Moonlight with the Photoperiodic Measurement of Time by Plants, and Their Adaptive Reaction," *Proceedings of the National Academy of Sciences* 62, no. 4 (1969).

Making the sculptures

With a wondrous impression of some of the known and unknown temporal phenomenon encompassing the lives of Red-bellied Black Snakes, I set about creating a series of bronze sculptures. Building on knowledge gained in the first project, my intention was to explore the thermal properties of wax in relation to the behaviour of snakes and to find a way to bend the snake sculptures while they were in the wax state. I also wanted to refine the form of the sculptures and to develop a quicker way to work. The sculptural process began with a large Red-bellied Black Snake slough or shed snake skin (fig. 46). The 2 metre long skin was abandoned by a female snake along the banks of the Bega River in February 2011. The inverted papery skin was found by an artist friend while she was walking her dogs near the Bega causeway. Anna Buck reported that the snake had recently left its skin behind when she came across it and that it had a strong metallic smell. Her two dogs were apparently repelled by the smell and walked along at some distance as she made her way home with the fragile snake skin draped around her neck. Not long afterwards, Anna presented it to me for the purpose of my sculptural research. It occurred to both of us that the shed skin implied resurrection, transformation, healing and immortality in Serpent mythology.⁹⁹ With an awareness of this potent symbolism, I welcomed the challenge to use the skin as a way to give a sense of life to the Red-bellied Black Snake sculptures.

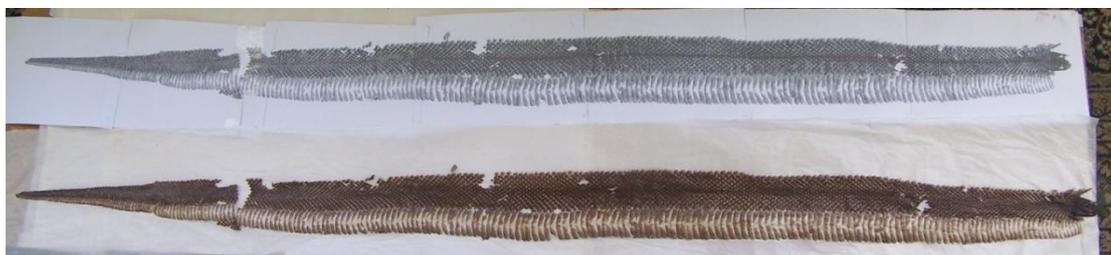


Fig. 46: The 2 metre long Red-bellied Black Snake skin glued onto tissue paper and a black and white photocopy of the shed skin.

The skin was reversed when the snake peeled it off. To turn it inside out I enclosed it inside a plastic bag with a wet sponge. Left for several hours, this allowed it to soften. Using small scissors I then snipped the delicate skin and cut it lengthways along a naturally occurring fold in-between the ventral and the paraventral scales. Following this I opened it out and glued it to a length of waxed paper. By dabbing the top of the skin with a wet sponge the underside became sticky and made a kind of glue. This adhesive substance was originally a fluid layer of dissolved skin that formed between the snake's old and new skin during its regular moulting procedure. At its time of ecdysis, when the snake sheds its old skin, this liquefied layer causes its eyes to become

⁹⁹ Stutesman, *Snake*, 34.

cloudy making it difficult for the snake to see. During this time snakes are vulnerable to predators and remain hidden in a state known as “in the blue”.¹⁰⁰

With the fragile skin stuck onto a sheet of sturdy backing paper it became easier to handle. I took a photocopy of the skin. In this way I created a working copy that could be used in the studio in different ways. From the photocopy I traced the outline of the skin onto a long piece of fabric. This served as a pattern for the shape of the snake. The next tracing was of the snake’s scales. Traced with red pen onto tissue paper this became a record of variations in the size and shape of the Red-bellied Black Snake’s scales and the distinctive way they overlap (fig. 47). The photocopy of the skin was also used as a measure for a steel armature to support a plasticine model of the snake.

Using these different tracings of the shed snake skin I set about to build a long straight model of the Red-bellied Black Snake. Plasticine was modelled directly onto the armature. The snake’s mass and tapering body shape was then created by fitting the fabric pattern over the plasticine sculpture. Scales were modelled onto the surface of the three dimensional form by laminating the tissue paper tracing over the model and pressing it into the soft plasticine with dental tools (fig. 48). Knowing that I was closely following the shed skin gave a sense of calculation and control over the exacting process of anatomical observation. The tracing allowed me to work quickly as I scored hundreds of scales along the two meter plasticine snake sculpture.

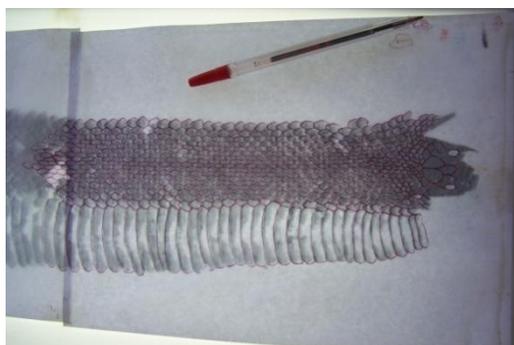


Fig. 47: The photocopied snake skin was traced onto tissue paper.



Fig. 48: The tissue paper tracing was pressed into the plasticine model.

The experimental process of creating a realistic bronze sculpture of the Red-bellied Black Snake continued into the mould making stage. Looking like a two meter long stretched-out *broom-handle snake* the plasticine model was designed to be integral to the mould making and casting processes. Like the first project, I constructed a two piece polyurethane rubber mould supported by a two piece plaster mother mould around the Red-bellied Black Snake plasticine sculpture. A pouring spout was built into the centre of the mould and vents were placed at both ends to let the air escape when wax was poured in. Through this design liquid wax could flow a meter in each direction to

¹⁰⁰ Harry W. Greene, *Snakes: The Evolution of Mystery in Nature* (Berkeley: University of California Press, 1997), 27.

fill the head and the tail of the snake sculpture. My untried plan was to pour hot wax into the mould, let it cool until it solidified then take it out and bend it into different shapes. If it worked, the mould would allow me to bend wax snake sculptures into a sequence of postures to create an illusion of movement in series of the finished bronze snake sculptures.

The first few attempts to cast and bend wax snakes from the mould failed dismally. When I lifted the warm wax snake out of the mould and tried to bend it, it crumpled into an irretrievable mess. However, after contacting the wax manufacturer I was able to establish the amount of time needed for the wax to congeal so that it would be firm enough to bend but not break apart. Peter Smith from *Darrent Wax* in Sydney reassured me that the properties of *Brown Wax* should allow my experiment to work and advised me to leave it for approximately an hour before removing it from the mould.



Fig. 49 a-d: A sequence of images showing the silicon and plaster mould and the process of bending a newly cast wax snake into a moon shape.

The third cast worked. After leaving the wax to crystalize for an hour I cautiously lifted it out of the mould with the help of an assistant and placed it onto a black modelling board. The board, which had been sitting in the sun, was warm and prevented the wax from cooling. By keeping the wax sculpture at a workable temperature I applied varying degrees of pressure to the soft form and gradually manipulated it into a circular shape (fig. 49 a-d). While I was bending the wax snake I discovered that exposure to

direct sunlight would quickly soften the sculpture and by moving into and out of the sun I was able to control its malleability. It was a process similar to the way Red-bellied Black Snakes shuttle between the sun and the shade throughout the day.¹⁰¹ Once establishing this technique I set about integrating my ideas about Red-bellied Black Snakes, the river and the Moon into a series of sculptures.

Six separate Red-bellied Black Snake sculptures evolved from these experiments with soft wax. The forms were bent to show a progression of snake movements unfurling over time. They were meant to be seen as different phases of the Moon and a formal reference to the Ouroboros. Amongst the different shapes that I created was an undulating linear snake that was a symbol of flowing water. Initially I devised the sculptures to be displayed on a wall. This idea was intended to communicate a sense of the night sky and to reinforce a symbolic reading of the snake. As the work progressed however, the display and the grouping of finished sculptures would take a number of different manifestations.

Casting and patination of the sculptures in bronze

The process of casting the series of Red-bellied Black Snake sculptures into bronze followed the same sequence used in the first project. On 12 and 18 of May 2012 they were successfully poured. A similar process of chasing and refining details on the metal sculptures followed (figs 50 & 51). Then by evenly heating the sculptures and spraying them with a chemical solution called *Liver of Sulphur* I was able to achieve the blue-black colour of the Red-bellied Black Snake's dorsal scales (fig. 52). Next, the belly scales were painted with successive layers of salmon pink and vermilion oil paint that was sealed with automotive lacquer (fig. 53). By referring to a museum specimen and images in books and the newspaper I was able to estimate the appearance of belly scales which vary in pigmentation in individual snakes from pale yellow to fire engine red and change in hue as they wrap around the underneath of the snake. In trying to work out a general pattern for the colour of the belly scales I observed that the red is brightest on the upper edges of the each scale where it meets the paraventral scales along the side of the snake and becomes paler towards the belly. The belly scales have a black edge where they overlap the preceding scale and the caudal and subcaudal scales under the snake's tail are black. The red and black paraventral scales are most distinctive and by painting a section of these scales red I was able to approximate the Red-bellied Black Snake markings.

¹⁰¹ Shine, *Australian Snakes: A Natural History*, 82.



Fig. 50: Two sculptures were attached to a gating system after the bronze pour.



Fig. 51: The sculptures were repaired using TIG welding.



Fig. 52: Heat from a blow torch and a chemical solution called *Liver of Sulphur* was used to oxidize the surface of the bronze sculptures.



Fig. 53: Red belly scales were painted with successive layers of oil paint and a protective layer of acrylic lacquer.



Fig. 54: The patina on one of the sculptures was finalized for display at the South Australian Museum in 2013.

The display of two sculptures

In 2013 I displayed two Red-bellied Black Snake sculptures from the *Moon over the Murrumbidgee* series in three different exhibition venues. The first bronze Red-bellied Black Snake sculpture called *Murrumbidgee Midday* was displayed the ACT Herpetological Association's exhibition *Snakes Alive* in January 2013 (figs 55 & 56). Building on experience from the previous year I decided to display the sculpture on a concrete base inserted into a wooden plinth. The idea behind this was to elevate the sculpture off the ground to allow viewers a closer look. It also provided a protective foundation for the artwork at the busy entrance to *Snakes Alive*. Once again I set the artwork up each morning, spoke with people and observed their reactions to my display. Throughout a hot week where temperatures reached above 32°C I noticed that people approached the display and responded with less interest than the year before. This pattern of audience engagement was similarly detected in May 2013 when another sculpture from the series that I called *all things known-all things sensed* was exhibited at the *Waterhouse Natural Science Art Prize* at the South Australian Museum in Adelaide and later at the National Archives of Australia in Canberra. While both these sculptures were on display I watched people walk directly to the artwork; bend down to inspect the sculptural detail and wander off in a few seconds.



Fig. 55: In January 2013 I displayed a bronze Red-bellied Black Snake sculpture called *Murrumbidgee Midday at Snakes Alive*.



Fig. 56: The sculpture was displayed on a concrete and wooden base.



Fig. 57: In October 2013 I presented a gallery floor talk at the *Waterhouse Prize for Natural Science Art* while my sculpture was on display at the National Archives of Australia.

Audience reaction and issues of sculptural likeness

An appraisal of audience reactions to these exhibitions indicated different sculptural and biological factors that affected the success of my inquiry to see if bronze as a process and a material could somehow reveal the life of snakes. It is important to point out that these reactions were in regard to two sculptures displayed horizontally on individual gallery plinths. Nevertheless, it seemed that the lifelike nature of the finished sculptures

firstly attracted people and then distanced them. Maybe this was due to the way the surface patina hid the metallic properties of the bronze. Perhaps it had something to do with theories of aesthetics first put forward by Gotthold Lessing in his 1766 treatise on *Laocoön* or Lynne Anne Isbell's snake detection theory. In Lessing's paragone between sculpture and poetry he sees the plastic mediums as fixed in a single moment where sole reliance on descriptive external appearance alone "is the least significant means by which he, [an artist], is able to awaken interest".¹⁰² As an artist of many years, I acknowledge Lessing's invitation to find succinct ways to activate sculptural imagination. But the manner, in which audiences were initially drawn to the snake sculptures and quickly dismissed them, indicated a different kind of looking. Conceivably it was an example of detection that occurs in neurological visual pathways in mammals for sensing venomous snakes. Isbell identifies these as the superior colliculus (SC)-pulvinar which "detects the objects and directs attention to it" and the lateral geniculate nucleus (LGN) which enables mammals "to identify the object as a snake (or not), ignore it, move away from it, utter alarm calls and stare at it, attack it, or eat it".¹⁰³ While nobody tried to eat my sculpture, in establishing that it was not a threat to their safety; the viewer's attention dissipated.

Summary

The series of sculptures with the working title *Moon over the Murrumbidgee* evolved out of a quest to find out if the material and processes of bronze could reveal the life of Red-bellied Black Snakes. It was multi layered experiment where I discovered how to: use a shed Red-bellied Black Snake skin as a template to record the external anatomy of the snake; to bend wax sculptures into different shapes while the wax was soft; and to make poetic connections between the snake, the Universe, the Moon and the river. This was an ambitious task for a project in its early stages. Through my endeavour to reveal the life of the snake, the process of manipulating wax on a black board and moving it into and out of the sun referenced shutting behaviour of Red-bellied Black Snakes and their ectothermic nature. This discovery allowed me to sense the life of the snake in the work of art. The display of two lifelike Red-bellied Black Snake sculptures as finished artworks however, presented aesthetic issues to do with the representation of snakes. This demonstrated a need to build a broader sculptural outlook into my practice-led inquiry. In the next project I found ways to address this problem by focusing on the foundry as a context for the snake sculptures. This idea occurred to me when I was studying ancient fragments of equipment and debris, excavated from archaeological bronze sites while I was on my research field trip.

¹⁰² Gotthold Ephraim Lessing, *Laocoön an Essay on the Limits of Painting and Poetry* [1766] (Baltimore: The Johns Hopkins University Press, 1962), 23.

¹⁰³ Lynne A. Isbell, *The Fruit, the Tree, and the Serpent : Why We See So Well* (Cambridge, Mass: Harvard University Press, 2009), 146.

3 Death Adders and Tiger Snakes: *allegory*

Bronze as an enigmatic material and way of working

My research trip to locate key examples of bronze Serpent sculpture provided a good opportunity to learn about bronze metallurgy in places where it has been practiced for thousands of years. This international study allowed me to think about the properties of bronze as a historical material and to reflect on both its physical and numinous dimensions. The concept of bronze is metonymic. It simultaneously implies a cast, copper-based object and a metallurgical process developed in the Bronze Age. Many of the museums I visited during the study trip housed galleries where the display of bronze objects and explanations of the bronze process were framed within an archaeological context. Here, thousands of functional and symbolic bronze objects that stood for previous cultural practices were displayed in illuminated museum showcases. Presented alongside the objects were explanations of the *cire perdue* or the lost wax casting process. As this process is described as “lost” and it entails a difficult-to-follow sequence of material transformations, graphic displays and gallery wall texts were used to illustrate the ancient casting procedure. These interpretations often featured fragments of equipment and debris excavated from ancient smelters and foundries. Shown next to the bronze objects were lumps of slag, dusty bits of clay tuyeres¹⁰⁴ and oxidized ingots that appeared to have been awoken from their passage back into the earth. The visceral quality of these casting artefacts added a deeper sense of mystery to the understanding of bronze and when I returned to working in the studio became a characteristic of my next series of sculptures which focused on Death Adders and Tiger Snakes.

Bronze as time

At the ANU foundry, amidst buckets of plaster, bronze off-cuts, the furnace and noisy extraction fans, is the environment where I pause to think about the network of connections that can be made not only between bronze and Serpents but also between bronze and all of existence. The tiny bits of bronze swept up from around my metalworking area were grounds to reflect on the elementary properties of bronze and how they are a product of time. The filings alluded to the fundamental forces that created the element of copper at the beginning of the Universe and how it continues to erode and reform in different states on Earth. In the geological history of the Earth, copper is amassed as deposits of native and mineral ores, sulphides and carbonates. It exists in the atmosphere, as an ion diluted in water, in the blood, tissues and bones of

¹⁰⁴ A clay tuyere is an air pipe connected to bellows in low technology furnace.

many animals and cells of plants, and is also a record of human industry. The colour and qualities of copper and its alloys appealed to generations of bronze metalworkers who gave shape to its atoms in the form of technical and sculptural expression. Continuously mined, broken down, smelted, traded, cast and replicated over time, bronze is a sculptural medium through which the vitality of human and animal existence is articulated. Looking at the filings swept from my work bench I wonder about the vast journeys that have led them to gather in my dustpan. Could they be fragments from coins, weapons or statues commemorating former dignitaries and deities? Were they once Serpent?

Bronze as an allegory for Death Adders and Tiger Snakes

Death Adders and Tiger Snakes emerged as the focus of my third practice-led project. This venture came about as an extension of my field trip and through creative exchanges with members at the ACT Herpetological Association. Thanks to the technical assistance of Nick Stranks at the ANU Hot Metal Casting Research Facility these influences resulted in a series of sculptures that used foundry processes and properties of bronze as allegories to illustrate characteristics of Death Adders and Tiger Snakes. Three of these works of art looked at the way Death Adders lure their prey by wriggling the tip of their tail like a worm. In one sculpture this behaviour inspired a narrative that referenced the history of bronze in the Renaissance and Serpent symbolism in the Old Testament. Tiger Snake defence tactics and the bronze Serpent that symbolically appears during a bronze pour were in my mind as I developed the subsequent sculptures that incorporated foundry crucibles into the finished work. Using other foundry materials and processes in a metaphorical way I worked quickly and intuitively in an attempt to conceal and then reveal sculptures of Death Adders and the Tiger Snakes. In the broader context of this investigation my intention was to point to the life of snakes through an anthropomorphic examination of their behaviour and to invite the viewer to consider them as living entities outside of this symbolic understanding. Even though real snakes were absent, sculptural narrative and material resonance endeavoured to communicate their existence.

Death Adders

What thoughts spring to mind with the common name Death Adder; a noxious killer, an adder? Actually Death Adders belong to the *Elapid* family of snakes in the genus *Acanthophis*. While not closely related to venomous vipers and adders from Africa, Eurasia and the Americas, Death Adders from Australia and Papua New Guinea are remarkably similar. Their body shapes, elliptical pupils and specially modified tail tips used in ambush foraging predation are some of the anatomical features that make Death

Adders an example of convergent evolution.¹⁰⁵ The similarity between Death Adders and Vipers is a herpetological anomaly which sets Australian Death Adders apart from other elapid snakes. On top of this, the biological relationship between different species of Death Adders that make up the genus *Acanthophis* is uncertain. Until research can prove the interrelationships between the different species of Death Adders and how they evolved to live in different habitats across Australia and Papua New Guinea, six groups are prudently recognized. Death Adders living closest to Canberra in the south east of NSW are called Common Death Adders, *Acanthophis antarcticus*. In this region the local Ngambri people call them *muddyawit*.¹⁰⁶ I have not seen *Acanthophis antarcticus* in the wild but a captive specimen of the desert dwelling *Acanthophis pyrrhus* belonging to herpetologist Richard Longmore is frequently on display at *Snakes Alive*. Richard (or Ric) is known for his work in compiling an authoritative survey of the elapid snakes of Australia and gave me several shed snake skins for the purpose of this study.¹⁰⁷ One of the *Acanthophis pyrrhus* skins he gave me was from a snake called Rowen that Ric kept as a highly regarded captive specimen for over 17 years. The well cared for snake was named after the British comedian Rowen Atkinson who played a cynical and devious character in the BBC1 television sitcom *Blackadder*.

At *Snakes Alive* Ric chooses a day to feed his Death Adder. Using a long pair of tongs he offers the snake a recently defrosted dead mouse that was purchased frozen from a reptile supply outlet (fig. 58). If the snake is hungry it will grab the mouse and swallow it head first. Within a few minutes the mass of the mouse can be seen to progress inside the captive snake's stomach where it is digested over time. In the wild, the feeding scenario of *Acanthophis* is quite different. It can be viewed as a creative act of natural selection where the snake's tail is used as a caudal lure to catch the attention of its prey. As an ambush hunter the Death Adder's complex markings and motionless body make it almost invisible amongst the ground cover in its particular environment. Standing out against darker surroundings, the bright tip of its tail moves in a horizontal, worm-like rhythm to lure lizards, frogs, small mammals and birds into easy striking distance.¹⁰⁸ It works! And two slightly arched, 6mm long fangs are used to inject neurotoxic venom into the prey.¹⁰⁹ The Death Adder uses these fangs to fork its paralysed food through outstretched skull bones to be swallowed past its trachea into its stomach. Internet footage of the phenomenon is compelling.¹¹⁰ To watch the deliberate actions and

¹⁰⁵ Richard Shine, "Ecology of the Australian Death Adder *Acanthophis Antarcticus* (Elapidae): Evidence for Convergence with the Viperidae," *Herpetologica* 36, no. 4 (1980).

¹⁰⁶ This name was provided through corresponding with Paul House from the Ngambri Local Land Council.

¹⁰⁷ Richard Longmore, "Atlas of Elapid Snakes of Australia," (Canberra: Bureau of Flora and Fauna, 1986).

¹⁰⁸ Harold G. Cogger, *Reptiles and Amphibians of Australia* (Melbourne: Reed, 1996), 632.; M. Hagman, B. L. Phillips, and R. Shine, "Tails of Enticement: Caudal Luring by an Ambush-Foraging Snake (*Acanthophis Praelongus*, Elapidae)," *Functional Ecology* 22, no. 6 (2008).

¹⁰⁹ Terrence Davidson, Susan Schafer, and Brian Capeloto, "Death Adders," *Journal of Wilderness Medicine* 3(1992): 9.

¹¹⁰ wildvisuals, "Deadly Australians; the Death Adder," <http://www.youtube.com/watch?v=ir9Ww6PbW7o>.

deadly reflexes of the Death Adder in relation to the curious innocence of a mouse or a small bird is an instance of dramatic irony. In maintaining biological objectivity however, it is important to note that the Death Adder's caudal lure is also attractive to invasive, toxic Cane Toads in northern Australian habitats. A high percentage of native snakes die after ingesting these poisonous introduced toads.¹¹¹



Fig. 58: *Acanthophis pyrrhus* belonging to Ric Longmore was fed a mouse at *Snakes Alive*, 2013.

Making the sculptures – Death Adder: *Matter*

The Death Adder's caudal lure, its attraction to mice, its lightning strike and the cryptic way it blends into its environment were behaviours that I hoped to comment on in the first sculpture of this series called *Matter*. The sculpture started with one of the last sloughs that Ric collected from Rowen's heated serpentarium before the snake died in 2011. Knowing that Rowen had been hand reared, closely studied and was a prominent attraction at *Snakes Alive* for many years, added a greater sense of purpose to recreating his form in bronze. Following the previous project I cut Rowen's shed skin from the middle of the lower jaw to the tip of the special lure and flattened it onto wax paper. This time, instead of cutting along the edge of the belly scales I cut through the centre of each belly scale which made it easier to join the skin back together later. I then modelled a plasticine sculpture of the Death Adder. To check the proportions, I showed Ric the model and by squeezing it at the neck he gave emphasis to its "somewhat triangular head" and "narrow neck" that typify the Death Adder.¹¹² The fact that I had created the model with a broad neck was a reminder of the elastic quality of snake skin

¹¹¹ Mattias Hagman, Benjamin L. Phillips, and Richard Shine, "Fatal Attraction: Adaptations to Prey on Native Frogs Imperil Snakes after Invasion of Toxic Toads," *Proceedings of the Royal Society B: Biological Sciences* 276, no. 1668 (2009).

¹¹² Cogger, *Reptiles and Amphibians of Australia*, 632.

when using it as a pattern. With a two piece silicon rubber and plaster mould of the Death Adder complete, I cast it in wax and bent it into a horseshoe shape characteristic of the snake's caudal lure strike posture. At this time I modelled a mouse in plasticine, then made a mould of the mouse and cast it in wax to go with the Death Adder sculpture.

The first sculptural arrangement of a Death Adder and mouse, investigated the bronze ludo investment and the flow of molten bronze during a pour as an allegory for the Death Adder's hunting behaviour. To create the sculpture I made a Death Adder and mouse in wax, joined them together with a wax gating system (fig. 59), flooded the sculptural group in ludo and plaster (figs 60 & 61), cast them in bronze. In making the sculpture I designed the gating system to imply the force and directional movement of the Death Adder's strike through the placement of the pouring cup and wax channels. This design allowed molten metal to flow into the body of the snake then through two channels into the body of the mouse uniting the predator to the prey in a manner that referenced two elapid fangs. After the bronze pour I left the ludo investment in place around the bronze and chipped the investment away to reveal the mouse and some of the snake's head and tail (fig. 63). The idea behind the sculpture was to explore the ludo investment as a kind of concealing and revealing landscape for the snake and mouse. During the investment stage the ludo flowed as slurry around the wax snake and mouse. It hardened in the burnout kiln and became cracked and seared around the bronze after the pour. White, powdery and inert, once fluid now baked and compressed, the investment material conveyed a sense of transformation as a symbolic setting for the snake and mouse narrative. Encasing the snake and mouse sculptures, this investment material had a similar quality to the fragments from ancient foundries that I had seen on my field trip.

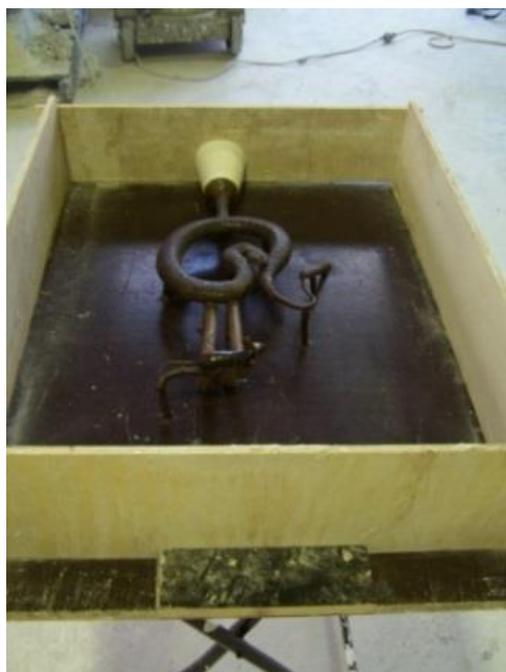


Fig. 59: The wax Death Adder and mouse were joined together with a gating system that was symbolic of an ambush predator.



Figs 60 & 61: The wax Death Adder and mouse were flooded with ludo and plaster to create the investment mould.



Fig. 62: The Death Adder and mouse were cast in bronze.



Fig. 63: The process of chipping the investment away gradually revealed the bronze mouse.

Death Adder: *Temptation*

Histories of bronze in the Renaissance together with the symbol of the Serpent as Satan were concepts that materialized in the next Death Adder sculpture. Titled *Temptation* the sculpture was a reference to the famous bronze doors of the San Giovanni Baptistery in Florence and the Death Adder's distinctive hunting strategy. There are three pairs of bronze doors at the San Giovanni Baptistery. The first doors were created by Andrea Pisano between 1330 and 1336. The second and third set of doors were designed and cast by Lorenzo Ghiberti and his workshop as commissions spanning the years 1400 to 1452. Sculpted with a goldsmith's attention to detail, the doors known as *The Gates of Paradise* were Ghiberti's final Baptistery commission. They are acclaimed as a defining artwork in the history of bronze sculpture and an icon of Renaissance art.¹¹³ The panel called *Adam and Eve* is presented as the first of ten "historie" scenes from the Old Testament that Ghiberti created as gilded bas relief panels inlaid into the massive bronze doors.¹¹⁴ The square format of *The Gates of Paradise* scenes differed from the earlier sets of doors which framed narratives from the life of John the Baptist and the New Testament within a barbed-quatrefoil decorative motif (fig. 64). The *Temptation* sculpture I created in 2013 referenced all of these bronze doors. It shows a Death Adder attracting two mice with its caudal lure and a barbed-quatrefoil motif sand-cast onto a bronze plate which serves as a stage for the Biblical and biological scene (fig. 65).



Fig. 64: Lorenzo Ghiberti's famous bronze competition panel, for the doors of the Baptistery of San Giovanni are framed within a barbed-quatrefoil motif



Fig. 65: *Temptation* shows a bronze Death Adder and two mice with material and ecclesiastical references to *The Gates of Paradise*.

¹¹³ Anna Mitrano, "Preface," in *The Gates of Paradise; Lorenzo Ghiberti's Renaissance Masterpiece*, ed. Gary M. Radke (Albany: Yale University Press, 2007). Page 7

¹¹⁴ Francesco Caglioti, "Reconsidering the Creative Sequence of Ghiberti's Doors," in *The Gates of Paradise: Lorenzo Ghiberti's Renaissance Masterpiece*, ed. Gary M. Radke (Atlanta: Yale University Press, 2007). Page 87

The Serpent in Genesis 3

Of all the Serpent mythologies perhaps it is the story set in the Garden of Eden in the Old Testament that has the greatest impact on the way that Christian cultures perceive real snakes.¹¹⁵ Genesis 3 portrays the Serpent as Satan who tempts Eve with a forbidden fruit from the Tree of knowledge. The narrative is so deep-rooted in Biblical doctrine that some Christians accept the creation story as historical fact. While belief in Genesis 3 is open to multiple interpretations, Karen Randolph Joines points out that the satanic depiction of the Serpent in Genesis 3 is a particular Jewish and Christian incarnation that came about sometime after the Babylonian Exile in 605 BCE.¹¹⁶ Prior to this, in the Yahwistic edition of Genesis 3 The Serpent is not the personification of Satan but a symbol of recurring youthfulness, wisdom, chaos, cunning and evil that can be traced back to a wide ranging anthology of Serpent mythology throughout the Ancient Middle East.¹¹⁷ Myths such as the Babylonian Epic of Gilgamesh as well as Adapa and chapter 87 of the Egyptian Book of the Dead serve as literary foundations for this earlier analysis of the Serpent as a crafty intermediary with a knowledge of plants who intercepts man's yearning to be his own god and to become immortal.¹¹⁸ Historical studies on symbols of evil also indicate that, even though the image of The Serpent and Satan are aligned; the demonic wicked spirit of the Serpent in Genesis 3 is often overstated and broadens in context throughout history.¹¹⁹

In a contemporary era where antivenins are effective treatment for snake bite, the intertwined concepts of the Serpent and Satan continue to have far reaching influence on the way that real snakes are comprehended and portrayed. Revealing this anthropocentric concern was the intention behind my bronze narrative sculpture *Temptation* in which two cute looking mice are shown to represent Adam and Eve. Seen venturing out from behind a rocky outcrop, the mouse Eve appears to be interested in the worm tail placed before her by the Death Adder Satan. The stylized bronze event is framed within a quatrefoil motif that is literally accentuated by four bronze eucalyptus leaves welded to the scene.¹²⁰ The raised quatrefoil shape directs visual movement throughout the panel and serves as a reference to the Genesis 3 story via Ghiberti's *Gates of Paradise*. Operating on a less noticeable level was of bronze as a process driven material. Several bronze casting processes were used to create the sculpture. The base plate was cast as a solid slab into a sand mould (fig. 66a-d), the snake and mice were modelled from plasticine and indirectly cast from silicon moulds,

¹¹⁵ 1 Genesis 3:1-4, 14-15 Hebrew Bible

¹¹⁶ Karen Randolph Joines, *Serpent Symbolism in the Old Testament : A Linguistic, Archaeological, and Literary Study* (Haddonfield, NJ: Haddonfield House, 1974), 27.

¹¹⁷ *Ibid.*, 17.

¹¹⁸ *Ibid.*, 31.

¹¹⁹ Jeffery Burton Russell, *The Devil: Perceptions of Evil from Antiquity to Primitive Christianity* (London: Cornell University Press, 1977), 217. ; James W. Boyd, *Satan and Mara* (Leiden: Brill, 1975).

¹²⁰ Quatrefoil is a decorative frame which means "four leaves".

and the rock formation was indirectly cast in bronze from a reusable mould that was taken from a pile of slag. Slag scraped from the top of molten bronze and discarded during the casting process would become a prominent feature in my next sculpture. In addition to these processes however, the four eucalyptus leaves were directly cast in bronze from real leaves that were invested in ludo and burned out in the kiln in a technique known as life-casting.



Fig. 66 a-d: A sequence of images shows the base plate for the sculpture *Temptation* being cast in a sand mould.

Renaissance life casting techniques

The art of life-casting involves encasing small sections of plants or small animals into a mould, burning them out in a kiln and casting them in molten metal. A bronze crab is one of the earliest examples of a life-cast animal that has survived from Roman antiquity.¹²¹ Various metals and alloys including lead, silver and gold are used in life-casting and the practice became common during the 16th century when metallic insects, crustaceans and reptiles were prized displays in many *Kunstammer* or cabinets of curiosities, throughout Renaissance Europe.¹²² Prominent amongst these collections were snakes and lizards cast in bronze. Recipe books and technical manuscripts from the time provide a source of practical techniques on life-casting from freshly killed animals. These manuals also offer a valuable insight into a philosophical understanding

¹²¹ Pamela H. Smith and Tonny Beentjes, "Nature and Art, Making and Knowing: Reconstructing Sixteenth-Century Life-Casting Techniques," *Renaissance Quarterly* 63, no. 1 (2010): 136.

¹²² *Ibid.*, 140.

of life-cast animals as spiritual connections between life and matter.¹²³ A French manuscript from 1580 includes foundry instructions on the process of feeding, killing, positioning and moulding a snake before casting it in metal. In his advice on feeding snakes the unknown author observes “that when snakes want to bite and eat something they do not strike straight on. On the contrary, they attack sinuously and obliquely as do Satan and his henchmen”.¹²⁴ Amongst the examples of life-casting from the middle to late 16th century is the Dubrovnik Cathedral Treasury, *Lavabo basin* which shows life-cast snakes and lizards with sprigs of plant matter held in their mouths. According to the French manuscript this was a way to indicate herbal antidotes for snake bite.¹²⁵ While the identity of the plants clasped in the reptile’s mouths on the *Lavabo basin* are unknown, I wonder if their historical significance refers to the Serpent’s knowledge of life giving plants that evolved out of Ancient Middle Eastern mythologies into the Genesis 3 story?

Death Adder: *Formation*

In the foundry, piles of slag build up next to the furnace. I had seen examples of ancient slag displayed in museums and archaeological sites overseas and identified it as a material of the earth. Full of elemental possibility, I speculated if this vitreous conglomerate of silicates, ferric and non-ferric impurities scraped from the top of the molten bronze could somehow be made to echo the life of elapid snakes. By now my intuition and the pace of my work had gained momentum. In the previous sculpture I worked from a silicon mould of slag that was cast in wax and bronze. This time I engaged slag directly to explore the crusty material for any sign of snakes. Working with Nick Stranks I was able to create the sculpture called *Formation*, the final Death Adder and mouse investigation in this series. This sculpture is dominated by a mound of slag which Nick deposited in successive layers onto a bronze plate every time the foundry had a pour (figs 67 & 68). The slag heap developed into a landscape for a bronze Death Adder and a mouse (fig. 69). To complete the sculpture it was placed into a box structure so that the Death Adder would be partially buried in bronze filings to make it appear as if it was buried in the sand. Together the sandpit, slag heap, bronze filings and bronze casts formed a material and allegorical context for the Death Adder and a mouse. The assemblage was designed to trigger a sense of surprise and material intrigue.

¹²³ Ibid., 142.

¹²⁴ Ibid., 128.

¹²⁵ Ibid., 163.



Figs 67 & 68: Nick Stranks uses an iron scraper to scoop slag from the top of the molten bronze and deposits it in a mound onto the bronze plate.



Fig. 69: *Formation* features a mound of slag deposited on a bronze plate which serves as a foundry landscape for a bronze Death Adder and mouse.

Sandpit Serpent

If you imagine a foundry as a Serpentarium or an enclosure for snakes, then the casting sandpit would be a likely place where snakes would rest. The sand would make a soft, clean bed for snakes and the pit would become a sunken vantage point from which they could detect predators and prey. Normally the sandpit is used to bury moulds during the pour. The sand insulates the moulds from the intense heat of the molten bronze and absorbs the liquid metal if the mould should break. It is also used as a receptacle for left over molten bronze if all of the ingot moulds are filled at the end of a pour. Watching the metal flow directly onto the sand was inspiring. It reminded me of the theories developed by Nissam Amzallag about the magical powers that were invested in Bronze

Age metalworkers and their connections to bronze Serpents.¹²⁶ Taking up his insights into ancient furnace technology I decided to conduct an experiment to invoke a bronze Serpent in the foundry sandpit. This was an attempt to create a supernatural link to ancient metalworkers by pouring bronze into a serpentine impression in the sand. It took a few seconds for the searing metal to flow from the crucible to partially fill the snake-line in the sand. The molten metal then sank heavily and formed an encrusted lump (fig. 70a-c). During its burning air-borne path from crucible to sand, a mesmerizing connection between serpent and bronze was briefly made. Photographs of the experiment show a stream of metal flowing in two directions. The glowing metal can be perceived as a liquid line from the crucible to the snake impression and from the snake impression back into the crucible. Later, I dug the cooling metal out of the sand and dumped it into the recycle metal bin. As a scrap of Serpent bronze it was ready to return to the furnace and reappear in a future pour.



Fig. 70a-c: A series of images show an experiment to cast a bronze Serpent directly in the foundry sand pit.

Tiger Snake crucibles

Embodying a sense of raw embryonic containment, several old crucibles from the foundry storeroom became the context for my next bronze Serpent investigation. This resulted in a progression of two sculptures that showed a bronze Tiger Snake curled up inside one crucible and a bronze Tiger Snake appearing to slide out of another. The idea for this project was an extension of the allegorical potential of foundry processes, equipment and by-products to symbolically reveal the life of snakes. The simple act of bringing together a bronze Tiger Snake and a crucible evolved easily from my previous work. It seemed a likely way to create a connection between snakes and bronze and to generate sculptural movement. Once again the Tiger Snake sculpture started with a shed skin that Ric had given me. In the process of making the sculptures in plasticine, wax (figs 71 & 72) and bronze (fig. 73) I became aware of Tiger Snakes through recent research and how their name, their toxic venom and their perceived aggressive defence strategies has led to a misunderstanding of their behaviour and resulted in indiscriminate culling of the species. This secondary research laid the foundation for my work ahead.

¹²⁶ Nissim Amzallag, "Yahweh, the Canaanite God of Metallurgy?," *Journal for the Study of the Old Testament* 33, no. 4 (2009): 398, 513.



Fig. 71: A wax Tiger Snake with the gating system attached before it was invested.



Fig. 72: The wax Tiger Snake was set into the top of an old crucible before it was cast in bronze.



Fig 73: *Tiger Snake crucible* as the sculpture appeared before patination.

Tiger Snake aggression

Like the Death Adder, I am yet to come across a Tiger Snake existing in its natural environment. To get a sense of Tiger Snake size, colour and habits and how these vary across the snake's distribution throughout southern Australia, I accessed information from libraries, museums, scientific journals and the internet. I also took a quick trip to the local reptile zoo which houses an impressive Tiger Snake specimen (fig. 74). It was late on a Sunday morning and the small zoo was teeming with excitable children and their interested parents. My mission was to observe a Tiger Snake and try to match it with herpetological information I had researched. The snake glistened under heating lights and moved slowly on its wood-chip substrate. Stretched out, it displayed its cadmium yellow paraventral scales and olive and brown cross-band markings. The colour and intensity of these *tiger* stripes vary greatly between individual snakes and along with its hostile hissing, aggressive posture and deadly strike; they give the snake its formidable common name. Containing neurotoxins, procoagulants and myotoxins their venom is potent and on average one person dies from Tiger Snake bite each year.¹²⁷ At the Canberra Reptile Zoo however, stuck on the wall next to the Tiger Snake compound was a printed sign with the heading *A timid tiger*. It had a message often repeated amongst herpetological descriptions that Tiger Snakes prefer to be left alone and will only attack if provoked.¹²⁸



Fig. 74: A tiger snake on display at Canberra Reptile Zoo in 2014.

¹²⁷ Clinical Toxinology Resources, "Australian Tiger Snakes," <http://www.toxinology.com/fusebox.cfm?fuseaction=main.snakes.display&id=SN0517>.

¹²⁸ Richard Shine, *Australian Snakes: A Natural History* (Sydney: Reed New Holland, 2009), 190.

Other Tiger Snake research

While I was creating *Tiger Snake crucibles* other aspects of Tiger Snake research hovered in the periphery of my thoughts and indirectly influenced the work of art. Of interest was genetic research demonstrating that isolated populations of Tiger Snakes living on mainland southern Australia and Tiger Snakes living on islands off southern Australia make up a single polymorphic species *Notechis scutatus*.¹²⁹ The study showed that the evolutionary effect of a restricted diet on islands was the cause of dramatic variations in Tiger Snake size and appearance. The study also indicated that snakes have been living on these islands for approximately 5000–7000 years before sea levels rose.¹³⁰ Inspired by this research I attempted to make two Tiger Snake sculptures; a dwarf Tiger Snake and a giant Tiger Snake by enlarging the skin on a photocopier and using two different sized photocopies as templates for plasticine models. This process was unsuccessful and the resulting giant Tiger Snake wax sculpture turned out proportionally awkward. Unfazed, this clumsy wax attempt was returned to the melting pot (fig. 75) and I proceeded to cast the Tiger Snake work of art in a direct 1:1 ratio to the slough. In the end the *Tiger Snake crucibles* were quickly realized. Like all the sculptures in this series they embraced allegory as a creative device to explore a set of interconnected meanings about perceived characteristics of snakes and the material processes of bronze. Living, breathing, sensing snakes were the focus of my next work.



Fig. 75: An experiment to create a giant Tiger Snake was returned to the wax pot.

¹²⁹ J. Scott Keogh, Ian A. W. Scott, and Christine Hayes, "Rapid and Repeated Origin of Insular Gigantism and Dwarfism in Australian Tiger Snakes," *Evolution* 59, no. 1 (2005).

¹³⁰ *Ibid.*, 227.

4 Snake picnic: life

A bronze sculpture designed to attract live snakes became the focus of my final project. Underlying this was a wish to shift the context of the bronze investigation into an environment where elapid snakes live and to initiate a sculptural interaction with a living snake. After thinking about a range of possible scenarios where humans and snakes might meet, I decided to create a sculpture called *Snake picnic*. This resulted in a still life sculpture consisting of an arrangement of bronze picnic items that were bolted to a bronze picnic blanket. The sculpture was designed to be placed on the farm where I live in a location near to where Eastern Brown Snakes had been seen in the past (fig.76). My plan was to put the sculpture in position at the beginning of spring to provide a basking platform for snakes as they came out of winter brumation. The project was based on the supposition that in suitable environmental conditions the thermal properties of the bronze blanket had the potential to attract snakes. A motion sensor camera would record their presence if they ventured onto the sculpture. In creating the sculpture my intention was to *invite a snake to a picnic*. Through this idea I thought it might be possible to demonstrate a physical connection between a live snake and bronze. *Snake picnic* also held the promise to draw attention to symbolic frameworks which anthropomorphize snakes. To complete the sculpture and have it in place at the end of winter was a major undertaking. While I could not be sure if the sculpture would be successful in attracting snakes, the project aspired to reveal snakes as biological and socially constructed reptiles and to communicate greater acceptance of them in an environment where they are adapted to live.



Fig. 76: The location chosen for *Snake picnic* near to where several snakes had previously been seen.

At first glance the idea of a picnic designed to attract snakes resonated with a range of contradictory views about human encounters with snakes in the Australian landscape. The concept wavered between not wanting to come across a venomous snake while relaxing in the countryside and perhaps a desire to do so. It also brought to my mind a

notion of colonial settlement in Australia and frequent tales of snake and human casualties prior to the introduction of wild life laws preventing the harm of snakes and the availability of antivenom which was originally developed for Tiger Snakes in 1929.¹³¹ In his chapter on *Snakes and Humans*, Richard Shine refers to incidences of sporting clubs organizing snake killing “picnic days” and extravagant bounties paid to eradicate Tiger Snakes in Tasmania.¹³² Some of these events are recorded in historic photographs taken around the turn of the 20th century. Among these, a well-known photograph called *Snake Hunt on the Murray* (fig. 77) shows dozens of dead Tiger Snakes draped like grim trophies on a railing in front the men who shot them. Taken at Bunyip Waterhole near Barmah on the Murray River in Victoria the picture has been reproduced in many formats: in newspapers and books, as a postcard, a lantern slide, and recently, featured in a sculpture installation by Shaun Kirby.¹³³ While the image has come to stand for an aggressive, masculine intolerance that Australian settlers had toward snakes, an oral history account of the event by Geoffrey Walter Corry indicates a different aspect to the story. Corry, a boy at the time, recalls that the event was staged by a persuasive travelling photographer. Workers from his fathers’ timber mill were directed to go out and shoot Tiger Snakes on several separate occasions and then build a railing for their display.¹³⁴



Fig. 77: *A snake hunt on the Murray, 118 tiger snakes in 2 hours*, pre 1914 picture. Photograph from the National Library of Australia Digital Pictures Collection.

¹³¹ Richard Shine, *Australian Snakes: A Natural History* (Sydney: Reed New Holland, 2009), 188.

¹³² *Ibid.*, 178.

¹³³ *Ibid.*; Shaun Kirby, *Cousin Beast*, 2005. installation, Museum of Contemporary Art.

¹³⁴ Geoffrey Corry, *Geoffrey Corry Interviewed by Gregg Borschmann in the People's Forest Oral History Project [Sound Recording] Tape 2, People's Forest Oral History Project*. (1995).

Another historic photograph taken during a family picnic at a property called *Fernlees* near Rockhampton, Queensland is notable for its formal arrangement of a snake and humans (fig. 78). The photo shows a snake on a muddy, cow trodden bank of a waterhole. It is positioned between a governess and two children while a man and a smaller child stand in the distance. From the way the people are posed it can be assumed that the snake had recently been killed and its central inclusion in the photograph is a documentation of the event. The photograph's long exposure time creates a clear contrast between the rigid Victorian countenances of people against the waterhole habitat. As a historic portrait it is equally a record of individuals and cultural practises as it is of attitudes towards snakes that are echoed in literary accounts of the time. *My Brilliant Career* written by Miles Franklin in 1899 begins with the central character Sybylla as a young girl who comes across a big black snake while picking flowers and ferns. She yells "Bitey! Bitey" to alert her father who "despatched the reptile with his stock-whip".¹³⁵ A few years earlier Henry Lawson wrote *The Drover's Wife*, a short story about a lonely woman who stays awake to protect her children from a snake that was hiding in the walls of their hut during a thunderstorm.¹³⁶ The story is about colonial hardship and stoicism where the woman's predicament is heightened by the recent death of a relative's child due to snake bite. In the end her dog tugs the snake out of a crack in the wall; the woman clubs it and burns it in the fire.



Fig. 78: A dead snake features in a historic photograph of a picnic at one of the waterholes on *Fernlees* in the Rockhampton district of Queensland. Photograph from the State Library New South Wales Picture Collection.

¹³⁵ Miles Franklin, *My Brilliant Career* (Edinburgh: Blackwood, 1902), 2.

¹³⁶ Henry Lawson, "The Drover's Wife," in *The Country I Come From* (Edinburgh: Blackwood, 1901).

Conflict with snakes in Australian folklore was one of the many points of reference I considered in thinking about and making the sculpture *Snake picnic*. I also took into account literary voices that were more sympathetic to the life of elapid snakes. D. H. Lawrence's poem *Snake* is the subject of much critical analysis.¹³⁷ The poem centres on the author's struggle with the legacy of his education that instils in him the urge to kill a snake that is drinking at a water-trough in Sicily. After throwing a log at the snake Lawrence feels diminished by a meanness of spirit toward the dignified creature that was worthy of his admiration all along. *Black Snake* is a contemporary poem written by Canberra author Kim Mahood.¹³⁸ It is also set at a source of water shared by humans and snakes. When the writer encounters a black snake between an outside toilet and a tap, it becomes the subject of intense blackness and sense of knowing as the snake's "darkness" enters deep into her consciousness. Creating an image of human and snake as one, *Black Snake* complements a range of interpretations that explore unexpected encounters with elapid snakes. While these creative responses served as written precedents for my sculptural project, I made *Snake picnic* with a hope of bringing about such a meeting.

Making the Sculpture

The making of *Snake picnic* commenced with a deep empathy for snakes. The project was an experiment to see if the thermal properties of bronze could attract snakes to the sculpture and in doing so expose symbolic frames through which humans project meaning onto snakes. This idea was driven by a sense of purpose to observe elapid snakes in the environment in which they live, to celebrate them in art and advocate for their welfare. It started with the fabrication of a bronze cake (fig. 79a-f). The cake, along with all the objects that would be bolted to the bronze blanket (a knife, coins, a Bible, three cups and saucers, a banana, two pears, an apple, a pomegranate and a basket) were initially made in wax from individual polyurethane rubber moulds before being cast in bronze. The bronze blanket was made by pouring plaster onto a blanket that was divided into four sections. With the blanket removed the sections became plaster moulds onto which molten wax was applied and built up in a layer about ten millimetres thick (fig. 80a-h). Nails were hammered through the wax into the plaster backing mould in an attempt to stop the mould expanding during the bronze pour. The scale and shape of the blanket sections made the casting procedure complicated and time consuming. All together the construction of *Snake picnic* took well over a year before it was ready to be placed in the landscape (fig. 81).

¹³⁷ David Herbert Lawrence, "Snake," in *Birds, Beasts and Flowers* (Exeter: Shearsman, 2011).

¹³⁸ Kim Mahood, "Black Snake," (unpublished 1991).



Fig. 79a-f: A series of photographs showing the process of casting a bronze cake from a rubber fruitcake mould.



Fig. 80a-h: A series of photographs showing the process of casting the bronze blanket from a blanket divided into four interlocking moulds.



Fig. 81: The bronze sculpture *Snake picnic* as it appeared when all the components were assembled in May 2014.

Symbolism of the bronze objects in *Snake picnic*

The group of bronze objects that were cast in bronze to form *Snake picnic* were selected for a combination of symbolic and indirect associations with snakes, bronze and picnics and for their potential to accommodate a live snake into the display. Mostly the objects were chosen quickly and intuitively as they were things sourced from around my home, on the farm or the sculpture studio. Finding a suitable basket with an approximate size and shape of a picnic hamper/snake basket took a little longer. The time I spent making each object allowed me to reflect on the object's broad significance in relation to snakes. A homemade fruitcake for example, carried with it a particular sense of European tradition that was disseminated throughout Australia from the period of colonial settlement (fig. 82). Baked in a square tin, the fruitcake had traditional connotations of Country Women's Association cookery competitions, weddings and Christian festivals that suggested institutional beliefs like those D H Lawrence questions in his poem *Snake*. Paradoxically the farming of many of the ingredients that are used to make fruitcake has influenced the dispersal of some species of elapid snake across terrestrial Australia. Cultivation of flour, eggs, butter and sugar all create favourable conditions for snakes that prey on mice and frogs, seek shelter in hay sheds and cane fields and drink from agricultural water supplies.



Fig. 82: The bronze fruitcake is symbolic of European traditions.

Water for snakes was a practical consideration in locating *Snake picnic* on the farm and in making the sculpture. The location I had selected for the sculpture was close to a farm dam. In addition to water from the dam, rain and dew that collected in the sculpture's cups, saucers and blanket folds had the potential to provide a drink for snakes and small animals. Three cups and saucers were included in the still life arrangement of objects. The number three was significant to me as it suggested a sense of hospitality and preparedness for an unexpected guest. A bronze knife alluded to the fear and danger of both snakes and humans. Seen as a potential weapon, the knife was also a symbolic reference to the expansion of bronze metallurgy for military purposes in the course of human history. Bronze coins that were placed in a pile and scattered on the blanket were similarly indicative of bronze as a commodity of trade and exchange of cultural ideals (fig. 83). Some of the coins were replicas of currency that I had collected on my field trip to study bronze Serpent sculpture. Inclusion of these coins in *Snake picnic* was a personal reminder of places where the Bronze Age and the evolution of elapid snakes overlap. Two coins were from India. They were typical of the small offerings that included food, flowers and coins that Hindu villagers in Batis Shiralia made as a votive to live cobras at the two thousand year old Serpent festival, *Nag Panchami*.



Fig. 83: Bronze coins were a reference to the veneration of snakes.

Veneration and vilification of snakes and Serpents in Christian culture also appeared in the picnic sculpture in the form of a bronze Bible, a bronze pomegranate split in half and a little bronze apple (fig. 84). The Bible that I cast in bronze materialized into a sculptural object laden with self-referential meaning. With the weight of a small ingot the bronze book was intended to be a parallel reference to the evolution of Hebrew biblical texts and copper based metallurgy during the middle and late Bronze Age. It is in this period that Nissim Amzallag suggests the origins of Christian monotheism can be traced to the worship of gods of metallurgy in ancient Canaan.¹³⁹ In *Snake picnic* the bronze Bible was presented partially obscured by two bronze tea cups and saucers resting on top of it. This informal layering of objects was an attempt to push the Bible containing the Old Testament stories relating to the bronze Serpent and the Serpent in Genesis 3 into the blanket which is also made of bronze. A sculptural pomegranate and an apple were placed close to the bronze Bible. Conveying a plenitude of religious symbolism, this fruit was put there to evoke a sense of Serpent temptation. Botanical debate about the type of fruit that grew on the mythological Tree of Knowledge of Good and Evil in the Garden of Eden tends to favour the pomegranate over the apple as a plant more suited to the biblical geographic region.¹⁴⁰ Allied to this idea is a scientific explanation of the significance of red coloured fruit in the Genesis creation story. In developing her Snake Detection Theory, Lynne Anne Isbell points out that primate vision and brain capacity evolved to better detect venomous snakes as a direct result of eating fruit high in glucose content.¹⁴¹ According to her theory there is a touch of evolutionary plausibility to the Genesis account of Eve's attention to the Serpent and her attraction to ripe fruit which her husband also ate before "the eyes of both were opened".¹⁴²

¹³⁹ Nissim Amzallag, "Yahweh, the Canaanite God of Metallurgy?," *Journal for the Study of the Old Testament* 33, no. 4 (2009).

¹⁴⁰ Nancy Haught, "A Pomegranate for All Religions," Religion News Service, <http://www.beliefnet.com/News/2005/11/A-Pomegranate-For-All-Religions.aspx?p=2>.

¹⁴¹ Lynne A. Isbell, *The Fruit, the Tree, and the Serpent : Why We See So Well* (Cambridge: Harvard University Press, 2009), 121.

¹⁴² 1 Genesis 3:6-7 Hebrew Bible



Fig. 84: The bronze objects in *Snake picnic* that alluded to Serpent symbolism in the Bible.

Other layers of Serpent symbolism were evident in *Snake picnic* through a separate display of bronze fruit and a bronze basket. A bronze banana resting between two bronze pears were intended to be suggestive of sexual desire (fig. 85). As an expressive bedfellow to death, human lust and sexuality are charged symptoms of the symbolic Serpent. The snake-as-sex myth takes many forms. Drake Stutesman identifies it as an unconscious female force known as the “Great Snake Goddess” associated with water, wisdom, fertility, the underworld, resurrection, healing and immortality.¹⁴³ She argues that this feminized Serpent is deeply felt as a creative and destructive energy and has a greater influence on understanding the snake as sexual potency than any visual resemblance to human genitalia.¹⁴⁴ Laying on the bronze blanket my sexualized fruit forms were not so subtle. The bronze casts resembling a banana and a couple of pears were there to indicate human psychology that is commonly projected onto snakes. They were also there for a real snake to chance upon; to test for signs of prey, warmth and other snakes and to pass over as it moved with self-determination within its rural habitat. Similarly a life sized bronze basket was there for the inspection of real, living, breathing, sensing snakes. Sitting near the centre of the still life the blanket was positioned in such a way that snakes could potentially enter and exit through a hole in the bottom of the basket that went through the blanket into a space separating the picnic blanket from the ground below (fig. 86).

¹⁴³ Drake Stutesman, *Snake* (London: Reaktion, 2005), 51.

¹⁴⁴ *Ibid.*, 153.



Fig. 85: Two bronze pears and a bronze banana were intended to be symbols of human sexuality.

Snake picnic as still life

In studies concerning the genre of still life painting as a discourse pertaining to subjects and objects, nature and culture, the basket, along with fruit and flowers, has been identified as a reoccurring theme.¹⁴⁵ Norman Bryson interprets the basket as a particular motif “with its suggestion of flow between nature and the domestic interior”.¹⁴⁶ Corresponding with this view, my bronze basket acted as a potential channel through which snakes could be revealed from the earth onto the still life and back again. As a sculptural exploration into domesticity however, my still life was made to go outside in nature where the meaning of a snake could be negotiated through biological, climatic and geological relationships as well as through cultural terms. The bronze blanket, in addition to serving as a potential basking platform for a snake, acted as a framing device for the still life. With its chequerboard pattern it signified domestic culture as a protective layer between the raw earth and human habitation. The picnic blanket squares were painted with an organic paint made from a mixture of flour, egg yolk and white clay taken from the nearby dam. This painted surface was intended to provide a cryptic visual background for an Eastern Brown Snake to blend into and to overlay the smells of recent metalwork with an odour from the snake’s environment. I also made sure that all sharp edges on the blanket were filed smooth to further increase the possibility that a snake might accept my invitation to bask on the still life and in doing so, complete the sculptural investigation.

¹⁴⁵ Pierre Skira, *Still Life; a History* (Geneva: Rizzoli, 1989), 49.

¹⁴⁶ Norman Bryson, *Looking at the Overlooked: Four Essays on Still Life Painting*. (London: Reaktion, 1990), 109.



Fig. 86: *Snake picnic* shortly after it was placed in the landscape on 7 August 2014. A hole in the bottom of the basket opens into a gap beneath the blanket.

Through a consideration of the way that a snake interprets signals in its world, the project had the potential to demonstrate a physical relationship between bronze and snakes and to add to the categorization of still life which in recent decades had expanded to encompass a wide range of artistic approaches. Traditionally the genre of still life is defined as an art form representing inanimate objects. If my work of art was effective in enticing a live snake into its frame then it would test the boundaries of this conventional understanding of still life. It would also, once again, form a loose connection to Pliny the Elder's ancient story about the birds that were drawn to Zeuxis's realistically painted grapes.¹⁴⁷ While the idea of attracting birds, insects and domestic animals to my sculpture was not new to my way of working, what was different about *Snake picnic* was the secretive nature of snakes and their wariness in a world of predators. With these factors in mind, in late winter 2014, with the help of Antony De Salis and his tractor, the bronze still life was put into place on the farm. The following day a motion sensor camera was set to record any diurnal movement on and around the sculpture (fig. 87).

¹⁴⁷ Pliny the Elder, *Natural History*, vol. 35.64-6.



Fig. 87: *Snake picnic* set up with a motion sensor camera.

Results

With *Snake picnic* and the motion sensor camera in place, I decided to monitor the sculpture for a trial period to coincide with the change of seasons from late winter to early summer. The camera was initially set to record any movement within its field of view, in a burst of three exposures over five seconds. It also recorded the date, time, moon phases and the ambient temperature. While it may have been possible for me to attract passing snakes to the sculpture with various smells such as mice and snake pheromones, I decided against this. Without these smells I could test the time of day and temperature alone, to see if the sculpture could attract a snake. During the test period I mostly checked the camera once a week. The first animal that the camera recorded was a magpie on 21 August. Eighteen days later a Jackie Dragon was photographed sitting on the blanket with its long tapered tail appearing from behind one of the bronze pomegranates. Following this, as the daytime temperatures started to increase and it frequently rained, the grass grew around the blanket. It grew so high that it obscured the sculpture and repeatedly triggered the camera when the wind blew. To remedy this, I cut the grass around the sculpture and adjusted the camera to record a burst of three images over one minute. In October, I began to notice a few more lizards around the area and sadly, I discovered two Jackie Dragons that had been run over whilst they were basking on a nearby road. Then on 10 November, the motion sensor camera detected an Eastern Brown Snake as it move on and around *Snake picnic* (fig. 88a-c).



Fig. 88a-c: The motion sensor camera recorded an Eastern Brown Snake moving across *Snake picnic* in a burst of three photographs.

The photographs first record the snake when it is well into the camera's field of view. They show the snake's size, colour and movement in addition to the date, time, waning gibbous moon phase and the temperature. Judging from the shadows in the photograph, the time was 16 minutes past 9 am, as the camera indicated. The high temperatures that the camera recorded at this time however are not correct. Meteorological data confirms that at 9am on 10 November the temperature was 17.6°C in Canberra.¹⁴⁸ Nonetheless, the previous day was the hottest since the beginning of spring, and an adult snake is clearly visible in the photos. Its head is lighter than the rest of its body which is the same colour as the unpainted bronze. The pattern on the blanket serves as a reference to measure the snake and the direction it took. It appears to be approximately 900mm long and 25mm wide in the middle. The sequence of photos also shows the pace at which the snake cruised across the sculpture and how it mainly stayed on the brown squares. It appears that the snake followed the same course across the dark chequer pattern in a continuous forward-pouring line, whilst the snake's head determined a different path off the bronze blanket. It went into the grass towards the shadow of the trees, in the direction of the nearby dam and the road.

Summary

Snake picnic was made in the form of a bronze still life that was designed to attract live snakes. When placed in a rural environment during the time when elapid snakes become active following winter brumation, a motion sensor camera was successful in photographing a free ranging Eastern Brown Snake as it made its way along the edge, and across the corner of the sculpture. In reviewing the sequence of photographs, in the context of my research question an Eastern Brown Snake was revealed by the bronze sculpture in its rural habitat. As a work of art the bronze sculpture became a symbolic setting for the snake. Furthermore, the way the snake moved along the chequered surface of the sculpture demonstrated a possible physical connection between the snake and the bronze blanket. It can be speculated that the Eastern Brown Snake deliberately followed the dark squares in an attempt to remain camouflaged or perhaps it was attracted to the warmth of the squares. Through these ways of seeing the snake I can say that *Snake picnic* was successful in initiating an interaction with a living snake. The life of the snake however, belongs to the snake itself. In the photos we see it interpreting the signals in its world as it moved with its own sense of purpose towards the trees. In cruising over *Snake picnic* the snake possibly left a scent trail as a marker to predators and prey. With the scent of the snake, the sculpture might attract other snakes and would be interpreted by them as a part their habitat.

¹⁴⁸ Australian Government Bureau of Meteorology,
<http://www.bom.gov.au/climate/dwo/IDCJDW2801.latest.shtml>.

Conclusion

With snakes about in early December 2014, it was an ideal time to bring this PhD practice-led research to a conclusion. This inquiry was a sculptural and biological research. It set out to answer a question: *Can the life of elapid snakes from the districts around Canberra be revealed through the material of bronze and the processes of bronze lost wax casting?* To find out if it possibly could, I grounded the inquiry in the bronze foundry where it was informed by range of research about herpetology, metallurgy, Serpent symbolism and bronze Serpent sculpture. This trans-disciplinary approach allowed me to acknowledge snakes as real and symbolic animals. It was an open ended way of working where I progressively gained knowledge from: researching; experimenting; exhibiting sculptures; speaking with people; travelling overseas; speculating; failing and sometimes succeeding. I did this with the aim that the project might raise awareness of elapid snakes and encourage tolerance towards them.

To explore my research question I embarked on an artistic search that was expanded and refined over four projects. It was a quest to reveal the life of snakes through the work of art in the bronze foundry and through finished artworks displayed at cultural events. In the end I discovered that the extent to which lost wax casting and bronze could possibly reveal the life of a snake centred on different understandings of the life of a snake. These concepts were influenced by semiotic and biological considerations and contained the certainty that, the life of snake is essentially known to the snake. The first project explored language as a symbolic strategy by making bronze Eastern Brown Snake sculptures in the shape of the word *be*. People attending two installations of these sculptures were keen to share their stories about living alongside venomous snakes. In describing their encounters with snakes, the lives of snakes were vividly revealed through symbolic language. This project was also an opportunity to reflect on making bronze snake sculptures to see if the life of a snake could be revealed through the process of lost wax casting. An interrogation of this ancient process revealed metaphysical aspects of snakes in three ways: in the material quality of wax; in the time it took for snake sculptures to transform in material state through moulds; and in the archaic atmosphere of the foundry during the bronze pour. In addition to this, the technique of bending wax sculptures by moving them into and out of the sun created a link to the thermoregulatory shuttling behaviour of Red-bellied Black Snakes in project two.

A search for allegorical connections between foundry processes, by-products, the history of bronze and elapid snakes, gave me greater creative freedom in the third project. The idea behind this symbolic approach was to inspire audience imagination through an unexpected use of materials, and to invite a consideration of snakes beyond anthropomorphic portrayal. In an endeavour to promote understanding of snakes, future

displays of these artworks have the potential to challenge pejorative stereotypes of snakes as evil. *Snake picnic* was the final project. A motion sensor camera was successful in recording a free ranging Eastern Brown Snake moving on the bronze picnic scene. Three photographs show the snake determine a path across the chequered picnic blanket as it slithered away. The photos momentarily reveal the snake against the backdrop of the bronze sculpture. While they reveal the snake in a symbolic and physical relationship to the sculpture, the life of the adult snake exists in its ability to survive in its rural landscape.

By trying to reveal the life of elapid snakes through bronze I set myself a challenge. I was interested in exploring ways to communicate, not only the external appearance, movement, and behaviour of elapid snakes, but to also speak about their life as something that continues. Ultimately I was able to show how the practice of creating bronze Serpents has an empathy with aspects of real and imagined snakes. The techniques that I developed and the moulds that I made in the studio will enable this to continue. As I go on learning about elapid snakes, the moulds can be used to generate further bronze sculptures that endeavour to speak about the ongoing life of snakes. The durability of bronze will also allow the sculptures to continue. It is tantalizing to think of my artworks in the light of the 2500 year old, *Serpent Column* that I studied on my field trip. Seen together with *The Serpent Column* and other examples of bronze Serpents, my research defines bronze Serpent sculpture as a sculptural genre, and within this field it establishes snakes from around Canberra as a unique local inflection. A quest to reveal the life of snakes through the material of bronze and lost wax casting also contributes a sculptor's practical knowledge to this discourse.

Many times throughout this investigation my imagination would descend into the ground where copper is formed and where elapid snakes live. Down in this terrain I get a sense of the environment in South Eastern Australia that allows ectothermic snakes to evolve and continue. One of the most distinctive elapid snakes from the area around Canberra is the Highlands Copperhead from the genus *Austrelaps*. With its metallic connection to bronze in name and surface appearance, the Highlands Copperhead has an obvious connection to my research. Its stout body and large smooth scales make it an attractive snake that is regularly encountered by people in southern NSW. Someone from Crookwell gave me a photo of a Copperhead that had eaten canned dog food out of their dog's bowl. It looked very fat. Also, a printmaker who lives near Wamboin, told me about a Copperhead living close to her house. She has invited me to visit her to see the snake, and promised to give me its shed skin if she finds it. I am looking forward to continuing this research with some drawings of the Copperhead. These studies of *Austrelaps ramsayi* from books and specimens in jars and captivity, will guide a path ahead, to a sculptural and biological juncture where elapid snakes live.

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Appendix: Research fieldwork

In 2012 I completed a programme of research fieldwork from 18 July to 15 September. Research into key examples of bronze Serpent sculpture, the history of bronze, Serpent symbolism and elapid snakes was conducted in India, Turkey, Greece and Israel. Each country was visited for two weeks. I attended several cultural institutions including archaeological museums and sites, a bronze foundry and a Hindu Serpent festival. Information was gathered in the form of photography, drawing, interviews, museum and library research.

India



Figs 89 & 90: Worshipers at the Hindu *Nāg Panchami* at Battis Shirala on 24 July 2012.

In India I attended a Hindu *Nāg Panchami* snake festival in a small village called Battis Shirala in Maharashtra state (figs 89 & 90). Predominately celebrated in southern India this annual festival is a veneration of the Indian cobra as a sacred Hindu deity, a symbolic guardian and a predator of rodents. The festival is linked to many ancestral beliefs mentioned in Hindu scriptures which unify humanity with nature, fire and the Sun. The opportunity to see live examples of Indian Cobras allowed me to compare this species of snake with the elapid snakes that have evolved to live in Australia. Herpetologists recognize a close genetic relationship between the two groups of snakes and describe their taxonomical connection as “sister species”.¹⁴⁹

¹⁴⁹ Joseph B. Slowinski and J. Scott Keogh, "Phylogenetic Relationships of Elapid Snakes Based on Cytochrome B Mtdna Sequences," *Molecular Phylogenetics and Evolution* 15, no. 1 (2000): 157.



Figs 91 & 92: A chaser at *Sri Jayam Industries* working on the hood of a five headed bronze Nāga.

Also in India, my research incorporated a visit to several well-known bronze foundries at Swamimilia, Tamil Nadu. *Sri Jayam Industries* is a family of bronze casters with genealogical links to the Viswakarama community of sthaphathies who designed and constructed the Thanjavur Temple in the 11th century CE. At the foundries I was able to learn about traditional lost wax casting techniques (figs 91 & 92) and locate precise information referring to the representation of Nāgas in Indian bronze sculpture as extensions of Gods such as Vishnu, Shiva, Krshna and Ganesh (figs 93 & 94).



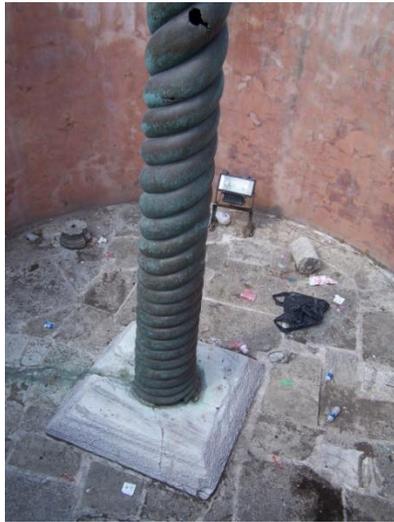
Fig. 93: K. Mohanraj Sthapathy showed me his bronze sculpture of Krshna dancing on the Serpent Kāliya.



Fig. 94: Serpents in Hindu Art were shown in a book of Indian iconography from the foundry library.

The trip to India finished up in Delhi where I visited the National Museum of India and saw the famous bronze sculpture known as *The Dancing Girl* from the Harappan culture in the Indus Valley in the 2nd and 3rd Millennium BCE. Seeing this little sculpture was important in gaining an understanding of the story of bronze told through particular iconic sculptures.

Turkey



Figs 95 & 96: I studied *The Serpent Column* in Sultan Ahmet Square, Istanbul where it has been standing since 324 CE.

Research in Turkey was carried out in Istanbul, Ankara and Ephesus. The time in Istanbul allowed me to study the history of *The Serpent Column* since it was erected on the spina of the Hippodrome in the 4th century CE after it was taken from Delphi in Greece (figs 95 & 96). Much of this research was done at Istanbul Archaeological Museums where, for one day, I was permitted to photograph, draw and hold the remaining head from *The Serpent Column* (figs 97 & 98).



Figs 97 & 98: Mine Kiraz and a gallery assistant from the Istanbul Archaeological Museums removed the Serpent head from its display for my independent study.

Following this, the Museum of Anatolian Civilizations in Ankara proved to be a valuable source of information regarding the history of bronze as a material and a process. Examples of bronze ritual objects known as *Solar Discs*, along with bull and deer figurines from the early Bronze Age settlements of Alacahoyuk and Horoztepe in central Turkey, were on display. Seeing these Hittite bronze artworks was important in building an understanding of the history of lost wax casting in the 3rd millennium BCE and the exchange of styles and knowledge of metallurgy throughout the ancient near east geographic region during this time.



Fig. 99: I studied a bronze snake at the Ephesus Archaeological Museum in Selçuk.



Fig. 100: The coiled bronze Serpent was found at unit 7 in Terrace House 2 at Ephesus. The house was destroyed by an earthquake in around 270 CE.

At the Ephesus Archaeological Museum I was able to study and draw the seven metre coiled Serpent which was unearthed at Terrace House 2 in Ephesus (fig. 99). It was possible to look closely and record the way the scales of the bronze snake were created through the lost wax casting technique. At the Ephesus archaeological site I learned that there were several large scale representations of Serpents in adjoining Terrace House 2 dwellings (fig. 100).

Greece



Fig. 101: A hammered copper Serpent protome was on display at the Vathi Archaeological Museum in Samos, Greece.



Fig. 102: The Heraion of Samos is an Archaeological site where many bronze votive objects from the Archaic, Hellenistic and late Antiquity periods have been found.

In Greece research was completed at Samos, Piraeus, Athens and Delphi where I discovered many examples of bronze Serpent sculpture in archaeological museums. Here I located tangible historical information about bronze casting techniques in the form of excavated moulds, crucibles, ingots, and casting pits in the museums at Athens and Samos. The Vathi Archaeological Museum in Samos has a vast collection of cast bronze griffin protomes and several examples of hammered Serpent protomes in their Bronze Gallery (fig. 101). Sculpted in the form of mythological animals these bronze artefacts were designed to be riveted to copper cauldrons which were prized as trophies and ceremonial vessels in Ancient Greece. As such they formed a functional and aesthetic reference for the 7.5 metre *Serpent Column* which originally supported a gold tripod and a cauldron. Many other bronze votive objects displayed at the Vathi Archaeological Museum from the Archaic, Hellenistic and late Antiquity periods were excavated from The Heraion of Samos archaeological site (fig. 102).

At the Piraeus Archaeological Museum I drew a larger than life size Classical bronze sculpture of Athena. A detailed study of this archetypical depiction of the Greek Goddess revealed the way that Serpents were incorporated into her image. The following day I visited the Acropolis and the Athenian Agora where the temple of Hephaistos once overlooked an area noted for its bronze foundries and metal workshops in Classical times (figs 103 & 104).



Fig. 103: I visited the temple of Hephaistos that is dedicated to the Greek god of metalworkers.

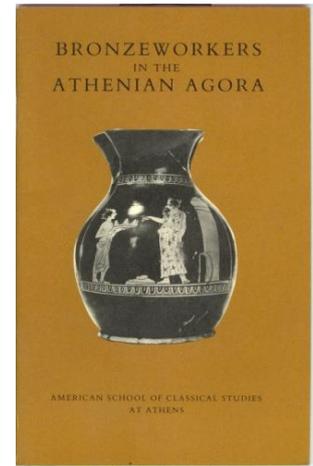


Fig. 104: A booklet published by the American School of Classical Studies identified the sites of ancient Greek foundries.

A three hour bus journey from Athens to Delphi took me to the place where *The Serpent Column* once stood at the entrance to the Temple of Apollo where it was known as the *Tripod of the Plateans* (fig. 105). Study at the Temple of Apollo archaeological site where the *Seat of Pythia* and the sacred *Oracle* were formerly located illustrated the extended historical context for the *Tripod of the Plateans* (fig. 106). The nearby Delphi Archaeological Museum had displays of Ancient bronze sculpture including the highly detailed, life-sized *Charioteer of Delphi* and some bronze Serpent motifs that were attached to household objects.

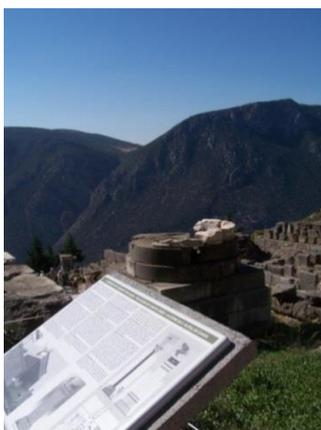


Fig. 105: The stone base at the Apollo Temple in Delphi is where the *Tripod of the Plateans* originally stood.

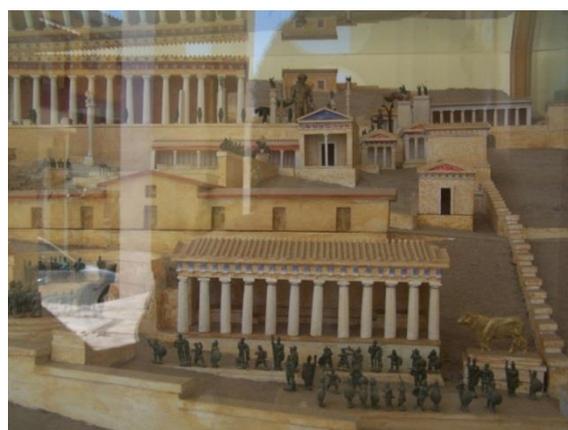


Fig. 106: A French Archaeological School model showed the Ancient Sanctuary of Apollo at Delphi where the *Tripod of the Plateans* and many large bronze sculptures were dedicated to Apollo.

Israel

The purpose of my visit to Israel in early September 2012 was the small *copper snake with a gilded head* which is housed in the *Nehushtan Pavillion* at the Eretz Israel Museum in Tel Aviv (fig. 107). Here I was able to study the undulating serpentine votive object which was discovered in an Egyptian Temple to Hathor, the goddess of mining, at Timna in the southern Arabah rift valley (fig. 108). The snake votive dates from a period of Medianite occupation of the Hathor Temple in the middle of the 12th century BCE. Within the context of the *Nehushtan Pavillion* at the Eretz Israel Museum the snake sculpture and the history of copper mining at Timna were placed in the context of The Old Testament. Forming a connection between Serpent and bronze, the copper snake found at Timna was a key example of bronze Serpent sculpture for my research.



Fig. 107: The interior of the *Nehushtan Pavilion* has a display of objects found at Timna Valley.



Fig. 108: The *copper snake with a gilded head* was displayed alongside Medianite pottery shards and the *Nehushtan* story in The Old Testament.

To follow up on the story of the copper snake with the gilded head, I travelled five hours by bus to Eilat in Southern Israel to visit Timna Valley Park. Located 30km outside of Eilat, I explored ancient copper mining and smelting sites on a bicycle in the desert heat. This primary research provided palpable evidence of the allure of copper and the evolution of furnace and smelting technology since the Chalcolithic era 6,000 years BCE (fig. 109). The site of Timna is now used for a range of recreational activities including abseiling, parachuting and tourism. It was interesting to note the way the Tourist Park had amplified the scale and the significance of *the copper snake with the gilded head* and the notion of the *Nehushtan* as a mystical material unification of Serpent and bronze through its display of signs and a contemporary stone mould in the shape of a Serpent (fig. 110).



Fig. 109: A copper furnace at the Production Camp at Timna remains from the Ramsesside Period, 13-12 BCE.



Fig. 110: The Copper Road leads to the Chalcolithic copper mines and Production Camp at Timna.

My research fieldtrip ended in Jerusalem where I gained a deeper appreciation of Jewish culture through visiting several national institutions. At the Israel Museum, Jerusalem I came across several more examples of bronze votive Serpents from Canaan cities and a bronze ritual sceptre head depicting two snakes either side of a figure from the 14th-13th centuries BCE. This was displayed in a gallery next to the iconic array of copper and ivory objects known as the *Nahal Mishmar hoard*. This collection of Chalcolithic objects comprising of solid copper mace heads, sceptres and other forms of unknown function were discovered in a cave near Nahal Mishmar in the Judean Desert and are some of the earliest known examples of the lost wax casting technique.



Fig. 111: Ritual snake objects were displayed in the Canaan Gallery at the Israel Museum, Jerusalem.



Fig. 112: The Israel Medical Association building in Jerusalem displays a bronze Serpent as a contemporary symbol of healing.

After visiting major museums in four countries the purposes of my study were to examine key examples of bronze Serpent sculpture, to locate bronze Serpents which I had not known about, to build a greater knowledge of the history of bronze as a material and a process, and to learn of Serpent beliefs in localities where elapid snakes live. During my quest for information I became aware of the material nature of bronze as both a commodity of geographic exchange and as a communication over time.