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FROM TRACKS TO GESTURE-DERIVED INSCRIPTION: AN AUSTRALIAN GENEALOGY FOR 'TRACKS AND LINES' PETROGLYPHS

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Abstract. Arguing for a lineage extending from (1) real tracks to (2) those represented in sand-drawn stories (where for narrative purposes they are combined with gesture-derived iconic designs) to (3) the making of more enduring images on rock surfaces, this paper pursues a possible genealogy for 'tracks-and-lines' (or 'Panaramitee Tradition') sites in Australia. Pedal sequencing as a means of depicting events is identified as an alternative to the familiar figure-based 'scene', and the narrative capacity of petroglyph tracks trails is discussed from the perspectives of motif iconicity, directionality, sequencing, and real-world contexts. By examining homologies that exist between sand-drawn and petroglyph motifs, and appealing to contemporary gesture (Kendon, Streeck), multimodal sound-sign-inscription (Green), and neuro-gesture studies (Rizzolatti, Arbib), this paper outlines an argument pointing to a proto-script repertoire of gesturally-derived iconic forms common to sand stories and tracks-and-lines assemblages. The highlighted association of trails with so-called 'geometrics' (described here as 'trace- or map-view icons') has bearing on our understanding of both footprints and apparent non-figuratives as they are found in rock art around the world.

Introduction

Though much of what follows may be applicable, with suitable modifications, to rock art in many parts of the world (Bednarik 1990/91, 1995), the focus of this

paper is on an extensive body of Australian petroglyphs featuring tracks imagery and line-based motifs or both of these in apparent association — a body of art referred to, usefully or otherwise, as the 'Panaramitee'



Figure 1. 'Panaramitee' motifs, Twelve Mile Dam, Pitcairn Station, South Australia.

(Fig. 1) or simply as 'tracks and lines' (Clegg 1995) or 'track and circle' (Edwards 1966). There are different ways of approaching this imagery in world rock art. Marks are scrutinised for more obvious and less obvious indications of the particular technique employed — see for example Bednarik (1998; 2007: 161–162), where the ultimate objective is to investigate human cognitive capacities — and they are dated or counted or otherwise measured in some way, either for the straightforward purpose of recording sites, or with the intention of serving a wider research interest such as establishing regional or temporal variation (for example: Franklin 2007; Tratebas 2012; Re et al. 2015). With the help of insights drawn from ethno-archaeological research we may set out to discover their sometimes elaborate culture-specific symbolic

meanings. The ethnography-informed discussions of Plains hoofprint tradition rock art in Keyser and Klassen (2001) or of the symbolism of Black Hills track-vulva associations in Sundstrom (2004) fall into this category. While I regard these and other existing approaches as important I come to the subject from a different angle and one that other researchers should find complementary to their own. The present approach does not seek to replace existing discourses employing different methodologies.

My approach may be described as phenomenological, that is, concentrated on the way we engage with the world, its specific aim being to salvage primary ecological meanings from the visible patterning of tracks-and-lines motifs. The overall method I employ centres on analysis of petroglyph design elements in terms of how they are perceived, but since the study of perception is itself an established discipline, this provides an opportunity to take advantage of what may be learned from cognitive psychology and neurophysiology. Increasingly scholars are turning to these last for insights and corroborations (for example, Hodgson 2000a; Alpert 2008; Watson, B. 2009; Dobrez, L. 2013) and in the present article I have done so in relation to perceived movement in tracks images, as well as part-for-whole reception. In addition, a preoccupation with hand and foot imagery has led me to mirror-neuron theory and proprioception/body ownership studies (Dobrez, P. 2013, 2015). At the same time, I do not hesitate to have recourse to ethnography where it is available. Indeed it is a central contention of this paper that much reliable ethnography which may be brought to bear on issues of concern to me has, for a variety of reasons, been sidelined by other researchers.

At the 18th International Rock Art Conference (IFRAO) 2015, Cáceres, Spain, I put forward a case for the antiquity of footprint motifs based on our understanding of hunting and tracking as a foundational lifestyle for humans. I argued that tracks in rock art have their origin in the observation of real tracks, and pointed out the obvious selective advantage in being able to share the facts of the hunt (Dobrez, P. 2015). In the present article I recognise a range of situations beyond the hunt in which the capacity to identify, follow and interpret tracks is valued by hunter-gatherers. Beyond emphasising the obvious momentum pursuing prey gives to the development of tracking skills, it is important to acknowledge that there can have been no effective management of habitats without these skills. (For the hunting thesis see Hodgson and Helvenston 2006, and for vegetable-gathering, combat, ceremony, the pursuit of small animals etc., see Bradshaw 2006.) My ecological focus has as its aim the examination of picture-making as expressing a special relationship with a material environment which not only affords

the wherewithal for the production of images, but also supplies the stimulus for such activity. From this standpoint and without overlooking the role of images as a vehicle for symbolic meanings, I again stress the need to put aside attempts to unlock culture-specific content — as consequential as this might be.

The ecological approach assumes that we have something in common with the makers of the rock art, viz our visual system — which is unlikely to have changed radically from that of ‘earlier hominids, or even higher primates generally’ (Bradshaw 2000: 21). At the macro level the laws of our environment have not changed either. If we accept that we live in a world which has the same chemical and physical attributes, is illumined by direct radiant light from the sun intermingled with diffused light from the sky and reflecting surfaces, and ‘consists of an arrangement of surfaces, that is, a layout of planes at various angles to each other’ (Gibson 1966: 1–30), it follows that there are vital questions we can ask about what we see, questions which may well lead to a recovery of fundamental non-culture-specific meanings. There are of course constants for senses other than that of sight, and we shall presently see how the haptic system comes into play in the production of drawings which bear a close resemblance to petroglyph tracks and their associated motifs.

Tracks functions: presencing and narrating

Before turning to the co-presentation of tracks and line motifs and taking fundamental ecological constants as a given, I shall begin by discussing the phenomenon of rock art tracks inscription in terms of two basic propositions. Apart from allowing an investment of additional cultural meaning, foot imagery functions, most basically, to represent either (A) the fact of human/animal presence, or (B) narratives involving humans/animals.

(A) *Human/animal presence*. Single images or paired



Figure 2. Hand and foot stencils in a low shelter, Cape York, Australia.



Figure 3. Variant hand stencils, central Queensland, Australia.
Courtesy C. Sefton.



Figure 4. Stencil composite, Cape York, Australia.

human feet will fall into this category. A foot will function as well as a hand to denote presence and the reason that we fail to find many *stencilled* feet in rock art may simply be that they are not easy to execute, except perhaps at ground level (Fig. 2). Added to this is their limitation in not being variable. The number of digits cannot be manipulated, so there is not the possibility of feet equivalents of variant hands such as we find at Gargas and elsewhere, variants which may be taken up for symbolic purposes (Fig. 3) — although feet may be used alongside hands in ‘composites’ (Walsh 1979) to extend meaning (Fig. 4). (For a discussion of variant hands see Dobrez, P. 2013, 2014.) With regard to the registering of presence, the early Australian ethnographer Herbert Basedow testified to both hand and foot stencils functioning as a ‘signature’, and I have argued that this stems from their being iconic traces of real actions (Basedow 1935: 102, 105; Dobrez, P. 2015). Real tracks function in the same way. An observer of Australian Aboriginal life in the Great Sandy Desert testifies that people not only identify the footprints of acquaintances but the tracks of their own and local ‘companion animals’, i.e. dogs — and even lizards

(Lowe 2002: 36, 38). Without possessing the same potent quality of *trace*, crafted (painted, pecked, incised or abraded) images of human and animal tracks will serve as surrogates. As Clegg insisted, a track engraving ‘contains or implies the same meaning and information as is implied by tracks; the past presence of an animal’ (Clegg 1984: 116). More strictly, it summons presence in the here and now, effectively returning a past event to present perception.

(B) *Human/animal narratives*. Here sequenced foot trails are implicated. (By ‘trail’ I mean just such a sequence, as distinct from the term ‘track’, referring to a single unit.) Trails appear to be very rare at stencil sites (but see the composite panel illustrated in Walsh 1979 and discussed in Dobrez, P. 2013: 292), so we need to focus on pecked, incised, abraded or painted images (in the present case, I focus almost entirely on petroglyphs). For discussion of narrativity, this being the chief object of my argument, I refer the reader to subsequent sections in this article.

In summary to this point: footprint imagery can both indicate presence and suggest activity — before any *specific* story, myth or legend or any other extraneous symbolic meaning is attached to the images. (Non-inherent meanings will of course vary from culture to culture, and we will need ethnographic input to understand what in any instance they might be.) With these coupled propositions in mind (coupled because ‘presence’ is taken over into the narrative function), we can move on to the

business of assembling evidence for the case that, prior to the addition of culture-specific elements, foot images possess a *primary meaning* accessible through the iconic nature of the image itself. This is important if we are to gain any understanding of the coming-into-being of tracks-based pictorial systems.

Representing motion: dynamic and static combinations

Consideration of (B) above, viz the phenomenon of trails — through which we instantly recognise a record of an *event unfolding* — obliges us to acknowledge that rock art footprint images in sequence present cues for motion, often in apparent association with line-based forms. I intend to return to the nature of motion cues below, but at this point confine myself to important general observations. In his study *Cognition and the visual arts* Solso appeals to the Gestalt principle of ‘continuation’ to explain the perceptual fact that ‘objects that flow “naturally” in one direction are seen as belonging together. Our eyes seem to go with the flow’ (Solso 1996: 94–95). Within the repertoire in question there are several forms which

configure in this way: tracks, lines made up of strokes or dots, and meanders. Zigzags are particularly disruptive in that they prompt one continuation response, then its opposite. Circles (to instance a dominant form) obey another Gestalt law, that of 'closure' allowing us to see them as 'unitary, enclosed wholes' (Solso 1996: 95). As Arnheim remarked at the outset of his chapter on movement in *Art and visual perception* (1974): 'motion is the strongest appeal to perception'; 'We distinguish between things and things happening' (Arnheim 1974: 372). Here I shall be making the case that tracks pre-eminently represent movement — feet engaged in locomotion. In representing movement they are effectively the more eye-catching element, along with zigzags, within tracks-and-lines motif assemblages:

It is understandable that a strong and automatic response to motion should have developed in animal and man. Motion implies a change in the condition of the environment, and change may require reaction. It means the approach of danger, the appearance of a friend or desirable prey. And since the sense of vision is keyed to the environment it is keyed to the task (Arnheim 1974: 372).

As Figure 5 illustrates, a sequence of tracks will introduce a dynamic element to a composition including a circle — for reasons which can be explained in perceptual terms. Sequenced tracks obey the law of continuation, circles that of unitary enclosure. When we consider the frequency of tracks in association with circles we begin to understand the usefulness of this perceptual binary, since it enables representation of movement in relation to a visually-stable form (Fig. 6). Further discussion below of comparable imageries used in other traditional Aboriginal media will show how central Australian groups build on this static-dynamic binary — see, for example Munn's references to 'circle-line notation' or the 'site-path notion' (1973: 110, 119) — to create situated narratives.

Scenes

In rock art we encounter two distinct ways of representing events. The first is the familiar figurative 'scene' (see Dobrez, L. 2016: Fig. 8) in which markers of movement cue perception of 'something happening' (for a detailed perceptual account see Dobrez, L. 2013). The second is sequenced pedal images. The

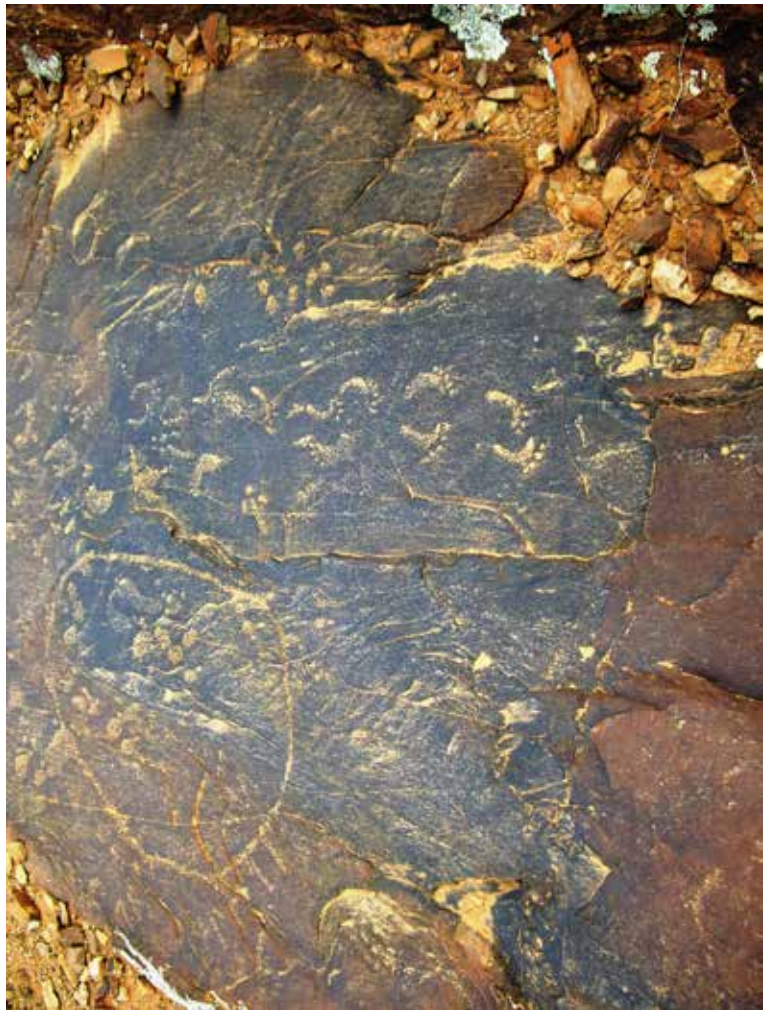


Figure 5. Karolta 1, Manna Hill Station, South Australia.

scene has been the preferred way of depicting an event in many cultures over a long period of time. Because of its versatility in conveying varied content, it has had a decisive role to play in the history of pictorial art. Rock art pictures of the hunt, mural narratives from the Nile and Tigris/Euphrates, Hindu epics



Figure 6. Panaramitee North, South Australia.



Fig. 44. Pictographic representation of emu-hunt.

Figure 7. Basedow's 1925 Fig. 44.

illustrated in low relief in caves and temples, Han dynasty wall-painting stories, the telling of the lives of the Buddha and Christ, the account of the *Night journey* of the prophet of Islam, mythical episodes and events from daily life in Persian and Indian miniatures, Mesoamerican records of legendary and historical events on walls and vessels, Japanese Ukyo-e and comic books are all exemplars of scene representation — as are works in the European tradition stretching from the Middle Ages and Renaissance to the Dutch realists of the seventeenth century and genre painters of the nineteenth. Australian 'tracks and lines' sites do not function as scenes, even when they (rarely) feature undisputed *figures*, such as recorded by Nobbs (1984) at Olary, South Australia — since they lack markers of movement. Rather, the figures in question qualify for the category of 'canonicals' as described by Dobrez and Dobrez (2014).

Pedal narratives

We come to the question: why are there practically no *scenes* in the central desert region of Australia where sequencing of animal and human footprints is widely practised across several media, including rock art? The answer is that there are indeed *representations of events*, but that these take another form. Early ethnographers were not conditioned to recognise such representations.



Figure 8. Deception Creek, South Australia.

Thus Spencer and Gillen (1899) simply noted their apparent absence:

One thing may be noticed with regard to these rock paintings, and that is, that we nowhere amongst these tribes, so far as we know, meet with any of the more complicated drawings depicting scenes such as a kangaroo chase, or men spearing emus, or a corroboree dance, such as are found amongst other tribes in the south and east parts of the continent, though the Central Australian is by no means, in art matters, inferior to the coastal tribes ... (Spencer and Gillen 1899[1968]: 617).

The kind of event-representation which would qualify as a scene in their eyes (e.g. the Arnhem Land emu-spearing, Dobrez, L. 2016: Fig. 8) corresponds to versions familiar from European tradition. But this is not what we find in inland Australia (Figs 7 and 8). Engrossed with those concentric circles and spirals (Spencer and Gillen 1899[1968]: 633–634) held in high regard in central Australia and employed extensively in sacred ceremony, Spencer and Gillen overlooked not only the alternative form of story-telling we have in sequenced tracks, but their frequent association with motifs from a lines-based range, including the favoured circle. Subsequently Basedow (1925), having sought indigenous explanations, understood the nature of pedal narratives and provided interpretative descriptions, glossing an Aranda example involving a zigzag line used to convey the motion of alternating feet as follows: 'A hunter is pursuing an emu and is accompanied by his dog' (Basedow 1925: 349, 344, Fig. 44.) The caption for this design reads 'pictographic representation of an emu-hunt' (Fig. 7). Basedow also touches on the meaning of line-based motifs (Basedow 1925: 348–351), and notes the combining of tracks with lines (as shown in Fig. 7). Figure 8 illustrates another combination, in this case of human tracks alongside macropod ones.

After Basedow others followed up the idea of pedal narratives, though by no means comprehensively. Tindale (1932), for example, glosses forms drawn by Pintubi and other men (Fig. 9) thus: 'Figure 1 shows a typical series. At first glance they appear to be highly symbolic. A-j may be grouped together as simple narrative drawings made by native men. They are inspired wholly by imitation of the ready-made patterns formed by the tracks of animals' (Tindale 1932: 39). He goes on to explicate other forms (*k-t*), showing some appreciation of design elements and their combinations. Studies of petroglyph sites in South and central Australia, published in

the 1960s by Mountford and Edwards, are characterised by a focused preoccupation with identifying images and estimating the frequency of their appearance. However, the authors draw attention to the phenomenon of sequenced tracks (Fig. 10). In a joint article, the configuration of spoors making up a 'line of kangaroo tracks' is interpreted as 'a kangaroo first sitting on its heels, then sitting on its forepaws on the ground, then hopping away' (Mountford and Edwards 1963: 140-141; see also Edwards 1966: 36).

With T. G. H. Strehlow's 1964 commentary, which unambiguously connects narrative tracks forms with other design elements, we arrive at a full appreciation of the role of trails imagery within the wider communications systems of central Australia. However, Strehlow's critical contribution is better taken up later in this article. Most recently, reading of pedal sequences as narratives has notably been pursued by Clegg and his students working at Sturt's Meadows (New South Wales). This proceeds naturally from the interpretations suggested by Mountford and Edwards. A simple example from field notes provided by Clegg at the AURA Inter-Congress Symposium 2009 shows a set of macropod tracks indicating the animal 'sitting on heels ... hands on ground', then 'hopping away'. On another rock, an extended trail of minuscule human feet climbs a slope, then descends on tiptoe. Ten examples are given in McDonald's 1982 thesis carried out under Clegg's supervision. Interpretations of trails range from persuasive to speculative (but possible), to entirely humorous. No doubt some of the jokes originate with Clegg. Thus we have a fuller description of what looks to be the Clegg example just referred to. Likewise a macropod sitting ready to hop (with tips deeply impressed), then, having hopped, landing weight forward, as shown by toes; a walking macropod; another hopping uphill (slower as it goes, i.e. with less and less space between hops). Of course with all of such interpretations there must be a degree of guesswork, and I should stress that in the end my concern is not with the precision or otherwise of a given interpretation, but on the fact of perceived pedal narrativity. McDonald

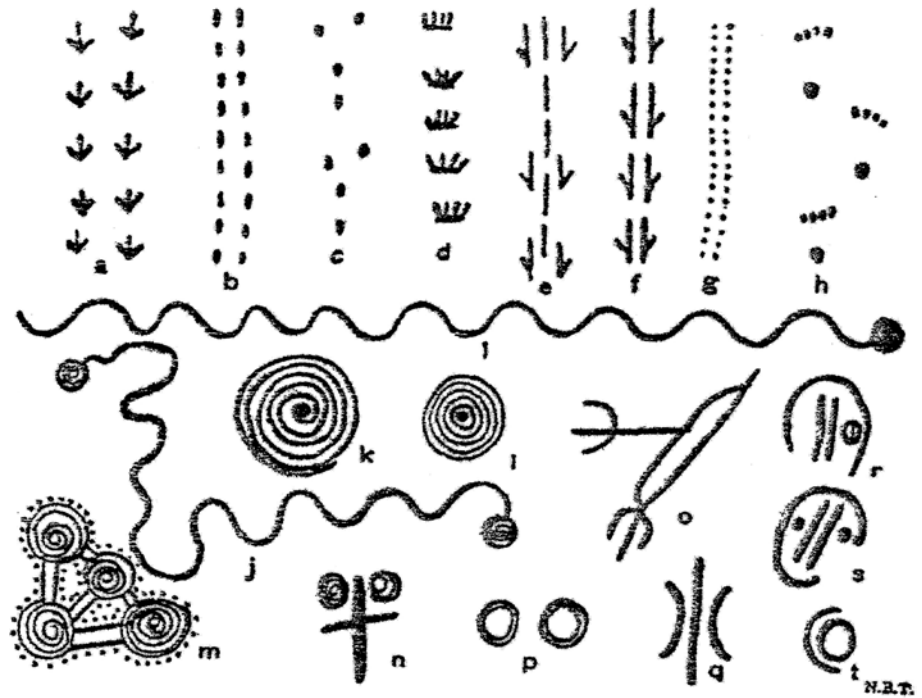


Figure 9. Tindale 1932: 39, Fig. 1.



Fig. 9. The Rockholes.

Figure 10. Mountford and Edwards (1963). Courtesy R. Edwards. The sequence described is on the right, coded E.

gives some more speculative but interesting examples: two macropod sets side by side (read as possible mother and joey); macropod with uneven hop (read as possible wounded kangaroo); macropod with splayed feet (read as possibly having an injured foot). Finally there are two intentionally comical examples: the macropod trail politely interrupted to allow an emu to pass, and possible lined-up macropod tracks with one as if it were jumping the gun to get ahead of the others in a kangaroo race (McDonald 1982: 79–80).

Following the above account of pedal narrativity (itself undeniable) and its (necessarily problematical) interpretations, it remains for us to consider details of the relationship between representation of motion and of stable forms. Before proceeding I shall briefly turn to those basic visual elements required for the actual recognition of any pedal narrative.

How we read a trail

At IFRAO 2015 I approached tracks imagery under four headings: iconicity, directionality, sequence and context, the elements essential for narrativity or storytelling (Dobrez, P. 2015: 266–273).

Iconicity

A crafted track image reproduces what is encountered in the real tracking situation in the form of a trace. While it may be conventionalised, it needs to be a readily recognisable canonical foot image. In the past L. Dobrez and I (Dobrez and Dobrez 2013a, 2013b) outlined the principles determining recognisability of picture content under the heading of a typical or canonical view. We postulated what might be the neural underpinning of easy and rapid recognition, citing neurophysiological studies of, among other things, ‘viewer-centred’ neurons responding to given orientations (Gross 1992). We also appealed to J. J. Gibson’s notion of ‘invariants’ (attributes which remain unchanged through the transformations of the object). Our focus was on profile depiction. In the present context, however, viewer-centred orientation delivers representational plan view, viz a set of invariant-capturing planar features and contours characteristic of trace tracks. It is important to stress that the idea of canonical form, as theorised by us, sidesteps the considerable problematics of the concept of ‘naturalism’. In discussing iconicity we refer to the recognition of an object, not its presumed truth to nature. So our concern with Clegg’s work and that of McDonald does not relate to their attempt to provide evidence for ‘naturalistic’ track images.

Taking the iconicity of tracks as a given, we require to refer back to another concept discussed under the heading of canonical form: that of registering an entire object from a partial view of it, as the *pars pro toto* phenomenon is clearly central in the perception of tracks. Moreover in the case of tracks this phenomenon is not merely visual but closely reliant on the proprioceptive. Putting forward a biology-oriented explanation for a perception of the whole animal via iconic tracks I

wish to appeal to the known plasticity of human body representation shown in the ready incorporation of illusory limbs (Botvinick 2004; Murray 2008; Dobrez, P. 2015: 266–268), to which may be added prosthetic limbs, tools, wheelchairs and automobiles, all of which require a reshaping of peripersonal space and a mapping of an external object onto proprioceptive body awareness. It should be possible to extend this argument to the tracking situation, thus accounting for the peculiarly-bodily synecdochic or part-for-whole functioning of tracks images. In the present context I especially draw the reader’s attention to the documented example of the ‘rubber foot illusion’ (Lenggenhager et al. 2014) by which an artificial body part (a foot) is incorporated into one’s own body schema. (For a discussion of the relevance of the rubber hand illusion to the reception of rock art hand trace images see Dobrez, P. 2013: 302.)

Thus I suggest the following sequence for the tracking situation: the track first needs to be recognised, i.e. read as iconic (say, kangaroo track), then read as an entire object (say, kangaroo), then, in practice simultaneously, incorporated into the tracker’s own body schema, i.e. perceived as an extension of the tracker’s body. The tracker visualises the entire animal from its track and lends his own body schema to the track. The long history of humans as trackers suggests the probability of an *automatic* processing of this visual and tactile phenomenon, rather than a learnt detective skill — as argued by Clegg and others. Since, in real tracking, perception of successions of track traces takes place in unison with rhythmic sensations produced by the motion of walking, it is not implausible to suggest a proprioceptive fusing of inputs, visual and motor. There remains a final issue: can we assume proprioceptive incorporation across diverse species (as in the situation of human tracking kangaroo)? This is a matter for experimental testing, but it seems likely that since we incorporate tools we should be able to do the same across animal species.

Directionality

This is a key element in driving a sense of space-time activity. If cultural knowledge allows us to identify a footprint as belonging to a particular species, then tracks direction will be transparent. Relevant here are Solso’s comments on an evolutionarily advantageous perceptual tendency to anticipate the course of something within our field of vision, to ‘predict trajectories’ in an unpredictable world (Solso 1996: 94–95).

Sequence

A sequence of tracks is not a neutral succession. It is a set of sequenced signs, each leading to the next. Indeed, from time to time we find statements like this about sequenced footprints: ‘they seem to lure visitors to walk from panel to panel’ (Sognnes 2011). What is it about sequenced feet which might justify such a claim? I have previously argued the case for

perception of movement by appealing to the theory of Representational Momentum (RM) — defined as the forward displacement of an observed and remembered object. This phenomenon has been documented by perceptual psychologists in the experimental situation: see especially Freyd and Finke (1984), Hubbard and Bharucha (1988) and Hubbard (2006). It involves registering forward motion in a succession of still images. When these images are tracks, the RM effect delivers the sense of motion through space. Coupled with proprioceptive incorporation as described above it will prompt the 'luring' from track to track intuited by Sognnes (2011). The upshot of these factors working together is the implicit narrativity of trails.

Context

It is important to bring into focus what petroglyph tracks narratives have in common with event perception when we encounter the tracks of real animals. In each case there is information pick-up from the environment which is directly relevant to our mental representation of an animal moving across terrain. We can conjecture real destinations — there may be a water source nearby, for example. We have a sense of distances to be traversed, paths to be navigated. We see where the sun rises and sets on the arena of action. Rock art *scenes* on the other hand, such as the example of a hunter spearing an emu, have foregone the possibility of this kind of concrete contextualisation. Here the choice of site may well be significant, but the event depicted is no longer embedded in the landscape. We do not stand in the place of a hunter whose image is displayed on the rock wall as if on a screen. By contrast, when we see a line-up of human feet next to a row of kangaroo or emu tracks on the very surface which supports us we are situated in the actual space-time frame of the hunter's world. While the scene offers the viewer the opportunity to observe from a distance, the sequenced pedal narrative invites us into the midst of an unfolding action.

A possible precursor for 'Panaramitee tradition' petroglyphs

To focus on our central concern, it is surprising that the glaring visual relationships between contemporary Aboriginal art forms featuring pedal narratives and rock art 'tracks and lines' assemblages have not attracted more attention. With this in mind we now turn our attention to the particular case of sand drawing, a continuing practice of graphic story-telling with connections to various other current cultural activities.

Here it is necessary to begin with the seminal contribution of T. G. H. Strehlow, who grew up with Aboriginal children on the Hermannsburg Lutheran mission near Alice Springs, spoke Arandic dialects and knew first-hand the traditional stories and ways of telling them. But it also helps to keep in mind the fundamental importance or centrality of ground-inscription in general. As Green observes in a study

which places such inscription in its context of a multimodal communications system, *Drawn from the ground: sound, sign and inscription in central Australian sand stories* (2014):

The use of the ground for illustrative and explanatory purposes is pervasive in the environment of Central Australia where there is ample inscribable ground, and this attention to the surface of the ground arises partly from a cultural preoccupation with observing the information encoded on its surface (Green 2014: 2).

When describing the co-employment of tracks and 'curvilinear designs, which are often labelled geometric figures' (Strehlow 1964: 46) in sand drawings across central Australia, Strehlow is at pains to characterise the performative mode of this kind of story-telling in which the ground in front of a narrator is smoothed, and the anecdote or fable enacted on this stage as miniaturising 'theatre' (cf. Watson, C. 2003: 106). His example is the enactment of a cautionary tale of severe punishment meted out to a boy who has strayed too far from camp. The fable begins with a circular depression made 'with the side or back of the hand' to represent a camp-fire and a U-figure to represent a key player in the story, the avenging '*njunju*' woman, sitting cross-legged in front of it. At the critical point when the truant who is the central figure in the developing drama makes his entry, the narrator now 'walk[s] her fingers across the sand, leaving behind a series of dots'. At this approach, the U motif is erased, and, as the tale has been told many times over with great verve, 'the story-telling fingers' skive off at a pace from the circle/camp-fire in pursuit of the absconder:

The chase would begin — round and round the camp-fire; and the index finger would indicate the trail and the pace of the pursuer by drawing a narrowing spiral more and more rapidly around the central circle that stood for the camp-fire. Suddenly the finger would stop: the boy had been clubbed and killed by the *njunju* woman ... (Strehlow 1964: 46).

The narrative continues until the marks in the sand are wiped out in preparation for a new episode.

It is noteworthy that Strehlow foregrounds strong gestural elements. Although Aboriginal *gesture* has been the subject of study for some time (Kendon 1988), Green's (2014) linguistics study of Arandic women's sand stories from central Australia has focused attention on a multimodal framework involving gesture, speech and depicted images. Spoken and sung language, signs (i.e. gestural conventions such as shifts of posture and altered facial expression), arm and hand gestures (studied for their imitative, deictic and punctuating functions, as well as potential for emblemisation), props (such as erect and 'painted-up' leaves used as stand-ins for people), sculpted features, and lines and depressions made in the sand, combine in day-to-day communication and the telling of stories (Green: 2014). A comparable combination of narrative modes involving singing and beating rhythm, mimicry of totemic animals and painted and sculpted representations of 'country' is employed by men in sacred ceremony where a pre-determined

graphic repertoire for body-painting and ceremonial objects, as well as for the ground designs themselves, conforms to that of sand drawing, viz tracks and lines (in large part circles). Men also use public sand drawing to pass on traditional knowledge of topography and Dreamings routes. The phenomenon of multimodality has implications for a study of petroglyph assemblages consisting of a similar range of motifs, motifs which are currently mostly studied from the point of view of what their relative percentages (e.g. tracks to circles) might tell us about regional variation, rather than for their probable auxiliary story-telling role within a wider communications framework.

Munn (1973) was the first person to investigate systematically those narrative sand-drawing elements so brilliantly identified and described by Strehlow, so that it remains the most authoritative and thorough study of its kind, an analytic documentation of a visual language of circles, lines and tracks from the art practices of the semi-nomadic Warlpiri of the Western Desert region of central Australia. Yet, while it is generally understood that surviving traditions of the sort studied by her (and, as noted above, by Green) have something to contribute to our understanding of 'Panaramitee' rock art, commentary to date has been cursory. One objection to such historical comparison is doubtless the knowledge that graphic designs chosen from the repertoire vary from group to group and, just as they vary geographically, they will have varied across time-spans (Franklin 2007: 96). Not only does motif preference vary among present-day groups proficient in graphic communication, but each element will carry multiple meanings, only some of which may be shared. Despite these reservations, a limited graphic repertoire with some measure of interpretative predictability has been acknowledged as facilitating communication 'across group boundaries' along extensive 'Dreaming tracks' associated with ancestral creation myths (Franklin 2007: 98).

In her 1991 article 'Panaramitee: dead or alive?' (a critique of received views of the Panaramitee; Maynard 1976, 1979) Rosenfeld — herself methodologically cautious — nonetheless encouraged a comparative approach to petroglyph motif assemblages bearing close resemblance to the iconography of living central Australian art forms such as the sand drawing of the Warlpiri. Rosenfeld noted Munn's assertion that 'far from being non-iconic, the system is perceived as having distinct representational referents by the Aborigines' (Rosenfeld 1991: 141; Munn 1973). I shall return to the subject of iconicity in the following section of this article, but note here that to date there has been no evident eagerness to pursue Rosenfeld's suggestion that we systematically compare motifs in varied graphic media (Rosenfeld 1991). This would be a substantial practical task, but a worthwhile one and the present article is keen to make a preliminary contribution, particularly by raising critical theoretical questions.

My focus is decisively on an iconic reading of tracks

and lines motifs. At this point, however, it is necessary to give a brief account of current rock art research approaches to the issue. The non-track elements in 'Panaramitee' assemblages are generally discussed in the language of geometricity (among others, Layton 1992; Flood 1997; Franklin 2004). Of course it is perfectly accurate to use of the word 'geometric' to describe circles and lines and arcs and the rest. In fact there is no art — whether gestural, abstract or 'realist' — without such shapes and in practice most rock art commentators appreciate the manifest resemblance of rock art assemblages to designs drawn on sand, as well as those engraved on sacred objects, applied to bodies and rockshelters, or fashioned as elements of ceremonial ground paintings. At the same time researchers have expressed understandable reservations. Franklin, for example, while acknowledging that certain pre-Historic petroglyph motifs may well have a figurative derivation, stresses that, since we cannot consult the makers to confirm it, we should refer to these as 'non-figurative' (2004: 28). Layton, concerned about reading 'prehistoric geometric art in the contemporary idiom', proposed the descriptive term 'geometric styles' (1992: 158, 54–58, 142, 148, 189). It should be pointed out, though, that research projects undertaken by those using these arguments and this terminology do not hinge on the kinds of questions I wish to raise.

There are other, very different, lines of argument which favour the geometricity option. These focus on mental image constants described by Lewis-Williams and Dowson (1988) as 'entoptics', and by Hedges (1982, 1994) and Bednarik (1984, 1987, 1994) as 'phosphene types'. Discussion of these constants ('images perceived by the human brain as visual images in the absence of visual stimuli', Hedges 1982: 1; 'templates ... genetically fixed by the physiological structure of the visual system', Bednarik 1984: 28) may come either in the context of shamanic or non-shamanic theory. I intend to comment on the latter, as the former introduces elements which are not relevant to my present argument. Since the phosphenes model of rock art directly sources those rock art forms which concern us to the structure of the visual brain, it is not surprising that it appeals to the terminology of geometricity ('pre-representational geometric forms', Hodgson 2000b: 870). It is currently the case that (non-shamanic) *externalisation of brain-sourced forms* models tend to regard the 'geometrics' which characterise presumed earliest rock art as non-iconic, when it might well be that, as I shall argue, an icon-dependent multimodal system of effective communication involving ground-inscription was already in place at their point of origin. Indeed, the remarkable homologies which exist between incised and impressed motif forms which have been found in deep-cave concentrations and the 'geometric' component of 'Panaramitee' assemblages (Bednarik 2006a: 11) might encourage us to keep an open mind on the question of iconicity and symboling origins. Nonetheless, what Bednarik and Hodgson have to say about

the way pre-Historic early marks 'simulate properties of the visual system' (Hodgson 2000b: 868; Bednarik 1984, 2006b) — thus setting up resonance patterns inducing repetition — may well constitute a significant factor in an over-determined perceptual situation.

Bednarik's forensic scoping of the evolutionary rise of symboling has led him to posit a deep-time, gradualist process beginning with non-referential forms. At the same time his aim has been to uncover the referential *potential* of marking, the actualisation of which he envisages as realisable through 'a subtle management of visual ambiguity' in which 'the defining characteristics of an iconographically already ambiguous object are intentionally accentuated' (Bednarik 2008: 91, 2006b). On this score, he is willing to give some weight to the parallel lines of finger fluting as possessing possible iconic-mimetic meaning: 'finger fluting over bear scratches', for example (1985: 87). However, since he is committed to the notion that iconicity came late he has maintained that the tradition of 'archaic linear petroglyphs' is 'entirely free of both human and other animal track-like forms as well as any other figurative imagery' (Bednarik 2010: 112). This line of thought has led researchers to employ the expressions 'convergent lines motif' (CLM) or 'trident' where they might otherwise have identified tracks. Just how we might be justified in drawing the line between a CLM and a track I cannot say. Certainly Bednarik's proposition of random repetitiveness and a lack of motif definition might offer a rule-of-thumb approach for recorders in the field (Bednarik 2010: 112). There is, however, no existing compass to guide us in our project and in the present situation it may well happen that marks of identical shape will be described as 'abstracts' in one context, tracks in another.

In dialogue with B. Watson (2008) on the subject of a doodling alternative to shamanic theory, Faulstich (2008) reminded us that we might look to ecological settings before innate forms in our desire to understand symboling. The designs in Warlpiri art resemble doodled phosphene-like forms, Faulstich argues, but their attributed meanings maintain a direct relationship with a lived environmental situation. This is an aspect of the argument which should not be overlooked. While the jury is still out on matters whose decidability ultimately hinges on augmenting the record and reliably dating sites, the ability to interpret iconic forms need not be assumed a late-comer to cognitive development but may be regarded as extending our biological capacity to negotiate the real forms of the world as carriers of, in Gibson's terminology, affordance meanings. Patently, if we are seeking the source of apparent universals, we cannot afford to ignore the constant form geometry of objects in the world itself. This geometry is not accessible to the brain in visual terms alone, but through the gamut of sensory experiences involved in the way bodies negotiate environments. Neither can we overlook as a possible explanation for universals 'motor primitives of drawing praxis' which are the

result of biomechanical options available in 'drawing a dot, a line, a curve, a circle, an intersection of two or more linear contours' (Bradshaw 2000: 20) — an area to which a study of 'neurogesture' (McNeill 2005) might have something to contribute in the future. We need to keep in mind the fact that the brain encodes what the body does, and that the shapes of the world, translated as 'iconicity' in visual art, are ever-present to perceptual systems geared to information pick-up — including proprioceptive information in the case of gesturing and other activities which mimic world objects, such as grasping a stone or tool. Attention to this fact will allow us to consider the likelihood that it is a much shorter step to figuration in art — making a meaningful shape — than we have perhaps allowed.

After all, forms in the world have been the deep-time shapers of the visual system itself. Where so much remains to be uncovered, especially from the point of view of the new horizons of visual ecology (Cronin et al. 2014) and neuroscience, Bullen's 1993 caution about foreclosing on possible explanations for apparent auto-generation of phosphene imagery is as relevant today as it was when she was moved to set up an experimental situation in which hypnotised subjects were asked to record spontaneously-occurring imagery:

It is not known when the evolution of the hominid nervous and musculo-skeletal systems reached the point where the deliberate creation of specific marks was possible. Nor is it known whether the first deliberate marks were inspired by a wish to copy gestures or to reproduce external images or those perceived internally (Bullen 1993: 54-55).

Of course we have no way of assessing the longevity of designs produced in ceremonial art and sand drawing when compared with the enduring petroglyph forms — apart from inferences which can be drawn from their belonging to a conservative tradition. We know that sand drawing as it is currently practised is open to change, with the 'story-wire' coming into use in place of the old multi-functional twig implement, for example (Green 2014: 53-55). However, as sand drawing constitutes an integral part of a multimodal system, elements constrained by the rhythmic motor performance of speech, gesture and marking working together will have been maintained over time. Clearly, dictates of economy of form and ease of recognition tend to reinforce traditional patterning, suggesting that what we see now has existed for a very long stretch and might therefore have provided a template for the imagery we find in the 'Panaramitee'.

On the subject of structural continuity: some antiquity of petroglyph motifs is assumed, given that they no longer operate as a living tradition, while longevity of the contemporary sand-drawing repertoire is suggested by the fact that the same designs were used in men's ceremonies in set ways which were locked into the 'method of procedure' (Basedow 1925: 274). Intricate designs fashioned out of the basic shapes were unique to a group and 'owned' by them, not to be disclosed to strangers or used in the wrong context.

The penalty for flouting the law was death (Strehlow 1964: 45, 49, 55–56). Men too engaged in sand drawing, particularly as a way of teaching the common motif devices. In the process of making ground paintings and decorating bodies and sacred objects such as the stone or wooden tjuringa, these became ‘elaborate and stylized’ patterns (Strehlow 1964: 47). There are also painted rock art murals, both sacred and secular (Spencer and Gillen 1968), composed of staple forms from the familiar range. The fact that the secret/sacred nature of ceremonial patterns would over time have had a restraining influence on change to the repertoire says something about the probable antiquity of many of the conspicuous design components including circles, U-shapes and tracks motifs. Strehlow writes: ‘The death penalty ... was undoubtedly a powerful factor influencing the relative stability of sacred art in this part of Central Australia for a long period’ (Strehlow 1964: 56).

When considering comparative longevity we might also postulate that what required less effort to achieve in all likelihood constituted first practice. Judging from a technical standpoint, drawing lines on the ground must precede manufacture with a tool. As Mountford pointed out, sand drawing is ‘probably the earliest form of pictorial representation’ (Mountford 1976: 58). A similar comment is made in the context of a discussion of animal depiction by Hodgson and Helvenston when they suggest that making impressions of ‘tracks in sand or mud with a stick or their fingers’ by early hominins constitutes the likely beginnings of graphic representation (Hodgson and Helvenston 2006: 12). A motive to record stories by the use of marks might have existed for the time that we have been hunters, and here I return the reader to my own case for the human ability to make and ‘read’ tracks having been learnt from ancient tracking skills (Dobrez, P. 2015). While my focus was initially on the representation of tracks, rather than associated imageries, I think it important – in the Australian context at least – to examine tracks as commonly connected with what we could regard as other form constants, since tracks themselves are form constants (i.e. iconic universals). What I am arguing on the basis of this very conspicuous association in the ‘Panaramitee’ is that tracks and so-called geometrics belong to the same order of image: both may be taken as figurative, and consequently there is no necessity to assume that they represent separate phylo-imagistic lineages. In other words, within the ‘Panaramitee tradition’ their real-world origins may well be the same. This is the case I wish to put, taking up Rosenfeld’s suggestion noted above.

Context and action: the story-telling function of tracks and line-based motifs

There are two related questions here: that of homologies between rock art assemblages and contemporary art/communications motifs (especially including those involved in ground-inscription) and the

relation between track motifs and associated signs (the ‘geometrics’). Discussion of the first has been initiated in the section above, but in general terms. I now wish to consider it more thoroughly. The second question will be treated in like detail.

Let us begin with the question: what do contemporary tracks-and-lines ‘art’ practices have in common with ‘Panaramitee’ rock art? From the point of view of iconography, the answer is simple: ceremonial designs, sand drawings and ‘Panaramitee’ petroglyphs all feature tracks, line-based motifs (whether circles, U-shapes, meanders, zigzags, or other possible variations) and dots. Furthermore, the basic formal principles guiding composition of individual motifs and their arrangement appear to be the same. A motif can be crafted out of lines and dots in a combinatorial process involving association. Attention is paid to spatial layout of designs to create a framework for movement. In the case of ground painting movement will be that of performers, the journey of an ancestral figure embodied in mimetic dance carried out in the vicinity of the sacred tjuringa images depicting the topography of the Dreaming. The elaborate preparation of ceremonial areas is described by Bardon: ‘Sometimes various mounds are formed to create a miniature landscape, and the designs of circles, spirals and loops made from natural ochres and charcoal are arranged by a special team of men who have a “custody” relationship with that particular Dreaming story’ (Bardon 1979: 13). We need not discount the possibility of an overlooked women’s ceremonial ground-painting tradition (Watson, C. 2003; Johnson 2016: 196), but see Layton for a discussion of Munn’s distinction between ‘the family camp and the descent group [the patrilineage] as settings for sand drawing and sacred art’ (Layton 1977: 42). In public sand drawings, which are especially the domain of women, representation of movement is transferred to agile hands. Hands are employed not only to draw and sculpt a setting for action on a cleared surface, but to enact movement across terrain by representing sequences of animal and human tracks using various parts of the hand, producing trails of pit marks with the tip of a finger, pacing out finger movements in the manner of walking, shifting the position of actor stand-ins in the form of leaf-props, or simply drawing a finger or twig across the sand (Green 2014; Strehlow 1964). Strehlow, who identifies at least three ways of representing movement of a figure across a landscape in sand drawing – a dot-producing walking of the fingers across a prepared surface, a continuous line (the particular example given is a spiral indicating the closing in of a pursuer), and the making of tracks images – captures in his description of the *njunju* story a narrator’s ability to indicate pace as well as direction (Strehlow 1964: 46). It is clear that in sand drawing and sacred ceremony performers rely on the body’s visuo-motor memory of moving relationally in space (to or from an object or person), except that one involves hand gesture simulating action in miniaturised

form, the other whole-body pantomiming. In both cases narrative is embodied.

What is happening, then, in the context of petroglyph images? This is the place to return more specifically to the motion/stasis binary principle outlined earlier in this article and implied in the above discussion of ground inscription action and setting. I pointed out that tracks imagery can bring dynamism to a composition whose motifs, if they are of the enclosed variety (pre-eminently the circle), will work to establish stable points of reference. However, unlike ground-painting, dance ceremonies and sand-drawing stagings of events, petroglyphs do not involve real-time mimetic action. In contrast to paced bodily movements, the pecking process unfolds as a disciplined and focused manual sequence which excludes mimetic spontaneity — unless, of course, the rhythmic act of pecking, which may have been accompanied by singing (some makers of desert acrylics will chant while they paint), functions as a substitute. We do have evidence of petroglyph sites involving ritual (Edwards 1966), in which case their function may have been similar to that of the frequently (but not exclusively) topography-evoking ground paintings. If we are looking for indications of function, their placement in the landscape in relation to known habitation areas would tend to suggest public use, and secluded settings sacred ceremony.

We turn now to the matter of the relation between tracks and associated images. If these are read as different in kind from associated signs, why then are they found in the same ensembles? But in putting forward the proposition that both are figurative we query the distinction. As we may see with the help of known imageries from other Aboriginal graphic media, so-called geometrics in rock art are themselves, if the parallel holds, iconic: it being simply a question of comprehending *in what fashion* they are iconic, since their referents will be obscure to viewers unused to Australian Aboriginal ways of relating to the world.

Strehlow (1964) observed that, like tracks, motifs which in sand drawing happen to conform to basic geometric shapes, represent the salient features of *traces* left by objects in the world. Consistent with tracks-view, they do not picture objects seen in perspective against a horizontal plane. This would also apply to desert sand drawing's modern derivative, acrylic painting. The problem for viewers non-conversant with this kind of art is that their orientation necessitates a re-adjustment to a world habitually seen in *plan view*, as if one were always looking at a map (Strehlow 1964: 47). In his description of sand drawing Strehlow outlines the underlying principle of a form of representation which is entirely attuned to the detection of the two-dimensional *traces* left in the landscape by objects and events. If this is correct, tracks and non-tracks motifs have figurativeness in common and, however we might wish to emphasise stylised 'geometric' abbreviation or likeness to phosphene forms, this commonality of track and line design should be kept to the fore. Tying

depiction of action firmly to gesturing in what she understands as a multimodal manner of story-telling — combining 'gesture signs, a singsong verbal patter, and a running sand notation of standardized graphs' — Munn terms the basic graphic elements of Warlpiri narration 'strokes' (recalling Chinese calligraphy). Strokes will be either 'radical graphic forms' (like circles, lines, meanders, arcs and U-shapes) or 'forms derived from conventional footprints'. Together these operate within a unified system described by Munn as 'iconic' rather than 'arbitrary' (Munn 1962: 973, 975; see also 87). In other words a distinction made between tracks and line-forms is more usefully based on something other than the proposition that there is figurativeness in one case and not in the other.

From the makers' point of view this reflects their world outlook as hunter-gatherers, often moving camp and depending for their livelihood and self-defence on their tracking skills, viz their ability to read traces of change in a landscape:

The basic figures themselves were undoubtedly stylized representations of the actual marks of persons, animals, and objects left behind on the surface of the ground. The ashes of a camp-fire are roughly circular in shape when viewed from above; the marks left behind in the sand by a person who has been sitting cross-legged are roughly U-shaped; a large camping-ground pitted by hundreds of footprints does look from above as though its surface has been sprinkled with dots; and sticks lying on the ground leave behind imprints like broad, straight lines; and so on (Strehlow 1964: 47).

This is Munn's point when she asserts that 'the elements themselves are "iconic" in the sense that they pick out simple perceptual qualities of the forms of objects and acts that they denote, and "translate" these into a graphic media' (Munn 1973: 87). The present argument would like to take these ideas further still. The basic issue is not merely that of homologies between ground-inscription and rock art (though that requires to be argued — as I have tried to do above). If the two practices are fundamentally related and, of the two, ground-inscription is almost certainly the more ancient, then there is the real possibility of establishing *derivation* of petroglyph motifs from ground-drawn ones.

Let us take a few possible examples.

Basedow (1925: 72) gives the following account of the making of a human track in the sand:

A human track is imitated by imprinting the outer edge of a half-closed hand, the left hand being used for the left foot and the right for the right. This impression will give the ball, the outer surface, and the heel of the required track; the toes are dabbed in with the finger tips.

Munn (1973: 120) glosses an illustration with the same comment. Likewise a similar description is offered by C. Watson (2003: 82): a woman uses 'the side of her hand and underside of her fist to form a human foot before adding the toes with her index finger.' My case is that the human tracks in Figure 11 conform to this pattern. It is not conclusive proof, but more than merely



Figure 11. Karolta 1, Manna Hill Station, South Australia.



Figure 12. Spiral, 'bird track' and other images, Karolta 1, South Australia.



Figure 13. Karolta 1, South Australia.

suggestive. Of course not all petroglyph human tracks need follow this particular model. There were no doubt varied ways of achieving a comparable result. In addition, we may suppose that both sand drawing and petroglyph representations will have regularly changed over time. These considerations complicate my thesis, but do not refute it.

Further Karolta images may serve to make the point. There are diverse ways of representing bird tracks (often emu).

Two of these may be illustrated here (Figs 12 and 13). Basedow (1904: 30; 1925: 71): 'an emu track is made by impressing lengthwise thumb and pointer in the sand; then, changing the thumb to the other side without lifting the pointer, a second impression is made with the thumb in this position at about the same angle as the first. Often the pad of the emu foot is added by an impression of the thumb at the intersection of the three toes.' This last sentence is a good candidate for the bird track illustrated in Figure 13.

Other examples could be cited. Variations on the 'tick' indicating macropod probably correspond to Basedow's note (1925: 71-72) that it may be done with two finger marks for each foot. For Munn's examples for a number of sand-drawn motifs see 1973: 120. The spiral motif, understood by Strehlow above as indicative of motion in sand drawing and illustrated by Green (2014: 146), as well as being found in the Flinders University Pitjantjatjara sand

drawing collection ('The man who went for water', Fontannaz 2000) is ubiquitous in rock art. The list could continue, but space does not permit it here. I shall merely refer to this last image from Deception Creek by way of conclusion to the discussion of possible petroglyph translations of sand drawing motifs (Fig. 14).

Mountford and Edwards (1964: 855-856) identified dog tracks at Deception Creek, where Basedow had not. For my purposes identification of depicted species is not relevant to the argument. However, a Figure 14 paw (below) may be one of those illustrated in 1964, p. 856. Certainly it could easily be rendered as a manual impression on sand and conforms to Basedow's description of making a sand image of a dog track: 'the tip of the thumb makes an imprint, which is to represent the pad, whilst the finger-tips supply those of the four toes' (1925: 72). For a similar description see Munn (1973: 120). What is required to provide (not conclusive, but reasonable) evidence of my general thesis is a detailed study, by someone well acquainted with rock art, of sand inscription in various Aboriginal communities. This would make an excellent postgraduate thesis topic, and it would be based on a testable proposition. In this article I am more concerned to sketch out the theoretical principles which would inform such a project, but we may note in passing the fact of practical difficulties to be overcome, not least that of establishing 'association' of motifs, given an inevitable degree of layering at most sites, including possible 'reappropriation' of pre-existing motifs.

'Body-internal kinesthetic perception' (Streeck 2009)

Intimacy with the artists who transferred sand drawing and



Figure 14. Deception Creek, South Australia.

ground painting to canvas in the 1970s prompted Bardon to characterise the Western Desert imagination as 'haptic' rather than visual. For Bardon this was specifically an aptitude of the fingers, as 'when telling of a ceremonial object a man would feel the incised scoring in the stone or wood and move his hand along the lines' (Bardon and Bardon 2004: 42). Allowing 'a consciousness of the visual element', Bardon put the stress on *touch*, observing that the process of making a design itself involves haptic rather than visual memory (Bardon 1979: 22–23; Bardon and Bardon 2004; see also Watson, C. 2003). On the subject of Aboriginal artists' orientation to the landscape as an internalised map, Bardon made the further observation that space is perceived as 'omnidirectional' (Bardon and Bardon 2004: 43), meaning that a story might be read from any side of the representation. The logic is clear: it is the land as foundation for all activity which is pictured, the land having offered the first 'canvas' for the inscription of the histories of things through the traces they have left behind. In order to explain an iconicity which simultaneously communicates spatiality and temporality, I think it necessary to extend Bardon's insights by postulating that what is described as 'haptic sensibility' – might be better understood in terms of a capacity, through conventionalised pantomimic gesture, to draw on and reproduce the rhythms established in the body's visuo-motor memory of pedal movement through materially-defined space. What the art tells us both in visual terms and when we attend to its rhythms is that the proprioceptive input the body has pre-eminently registered is the touch of feet on the ground. In dance the feet and legs exercise their muscular memory of a demanding locomotive activity fundamental to nomadic life. In sand drawing this memory is transferred to fingers in their mimetic simulation of pedal motion.

Bardon himself captures a whole-body proprioceptive

involvement when he writes that 'the visual words' (alternatively 'designs', 'archetypes', 'received cultural depictions' in Bardon's lexicon) permit 'an interactivity on a space or field of action as each painter's emotional transcription of space, and that of [bodily] physicality' (Bardon and Bardon 2004: 13, 43). Here Bardon's view of the haptic would seem to correspond to Gibson's when he described the function of the 'haptic system' as involving more than a pick-up of tactile sensations (Gibson 1966: 97). From the discursive standpoint of the discipline of gesture studies, Streeck has construed Gibson along these lines, describing proprioceptive information as derived from 'the motions and relative positions of our joints':

The haptic system not only includes our sense of touch, but also our body-internal kinesthetic perception; it integrates manually acquired information of the world within our body's self-perception ... (Streeck 2009: 54)

What does this mean in the context of Aboriginal art practice? I would suggest a great deal. The stories of ancestral journeys represented in Aboriginal Western Desert art, and indeed across Australia, typically involve protagonists with both human and animal attributes. Consideration of the focused skill of tracking has previously led me to suggest an active proprioceptive identification of trackers with the animals they are pursuing. Future discussion might, among other things, direct attention to the known plasticity of human body representation to support the notion that an updating of body schema – in this case through the influence of vision on proprioception (Touzalin-Chretien et al. 2010) – 'may explain the phenomenon of mythic therianthropy' (Dobrez, P. 2015).

More generally, acknowledging a central role for proprioceptive awareness in the process of acting out the rhythms of human and animal movement encourages the foregrounding of *mimicry* as the driver of this kind of embodied representation. While at the

same time displaying a certain amazement characteristic of the moment of historical contact, Basedow, who provides many vivid examples, remarks perceptively of Aboriginal imitation and impersonation: 'as a conversationalist an aboriginal is usually so animated by the recollections of his experience that he unconsciously becomes a dramatist, and his narration an epic'. Such imitative capacity clearly derives from bodily resonance with conspecifics and other creatures (Billard and Arbib 2002). (With regard to motor resonance responses to non-human animal behaviour it might be useful to examine the frequency of human-like creatures, such as the sometimes upright plantigrade bear or kangaroo, in world myth.) In Basedow's chapter on 'Music and dance' an emphasis on collective attunement to imitative display (Basedow 1925: 371-385) strongly suggests the recruitment of shared motor knowledge. Within anthropological discourse we freely talk about an object-directed 'animism' and entertain the reifying concept of 'totemism' (construed as a projection onto rather than an empathetic merging with) when we might be paying attention to an inwardly charged proprioceptive own-body awareness so clearly evident in an Aboriginal ever-readiness for responsive action. From the standpoint of the present discussion the importance of this talent for mimicry is twofold, expressed in the propositions that the *origin of pictures is gesture* (the corollary of the gestural origin of language thesis), and that an opportune case study supportive of this hypothesis exists in sand drawing (different from, yet so closely allied to, emulative 'totemic' performance).

Gestural origins of forms employed in ground-based narration

In recent years there has been an increasing amount of evidence and argument presented from the disciplines of neuroscience (Arbib and Rizzolatti 1997; Rizzolatti and Arbib 1998; Corballis 1999; Rizzolatti and Craighero 2004; Arbib 2005), linguistics and gesture studies (Kendon 1988; 2011; Corballis 2002; McNeill 2005), and ethology (Tomasello 2008) in favour of the gestural origins of language. The evolution of language among humans, while a recent appearance on evolution's deep-time scale, has been seen as 'one of the most significant and interesting events that has occurred in the last 5-10 million years' (Fitch 2010: 1). Indeed, speech has been regarded as our defining capacity, the attribute that 'makes us human' (Fitch 2010: 1). It is said that 'humans can talk and chimps can't' (Poe 2011: 28), an assertion less challenged at this point in time than it has been in the past (Fitch 2010: 13-15, 166-168) — due in part to a new disposition to examine all forms of animal life in their environmental niches for the phylogenetic distinctiveness these confer (Tomasello and Call 1997; Levinson and Holler 2014). In linguistics and communications studies preoccupation with event-perception, event-memory and event-representation has been gaining ground as a freshly-

conceived field of inquiry. While some of the most exciting contributions have come from neuroscience, particularly with the emergence of 'mirror neuron' theory (Arbib and Rizzolatti 1997; Rizzolatti and Arbib 1998; Rizzolatti et al. 2001; Rizzolatti and Craighero 2004; Arbib 2005), new perspectives on communication which take account of environments have been gaining ground. Adding a situational dimension to the notion of multimodality — Streeck et al. speak of 'embodied orientational frameworks' — this approach stresses inter-relatedness of 'talk, gesture, and structure in the world' (Streeck et al. 2011: 2). In this turn to the notion of 'embodied interaction' taking place in a 3D world, a world from which contributive meaning can be extracted, the shared spaces of interlocutors are as much emphasised as directed semiotic acts. This is consistent with Tomasello's emphasis on 'joint attention' based on 'shared experiences from the past' (Tomasello 2008: 78). When 'common ground' is established through cooperative activities (such as hunting and foraging), many communicative acts will take place without the need for language which, as Tomasello points out, is a *code*, and as a code must have its origins elsewhere:

If we want to understand human communication, therefore, we cannot begin with language. Rather we must begin with unconventionalized, uncoded communication, and other forms of mental attunement, as foundational. Excellent candidates for this role are humans' natural gestures such as pointing and pantomiming (Tomasello 2008: 59).

The *gestural origins of spoken language* thesis is summed up thus: 'humans used some vocalizations while pantomiming actions or objects in a naturally meaningful way' (Tomasello 2008: 243).

For Arbib and Iriki the development of mirror neurons in humans set in train an evolutionary sequence leading from mutually-understood pantomime via motor resonance (protosign) to a conventionalising of gesture: 'this created the new cognitive niche in which the evolution of structures for vocal learning proved advantageous, building protospeech on the scaffolding of protosign' (Arbib and Iriki 2013: 493). The corollary that graphic inscription — pantomime-derived *protograph* to conventionalised *proto-script*, making the brain *writing-ready* — may have evolved in the same situation is not considered. Arbib and Iriki's characterisation of the possible evolution of spoken language involves the idea that conventionalisation came into play to dispel ambiguities (Arbib and Iriki 2013: 489, 495). It may be so, but it is surely *context* which does the work of confirming meaning. Basedow describes how the mimicked 'caw of a crow is embodied in the musical program of a ceremony', i.e. how context ratifies the meaning of an utterance. First the performers simulate the appearance and behaviour of a crow, transitioning to the actions of a young bird begging to be fed, at which point they begin to chant 'in imitation of the crow's call: "A wa, a wa, a weh!"' Basedow gives many examples of comparable vocalisations (Basedow 1925: 378-379). Such illustrations might lend support

to the 'protolanguage as musical' thesis (see Kendon 2011). Repetition no doubt does entrain stylisation and conventionalisation, no less in graphic inscription than in the case of language.

Here a Gibsonian emphasis on meaningful real-world affordances only partially susceptible to uncertainty might be a helpful approach and one which could be readily taken over into the graphic sphere as explored in the present article. The meaningfulness of visual records of human and animal activity (e.g. tracks) will in normal situations be no more enigmatic, opaque or puzzling than perceiving a real object (e.g. a lizard on a rock), and an imitation of the record, i.e. its representation, will bring this meaningfulness to mind. On a different but related point, the Arbib and Iriki founding of compositional meanings on *praxis* is consistent with what can be learned from a study of sand drawing's co-speech hand gestures and their inscribed marks.

Returning to the multimodality of our co-speech-gesture-inscription system we find the resonant body with its capacity for imitation positioned at its centre. What else? Communication is embodied: an agent gestures, speaks or sings and draws marks in the sand. While extending and enriching communication in diverse ways the modalities are broadly isomorphic (for microanalysis in the service of an appreciation of complementarities see Green 2014: Ch. 4). Just as sentences have nouns and verbs, so does gesturing and marking. Noun-verb or in Kendon's terminology *depictive-enactment* structure in gesturing is illustrated by an example provided by Green when she describes a modern central Australian way of making a sign for a credit card: 'The sign for the card is formed by combining a depiction or a "sketch" in the air of the oblong shape of the card with an enactment of the way that the cards are inserted into automatic tellers or cash dispensers' (Green 2014: 142). Kendon observes: 'many signs are created as dynamic gestural renderings of a *concrete visual image*, either of the visible appearance of something or of *some pattern of action*' (Kendon 1988: 185, my emphasis). (For a discussion of the complexities of a relational system requiring a necessary reduction or abbreviation of depictive or pantomimic gesture see Kendon, 1988: 185-190; obviously a principle of *economy* is also at work in co-speech and gesture graphing.) In the sphere of marking we might say, by way of illustrating the static-dynamic binary on which I have suggested the graphic system operates, that there are icons which take up the noun function and miniaturised mimetic performances which take up the verb function (see also Bardon 1991: 132). While the range of iconic shapes is limited by manual constraints, contextual situations provide a 'dictionary' function since the range of possible meanings for shapes such as circles, meanders and arcs is permanently on view in the form of real objects in material landscapes.

As a case study gesture-speech-inscription multimodalism would seem to ground both spoken and

inscribed graphic language in gestural pantomime. This is in line with what I have previously argued in relation to rock art hand stencils and prints as traces of real gestural actions eliciting mirror-neuronal responses which allow a viewer to unlock meaning on the basis of shared motor knowledge (Dobrez, P. 2013; Fogassi 2013: 92, 101). There is a difference, however, between the direct trace of a hand we encounter in stencils and prints, and the traces of hand movements which are used to form the vocabulary of sand drawing. With stencils and prints there is no after-the-fact matching up of the mark with its given meaning. Even in instances where digital manipulation can produce variations on the stock hand the result is simply the trace of directly-imprinted gesture. In contrast, sand drawing inscription marshals manual dexterity to compose analogues of gestural patterns. Here, what the body is capable of in terms of a mimetic capacity provides the template for a form of graphing which is no longer straightforward hand-to-image imprinting, thus putting sand-drawing trace marks at a remove from their source.

My discussion of the readable iconicity of hand marks in 'The case for hand stencils and prints as proprio-performative' led me to propose a model for communication in which the direct hand trace emerges as the first external term in an exchange of meaning on the basis of which further meanings can be constructed (Dobrez, P. 2013: 318): 'with embellishment through decoration or patterning or, alternatively, manipulating fingers to vary the iconic hand image, a foundation is laid for elaborated communication in the form of symboling' (Dobrez, P. 2014: 388). Arbib's stress on the need for effective communications systems to 'generate unbounded pattern diversity by combining a relatively small set of discrete and non-blending elements into larger individuated pattern entities' (Arbib 2013: 20) has, however, led me to reconsider hand traces in the light of the probability that the inevitable exhaustion of the manipulative possibilities of bent fingers and easy to reproduce decoration encouraged the development of a more variable and flexible ground-based system. On this scenario the limits of a gesture-based hand stencil/print repertoire would have become the driver of inventiveness in the arrangement of marks involving graphic copying of iconic gestural forms and trace tracks shapes, employed in tandem with the imprinting of traces from mimicked enactments. In any case, as the print is a real trace of the kind that exists in the world, it is logical to assume that an unmodified hand or foot print in the earth preceded the stencil with its special technique of spray-painting and in all likelihood can be regarded as the *ur*-human mark. Whichever came first, the complementary parietal (hand stencils/prints) and ground-based (sand drawing/tracing) systems would appear to have shared gestural origins. Furthermore, the two systems may be simultaneously maintained as communications options serving different needs. Whether we entertain possible graphic beginnings in printed or stencilled hands utilising the convenient

symbolic range-extender of digital variation, or alternatively in stamped foot traces eventually overtaken by copied foot traces and digital enactments of tracks — combined with auxiliary iconic forms also gesture-derived — the human hand as direct tool remains at the centre of the story.

Perhaps it is a very small step from the visuo-motor memory of a gestural sign to graphic inscription involving continuous sweeps of the arm and hand facilitated by proprioceptive carryover of body awareness from one step to the next. If this is an accurate description of the phenomenon, then graphing or picture-making needs to be accorded equal standing with spoken language in human evolution. I predict that the kind of depictive representation we find in sand drawing, so far largely overlooked in favour of the gestural component of the multimodal system, will yield more insights about graphic inscription and its origins once we have had time to consider its potential, as flagged by Munn: 'Although the Walbiri graphic system is not a code for language morphemes (i.e. a form of writing), it does operate as a visual code for verbally conveyed narrative sequences' (Munn 1962: 973, 981).

To summarise. In agent-to-receiver situations gesture is understood in motor terms: 'only [acts] known motorically by an individual — either because the acts were learned or already part of the innate motor repertoire—enter their [the observer's] motor network' (Fogassi 2013: 92). I have argued that what obtains person-to-person also extends to the reception of hand stencil and print traces. Sand drawing's embodied pantomime, its tracings and contextualisations will be understood both motorically (through its performance aspect) and through visual recognition of meaning-laden iconic shapes employed in the setting up of a map-like action-base. This last map-like dimension originates in the habitual scanning for traces of significant events (such as footprint trails) on the part of hunters and foragers.

The descent of pictures

It stands to reason that an art form which makes unassisted use of the hands is antecedent to one requiring the use of a percussive tool or the preparation of paints and brushes — which is the case for petroglyphs and painted or stencilled images respectively. We have seen that in present-day sand drawing some kind of implement (a twig or a wire) may be employed to extend the range or precision of hand-drawn marks. But this is not of the same order as the use of tools and prepared materials in image composition. However, in view of everything which has been canvassed here in terms of the relationship between trace marks in sand drawing and the gestures they record, resonate with, and sometimes match iconically (Green 2014: 227), we can be in no doubt that sand-drawing traces function as analogy, whereas gesture itself would appear to communicate directly via first-person motor

knowledge. If sand-drawing imagery pictures at one remove (as re-presented mimicry), what then can be said of petroglyph and (non-trace) painted motifs? It is logical to suggest that they stand at yet another remove, having in all probability originated as 'new media' transcriptions of sand trace and gestural depiction. But how do we go about assembling evidence for this line of descent?

It seems abundantly clear that the evidence, to date overlooked, is there in the rock art assemblages awaiting detailed documentation, as suggested above. If the predecessor thesis claimed by the present author is valid, rock art images (at least in general) should match not real objects but their representations in sand drawing, something which should be especially apparent in the case of tracks. These last will not necessarily correspond to real tracks traces in size (although there will be nothing to impede size equivalence) and will most likely display many of the stylisations which clearly belong to a gesturally-derived repertoire dependent on the dexterity of hands in motion. The issue of presumed 'naturalism', proposed by Clegg/McDonald (McDonald 1982) would be best avoided by reference not to 'correspondence to reality', but simply to 'recognisability', i.e. to the concept of canonical form. Indeed the McDonald finding of sufficient foot-shape resemblance to produce clusters corresponding to two relevant macropod categories, while failing to verify mimetic naturalism (for reasons we have not the space to discuss here), does suggest canonical recognisability — which is consistent with the notion of a *derived* set of established representational conventions.

It is the case that marking the ground in Australia is not limited to desert regions (Sinclair 2015). Extending the argument, it would seem short-sighted to argue that as a communications system this activity belongs exclusively to Australia. There are well-known sand-picture traditions from Tibet to the American Southwest (Green 2014 additionally mentions Alaska, Vanuatu, Angola and Tamil Nadu), but more fundamentally, the option of inscribing the ground has been available to our ancestors since the bipedal freeing of hands, and it would seem highly unlikely that this option was not taken up in many places and times.

On the world scene there are broader questions which need addressing in connection with tracks and geometrical forms which, in relation to the 'Panaramitee' and extrapolating from Australian sand drawing, I prefer to call trace-icons or map-view icons. The global use of the word 'abstract' as a name for geometrical unidentifiables unfortunately forecloses on the possibility of a motif's iconicity. This matters if our aim is to extract as much information as we can from what we see on a spectrum of differing presentations across the planet. We need to consider what might have favoured parietal art (often profile-view lending itself to 'scene' depiction) in some places and ground-based (encouraging topographical overview) in others. Above all, for the purposes of geographical and temporal

comparison, there is a pressing need to bring into clear focus what we find at diverse locations and within different temporal episodes in the way of stand-alone human or animal tracks at some sites, trails at others, trails in association with iconic map-view motifs, as well as associations of trails with profile figuratives (thus combining scene with overview, as in American biographic tradition petroglyph compositions). In addition to this list of options there remains of course the real possibility that some motifs may be genuine abstracts used for either decorative or supererogatory symbolic purpose, or for no purpose at all — as in doodling. Such motifs might occur in isolation or in association with other imageries, and indeed outside Australia we do find presumed non-iconic geometrical forms in association with figuratives (with or without the presence of tracks). But it would be too easy to pass off (for argument's sake) a grid in association with animal figures as an abstract component when it might be better read as a hunting net in plan view. Given various world manifestations of tracks and lines forms, it would help to know of other sites on other continents which might compare with the Australian Panaramitee model in terms of a possibly associated iconicity. Is there something more to 'Signos y pisadas de animales' in Patagonia (Podestà et al. 2005: 33), for example, than a sporadic and incidental co-presentation? A wealth of site information was given exposure at the two IFRAO 2015 sessions, 5 and 28, on tracks imagery — *Feet and sandals in rock art* and *Grabados abstractos y de pisadas en América del sur. La huella de animales como tema del arte rupestre* — where a number of questions were raised, including the need for revision in some areas (Collado Giraldo and García Arranz 2015: 259–422, 2131–2268). For all those interested in footprint traces, tracks, trails, tracks and lines, geometrics, abstracts, phosphenes, entoptics and doodles a global discussion is just beginning.

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