

Micro Mobilities and Affordances of Past Places

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Introduction

The careful excavation of physical evidence and examination of contexts and provenance allow us to make informed hypotheses about the physical construction and location of past structures, but is it possible to inform our understandings of how people moved around and through these structures? Is there any manner in which we can use the same physical evidence to infer how these structures were used? Can we apply understandings of how human perception informed past people about the meanings of environmental objects? Can we apply elements of Experimental Archaeology in an attempt to replicate past processes? Can we borrow from J. J. Gibson's theories of affordance or direct-perception, where objects and events have inherent meaning detected and exploited by human beings without mental calculation to aid our understanding of Past Places? Do ecological approaches to embodiment and cognition help us to understand relationships between past peoples, their tools, their environments, and how all of these elements function together as a system? If human movements, or moving humans, are added to heritage reconstructions without consideration of how environment, artifact, perception, and action are linked, they become aesthetic adornments. However, if movement is captured and applied with rigour similar to that applied to the materials used for the reconstructions, the virtual models become more than sculptures and can more usefully reflect the activities and behaviours conjectured to have taken place in the location.

As an aid to understanding these links between sites and movement, it is useful to look at the UNESCO definition of Intangible Cultural Heritage. During development of the definition, the team looked at Rangihiroa Panoho's example of the Marae, as simultaneously a building and a cultural meeting space for the Maori. It functioned along the lines of what Joseph Roach calls "vortices of behaviour", which characterize churches, marketplaces, theatres, schools, and kitchens, i.e. places where certain kinds of behaviours and values are learned and certain memories are transmitted. (Roach 1996: 26-28).

Another useful approach to understanding this issue comes from the philosophical construct of phenomenology, or of interpreting locations in terms of experience of them. Typically phenomenology has focused on the embodiment of interpretation of locations-specific practices such as cult and religion, or the remediation of pathways through the landscape that are demarked by some extant physical structure, such as earthworks (see Tilley 1994; Copeland 2009). In a wide-ranging review of the subject in 2005, Joanna Brück notes:

[O]ne of the most productive strands of phenomenological writing within archaeology has been the deconstruction of the dualistic thinking that is a product of post-Enlightenment rationalism. This has facilitated a radical reconceptualization of the nature of materiality and the relationship between people and artefacts. ... Only by seeing objects as inanimate can we adhere to a model according to which humans impose meaning on a passive and pre-cultural universe. If, on the other hand, we recognize that artefacts, buildings, monuments and landscapes not only affect us but make us who we are, then our engagement with the

archaeological record is necessarily a dialogue in which both archaeologists and the axes, houses or burials we study are created and transformed (Brück 2005: 65).

In order to explore these relationships between human movement and site, or place, an interdisciplinary consortium was brought together through funding from the UK Arts and Humanities Research Council (AHRC) to develop a Motion in Place Platform (MiPP). This consortium, led by the authors of this paper, aimed to develop tools and working methods to move beyond the study of purely material cultures by adapting current motion capture technologies, enabling them to be taken out of the studio in an attempt to capture quantitative data, which can demonstrate links between environment and movement. Once this data had been captured, the MiPP team developed techniques for analysing the relationships between the data and the environments and conditions under which the data were captured. Earlier publications focus on construction of this system (see Dunn 2012a, Dunn 2012b). This chapter focuses on understanding how artefacts, sites, and places afford movement, and uses MiPP data in an attempt to demonstrate that these relationships do exist, they can be quantified, and they are crucial to our understanding of archaeological material evidence.

Framing Place:

One of the most daunting challenges for the Motion in Place Project, has been the search for a clear, concise theoretical framework for understanding relationships between moving bodies and locations. This brings the project into the realm of *Place*. It is beyond the scope of this chapter to fully cover the concept of a place. Even John Cresswell's overview, "Place: a Short Introduction" is 168 pages long. We will however attempt to provide a general introduction by citing a number of key statements by authors working in a range of sectors to clarify and focus this issue with respect to our own research. The disciplines of Geography and Architecture deal at length with notions of *Space* and *Place*, but have great difficulty in agreeing on definitions for them. One branch of Geography, "Human Geography", specifically addresses 'issues of the world, its people, communities, and cultures with an emphasis on relations of and across space and place.' (Johnston 2000: 353), but human geographers continue to find it difficult to succinctly and consensually define Place. John Cresswell, one of the representatives of this new discipline, opens his introductory book on place by stating,

'The popularity of place ... is also a problem as no-one quite knows what they are talking about when they are talking about place. Place is not a specialized piece of academic terminology. It is a word we use daily in the English-Speaking world. It is a word wrapped in common sense. In one sense, this makes it easier to grasp as it is familiar. In another sense, however, this makes it more slippery as the subject of a book. As we already think we know what it means it is hard to get beyond that common-sense level to understand it in a more developed way.' (Cresswell 2004: 1)

The many definitions of place Cresswell cites includes this one by the political geographer John Agnew:

'Places ... are located. They have fixed objective co-ordinates on the Earth's surface (or in the Earth's case a specific location vis-à-vis other planets and the sun). New York is *here* and Kosovo is *there*. Given the appropriate scale we could find them on a map. The word place is often used in everyday to simply refer to location. When we use place as a verb, for instance, we are usually referring to some notion of location – the simple notion of *where*. But places are not always stationary. A ship, for instance, may become a special kind of

place for people who share it on a long voyage even though its location is constantly changing. By *Locale*, Agnew means the material setting for social relations – the actual shape of place within which people conduct their lives as individuals... It is clear that places almost always have a concrete form. New York is a collection of buildings and roads ... [a] child's room has four walls ... Places then, are material things... As well as being located and having a material visual form, places must have some relationship to humans and the human capacity to produce and consume meaning.' (Cresswell 2004: 7)

This relationship between a located, material *place* and a *space* defined by human thought or action has frequently been examined by cultural theorists. Henri Lefebvre's book "The Production of Space" has made a major contribution in this field, as has Michel de Certeau with his book on *The Practice of Everyday Life* where he states:

'A space exists when one takes into consideration vectors of direction, velocities, and time variables. Thus space is composed of intersections of mobile elements. It is in a sense actuated by the ensemble of movements deployed within it. Space occurs as the effect produced by the operations that orient it, situate it, temporalize it, and make it function in a polyvalent unity of conflictual programs or contractual proximities. On this view, in relation to place, space is like the word when it is spoken, that is, when it is caught in the ambiguity of an actualization, transformed into a term dependent upon many different conventions, situated as the act of a present (or of a time), and modified by the transformations caused by successive contexts. ... In short, space is a practiced place. Thus the street geometrically defined by urban planning is transformed into a space by walkers.

Both De Certeau and Lefebvre define *space* in terms of actions and practices of society. They write of non-material spaces. Lefebvre writes at length on the space of speech whereas De Certeau focuses on the space of stories. Much theory on space and place avoids the materiality of human beings, their bodies, and how these bodies must act or move in places or spaces. The human geographer Derek McCormack outlines some of these challenges understanding moving bodies:

'If it is difficult – and indeed dangerous – to define what bodies are, there are some things we know bodies can do, even if our understanding of precisely how they do these things remains partial and fragmentary. First, bodies move: they walk, crawl, gesture, run, stumble, reach, fall and embrace. However, bodies move in more ways than one: yes, they move physically, but they also move affectively, kinaesthetically, imaginatively, collectively, aesthetically, socially, culturally and politically. Then, and second, we know that by moving in these different ways, bodies can "produce" or generate spaces. That is, the quality of moving bodies contributes to the qualities of the spaces in which these bodies move. Put another way, spaces are – at least in part – as moving bodies do. Think, for instance, of the difference between a football pitch with and without a game taking place on it. The presence of moving bodies is not only a physical transformation of the pitch: it also alters the imaginative, affective, sonic and social qualities of this space (McCormack, 2008: 1823).

An academic who remarkably deals at length with the movement of human beings, bodies, and spaces, anthropologist Tim Ingold, states:

'My contention is not that lives are led not inside places but through, around, to and from them, from and to places elsewhere. I use the term wayfaring to describe the embodied experience of this perambulatory movement. It is as wayfarers, then, that human beings

inhabit the earth. But, by the same token, human existence is not fundamentally place-bound... but place-binding. It unfolds not in places, but along paths. Proceeding along a path, every inhabitant lays a trail. Where inhabitants meet, trails are entwined, as the life of each becomes bound up with the other. Every entwining is a knot, and the more that lifelines are entwined, the greater the density of the knot... Places, in short, are delineated by movement, not by the outer limits to movement.' (Ingold, 2011b: 148)

A space, then, is a practiced place, and we live our lives not inside places, but through them. But what are the practices which transform places into spaces? At what point does a space become 'inhabited', and through what processes of human intervention in the material record do places become spatial artifacts? And, how do we move through these spaces? How can we define, capture and understand them? These are the starting questions for the development of the Motion in Place Platform. Additionally, MiPP aims to address a further, equally complex question, and to shed new light on the relationship between environment, accumulated experience and perception.

When reflecting upon a sign at a railroad crossing stating: "Stop, Look and Listen", Tim Ingold reflected:

"Supposing that our knowledge is ultimately founded on sensory experience, how do we know that the sights and sounds that come to our notice are all manifestations of the same thing... If we hear sounds rather than things (like trains), then how do we know that this sound I hear belongs to that train I see? These are among the most ancient of philosophical conundrums, and it is not in my intention to resolve them here. I do mean to suggest, however, that the way in which they are posed bears the imprint of a certain way of imagining the human subject – namely, as a seat of awareness, bounded by the skin, and set against the world – that is deeply sedimented in the Western tradition of thought. The problem of perception, thus, is one of how anything can be translated or "crossed-over" from the outside to the inside, from the macrocosm of the world to the microcosm of the mind... As such, perception is not an "inside the head" operation, performed upon the raw material of sensation, but takes place in circuits that cross-cut the boundaries between brain, body and world." (Ingold, Perception 243-244).

The Architecture theorist, Juhani Pallasmaa, clarifies this relationship between interior and exterior environments as follows:

"Our bodies and movements are in constant interaction with the environment; the world and the self inform and redefine each other constantly. The percept of the body and the image of the world turn into one single continuous existential experience; there is no body separate from its domicile in space, and there is no space unrelated to the unconscious image of the perceiving self.' (Pallasmaa, 2009:40-41).

However, all these questions and debates pertaining to motion, place, and perception remain just as subjective as they have been for hundreds of years. The Motion in Place Platform builds on advances in motion capture technologies in order to provide qualitative data to reinforce or challenge these debates. It specifically explores technologies and methods for observing and analysing the practices and movements involved in the making of place and/or space.

Human Factors and Techniques of the Body

Experimental archaeology is a branch of archaeology that replicates or attempts to replicate past processes in order to understand what is found in archaeological records. This branch is often cited as offering an important asset in the study of human interaction with material culture, especially when dealing with remote periods of history where there are few other sources of data on the human interventions. This attempt to understand processes has found many expressions in the discourse of archaeological theory, including the so-called *chaîne opératoire*, or 'operational sequence' theory (see, e.g. Bar-Yosef and Van Peer 2009). However, due to an understandable desire to adhere to empirical evidence, means of inferring the human movement behind interventions are rarely considered in the reconstruction of archaeological environments. The most obvious reason for this is that buildings, features and artefacts can be understood and reconstructed (whether digitally or not) from empirical archaeological remains, whereas there is little or no direct evidence for how people might have looked and moved through the places they created. Approaches that seek to go beyond this are methodologically fraught as a result of 'the human factor'. It is further inevitable that such living interpretation will be problematic, since environments, objects and landscapes are, to one extent or another, cultural constructs: society attaches significance to landmarks and features which cannot be retrieved without written records. However, implicit in all archaeological interpretation is the truth that this human factor is behind the process of the material record's creation. Human processes have, in the past, been regarded as intangible and unrecoverable, and therefore implicitly and explicitly written off in experimental archaeology; and the problems of equating present-day movement with its historical counterparts discussed elsewhere (Brück 2005). This is reflected in global regulatory practices on 'intangible cultural heritage', which UNESCO considers protectable alongside tangible heritage (such as the Great Wall of China) and natural heritage (such as the Amazon basin). Intangible cultural heritage encompasses language, oral traditions, practices transmitted by gesture, music etc. Recent governance models seek to sustain traditions, which are extant by supporting those who practice and transmit them: "not only the masterpieces but also the masters" (Kirshenblatt-Gimblett 2003). When one is dealing with pre-literate societies, such as the British Iron Age, there are of course no individual 'masters' to whom cultural practices can be traced. There is therefore a tension in the reconstruction, as opposed to the preservation, of ancient intangible heritage. These traditions are 'dead', and therefore not 'preservable'. For this reason, experimental archaeologists have traditionally shunned 'the human factor', focusing instead on the re-creation of archaeological features from empirical evidence (Harding 2009, Coles 1979). Indeed, the very notion of attempting to include 'the human factor' in experimental reconstructions is viewed with scepticism at best and outright hostility at worst. As Peter Reynolds, the founding director of the Butser Ancient Farm experimental archaeology laboratory in Hampshire, England (see www.butserancientfarm.co.uk) states:

"In real terms it is only sensible to examine structures physically and as far as possible to dehumanise the examination process. Re-enactment is best left as a dramatic indulgence to the imagination, which can be recognised as singularly valueless and instantly forgettable ... History, and by implication prehistory, is swiftly becoming a tabloid newspaper sub-editor's view of the past" (Reynolds 1993).

While some might view this undermining of imagination as being somewhat harsh, it nonetheless highlights a significant gap not only in 'real world' reconstruction projects such as Butser, but also,

in the application of virtual reality reconstruction, or any attempt to (re)create past movements in any place.

In British Iron Age domestic culture, there are no historic or material referents to how particular houses were built, or how artefacts such as arrowheads or ceramics were made. The methods must be inferred by a process of logical deduction, and examination of the available empirical evidence. However, how we approach this process of deduction can, and often does, involve a human factor. The reconstruction process in experimental archaeology now has a long tradition of researching and utilizing past methods construction and craft to construct (the term ‘reconstruct’ is explicitly avoided in the literature – see Reynolds 1993) non-extant buildings using those methods. The experimental approach, now well established and widely referred to, requires the ‘human factor’, in that it requires human intervention in, and interaction with, the physical world. While it is not possible to go back in time to capture the exact motions involved in creating archaeologically relevant places, we *can* capture current activities and the physical processes and their transmission in order to gain more insight into probable past activities. These processes, specifically what the MiPP team hoped to capture in order to better understand possible activities in Iron Age Roundhouses, are what the French sociologist Marcel Mauss refers to as techniques of the body, transmitted through tradition:

‘I call technique an action which is effective and traditional ... There is no technique and no transmission in the absence of tradition. This above all is what distinguishes man from the animals: the transmission of his techniques ... we are dealing with techniques of the body. The body is man's first and most natural instrument. Or more accurately, not to speak of instruments, man's first and most natural technical object, and at the same time technical means, is his body.’ (Mauss 1973:73)

Mauss used his concept of techniques of the body to analyse numerous motions and activities, for example:

‘during the War I was able to make many observations on this specificity of techniques. e.g. the technique of digging. The English troops I was with did not know how to use French spades, which forced us to change 8,000 spades a division when we relieved a French division, and vice versa. This plainly shows that a manual knack can only be learnt slowly. Every technique properly so-called has its own form. (Mauss 1973:71)

Mauss’ techniques of the body became clear during a studio-based capture at the University of Bedfordshire for the MiPP project. When asked to sweep out the virtual round house, one of the performers emulating Iron Age activities grabbed a 20th century push-broom in the corner of the studio and began sweeping with it. It was obvious to people watching that this was a 20th or even 21st century movement. This action was a form closely linked to a “modern” artifact. After the performer was reminded that the push broom was a 20th century invention which would not have existed in a round house, she swung the broom from side-to-side without touching the floor. Neither of these sweeping actions could be considered “correct” and neither helped us understand how or why round houses were constructed in forms we have found. The studio-based approach to modelling movement demonstrated the power of techniques, the importance of provenance and the need to document assumptions made during capture.



Figure 1: Sweeping in a virtual (U. Sussex) and physical (Butser Ancient Farm) round house

Capture in Material and Immaterial Environments

The experience with the broom showed that the connection to material objects such as tools and buildings are of crucial importance in elucidating our understanding of possible behaviours and movements at a historically inaccessible period. Consequently, a further set of experiments was devised around the tasks of sweeping within two (re)constructions of the same round house. Both round houses were constructed according to excavation data from Moel y Gerddi, Wales. The first, immaterial, or virtual round house was created using projections and a head-mounted display at the University of Sussex. The second, material, or physical round house was constructed of materials expected to have been available in Iron Age Wales at the Butser Ancient Farm. Two performers were given a broom, constructed using materials and methods sufficiently generic as to approximate to those likely to have been used in the Iron Age, to sweep the virtual round house as well as the physical round house (see figure 1). In the virtual round house, their movements had no consequence. In the physical round house, phenomenologies taught them that large, fast movements not only failed to clear the floor, but also created dense clouds of dust and damaged the floor of the house. The performers' movements were then compared with the movements of an experimental archaeologist who worked in the house on a daily basis, performing the same task. Other daily activities including grinding grain with a quern, fetching water, and making bread, were all captured both with props in the studio, and with (re)constructed artefacts in the round house. We may thus learn from this that even well-rehearsed models of phenomenological and experimental archaeology are dependent on cultural conditioning and personal experience, and highlight Brück's point (2005) that the reception of locations is not constant or ahistorical. The use of motion capture technologies allowed the research team not only to capture motion data for visualization, but to analyse the difference in movement dependent upon the artefact, environment and the experience of the user. Figures 2a and 2b show respectively an inexperienced user and the experimental archaeologist operating a quern stone for grinding corn. It is plain to see that, in 1b, there is a far clearer and more consistent set of motions, along with clear clues as to the object's most efficient usage: the employment of a circular motion on the quern stone by a skilled operator, rather than the back-and-forth motion of the inexperienced user. This is, in effect, an extension of experimental archaeology, which allows us to infer how people are likely to have interacted with their physical environments and how those environments (or tools) were constructed.

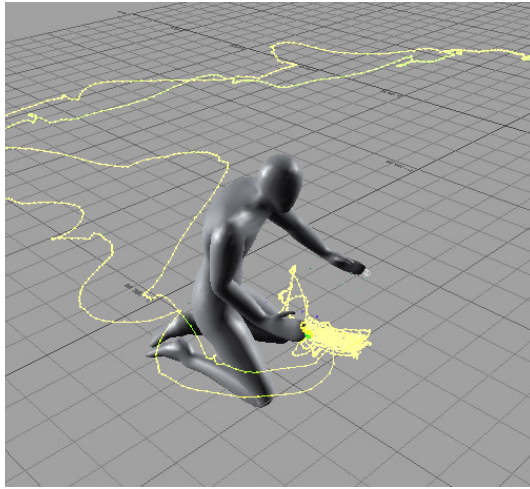


Figure 2a: Inexperienced performer using quern to grind grain by using short, rocking movements

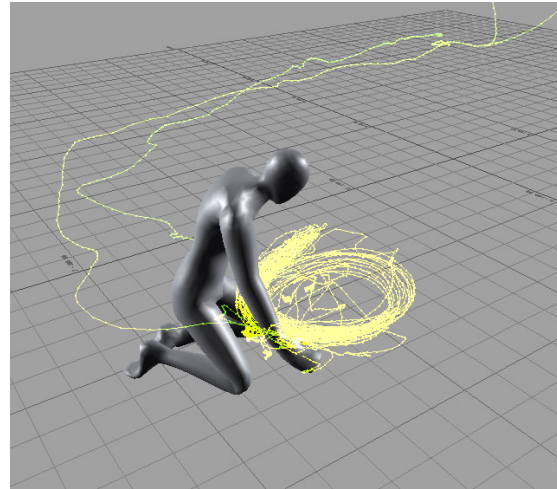


Figure 2b: Experienced experimental archaeologist grinding grain with larger movements and rotating quern through it's entire range of movement

As noted, the purpose of this exercise is, emphatically, not to attempt to re-enact possible scenarios of history or prehistory, but to capture and visualize human interaction with place and material culture as documented by archaeological evidence. During the capture process, the MiPP team became aware that numerous assumptions being made about motion needed to be recorded in order to provide a context for the data (commonly referred to as “metadata”). For example, when capturing in the studio, the hard floor and performer’s shoes constrained and reshaped the movement, so this capture was replicated barefoot, outdoors on uneven grass. External factors such as footwear, clothing, training, experience, age and gender of the mover impacted the motion data. Many assumptions of this kind are either overlooked altogether, or implicitly encoded into models, of which the virtual round house offers a clear example. While such assumptions cannot be removed from the reception and transmission of virtual environments, MiPP was able to propose a means for isolating and critically assessing them, as readily shareable visual material that avoids the pitfalls of discipline-specialist language and jargon.

It is clear that one key factor missing from these reconstructions of hypothetical tasks is the ability to annotate and describe the motion data. The main difference between the kind of ‘human factor’ representations and re-enactments that are currently viewed with suspicion by experimental archaeologists is that digital capture should allow particular actions, and particular temporal points in each trace, to be labelled with a) what material evidence relates to each action or trace or b), if there is no material evidence, what action has been represented. Given the history of a field such as archaeology, where there are already highly developed information recording and presentation conventions, marking up quantitative representations of immaterial events should be straightforward. One way of doing so might be to assign levels of certainty to various activities, in much the same way that textual mark-up allows editors to grade the scribal or editorial certainty of sections of text. It should be possible, for example, to state that ‘we have 100% certainty that there were activities to do with fire in this room because there is a hearth and charring, but only 50% certainty that the fire was used for ritual activity because of the paucity of supporting evidence’. It should

also be possible to develop a system for citing archaeological contexts in support of particular types of activity.

Affordances and Effectivities

James Gibson wanted to understand how perception—that is, an animal’s only means of collecting information from outside itself—can inform the animal about the meanings of environmental objects. For example, how does perception inform my cat that she can or cannot jump onto the kitchen table, or how does perception inform my daughter that she can or cannot reach something? Theories that address such questions fall into two categories. The first category assumes that objects and events have no inherent meaning, and thus the meaning must be created internally and stored by the animal, that is, an indirect-perception view. The other category assumes that objects and events have inherent meaning, which is detected and exploited by the animal without mental calculation, that is, a direct-perception view. J. J. Gibson’s theories fell into the latter category. In fact, within experimental psychology, it is not clear that the latter category even existed before Gibson. (Jones, 2003:107)

The theory of affordances is based on ecological psychology, and advocates that knowing is a direct process. It states that an animal’s (e.g. human’s) perceptual system extracts invariants, or unchanging relationships embodying the ecologically significant properties of the perceiver’s world. Gibson bases his theory on the tenet that animal and environment form an inseparable pair. We can extend this slightly to say that humans and their environment, whether contemporary or past, form an inseparable pair.

Gibson uses of ecological physics to clarify this complementarity. Such physics considers functions of the environment at an ecological level instead of the levels of space, time, matter, etc., within classical physics. Affordances have to be described relative to the animal, i.e. the person perceiving them. For example, a chair’s affordance “to sit” results from a bundle of attributes, such as “flat and hard surface” and “height”, many of which are relative to the size of an individual. Later work with affordances builds on this so-called agent-environment mutuality. Affordances can be considered as measurable aspects of the environment, but only to be measured in relation to individuals in said environment. For example, a “climbability” affordance of stairs is specified as a ratio of riser height to leg length. People of different heights may, or may not, perceive stairs as climbable depending on their own leg length, as opposed to some extrinsically quantified value.

Just as *Place* is a very complex issue with numerous interpretations and understandings, *Affordance* is a dense issues who’s depths we can only begin to explore here. Keith Jones gives a clear overview and history of the concept in the journal *Ecological Psychology*, and Mark Gillings uses affordances to understand ancient landscapes while warning that:

“affordance is not a static concept and that considerable debate has, and continues to take place, within the field of Psychology, in large part a consequence of Gibson’s own thoughts on the topic being a work-in-progress. The assumptions that underlie direct perception in turn require a new ontology capable of dealing with the requirement that the environment now embodies meaning alongside its raw physicality. This is where the notion of affordance enters the picture. The first point to realise is that having introduced the concept of affordance, Gibson’s own attempts to define it in detail were at best vague. This, in turn, has led to considerable efforts within the field of Ecological Psychology (as well as Psychology more broadly) to develop a rounded and coherent theory of affordances ... Whilst all take Gibson’s assertion that affordances are environmental properties that are

meaningful to animals as their point of departure, they differ in a number of ways, most importantly for us what qualities shared between animals and environments constitute affordances and whether they can be considered to exist in the absence of animals. (Gillings, 2012)

Gillings also points to an essay by Anthony Chemero characterizing two dominant approaches within the psychological literature to this problem of defining an effective theory of affordance. In the paper Chemero defines these approaches as selectionist and dispositional. Through the selectionist model, affordances are portrayed as resources in the environment, which are exploitable by animals. These affordances exist in the landscape prior to arrival of the animal and therefore do not depend upon the presence of an animal in order to exist. The concept of 'selection' derives from the direct association between availability of affordances and evolutionary selection pressure. In direct contrast, the dispositional view proposes that affordances are properties of the environment, which only manifest in certain circumstances and cannot always be considered as present. The dispositional view states that under different circumstances, the same environment may reveal different properties (i.e. affordances) in the presence of different animals. (Chemero 2003, pp. 182–183).

To overcome this contradiction between the selectionist and dispositional definitions, Chemero offers an alternative—a relational theory of affordances. This approach differs in its insistence that affordances not be considered as properties (whether latent or dispositional) of either animals or environments in any formal sense, but instead relations between the two. Through this relational theory, the perception of affordances is contingent upon what he terms *feature placing*, i.e., the ability to perceive that a situation has a certain kind of feature (e.g. flooding) and that this in turn requires certain kinds of action that draw upon the abilities of the perceiving animal. To Chemero, affordances can never be properties of environments, but instead are linked to 'features of whole situations'. Humans form an essential part of these situations with affordances lying in the relationships between the abilities of humans and situational features. Put simply, in perceiving affordances, humans perceive relations. Changes in affordance can come from both changing environmental situations and animal abilities (Chemero 2003, pp. 185–92), the latter changes come through social factors such as experience and learning as evidenced by Mauss.

Naoya Hirose further explains the relational aspects of affordances by introducing Effectivities (Hirose, 2002). Effectivities, he explains, are means for acting that a person can use to realize a specific affordance. Affordances and effectivities are complementary concepts. Effectivities may change as the state of a person changes, because they are properties linked to the individual person. Tool use is a typical case where effectivities come into play. Tools may extend humans' existing action and perception capabilities. Tools are treated as functional extensions of the user; they play a central role in extending the user's effectivities to realize affordances of the environment. Consequently, tool use involves the task of detecting affordances not of the tool itself, but of functional relations between the tool and the environment." (Hirose, 2002:290-291). Hirose goes on to explain:

"a blind person's stick cannot be sensed for itself, as a person gets accustomed to using it. The stick can be embodied as part of the user's arm. For that reason, it is worthwhile ... to investigate the perception by probing with hand-held objects. Recently, perception of hand-held objects has been studied in the area of dynamic touch ... Dynamic touch is the kind of touch that occurs when one grasps an object firmly and wields it. Investigations on dynamic touch have shown that one can perceive various properties of a hand-held object by wielding and hefting it without help of vision. Moreover, one can perceive not only properties of a hand-held object itself, but also properties of a distal object by probing with a hand-held object." (Hirose, 2002:290-293).

In other words, tools become invisible to the user's perception. They also alter a user's effectivities of perceiving and acting. Tool use effects both perception and action. Tools extend a user's body into the environment, and become a direct link connecting body and environment, making it very difficult to demarcate boundaries between people and places.

Conclusions

Both the discussions of *Place* and *Affordance* demonstrate that humans and their environments, whether contemporary or past, form an inseparable pair. The boundaries between bodies, tools, and environment are fluid and dependent upon relationships more than materials. Ecological approaches to embodiment maintain that tool use extends users' bodies beyond the surface of the skin and through dynamic touch and probing, the user's perceptual body can be extended into the surrounding environment. This brings us back to our MiPP experiment with sweeping. When the performers were sweeping in a "sterile" studio, some information was being fed into the performer's body through the tool, i.e. the broom, but very little information was afforded by the smooth surface of the studio floor. However, when the performer took the same broom to the reconstructed roundhouse at Butser, a wealth of environmental information was obtained through the relationship of the broom head and the hard dirt floor. In order to continue to sweep, he had to change his movement in accordance. He had to make shorter strokes to prevent brushing up a large cloud of dust. He had to avoid wooden posts and monitor the placement of his feet on the irregularly shaped floor. All these environmental elements became embedded in the motion data. If this motion is re-played in a sterile, virtual environment, the extra data becomes exceptionally apparent as the virtual character moves in and out of the "flat" virtual floor. Likewise, if the movement data is captured on a smooth floor in a studio, and placed onto an uneven floor in a reconstruction, the virtual character floats above it or steps through it. Modern animation packages and game engines have systems to lock character's feet to surface topologies in order to deal with these issues with varying degrees of accuracy. However, issues of foot locking are most often seen as problems rather than invitations to accept that human being exist in a material world. When they are added to virtual reconstructions, the relationships between their bodies and the virtual materials of the reconstructed objects needs to be taken into account. When material aspects of the virtual characters aren't taken into account, the characters act as spirits floating through dead worlds without influencing or being influenced. Only by accepting that the materiality of the characters moving through these reconstructions needs to be afforded as much attention as the materials used to construct the buildings and landscapes can we hope to have realistic depictions of human activity, and mobility in these reconstructions.

To paraphrase Spinoza, there is much we still do not know about relationships between humans and their environments. Humans remain elusive and paradoxical, always excessive of attempts to define their essence. However, by using tools and concepts such as affordances, effectivities and place, we can begin to understand how past places may have been used in order to better understand what has been left behind. No, it's not possible to definitively know how Iron Age Britons used their round houses. We can infer past movements from an understanding and analysis of current movement in much the same way we infer the structure of past buildings and material objects through fragments that have survived to our current time. However, just as we make clear distinctions between what material objects have actually been uncovered and what we conjecture to have existed, we need to be clear about exactly what movements we're using as context and under what circumstances this movement has been captured.

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For more information, please see <http://www.motioninplace.org>

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