Excavating Humanness: Palaeoanthropology at the Human-Animal Boundary

By Murray Goulden, BA, MA.

ISS, University of Nottingham

Abstract

The human-nonhuman animal boundary marks the interchange between human and animal, culture and nature, the social and the natural. This powerfully symbolic site has traditionally been structured via religion-based ideas of humanity's origins, that in the West have been used to maintain a strictly impermeable boundary: humans, created in God's own image and blessed with a soul on one side, on the other the senseless, soulless beast. This image is one which has come under threat from work in multiples branches of the natural and social sciences; in the humanities; and from animal rights activists and other social movements. Such culturally contested territory makes fertile ground for the study of interactions between science and popular culture, framed via Gieryn's concept of 'boundary-work' (1983), and Bowker & Star's sociology of classification (2000).

Using the fossilised figures of palaeoanthropological research as a prominent site at which the aforementioned boundary is constructed, the thesis considers both how such "missing links" are positioned within the popular human-nonhuman animal dichotomy, and how the boundaries between science and nonscience culture are negotiated during this process. The project makes use of two case studies - the infamous Piltdown Man (discovered 1912) and the recent Flores 'hobbit' (2004). Both received huge scientific and popular attention at the time of their respective discoveries, and it is a critical discourse analysis of relevant scientific and popular news media that provides the research data.

The thesis addresses how missing links create connections far beyond simply their antecedents and descendants. Indeed, their emblematic position sees them use to explore fundamental notions of humanness, becoming tied to all manner of socio-political ideologies in the process. It is through this process that their 'natural' position is made culturally meaningful. Such actions requires repeated transgression of the science-nonscience boundary, a lesson which is used to critique 'canonical' and 'continuum' models of science communication, and to suggest a more complex, multi-directional 'hydrological' model in their place. The thesis concludes by drawing attention to the gaps between formally recognised categories, and how these are utilised by scientists and journalists alike, both in the translation of these missing

links between different systems of meaning, and in their role as a creative space for all parties to think with.

Acknowledgements

First I must thank my supervisors, Prof. Robert Dingwall and Dr. Paul Martin, for their ideas, support, and guidance, and for keeping a leash on my writing whenever it threatened trip over its own rhetorical flourishes.

The numerous anonymous referees who critiqued the published chapters are owed a great debt, as too are the thesis referees Prof. Alan Irwin and Prof. Brigitte Nerlich, who not only shared their expertise, but were also kind enough to ultimately judge this work on its strengths rather than its weaknesses.

I also owe a great debt to my friends and colleagues in ISS, without whom this thesis would be greatly inferior, and possibly non-existent. Though I cannot thank everyone individually, I would like to give particular recognition to Cecily Palmer, Andy Balmer, and Martyn Pickersgill, both for their constructive criticism, and enjoyably brutal put-downs. Without my friends, the PhD would have been a far less enjoyable experience, and this thesis would have doubtless suffered as a result. Thanks too to 'department mum' Gill Farmer, who's attention to detail ensured that the thesis cleared all bureaucratic hurdles placed in front of it.

My family have had the kindness to not only read and comment upon the rather obscure material produced by their son, but also to fund me through the writing up year, and all without the requirement of a funding application. Again, this would not have been possible without them, and I am most grateful to them.

Finally, my greatest thanks must go to my partner, Amy Bladen, for her love and support, and for always being there come the end of the day, (almost always) with a smile on her face.

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Chapter 1: Introduction

We are accustomed to look upon the shackled form of a conquered monster, but there – there you could look at a thing monstrous and free. It was unearthly, and the men were – No, they were not inhuman. Well, you know, that was the worst of it – this suspicion of their not being inhuman. It would come slowly to one. They howled and leaped, and spun, and made horrid faces; but what thrilled you was just the thought of their inhumanity – like yours – the thought of your remote kinship with this wild and passionate uproar. Ugly. Yes, it was ugly enough; but if you were man enough you would admit to yourself that there was in you just the faintest trace of a response to the terrible frankness of that noise, a dim suspicion of there being a meaning in it which you – you so remote from the night of first ages – could comprehend. And why not? The mind of man is capable of anything – because everything is in it, all the past as well as all the future (Conrad 1990: 32 [1902]).

The discovery that we had a long-lost relative who died out only a few thousand years ago is amazing enough. Finding one alive today and gazing into its eyes would be mind-blowing. In those dark, flickering little pupils, would we see a disturbing shadow of our own bestial past - or the comforting recognition of a fellow intelligent being? (Daily Mail 30.10.2004: 48).

1. Introduction

In Joseph Conrad's account of Marlow's journey into the alien wilderness of central Africa, the 'Heart of Darkness' lies not only in the epic, unexplored interior and its inhabitants, but within Marlow and, by extension, each of us. The passage above speaks of this ominous union between the Edwardian Englishman and the untamed savages he appraises from the precarious safety of his steamboat. The symbolic bond between these parties is in many respects the same as that between 20th and

21st century Western publics, and the archaic human fossils reanimated by palaeoanthropologists and journalists. What thrills is the "thought of their inhumanity – like yours – the thought of your remote kinship with this wild and passionate uproar". The second passage above shows the *Daily Mail* attempting to elucidate this same relationship 102 years later, but here the savage is LB1, newly discovered type specimen of the species *Homo floresiensis*. The suitability of Conrad's account does not end there, for ten years after his work, the discovery at Piltdown, England, of a creature half ape, half human, saw the living savage invoked as a template for Piltdown Man's semi-humanness. Furthermore, in Conrad's stirring vision of these spear-wielding brutes we see the same 'Man the Hunter' trope around which 20th century fossil humans were invariably recreated. Such was its durability through times of enormous cultural upheaval that the template remain operational in 2004 during *floresiensis*' journey to the public, though recontextualised for a new era. One might also see what is to follow as an attempt to unshackle the 'conquered monsters' we find in black-boxed scientific accounts of archaic human ancestors, and to study them 'monstrous and free': before the lid has been closed. Finally, in Marlow's last words above, we have a hint of a theme that I shall return to throughout the thesis – that these accounts of the past are, to a much greater degree, stories of the present.

In addition to 2004's *Homo floresiensis*, the thesis will use as case study the 1912 discovery of Piltdown Man, scientifically *Eoanthropus Dawsoni*, though I will refrain from labouring through further introductions at this early stage. The 92 years between the discoveries is both a hindrance and an aid. On the one hand, the very different circumstances (spatially, as well as temporally) of the finds makes direct comparisons difficult. On the other, its makes similarities between the two all the more striking. Regardless, the method of analysis used (see below) demands a sensitivity to the context in which any data exists, and it is this sensitivity which will mediate potential problems in this regard.

Throughout the thesis I refer to these creatures as 'missing links'. This colloquial term is perhaps the best recognised for such entities and was used heavily during the Piltdown episode. In all the coverage collected of LB1, the phrase does not appear once however. No doubt this is a reflection of its unpopularity with modern scientists, who baulk at the implied simplicity of evolution which betrays its origins in the very earliest days of evolutionary theory (first appearing in Lyell's *Geological Evidences of the Antiquity of Man* (1863)). In addition to a being a reflection of the term's public recognition, it usage here is a deliberate underscoring of the problems these discoveries pose to our categorical systems. As a transitionary form between two discrete classes, 'missing link' is predicated on the notion of a human-animal binary[1], and though modern scientists might shun the term, the conceptual confusions it heralds remain all too apparent in the work here.

Missing links offer the opportunity to observe the negotiation of the boundary between humans and nonhuman animals by scientists and journalists. The cultural importance of the human–animal boundary has already been demonstrated by writers such as Haraway, who refers to boundary straddling figures (contemporary primates in her text, Piltdown man here) as "occupying the border zones between those potent mythic poles" (1989:1) of nature and culture. Haraway seeks to escape from the nature-culture dualism, and does so by demonstrating how both 'nature' and 'culture' in any particular scientific investigation of the boundary are the culturally constructed outcome of the particular socio-political context in

[1] Any constructivist attempt to discuss the human-animal boundary is hampered by the assumptions implicit in our language. Humans themselves are of course animals, and yet "animal" in its common usage tends to preclude humans. As such tensions are at the heart of the discussion here, they must be acknowledged. The problem can be avoided with the unwieldy distinction "human-nonhuman animal", but for the sake of the text I will persevere with "humans" and "animals", asking that the reader remain aware of such issues. "Primate" will also be preferred over the more accurate "non-human primate" for the same reason.

which the work takes place. Similar efforts to show how fluid, and culturally dependant, our ideas of what nature is have included investigations of hunting (Cartmill 1996), pet ownership (Franklin 1999), meat eating (Fiddes 1992) and anthropomorphism (Daston & Mitman 2005).

The case studies will be explored with two research questions in mind:

What shapes the positioning of missing links relative to the human-animal boundary?

What do we learn about the communication of knowledge between science culture and popular culture during these episodes?

The answers to these will be used to inform a third, overarching question:

What is the relationship between scientific and popular classification systems during these episodes?

The source material of the thesis – science journal media and mainstream news media – will be compared to see how constructions of these figures change across fora. Furthermore, the critical discourse analysis used will seek to position the texts studied within their wider socio-cultural contexts as a means of locating the otherwise unseen influences shaping these imaginings. This data will be used to explore the symbolic role of missing links; to critique existing models of science communication; to attempt to find some form of synthesis of the concepts of

"boundary-work" and "boundary object"; to highlight how both science and popular cultures use dynamic, graduating categorisations whilst formally remaining wedded to fixed, discrete ones, and finally to show how conceptual spaces within popular culture classifications are utilised as important creative spaces for scientists and nonscientists alike.

2. Theoretical Framework

The two strands of the thesis connect not only through the missing link, but also through their shared conceptual structures. At issue are two binary concepts – human-animal; science-culture – which are theoretically discrete, yet in practice transgressed daily. The questions then are of boundary construction and boundary crossing. The thesis owes a debt in this regard both to the work of Gieryn, specifically his notion of 'boundary-work' (1983, 1999), and Bowker & Star's (2000) sociology of classification. The former stems from a recognition of a disparity between numerous failed attempts to separate science from other forms of knowledge production theoretically, and the on-going separation of the two in practice that occurs every day. It seeks to address this disparity by focusing on how science is conducted "down-stream" of its actual production, in its consumption outside the laboratories and university departments from which it originates. Going beyond Latour's (1987) two-faced Janusian visage of science engaging different groups with different voices, boundary work in practice involves the deployment of multiple, contextually dependent, images of science, created with the aim of maintaining science's demarcation from wider society. Informed in part by Abbott's (1988) structural study of how professions compete with one another for jurisdiction, at the heart of Gieryn's model is a recognition that such every-day demarcations have a very tangible effect, both on how knowledge claims are treated, and how future work is supported.

One of the great strength's of Gieryn's model – its sharp, narrow focus – is also its greatest weakness. Although a powerful tool for analysing micro level

boundary actions, the model has little to say on the role of structure in boundary drawing; on how boundaries become embedded in the systems of meaning through which the world is interpreted. Here Bowker & Star's (2000) magisterial analysis of 'classification and its consequences' is required. Though sharing Gieryn's interest in cross-cultural interactions, Bowker & Star approach the issue at the macro level, paying particular attention to interactions between explicit, formal classifications and implicit, mundane classifications. Underpinning this distinction are two differing methods of classification. Formal classifications are based on Aristotelian, binary principles: that there are consistent, unique classificatory principles in operation; that categories are mutually exclusive, and that any system is complete (*ibid.* p10-11). The authors stress however that these are ideals which no system fully meets in practice. Mundane, everyday classifications rely on what Rosch (1978) calls 'prototypes'. An extension of Wittgenstein's 'family resemblances' (1953), prototype classification involves categorising objects into fuzzily-bounded, overlapping classes, on the basis of dynamic, metaphorical linkages. This distinction will be applied here in the explication of how science culture and Western popular culture, both based on Aristotelian methods of classification, interact with the episodic, local classifications of everyday actions which are prototypic in nature. Making sense of missing links requires not only the classification of such entities within both cultural systems, but also their successful transition from prototypic classifications to these systems. It is in these processes that the thesis will seek to find answers.

3. The Missing Link

Applying Gieryn's science-culture boundary-work model to the human-animal boundary reflects the great parallels between the two. Both boundaries carry enormous practical implications, the first enabling the on-going dominance of science as *the* source of knowledge production, and the second enabling the on-going dominance of humans in relation to the natural world. As with the former, the human-animal boundary is marked by a disparity between failed theoretical

attempts to clearly delineate the two whilst, at the same time, a successful division is maintained in popular culture. Traditional Judeo-Christian beliefs have helped support a rigid, distinct boundary between human and non-human animal within Western culture (Thomas 1996:17-25), furthered by prominent thinkers such as Aristotle and Descartes, yet almost 150 years ago *Origin of the Species* demonstrated that humans were fundamentally connected to other animals; that rather than being uniquely created in God's own image, our ancestors were in fact nonhuman too. A flood of scientific research in the twentieth century, primarily into the great apes, has undercut a number of grounds on which the boundary might be maintained. Primatology research with chimpanzees has found evidence of tool use and "cultures" specific to particular groups (e.g. Kawai 1965, Whiten et al. 1999); the ability to converse in sign language has also been attributed to them (e.g. Gardner & Gardner 1975); whilst the recent chimpanzee genome project confirmed that chimps share approximately 98 per cent[2] of their genome with ourselves (The Chimpanzee Sequencing and Analysis Consortium 2005). Features thought to be unique to human speech have been identified in other species, such as grammatical recursion in starlings (Gentner et al. 2006). In addition, there is a growing body of science seeking to attribute personality - formerly a quality strictly reserved for those on the human side of the line - to animals as diverse as octopuses and mice (Mather and Anderson 1993, Gosling 2001). On a philosophical level too attempts are being made to challenging existing dichotomous understandings (Singer 1990, Gray 2002).

Despite this mountain of evidence suggesting that any differences that do exist are but differences of degree rather than of kind, and that the boundary as it stands may be built on decidedly shaky ground, a strict division is still maintained in

[2] The preciseness of such figures, which can vary by several percentage points depending on the particular genetic material being analyzed, and the methods used, must be taken with a pinch of salt (see Marks 2003). Regardless, chimpanzees share the vast majority of their genome with ourselves.

Western culture. This is evidenced in our language[3]; in our laws; in our treatment of animals in the meat and diary industry and in our use of them scientific testing; in countless examples of economic development being put before ecological protection. As with the science–culture divide, the maintenance of dichotomous understandings of humans *and* animals, as opposed to understandings of humans *as* animals, raises the question of how this dichotomy is preserved, and what role science plays in it.

Latour's (1993) work is useful here in highlighting just how critical the disparity between theoretical and practical divisions of nature, culture, and science are. He argues that modernity is essentially built upon a system of ontological gerrymandering, that relies on a clear theoretical separation of nature and culture whilst in practice the joining of the two is the very thing that sustains the project. This joining takes the form of hybrids, the interlinking of human and nonhuman/object, whether conceptually or physically, but this profusion of mediation is, paradoxically, only made possible by insisting that nature and culture are entirely independent of one another. To explain this paradox Latour makes a comparison with premodern societies where no such division between nature and culture exists and in fact their co-constitution is a conceptual bedrock – here the cost of allowing hybrids to propagate is simply too great, as it could threaten their entire world view. The crucial lesson that I wish to take from this is that science is dependant upon modernity's separation of human and nonhuman representations, and so not only does science help construct the nature-culture boundary, it is also constructed by it. Not only then is the inspiration for the boundary-work model – the disjuncture between theory and practice – present at the human–animal boundary, it is also, if we accept Latour's argument, fundamental to modernity, and the entire edifice of science/culture/nature. In this light, utilizing the science–culture boundary-work model is all the more appropriate.

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[3] See footnote 1

It should be noted that there is a great deal of debate within biology regarding how the classification of life should be organized. The original system, Linnaean taxonomy, is based heavily on the notion of natural kinds, and so seeks to order species in fixed hierarchies. The more recent cladistics system rejects some of these essentialist notions, and limits itself to showing relative evolutionary relationships between species. As these distinctions are largely irrelevant to the questions at hand, I simply refer here to 'taxonomy' – by which I mean an Aristotelian system of classifying life used by scientists that seeks to order evolution through dividing it into discrete, exclusive units. Further discuss of this is given in chapter two.

4. Structure of the Thesis

The data chapters of the thesis are structured around the two case studies and the two boundaries investigated. Chapter four then considers the first case study, Piltdown Man, in relation to the human-animal boundary, and chapter five considers the science-nonscience boundary during this case. Chapters six and seven consider these boundaries in relation to the second case study, LB1, but the order is reversed, so that chapter six deals with the science-nonscience boundary. The reason for this was that the two science-nonscience chapters were felt to be more closely aligned than the human-animal chapters, and would reward sequential running. I now proceed to discuss each chapter in more detail.

In chapter three I discuss the design of the thesis and the research methods used. How the thesis evolved from its beginnings, and how the case studies came to be selected is considered first. The data chosen and how it was gathered and analysed is detailed, with particular attention paid to explicating the critical discourse analysis used to study the data. The difficulties of utilising that most elusive of concepts – 'popular culture' – is also discussed.

Chapter four, the first data chapter, considers Piltdown Man and his positioning in relation to the human-animal boundary. It begins by outlining the resolute challenge such an obvious chimera posed for popular binary conceptions of the human-animal boundary. The response of scientists and journalists was unhesitating: declare the figure human, even whilst simultaneously acknowledging its nonhuman features. The deciding factor in this interpretation lay not in Piltdown's fossilised remains, but in its symbolic appeal. This appeal saw it become tied to a strongly nationalistic discourse, as English scientists sought an ancient ancestor to call their own. European and American scientists by contrast saw only the mistaken conjoining of an ape jaw and human skull. Humanising such a monster required a role model: a pre-existing semi-human. Scientists found the answer in contemporary indigenous tribes, or 'savages' as they were likely to be labelled. In this way Piltdown Man's positioning on the human (i.e. white European) side of the boundary as strengthened, whilst these living humans' position was weakened. Thus Piltdown not only gave England an ancient history, but also a mandate to continue its imperial ambitions. Finally, the difficult relationship between the scientific '*Homo*' and the popular 'human' is also briefly flagged up. Though scientists gave recognition to Piltdown's hybridity by placing the find in a new genus, they continued to refer to it as human, an act that exported humanness beyond the confines of *Homo* and threw the boundaries of both into question. Careful boundary management was required to admit Piltdown whilst undesirables, like extant primates, where kept out. During this process, the binary itself became a more complex 'trinary' configuration, but only in a unreflexive manner which left the boundary formally unthreatened.

In chapter five I consider the relationship between science culture and popular culture, by studying the manner in which Piltdown Man was created for the general public. Particular attention is paid to the narratives used to reanimate the creature. At the centre of the chapter is Hilgartner's (1990) analysis of popular

science, which sees it as a rhetorical device for allowing scientists to engage with the public whilst simultaneously protecting their epistemic authority. Scientists referred to Piltdown as human within both science and mass media, the only difference being that in the former no justification (beyond the conflicting physical remains), and no explication of what human meant in this context, was given. Scientists continued to use human however as it the best means of engaging public interest in the find. The fact that human was only given any meaning with the mass media is used to critique the assumption underpinning the pure/popular model – that science is the solely producer of useful knowledge. I support this argument further with an appraisal of 'Man the Hunter' constructions of human evolution, which demonstrate clearly the influence of wider cultural ideas on scientific knowledge claims. The subversion of the Hunter template by the *Daily Express*' Piltdown coverage – turning it into an attack on the women's emancipation movement – shows how such reconstructions are more revealing of the present than the past. As a final example of the culturally-specific nature of missing links, I compare Piltdown's construction with that of Sommer's (2006) analysis of a Neanderthal discovery in France in 1908. I conclude in support of Hilgartner's critique, and add to it the important role of the mass media as a creative space in which scientists can explore concepts like humanness more freely. Returning finally to the trinary concept, I suggest that popular science, like the missing link, acts to protect the binary in which it stands, by providing a space in which transgressions of the binary might be safely excused.

Homo floresiensis provides the material for chapters six and seven. Chapter six follows on from the previous chapter's focus on science-nonscience boundaries. Like Piltdown, LB1 received huge media attention, which was both a cause and effect of the fact that such missing links are far removed from everyday, 'routine' science. Moving beyond Hilgartner's work, the chapter begins by analysing models of science communication more widely, paying particular attention to Bucchi's (1996) more complex analysis. A chronological examination of the LB1 data is used to study where

claims around the figure were first made, and how they dispersed and evolved. As at Piltdown, the manner in which knowledge spread through different fora lends support to Hilgartner's work, but not without exception. For the nonspecialist audiences of intraspecialist and mass media, the discovery was structured around three tropes: 'Lost World' and 'hobbit' literary discourses, and the now familiar 'Man the Hunter'. Despite recurring motifs, contemporary reinterpretations are clear, for example in a misanthropic imagining of the Hunter. Not only was nonscience culture important in this respect, but also in the many elements of the episode which took place solely within non intraspecialist media. For this reason I reject the uni-directional flow of knowledge from science to nonscience culture that is implicit in the river metaphor used by Hilgartner. I conclude by positing my own model of science communication, that seeks to incorporate previous work, but better recognise the multi-directional nature of knowledge flows around such symbolically powerful entities.

Chapter seven parallels chapter four, considering how LB1, 92 years after Piltdown, was made to fit the human-animal binary. Again, pre-existing figures were central to the process of fixing its semi-humanness, but in more culturally sensitive times a fictional creation is required to take the role of the savage. The manner in which missing links forge far more numerous cultural connections than biological ones is evident once more, as nationalism, gender and anthropocentricism influence events. The chapter also extends beyond the ambitions of its companion chapter, to consider in more detail the scientific categorisation of these figures, and the interactions between it and popular categorisations. This process revolved around the categories '*Homo*' and 'human'. The contested origins of '*Homo*' are discussed, and how science, though its monopolisation of the term, was able to black-box it. Considering it in relation to LB1 reveals the tensions that still exist within this most personal of taxa, tensions which are played out in the leaching between it and 'human'. One of the outcomes of this is a reifying of humanness, leaving scientists

searching for an empirical basis to an intangible concept. Despite the two terms many inconsistencies and conflicts, scientists are driven to conflate the two in the effort to draw public interest and also, it is suggested, use this less constrained arena as a creative space in which to consider the wider implications of such chimeras.

The concluding chapter collates the data chapters to address the key questions of the thesis. The trinary concept is explored in detail, and considered in the context of Gieryn and Bowker & Star's work. Finally, the ethical dimension of the human-animal boundary is considered, and the possible outcomes of undermining it. This final section returns us to the symbolic role of the boundary with which I began.

The question of questions for mankind—the problem which underlies all others, and is more deeply interesting than any other—is the ascertainment of the place which Man occupies in nature and of his relations to the universe of things (Huxley 1863 [2007]).

Chapter 2: Literature Review

In the following chapter I shall provide some background to some of the key issues of the thesis. I begin by discussing the act of classification, to provide a wider perspective than the brief discussion of Bowker & Star's (2000) work in chapter one. I shall then move on to discuss taxonomy more specifically, as the scientific method of classification, before finally focusing on the missing link and its history.

Several prominent themes of the thesis are not covered here, as discussion of them is left to the chapter, or chapters, in which they are particularly relevant. Discussion of boundary work and boundary objects takes place primarily in chapters one and eight. In chapter three I unpack the terms 'science culture' and 'popular culture'. Consideration of Hilgartner's model of popular science, so important to chapter five, is, appropriately, left for that chapter. Chapter six discusses models of science communication more generally. Although all this material could have been analysed here, it was felt that the reader would be better served by distributing such material to where it was most needed.

1. Classification

The popular conception of a missing link is simply of an individual that at some point in the past stood on the evolutionary line between modern humans and modern primates. However, the popular conception is a reduction of a far more complex natural world. Problematic in the hunt for a missing link is that a simple model mistakes human classification for biological fact.

The practice of classification is integral to human thought. At its most basic, it is the grouping together - and separation of - objects and/or individuals on the basis of a selection of criteria. In grouping together otherwise disparate elements, classification allows the unimaginable complexity of the social and natural worlds to be reduced down to a consistency that the limited human mind is able to grasp.

Berger and Luckmann's sociology of knowledge work affords a detailed picture of how classification, or 'typification' as they refer to it, is a process inherent in our comprehension of the world. The world is viewed as a continuum of typifications, ranging from the specific to the anonymous. At the specific end is the face-to-face situation in the "here and now" (1991:36), in which typifications are relatively detailed and also open to adjustment depending on the behaviour of the other;

> Thus I apprehend the other as 'a man', 'a European', 'a buyer', 'a jovial type', and so on. All these typifications ongoingly affect my interaction with him… Our face-to-face interaction will be patterned by these typifications as long as they do not become problematic through interference on his part (*ibid.* p45).

At the other end of the continuum are grand abstractions, such as 'popular culture' (see below) which reduces what is in reality a huge number of complex individuals down to a limited number of stereotypes, which can be grouped together and imagined as one unit. It is the sum of these typifications, and the patterns of interaction coded within them, that comprise the social structure of society.

To pursue this idea further, it is necessary to understand Berger and Luckmann's ontology in more detail. They argue that humans occupy a unique position in the animal world in that they have no "biologically fixed character of their relationship to the environment" (*ibid.* p65). As a result our relationship with the external world is distinguished by a 'world openness' (*ibid.*), that if unchecked would leave human existence in a perpetual state of chaos. In a statement that should be borne in mind throughout this thesis, they declare

> While it is possible to say that man has a nature, it is more significant to say that man constructs his own nature, or more simply, that man produces himself (*ibid.* p66).

This world openness, a fragile connection to the external world, helps to explain the 'allure of belonging' which lies at the heart of the nationalism which features in chapters four and seven, and which the missing link itself appeals to. This can be seen in Anderson's (2006) discussion of the manner in which patriotism uses language of "kinship (motherland, *Vaterland, patria*) or that of home":

> Both idioms denote something to which one is naturally tied […] In everything 'natural' there is always something unchosen. In this way, nation-ness is assimilated to skin-colour, gender, parentage and birth-era – all those things one cannot help. And in these 'natural ties' one senses what one might call 'the beauty of *gemeinschaft*'. To put it another way, precisely because such ties are not chosen, they have about them a halo of disinterestedness (p143).

Without any biologically based instinct to bring stability to our existence, it is necessary to create order for ourselves, and this is achieved through the social world. The act of typification is one element of this effort, reducing complexity and ordering it. Another element is habitualization, the typification and repetition of behaviour. An example would be the social rules governing polite conduct when meeting a stranger. By carrying out the accepted behaviour of shaking hands in such situations, one avoids an internal debate about how to physically acknowledge the other's presence, allowing one instead to concentrate on other matters, such as the content of conversation. This narrows the potentially huge number of choices we face each day in living our lives, moving many decisions into the cognitive

background, to allow us to focus on only the most pressing. In this way, habitualization can be thought of as a form of 'social instinct'.

The final element is institutionalization. This occurs when habitualized actions are reciprocally typified by types of actors;

> What must be stressed is the reciprocity of institutional typifications and the typicality of not only the actions but also the actors in institutions. The typifications of habitualized actions that constitute institutions are always shared ones (*ibid.* p72).

Institutions shape our behaviour by influencing patterns of conduct, as the institution of science shapes the behaviour of scientists. Like any other feature of the social world, institutions reside ultimately in the minds of individuals, but they develop coercive power beyond that of subjective thoughts in the here and now though the transcending nature of sign systems like language. Language holds the history of an institution in the present; it brings the past (and future) into the here and now, not as subjective knowledge, but as knowledge external to our own biographies, as facts about the world. As such, they have a much greater coercive power. This process is centrally important to the influence of scientific classification.

Berger and Luckmann base their sociology of knowledge within the framework of Schutz's 'common sense world' (1973), the intersubjective world of social action in which our day to day lives occur. In scientific thinking similarly, our knowledge of the world is formed through constructs; through abstractions, idealizations, generalizations etcetera. For this reason 'facts', as self-defined entities, do not exist. Instead they are selected from the external world by our minds, and as such are interpreted facts. However, "This does not mean that, in daily life or in science, we are unable to grasp the reality of the world. It just means that we grasp merely certain aspects of it, namely those which are relevant to us" (*ibid.* p5).

Although classification is integral to all human thought, whether popular, scientific, or any other, Bauman argues that it is only in modernity that classification is marked out by the setting of "order as a task… as the archetype for all other tasks, one that renders all other tasks mere metaphors of itself" (1991:4). Humanity can only control what it knows, and it can only know what it has classified. The outcome of this process should be (apparently) definitive, stable knowledge regarding the workings of our environment. Ranged against order is chaos and ambivalence; the unordered and hence uncontrolled. This is experienced as a threat; it renders us powerless, resulting in anxiety and indecision. Nowhere is this threat countered with such ferocity than in modern science, "born out of the overwhelming ambition to conquer Nature and subordinate it to human needs" (*ibid.* p39), an ethos which can be traced back to Francis Bacon and his declaration "scientia potentia est[4]" (1597). Classification is more than simply an ordering of knowledge however: it has a power dynamic too. The practice of ordering creates dichotomies, separating those within from those without, but at the same time suggests symmetry and equality between groups. Bauman considers this a sham, as the creation of a dichotomy requires the presence of a 'differentiating power' (p14) to separate and maintain the divide. As a result an asymmetry of power is at the root of all such dichotomies.

However, no classification offers a complete fit, as nature and society can always produce cases which fall between classes, or which span two or more classes simultaneously. This creates a third category which challenges the comfortable dichotomy of order and disorder; us and them; good and bad. This ambivalence is an unavoidable outcome of the ordering project in modernity; the greater the push to order, the greater the production of ambivalence. In the physical world, this ambivalence is often realized as 'waste', defined by its refusal to comply with accepted divisions;

[4] The Latin maxim "*scientia potentia est"* translates as "for also knowledge itself is power", or simply "knowledge is power".

> They are waste, as they defy classification and explode the tidiness of the grid. They are the disallowed mixture of categories that must not mix. They earned their death-sentence by resisting separation (p15).

Such a violent response is a measure of the threat these ambivalent groups pose to the accepted order. Within the social world, Bauman refers to 'strangers', who by their very existence call into question the opposition model of 'friend' and 'enemy'. 'As that opposition is the foundation on which rests all social life and all differences which patch it up and hold it together, the stranger saps social life itself.' (p55).

Bauman's work on ambivalence is compatible with Douglas' reading of pollution taboos. Douglas takes her cue from seemingly the most mundane of matter; dirt. As with Bauman's 'waste', dirt is so defined because of its refusal to comply with our attempts at order. There is nothing inherent in certain matter which makes it 'dirt', rather it is the context within which it is placed. Soil in the garden is simply soil, only when it is deposited by shoes across a gleaming kitchen floor does it become dirt. This suggests both an ordered system of relations - certain materials should be in certain places - and a breach of that system by the dirt. Hence the practice of cleaning is an ordering of the environment as much as anything else, the removal of soil from the house a confirmation of the distinction between inside and out, culture and nature.

> In chasing dirt… we are not governed by anxiety to escape disease, but are positively re-ordering our environment, making it conform to an idea… it is a creative movement, an attempt to relate form to function, to make unity of experience. (1969:2)

In *Implicit Meanings* (1975), Douglas refers to the maintenance of the dichotomy between culture and nature specifically through reference to the 'purity rule' (p213), which polices a no-man's land between the two by prohibiting the excursion of natural processes into the social world.

An important lesson to take from all the accounts above is that there is no disconnect between the ordering of social categories and the ordering of the natural world. The two are interlinked in the process of structuring the world we perceive, and also in the meaning invested in this structuring. The search for structure amongst chaos creates 'waste' and 'strangers' alike. Analogies, conscious or not, may be extended between the social and natural realms to justify the divisions drawn. 'Cosmologies' (*ibid.* p226) drawing on divisions of the natural world, become self-evident truths utilized within societies, as they do in the Lele society studied by Douglas, where the principles of hygiene and diet mirror those for classifying animal kinds (*ibid.* p209). In the case of science specifically, Bauman lays responsibility for philosophical environment in which Hitler carried out his extermination of the Jews at the feet of modern science. What is more comforting to think of as an momentary act of madness was in fact a wholly rational project from the point of view of its perpetrators, devoid of any moral dimension, in fitting with its status as scientific social engineering. When the rational, supposedly objective, division of the natural world by modern science was mapped on to the social world, the eugenics movement was born. The 'visions of artificial order' (1991:38) created by a dichotomizing science hide the asymmetry of power present in its creation, giving legitimacy to the division of the haves and have-nots.

This intertwining between the ordering of natural and social worlds is also uncovered in Levi-Strauss' investigation of totemism (1962). In similar language to Bauman, he states;

> The resemblances and differences of animal species are translated into terms of friendship and conflict, solidarity and opposition. In other words the world

> of animal life is represented in terms of social relations similar to those of human society (p160).

Animals become metaphorical devices for structuring and imagining human relations. Natural species are chosen not because they are 'good to eat', but because they are 'good to think' (*ibid.* p162). This is the role we shall see taken on by the missing link.

It is worth noting that both Douglas and Bauman alike state that no classification can ever be comprehensive. For Bauman the outcome is ambivalence, which in turn encourages greater efforts at classification, inevitably leading to even greater ambivalence. For Douglas, this 'non-fit' gives us a chance 'to divest our categories of their halo of eternal truth' (1969:226) and to reappraise how we construct categories and deal with anomaly. This is the standpoint taken here too (see chapter three).

2. Taxonomy and Classification

Throughout the thesis I refer to scientific classification simply as taxonomy. However, a protracted debate has taken place within the philosophy of science as to the degree to which scientific classification of biological organisms is revealing of natural kinds, as opposed to merely the cognitive constructions of scientists, and what particular method is best suited to the task of classifying. The field of work is too large to attempt to chart here, but it is worth considering a few of the most fundamental questions raised.

Perhaps most fundamental of all is the criteria upon which to base any classification. Ultimately, the choice lies between attempting to classify organisms based upon comparisons of total number of characteristics, or classifying based on comparing selected characteristics. Both are problematic. The former, often referred to as numerical taxonomy (e.g. Sneath & Sokal 1973) faces the insurmountable

problem that there is no finite number of characteristics in any organism, a problem Pratt (1972) equates with attempting to count the number of heaps of flour within a bag;

> you can only count heaps once the flour has been poured out, just as you can only count characters once the individual has been described in a particular way (p317).

To describe the individual in a particular way is merely to resort to the latter choice available however, that is a comparison of selected characteristics. This raises the question of on what grounds one is selecting however. Do the distinctions produced by this selection reveal natural kinds 'grounded in the objective nature of the world' or just the 'psychological processes of the scientist'? (Fales 1982:69). The case of Linnaeus and the Mammalia class (see chp. 7, sec. 1.2) shows how socio-cultural factors can influence the selection of criteria and so radically shape if not the membership of a group, then certainly the conception of it. In terms of group membership, a distinction must be made between species and higher level taxa, which have no physical reality in the sense that a species might be argued to have. At the species level, the presence of reproductive communities allows for a defence of the natural kinds concept, as attempted by the Biological Species Concept (BSC), defined here by one of its strongest backers, Ernst Mayr; 'A species is a reproductive community of populations (reproductively isolated from others) that occupies a specific niche in nature' (1982:273). This is just one of many such concepts of species however; no less than ten are listed by de Queiroz in his (1999) paper. That so many systems of defining species should propagate is testament to the problems faced by scientists attempting to chart the uneven and variegated biological world. Dupre (2001) argues that the classical teleological tree of life image of evolution as consisting of sharply defined channels splitting cleanly at various nodal points must

be rejected, and that instead evolution would be better thought of as an estuary at low tide;

> We find large streams of water and many side streams, some petering out, others rejoining a main channel or crossing into a different channel, and a few maintaining their integrity to the ocean; there are islands around which streams flow and then rejoin; eddies and vortices; and so on. Some parts of the general flow are naturally and coherently distinguishable, and it is easy enough to recognise parts of the pattern that are definitely not parts of the same 'unit of flow'. But in between, there are many cases where any such distinction into discrete units would be largely arbitrary (pp.207-208).

To give just one (considerable) example of 'non-fit' in the case of the BSC, it gives no account of asexual organisms, which have been the only forms of life on our planet for the greater part of its history (*ibid.* p206). As a result philosophers like Dupre and Kitcher (1984) have called for a rejection of monist attempts of classification, and argued instead for a pluralist approach, which makes a pragmatic utilization of whichever classificatory system provides the best results for specific research foci. Such a pragmatic approach calls into question whether the existence of natural kinds in the Aristotelian essentialist sense can be maintained: if an individual can be categorized differently dependent on the classificatory system used, how can it be said to have an immutable essence? Interestingly, Pratt (1972) attempts to argue that natural kinds can be defined as any group which proves to be inductively valid as, he argues, a group will only have such validity if it has a shared phylogenetic heritage. This conception implies – without acknowledging - that nature is defined only by what humans ask of it, which appears counter-intuitive to the perception of nature as being the Other to humanity and our attempts at ordering, as detailed here by Bauman;

> The concept of Nature, in its modern rendition, opposes the concept of humanity by which it has been spawned… Anything that spoils the order, the harmony, the design, and thus refuses purpose and meaning, is Nature. (1991:40).

I do not here attempt to provide any resolution to what is an extensive and on-going debate. The point I hope to make is that biological classification is a complex and contentious task, which even at the species level struggles to defend the notion of natural kinds. This is not to say for one moment that biological classification is wholly constructed or arbitrary, but rather that there is no privileged window through which scientists can simply view the biological world 'as it is', no method guaranteed to reveal natural kinds. The wealth of differing species models are evidence that biological organisms refuse simple classification. Pratt's idea of species as inductively valid groups could be said to be how species groups are formed in practice by scientists, however, such a definition subverts the idea of natural kinds to such a degree as to make it meaningless. This argument brings to mind Latour's third rule of method;

> Since the settlement of a controversy is the cause of Nature's representation, not its consequences, we can never use this consequence, Nature, to explain how and why a controversy has been settled (1987:99).

Pratt is guilty of just this however: labeling groups as natural kinds post hoc, on the proviso that they survive their period of scientific debate for long enough to become black boxed. As Latour argues though, it is not Nature which determines whether a

claim survives long enough to become black boxed, but the process of scientific debate.

In recent decades a concerted attempt has been made to make biological classification more methodologically rigorous in an effort to escape debates like the one above. One outcome of this has been cladistics, a method of taxonomy which seeks to chart the relative relationships between different species by comparing for similarity and difference on the assumption that similarity will be revealing of a shared phylogeny. From this a branching diagram, or 'tree of life', is produced, showing the evolutionary relationship between different groups. One advocate argues that cladistics avoids 'any prior assumptions about cause and effect, or ancestry and descent… cladistics is a way of 'seeing', of looking at the products of evolution as they are, and not as we would like them to be' (Gee 2001:6).

Can cladistics illuminate the search for a missing link then? Firstly, it must be acknowledged that cladistics does not have any 'magic bullet' remedy to the philosophical problems already encountered with taxonomy, as its novel methodological elements are focused on producing empirically valid, testable knowledge through a clear, rigorous epistemology, rather than solving philosophical issues regarding the relationship of knowledge and reality. Like any biological taxonomy, cladistics requires the comparison of characteristics, a process which we have already seen to be philosophically problematic in the selection process required. Whilst cladistics offers no answer to these considerations, it does attempt to stabilize the comparison of characteristics through strict adherence to Occam's razor, that is, where two or more interpretations are possible, the most parsimonious is chosen. What this means in operation is that the interpretation that requires the fewest evolutionary changes is assumed. Contrary to Gee's claim, this itself requires a considerable assumption, as there is no necessary reason to assume that evolution will always take the simplest route (Felsenstein 1983). In addition, the 'tree of life' understanding of evolution is an assumption that may be reasonably

successful for ordering higher mammals, but is far more problematic elsewhere, where Dupre's 'estuary of life' may be more accurate.

In regards to the missing link specifically, cladistics faces the same difficulties as any other taxonomy, namely, a dearth of evidence from the fossil record, which makes the identification of distinguishing characteristics extremely difficult (Hawks 2004, Woods & Collard 1999), discussed in detail below. In addition, the relatively close evolutionary relationship between modern *Homo sapiens* and our immediate ancestors makes any parsimonious selection of characters prone to error. Gee himself is obviously in agreement with at least some of these points, as he argues that even cladistics is unsuited for the task of identifying a missing link, and that the only way to investigate humanity's relationship with other life on Earth in a scientifically acceptable way is to give up on any notions of revealing our ancestry, and instead to limit ourselves to investigating our relative relationship to other contemporary species.

The absence of any meta-concept of species supports Bauman and Douglas' claim that no classification ever provides a complete fit, and that in the spaces between the natural world and our attempts to order it, there lies ambivalence, the threat of the unknown and the uncontrolled.

3. Missing Links

The story of the missing link begins in 19th Century Europe, as evolutionary science began to challenge the dominant Judeo-Christian tradition for the right to circumscribe the origins of humans. At stake was, and is, perhaps the greatest story of all; not just how we came to be here, but also who we are, and how we are related to the world in which we live. The present can only be understood with reference to what has gone before it; in shaping the past one may shape the present. Holding the authority to claim humanity's past allows a knowledge system to deploy enormously powerful discourses dictating what is and is not acceptable behaviour,

by referencing the idea of 'natural' human behaviour, and by calling on potent notions of heredity. Such discourses continue to be deployed by all sides in debates that involve issues of human identity, ranging from intensely personal issues like race and sexuality (e.g. "homosexual activity is *unnatural*") to collective issues like ecology (e.g. "humanity is driving its *animal brothers and sisters* to extinction").

The first assumption to be rejected is the notion of *the* Missing Link, the idea of a single group, or even individual, which bridges human and nonhuman lineages. Any fossil which is recovered today is merely a snap-shot, a glimpse at a single moment in evolution on a timeline that stretches back six million or so years to our split with primates. To be *the* Missing Link in the strictest sense, the fossilised individual would have had to be the progenitor of two or more offspring, one of which passed its genes down the primate line, whilst the other's genes passed down the human line. This individual, or group, would have had to exist at the exact point in time when a formerly cohesive group began to divide, and form two separate breeding pools. Amazingly, throughout evolution there must have been many such groups, in fact wherever one line of evolution branched into two (or more). Here we are not concerned with such groups' existence however, but with finding evidence of such groups today.

This leads us to the first of several problems which the search for a missing link presents; palaeoanthropological classification relies heavily upon incomplete fossil data. The conditions necessary to turn bone to fossil, and the luck and skill involved in uncovering them, means that the only a tiny number of specimens are available. It has been calculated that a collection of ten skulls uncovered from East Turkana in Kenya represent only one individual in every one hundred million of the original population (Reader 1981:16). Of 6000 species of extinct mammal thought to have existed at one time or another, fossil evidence only exists for between 60 and 180 of them (Lewin 2005:64). Reader quotes a scientist describing the challenge to understand human evolution from fossils as being 'rather like trying to follow the

story of *War and Peace* from twelve pages torn at random from the book' (Reader 1981:16).

When finds are made they are inevitably incomplete, to the degree that some posited missing links consist of nothing more than a single bone. The dangers of this were demonstrated by Nebraska man, a find in 1922 which was comprised of only a single tooth. It was originally thought to be the tooth of an ancient human, from which an entire species was constructed, complete with artist's graphic reconstruction, but by 1927 it had been established that the tooth was actually that of a peccary, a close relative of the pig, and Nebraska man was no more. As such, Nebraska man serves as an example of the power not of fossils, but of the beliefs we attach to them, beliefs which can extract an entire species from a single tooth. Though obviously an extreme example, the case demonstrates how flimsy the relationship between theory and evidence can be in palaeoanthropology. The incompleteness of fossils is a recurring problem in the search for a missing link, and a regular source of controversy (e.g. see http://www.talkorigins.org/).

A discussion of taxonomy also leads us to a second, related point, namely, what criteria distinguish modern anatomical *Homo sapiens* from our evolutionary relatives - at what point does a missing link become so similar as to be indistinguishable, and, reversing the time line, at what point does it become so different as to not be a link with humanity at all? Unfortunately, the clearest distinguishing criterion between Homo sapiens and all other contemporary life on Earth, namely our use of highly developed language systems, makes for a poor interrogator of fossils. In recent years scientists have begun to look at the size of the holes in vertebrae through which vocal nerves pass through, on the premise that our language use requires considerably more nerve fibres for the fine control breathing required for speech – hence a larger hole – than species that do not/did not speak. On this evidence it appears language appeared between 500,000 and 1mya[5].

[5] 'mya' is an abbreviation of 'million years ago'.

However, few fossils have been complete enough to study in this way. Given these limits, and the apparently recent arrival of language, other criteria are required as well.

Being, as they are, incomplete skeletons, the information that can be drawn from hominid[6] fossils is obviously limited. Of course 'limited' is a relative term, and scientists have been ingenious in extracting details from what is often no more than a handful of mineralized, fragmented bone. Nevertheless, restricted to anatomical data, the task of determining whether a fossil is a missing link has fallen to two main criteria; brain size (determined by skull capacity) and bipedalism. Conventional thinking amongst evolutionists has been that the development of larger brains marked the evolution of Homo sapiens, a belief we will return to later with Piltdown man. Over the last fifty years it has become clear, though, that brain expansion only really took off around 2mya, and rapid expansion only as recently as 500,000 years ago, reaching current size about 150,000 years ago (Dunbar 2004:22-30). The 4mya footprints Mary Leakey uncovered at Laetoli in Tanzania show that bipedalism was a much earlier adaptation however. A third distinguishing criteria has been tool use, evidence of cultural, rather than biological development, early examples of which appear to date to around 3mya, but these are little different from the rocks used to break open nuts by chimpanzees today. More developed handaxes appear around 2mya, but no further improvement appears until the last 50,000 years, at the time of the so called Upper Palaeolithic Revolution.

This confusion of dates highlights the difficulty in determining a missing link. No rubicon exists in our past across which we irrevocably became human, as our identifying traits as humans evolved piecemeal over several million years. Hence the

[6] "Hominan" is used to specify humans and their extinct relatives, in contrast to "hominid" which refers to any member of the Hominidae family (humans, chimps, gorillas and orangutans). 'Hominin' encompasses humans and their closest living relatives chimpanzees, along with their mutual ancestors.

question becomes 'what is this missing link a link to?'. A short overview of the current view of our evolutionary line should be effective in conveying the complexity of answering such a question. The general consensus amongst evolutionists is that anatomically modern *Homo sapiens* appeared about 150,000 years ago, around the time that our brains stopped expanding (e.g. Dawkins 2004:56-85, Lewin 2005). Before this existed Archaic *Homo sapiens*, who had slightly smaller skulls and more robust skeletons, up until around 1mya. Some scientists however see Archaic as a subspecies of *Homo sapiens*, whilst others see them as a separate species entirely; *Homo heidelbergensis.* Neanderthal man is now believed to be a fellow descendant of Archaic *Homo sapiens*, though (limited) genetic evidence implies that their lineage was separate from our own. If the recently found *Homo florensis* survives its current controversy and comes to be accepted, then another hominan species existed up until as recently as 12,000 years ago.

Preceding the Archaics the hominan line grades into *Homo ergaster* (formerly known as *erectus*), though it must be noted that here, as elsewhere, there is evidence of a considerable overlap between the two species, as *ergaster* is believed to have persisted up until 250,000 years ago. *Ergaster* had a smaller brain still, with a 'swept back' skull and receding chin. Around 2mya *ergaster* appeared from *Homo habilis,* though in addition some recognize a similar contemporary called *Homo rudolfensis. Habilis*' brain was approximately 750cc, far smaller than modern *Homo sapiens* at 1400cc, but considered to be enough to mark the beginning of its expansion, which is the reason for its inclusion in the *Homo* genus.

Looking back past *Homo habilis* the picture becomes even less clear, as the human lineage emerges from the genus *Australopithecus*, a family of gracile apes. At this time our ancestors co-exist with a number of other species, including *Australopithecus robustus, Australopithecus boisei* and *Australopithecus afarensis*. Beyond these, two recent finds, *Orrorin tugenesis* and *Sahelanthropus tchadensis*, both who show evidence of bipedalism and date to around 6-7mya, occupy the period around which the human and chimpanzee lineages join.

This flurry of Latin hints at how non-linear evolution really is, a riposte to the idea of a simple straight line progression from primitive ape to complex human. In light of the tangled, heterogeneous nature of our lineages' descent, a missing link begins to appear less like a link in a chain, and more like a link in a spider's web. In all this confusion does the missing link become the link between anatomically modern humans and Archaic *Homo sapiens,* or somewhere between Archaic and *Homo ergaster* when language seemingly first appeared, or between the first '*Homo*' - *habilis* and its predecessor *Australopithecus*, or back further still between the biped human and quadruped primate lines? The hope that a missing link will illuminate for us today an Adam and Eve; the first man and woman who walked the Earth, is inherently flawed, as there was no 'first human', but instead a multitude of tiny gradations towards what we are today.

What all this demonstrates is the problems faced when trying to determine whether a fossil is a missing link or not. Species do not exist, as a taxonomic evolution tree might imply, as discrete groups which suddenly one day evolve into one or more new species, en masse. According to the traditional Darwinian 'gradualist' view of slow, steady development, the evolution between one species and its ancestor(s) is likely to be drawn out over hundreds of thousands, if not millions of years. At any one point during this process, the various individuals which make up the group will display those traits that mark out the new species to varying degrees, so that any one individual may be phenotypically or genotypically closer to another individual several generations previously or subsequently, than to any particular one of their contemporaries. Once again, we are reminded of Dupre's imagining of evolution as an estuary at low tide. Similarly, for any particular gene an individual may actually be closer to individuals in another species entirely than individuals in their own group, as is the case with the blood groups of humans and chimpanzees (Dawkins 2004:55). For a considerable span of time after an evolutionary line has begun to split, it is also likely that individuals in the two groups would retain the ability to cross-breed. All of this means that the single snap-shot in

time that a fossil exposes is massively unsuited to the task of identifying a missing link.

The alternative account of evolution, punctuated equilibrium theory, promoted by Gould (2002) amongst others, argues that that, whilst gradual evolution does occur, more frequently evolution takes place in bursts of development, followed by long periods of little change. This does not make the search for a missing link any easier however. If human evolution were marked by punctuated equilibrium rather than gradualism, then one would expect to find fewer intermediaries between species, as the period of change would happen relatively quickly. This might make it easier to define the species that have led to *Homo sapiens*, as they would exist as more discrete groups. However, the stop-start nature of development could make it even harder to construct a chronological picture of evolution, and the lack of intermediaries could make the reconstruction of evolutionary relationships between species more difficult. For a strict conception of *the* missing link, the rate of evolution makes no actual difference, as it will always begin with one reproductive couple/community whose offspring become separated from one another.

The difficulties faced when attempting to create a coherent account of human ancestry are such that Gee (2001) has argued that any such attempts must be divorced from science altogether, as it is a task which cannot be accomplished in any scientifically valid way. The reasons for this are largely those already discussed, which Gee discusses within the concept of 'Deep Time'. Deep Time refers to geological timescales – millions, even billions of years. Within this temporal hinterland, the empirical data upon which palaeoanthropology relies is simply not up to the task asked of it;

> each fossil is an infinitesimal dot, lost in a fathomless sea of time, whose relationship with other fossils and organisms living in the present day is obscure. Any story we tell against the compass of geological time which links

these fossils in sequences of cause and effect – or ancestry and descent – is, therefore, only ours to make (*ibid.* p1).

Gee asserts that Deep Time cannot support contemporary attempts at structuring it into a narrative, in effect, restricting palaeoanthropology to mere fossil hunting. He argues that fossil evidence is so fragmentary and insufficient that in choosing between rival theories one has no choice but to based one's decision on two other factors; firstly, whether the presentation of the claim conforms to already-held prejudices; and secondly, the respect held for the theory's supporters and their authority. Obviously neither of these factors is in keeping with the scientific ideal of rational empiricism, though a palaeoanthropologist might counter (with good reason) that factors such as authority play a powerful role within all sciences, and that the perceived gulf between available evidence and the vastness of reality is not distinct to palaeoanthropology, but rather is a common to all branches of science in the form of Hume's problem of induction.

Returning to the mention of Adam and Eve, it is perhaps necessary to clarify the position of the so-called 'Mitochondrial Eve' who found fame in the late 1980s. Mitochondrial Eve was the result of a study that sampled the mitochondrial genome of 147 individuals from diverse groups and compared them (Cann et al. 1987). As mitochondria only pass down the female lineage (mother to child, hence the 'Eve' reference) its evolution is easier to track than other DNA. By comparing the difference between the mitochondria tested, and checking this against the dates of human migration out of Africa, a 'tentative' (*ibid.* p33) date was produced for the ancestor of all contemporary human mitochondrial DNA. This gave a result of 140,000-290,000 years ago. *Newsweek* ran a cover declaring 'The Search for Adam and Eve', which depicted a naked African couple in a "Garden of Eden" type setting. The biblical imagery was further reinforced by showing the Eve figure offering an apple to the man.

The pinches of salt that should be taken with this work are as follows; firstly the inaccuracy of the dating means that Eve would have been one of probably hundreds of thousands, if not millions, of individuals who lived and died during this period. Secondly, and more relevant to the missing link story, what this reveals is the common ancestor of our mitochondrial genome, but this makes up just a tiny fraction of the roughly 30,000 genes on the human genome. Humans are no more reducible to their mitochondria than their toe nails, and to imply that the first human could be defined by its mitochondrial DNA is nonsensical. Rather than the literal Ur-mother, ''Eve' was simply one of many individuals in a population from which modern humans eventually evolved' (Lewin 1998:90). The final point to be made is perhaps the most obvious, and yet is ignored all too often in Missing Link debates. This is the conflagration of limited, empirically-based scientific claims (in this case a female individual living 140,000-290,000 years was the progenitor of all mitochondria genes in today's population) with faith-based stories, despite the glaring contradictions involved in trying to blend an evolutionary and a creationist account of human origins together. The appeal of such an approach is that a faith-based account will always be able to offer far more answers than a scientific approach committed to testability. As is typical of scientific claims, the knowledge produced of Mitochondrial Eve only raises more questions; such as how did she live?; why was her mitochondria passed on and not someone else's?; what does all this mean for us today? The production of knowledge only creates more ambivalence around it, and it is often the most intriguing questions raised, those of 'ultimate meaning', that science is most poorly suited to answering. The treatment of the Mitochondrial Eve story can be read as an attempt to overcome ambivalence by attaching the empirical claim, anchored as it is in the external world, with a system of meaning (the story of Creation) which has no such debt to events external to the human mind, and hence is not limited by the relationship of order and ambivalence that science is. In this way a limited claim about our past is invested with meaning for us today.

From Bauman's and Berger & Luckmann's work, one is tempted to read the appeal of heredity as the appeal of order. In contrast to other animals, humanity's relationship with our surroundings is characterized by a biological 'world-openness' (Berger & Luckmann 1991:65), from which the desire for order and stability stems, lest we be lost in chaos. We have no option but to construct this order from our social world, but this does not preclude a desire for some form of biological order too, from which to structure our lives, to tell us 'who we are'. In fact as elements of the natural, external world, as opposed to the elements of our cognitive constructions, there is the temptation to view biological orderings as superior, being more factual, to those of our social world. From this stance, the search for a missing link becomes a search for world-closedness, to narrow down the dizzying possibilities the natural world offers, by reading our ancestors as institutions by which to order our lives. Like all systems of classification, it is the search for order. This is the powerful allure of the historical human-animal boundary, and what is at stake in scientific orderings of it.

Chapter 3: Research Design and Methods

In the following chapter I shall outline the evolution of the thesis, and its methodological framework. In the first section I discuss the considerable change in focus from the original plan and how the case studies came to be chosen. In section two I explain the data sources used, with particular attention paid to explaining in more detail how that intangible entity 'popular culture' was construed for the purposes of investigation. In section three I cover how data was gathered, and provide some statistics on the news media used. In section four I run through the method of data analysis used – namely, critical discourse analysis, as well as some of the implications and assumptions of this approach. Finally, the brief section five considers the ethical dimensions to the research.

1. Genesis of Thesis

In some respects, the thesis has changed considerably from the original proposal. The project was initially entitled '*Humans, Apes and Genetics: Myths and Science*', and aimed to explore the manner in which comparative genomics was reconstructing the human-nonhuman boundary through its study of primate genomes. The discovery of *Homo floresiensis* during the first year of the thesis, and the resulting media coverage, changed this focus radically. The roles that extant non-human primates and extinct missing links hold in respect of the human-animal boundary are in many respects indistinguishable, a fact I alluded to in chapter one. In light of these parallels, and the topicality of the discovery on Flores, it was decided that it would be beneficial to incorporate this archaic primate into the study. As the Flores find was still very much unsettled at this time it was agreed with my supervisors that I should take a look at another famous missing link as a pilot study, for which Piltdown man was perfectly suited. Like *floresiensis*, Piltdown was a very literal rebuke to the notion of a human-animal binary, and it too received considerable mainstream media coverage. The ninety two years separating the finds also allowed a welcome

historical dimension to the study, given the interest in socio-cultural influences on the scientific study of such creatures. The very different circumstances of the two finds aided the task of identifying such influences.

The material generated from this pilot work was so great that the decision was to use Flores and Piltdown as a case study. It quickly became apparent that incorporating both this work and the primate genomics work within one thesis would be impossible, and so the decision was taken to switch the focus entirely to missing links. Appropriately foreshadowing events in the real world, (proto) man had displaced ape.

Despite this change of fields, from genomics to palaeoanthropology, the interests of the thesis were left unchanged. The focus remained on the interactions between science- and popular- culture in drawing the boundary between human and animal. The specific field of science may have changed, but the vastly superior attention accorded to both *floresiensis* and Piltdown man, comparative to even the most newsworthy comparative genomics, meant that the new field was far better suited for exploring the thesis' main interests.

Within the text of the thesis itself, I have gradually introduced the theories used and applied them with increasing complexity to the questions at hand. As a result, concepts such as the 'trinary', and the hydrologic metaphor of science communication, are built on over the course of the thesis. This allowed the concepts used to be tested and refined against all the data analysed, before they were deployed to their full extent. It also, I hope, affords the reader an easier introduction into the framework of the thesis, avoiding overburdening the early chapters. Finally, such an approach – i.e. of gradual development – appears fitting for a thesis which fixes its gaze on attempts to understand the process of evolution (assuming one discounts the theory of punctuated equilibrium, which would make for a rather jarring read).

2. Data Sources

The research consisted of a critical discourse analysis (CDA) of science and mainstream media coverage of the two case studies, supported by a literature review of appropriate texts. I will discuss CDA in detail below, but here I wish to focus on the choice of materials used. To study the interaction between scientific and popular knowledge claims, its was necessary to begin with intraspecialist scientific media, that is to say the peer-reviewed journal papers in which the discoveries were initially detailed, and any others which followed in response. Additionally, borrowing Cloitre & Shinn's (1985) terminology, 'interspecialist' science media coverage was also studied, as an example of an intermediate stage between the two realms of interest. By interspecialist, I am referring to what is more commonly know as popular science: material aimed at nonspecialist scientists and nonscientists generally, examples being *New Scientist* and *Scientific American*. This was the news and analysis provided by science magazines aimed at scientists and lay public alike.

Analysing popular culture is a rather different task from analysing science culture, as it is not embodied in any formalised institution and its practices, whether material or semiotic, in the manner that science is. In light of this it is tempting to define popular culture by what it is not: as being those ideas and practices which is not claimed by any formal profession. To do so would be a mistake however, for more than one reason. For a start, this would be to imply that rigid lines can be drawn between popular culture and other forms, yet a considerable part of this thesis is concerned with questioning the walls that are erected between science and popular culture. Additionally, there are professions - an appropriate example being newspaper journalism - which do operate within this realm, but the difference is that, unlike scientists, these professions can claim no monopoly on the production of knowledge within their realm. Science too is, of course, highly influential on popular culture (and vice versa). It is, clearly, a hopeless task to attempt to define popular culture in terms of its practitioners, for it is everywhere, it is "the reality *par excellence*. This is the reality of everyday life" (Berger & Luckmann 1991:35), which

may incorporate ideas from science as easily as it does from religion, or any other system of knowledge. It is this definition that that I will take as identifying popular culture, as being that which constitutes the

common sense world typically taken for granted, and this means that these structures of daily life are not themselves recognized or appreciated formally by common sense. Rather, common sense sees the world, acts in the world, and interprets the world through these implicit typifications (Schutz 1973:xxvii).

Given that popular culture lacks the centralised system which underpins science culture, evidencing it is undeniably more problematic. Newspapers are however as good a proxy as any, being (as part of journalism more generally) the primary industry tasked with providing the public with current, reliable (in theory) information about the external world. Their influence can be read in their sales figures (see below) which reveal their mass audiences, and in this respect the timing of Piltdown is fortuitous, as it was during the 1910s that the news media in the UK began to achieve mass readership for the first time (Stevenson 1990:402). However, one must always remain aware of the intangibles associated with attempting to chart popular culture in this way:

> Does media science make a difference to how people think about science? Possibly, but we do not know. How can we separate the influences of a particular medium from those of other media and from other sources of impressions and influences? We cannot. Do media give people information? Yes, sometimes, to a certain extent. Does that information have any effect? Sometimes, for some people: but when, and how much, and for whom, we do not know (Gregory and Miller 1998:131).

These issues are unavoidable in attempting to study an entity as abstract as popular culture, and in the absence of any better source, the print news media was chosen as the most appropriate means of studying reactions to the challenges raised by the missing links.

At this stage, it is important to state that although popular culture is treated as single, unified entity for the purpose of analysis, it is recognised that its ontological reality is in fact hugely complex, and interlinked with countless more specific, local forms of knowing and knowledge. Any single individual is liable to have their experiences and world-view structured as much by the nuances of their daily existence: their job and education; those they come into contact with; any number of demographic variables; religious beliefs etcetera, as they are by the overarching framework of popular culture, which can be thought of as a residue, or concentrate, of these more specialised cultures. This dynamic, multi-layered picture is supported by Bowker & Star:

> If someone is comfortable with the things and language used by a group of others, we say that he or she is a member of that group. In this sense, categories – our own and those of others – come from action and in turn from relationships. They are, as sociologists like Aaron Cicourel (1964) remind us, continually remade and refreshed, with a lot of skilled work. (2000:285).

No analysis could hope to encompass all of popular culture: in its complexities it appears fractal, with any level of detail incomplete, limited by its resolution. This thesis is no exception, and with the viewing field necessarily wide, to incorporate both science and popular culture, specialist and general media, and a time span of a century, much of this intricacy is beyond the scope of my research: to problematise the boundaries of science culture-popular culture, and human-animal,

are considered to be challenge enough. For that reason a heuristic conception of popular culture is operated here, that strips away those nodes deemed extraneous. It must be kept in mind however that the fuzzy, multi-level relationship found here between popular and science cultures is not unique, and that a profusion of cultures – overlooked here – share such a tangled border with each other, and those singled out here.

2.1 Secondary Sources

As the thesis' focus was on knowledge claims made within the public realm, and their relationship to those made within science, it was not felt that interviews with stakeholders (i.e. scientists and journalists) would be necessary: their relevant views would, by definition, be available publicly in the form of texts. This approach also meant that more time could be devoted to textual gathering and analysis. There were exceptional cases where information was required that was not available to the public however. In chapter seven, as the remit of the thesis developed, it became beneficial to understand what palaeoanthropologists meant by the label 'human'. It became apparent that this was a somewhat grey area, as despite their usage of it the term remained a nonscientific one. To clarify the issue I contacted several prominent scientists by email for their views. Given the small role this question plays in the thesis as a whole, full interviews would have been an extravagance.

That said, several unplanned-for sources did materialise over the course of the research, and it was felt that it would be far more rewarding to take a pragmatic, opportunistic approach to such materials, rather than disregard them on the grounds that they did not fall within the original remit. An example of such material was the *Nature* press release announcing the Flores discovery. This was a serendipitous addition to the data set, received – unrequested – from *Nature* during an email correspondence regarding minor details of the press conference that announced the discovery. Once received however it was of use in charting the flow of information from the original intraspecialist publications on the find to the mainstream news

media. Another useful source proved to be Morwood's account of the discovery of LB1 (Morwood & van Oosterzee 2007), and Gregory Forth's (2006) anthropological accounts of reactions on Flores to the discovery. This final source was particularly helpful as it helped span a gap in the data, namely local accounts of the Flores discovery. If at all possible it would have been beneficial to analyse Indonesia media coverage, so that a clearer comparison with Piltdown's reception could be carried out. However as much of this coverage would have been Indonesian, or possibly even local dialects, such an element of the research was simply unviable in terms of translation costs.

3. Data Gathering

3.1 Piltdown

The limited extent of digitised, searchable databases for the period in question created problems researching Piltdown that were not applicable to Flores. First it was necessary to gather intra- and inter-specialist science journal coverage. *Nature*'s contemporary coverage was obtainable from Web of Science's database (apps.isiknowledge.com). Further sources were obtained from secondary literature, such as published literature concerned with the fraudulent nature of Piltdown (e.g. Spencer 1990, Weiner 1980), and through a citation search of the *Nature* material. In total 33 articles were recovered, dating between 1913 and 1922 (though all but one were published before 1919). Whilst every effort was taken to ensure that all 'core' articles were included, by which I mean all relevant material produced by discoverers Dawson & Woodward, rival scientist Keith, and the most prominent critics from the debate, it is possible that some material was missed due to the limited nature of applicable search tools. However, I am confident that the search was comprehensive enough to be considered representative.

For mainstream UK media coverage, it was first necessary to identify periods in which Piltdown was "newsworthy". This was achieved via a search of the *Times*

newspaper's digital archive, in addition to the secondary sources outlined above. The *Times* was, at the time of analysis[7], the only UK national paper to have a digitally indexed archive of the period in question. From these sources two periods of heavy coverage were identified, the first being the six weeks between the leaking of the discovery in mid-November 1912 up to the end of that year, including the official announcement on December 18th, the second being August-September 1913, during which time Piltdown featured prominently at two scientific conferences. Copies of the *Manchester Guardian, Daily Telegraph, Daily Mirror, Daily Express* and *Illustrated London News* were then searched by hand at the British Library, Colindale, for coverage of the Piltdown find during these dates, and added to the *Times* material. These papers were chosen to represent both ends of the market: what would today be referred to as 'broadsheet' and 'tabloid'. Although the *Manchester Guardian* was a regional paper at this time, it was chosen for inclusion because it broke the Piltdown story originally.

Coverage by the respective newspapers, and their circulation figures, is shown below-

Number of articles/letters on Piltdown (Nov-Dec 1912 & Aug-Sept 1913)

Daily Express	8
Daily Telegraph	2
Daily Mirror	0
Illustrated London News	10
Manchester Guardian	9

[7] The Guardian now has a digitally indexed archive, but this only became available in Oct 2007, a year after the research took place.

Times	12

Circulation Figures 1910

Daily Express	400,000
Daily Telegraph	230,000
Daily Mirror	630,000
Illustrated London News	200,000*
Manchester Guardian	40,000
Times	45,000

Taken from Butler (1975) *British Political Facts* 1900-1975, R&R Clark Ltd.

* Estimate by The Illustrated London News Picture Library.

The *Mirror* was the only newspaper to be published in a tabloid format at this time, although the *Express* took a similar approach to content (Bromley 1997). The *Mirror* boasted the widest circulation figures of any paper during the period of study, but Piltdown did not feature at all in the time frames identified. As a result, the *Mirror* played no further part in the analysis.

3.2 Flores

The comprehensive search facilities readily available today made the task of recovering material on *Homo floresiensis* a far easier, time-efficient task compared to the Piltdown case. This was particularly the case in respect to newspaper coverage, which was gathered using a LexisNexis search (lexisnexis.com) for the

terms ‘Homo floresiensis’; ‘Flores hobbit’; ‘Flores island’ and ‘Human hobbit’. As before, newspapers were selected that would reflect both the broadsheet and tabloid sections of the UK market.

Number of articles/letters on Flores discovery (Oct 2004 – Jan 2007)

Daily Express	3
Daily Mail	7
Daily Mirror	2
Daily Telegraph	8
Guardian	19
Times	11
Sun	3

Readership* Figures (2007)

Daily Express	1,678,000
Daily Mail	5,409,000
Daily Mirror	3,773,000
Daily Telegraph	2,107,000
Guardian	1,114,000
Times	1,627,000
Sun	8,051,000

* Readership refers to the number of people reading a title on an average day over the stated time period. Source: National Readership Survey (www.nrs.co.uk).

Intraspecialist material was sourced through a Web of Knowledge search, looking for the term 'Homo floresiensis'. In total 17 papers were obtained. Finally, the interspecialist magazines *New Scientist* and *Scientific American*, in addition to the interspecialist material in hybrids *Nature* and *Science*, were searched individually using their own databases. From this 42 articles were gathered. The much greater volume of material sourced for the Flores case study comparative to the Piltdown one in part reflects the greater ease of finding them, but it also reflects the much greater volume of material actually produced by publications in the more recent time frame. It was then necessary to expand the data set if it was to remain representative.

4. Data Analysis

4.1 Critical Discourse Analysis (CDA)

The data analysis of the thesis was underpinned by critical discourse analysis. The key tenet of CDA is not a particular technique of examination, but rather a demand that we view the data to be analysed as inseparable from the social structures, and their associated cultures, within with it exists. We must then consider both if we are to understand either. In this respect it complements the 'boundary-work' (Gieryn 1983) theoretical framework of the thesis, which focuses attention on agents' discourse as the site at which socio-cultural boundary drawing takes place.

It was not a concern of the thesis to provide a guide to CDA techniques, and so its influences on the thesis go unheralded. Like the proverbial Victorian child, I was happy for it to be see but not heard. For this reason, it is all the more important here to set out clearly what remains in the background elsewhere, namely, the ideas underpinning CDA, and how it framed the research.

The term 'critical discourse' is used by a diverse body of literature, but here it will be primarily be based upon the methods advocated by Fairclough (2003). Following this method, the discourses (being forms of ontological representation which shape what ever social objects they discuss) within the texts studied are read as being in a dialectical relationship with the cultures in which they exist, that is to say they are mutually constitutive of one another. At the heart of the CDA approach lies a neo-Marxist informed interest in power relations, that eschews economic determinants in favour of cultural factors in the building, maintenance and destruction of networks of power. For that reason texts are a major source of interest for critical discourse, as repositories of culture which may be dissected to reveal the forces which shaped them.

To better understand a CDA approach it is necessary to consider some of its general principles and concepts, as identified by Wodak (in Titscher et al 2000:146)-

- The focus of CDA is not linguistics per se, but rather with the linguistic nature of social and cultural processes and structures. In fitting with Gramsci's ideas on praxis, CDA is politically involved and concerned with social issues, and their constitution within power relations.
- CDA analyses discourse rather than text. 'Text' refers to a body of written language, or a transcription of verbal interaction, whereas 'discourse' covers a much greater area; 'I shall use the term *discourse* to refer to the whole process of social interaction of which text is just a part' (Fairclough in *ibid.* p147).
- As all discourse is embedded within specific cultural, historical, ideological and intertexual frameworks, context is crucial to the understanding of any given example of it. For example, to determine whether a text is ideological it is necessary to understand its 'interpretation, reception and social effects', which requires the analyst to look beyond just the text itself to the relations that constitute it (Wodak in *ibid.* p146).
- The relationship between discourse and society and culture is understood to be a dialectic one; they are mutually constitutive of one another. All examples of

> language either reproduce or challenge society and culture. Language then is never neutral, but rather is understood as a form of social practice which may be used to achieve actions at the societal (in addition to the interpersonal) level. This is not merely a mechanistic cause-and-effect however; the influence of any instance of language depends upon the context in which the language occurs. To understand this dialectic relationship, CDA seeks to use an interdisciplinary approach, combining social theories with textual analysis.

Gramsci's utilisation of *hegemony*, which details the subtle interplays of power in which the superstructure became contested terrain between the different social classes, is a key informant to CDA's approach. Central to Gramsci's theory was that rather than rule purely through physical domination, the ruling classes utilise 'intellectual and moral leadership' (Gramsci in Swingewood 2000:118) over subordinate groups. This is achieved through the saturation of civil society with 'the spirit of its morality, customs, religious and political practices' (Swingewood 2000:118). This saturation is achieved through the dissemination of the ruling group's ideologies through discourse.

Gramsci's work draws attention to the presence of ideologies within scientific discourse, and the role these discourses play in shaping our conceptions of the world, at both an individual and societal level. Rather than being a source of purely objective knowledge, science is seen to be a institution with its own discursive practices, and which uses its position in contemporary Western societies as a privileged knowledge provider to disseminate its ideologies. Of equal importance is the social influences that shape scientific discourse – it is the mediation of power through a two-way relationship that CDA seeks to understand. In this respect, CDA suits an investigation of boundary-work well, as its focus on individual agents' drawing of boundaries in their discourse encourages a focus on the power interests of those agents, and the manner in which they gain, and utilise, authority to support their boundaries.

In its application here, the 'social issue' requiring investigation by CDA is the power of scientific discourse - as a privileged knowledge provider - in the shaping of debates centring around humanity's self-image, as determined in this instance by the reconstruction of our evolutionary ancestors. Much, if not all, of this power is based upon science's claims to be able to produce rational, objective, accurate knowledge. The thesis will challenge these claims by pointing out the myriad of interconnections between scientific and popular ideas regarding our ancestors. The aim is not as much to denigrate science culture's role in this story as it is to celebrate popular culture's. The empirical data produced by science is fundamental to the project of learning more about our evolutionary past, yet the knowledge produced inevitably incorporates ideas that have not been evidenced, and ideas that *cannot* be evidence. These ideas are those of the wider culture in which scientists operate, as missing link stories are fundamentally stories about ourselves as much as our predecessors. It is worthwhile to recognise this both to give 'inferior' sources of knowledge their due, and also to recognise the limits of science, lest its authority be wielded in the promotion of accounts like Washburn's Mighty Hunter.

CDA's demand for 'thick description' (Geertz 1973) of texts extends to a self-reflexive recognition of the analyst's own context. In this respect it dovetails snugly with the reflexivity clause of the strong programme (Bloor 1976). CDA is open in its use of *a priori* theorising to link a text with wider social elements, and openly acknowledges the role of its own ideology in its analysis. The binding textual analysis with wider social contexts has attracted criticism, for example Widdowson's accusation that it is ideological interpretation rather than analysis (in Titscher et al. 2000:163). Widdowson argues that CDA's interpretation of texts is biased firstly in the manner in which it selects texts to support its chosen interpretation and secondly on the basis of a chosen ideological commitment which is evident from the outset. Fairclough attempts to defend against these accusations with a critical-realist inspired argument. Against the former accusation he points out that all textual analysis is inevitably selective in choosing what to study, and what questions to ask

of it. In response to the latter he acknowledges the role of an ideology in driving CDA:

> the belief that texts have a social, political, cognitive, moral and material consequences and effects, and that it is vital to understand these consequences and effects if we are to raise moral and political questions about contemporary societies (Fairclough 2003:14),

but argues that any analysis of text is shaped by the subjectivity of the analyst, who is inevitably part of the context in which the text is interpreted. Given this, CDA only differs from other methods in that it is open and reflexive about its ideological commitments. It should also be noted that CDA does not claim to generate exhaustive knowledge of its subject; in recognition of the important role of context in CDA, no analysis can ever be considered definitive or complete because the context is dynamic and historically constituted, and thus open to change.

Along the line of attack taken by Widdonwson, Schgeloff (1997) argues that due to its prior theorising, CDA can only find out what it already knows. Because of this potential weakness it is all the more vital to support CDA claims with appropriate data. As a further guard against this, the "symmetry" clause of the strong programme is a useful bulwark. This holds that all knowledge claims, regardless of their success or failure, should be analysed by the same criteria. Treating claims in this way avoids evaluating them by criteria which were not available to contemporary agents e.g. their future status as 'true' or 'false'. In this manner the analyst might avoid critique-by-hindsight, that is to say agents should be judged by the context in which they operate, not by the analyst's context.

As CDA recognises the unavoidable presence of its analyst's own representation in any analysis, and the role of agency in the actions and interpretations of others, it does not claim to ever generate a single, comprehensive

account of any text that is studied. Gilbert & Mulkay's critical discourse-driven investigation of scientific culture rejects 'the traditional sociological goal of producing a single, coherent account' (1984:188) in favour of recognising the multiple perspectives of the scientists themselves. This standpoint acknowledges the problem of representation that Woolgar (1988) identified in his SSK work – namely that any sociological critique of scientific representation is inherently flawed if it fails to recognise the role of its own representation in its critique of science.

In recognition of this, for the author's own work here classification is crucial. Through the manipulation of selection criteria I am able to construct an argument between a protagonist (e.g. 'palaeoanthropology'), and a number of antagonists (e.g. 'STS') with which to challenge it. None of these characters has a cohesive physical reality detectable to the human senses, and yet by classifying them by their shared agents, structures, knowledge claims etcetera, a single body can be identified. The strength of classification is also its weakness however; it relies upon a simplification of reality. To attempt a work such as this, without recourse to definitive bodies like 'palaeoanthropology', relying instead on a universe of atomized elements, would be an exercise in disaster. Only by 'limiting and filtering the visible' can reality be 'transcribed into language' (Foucault 1992:135). However, for classification to be an aid to knowledge rather than a hindrance, two flaws must be borne in mind. The first of these is recognizing that, as a necessary simplification, classification is a process of abstraction that cannot produce 'complete' knowledge of its subjects, but rather is suited for finding residues of whatever it is which constitutes 'Truth'. The second flaw relates to the power dynamic which Bauman (1991) identified, namely that the classification of a group inevitably requires a judgment on the part of the classifier as to what distinguishing criteria to utilize. This 'judgment' inevitably resides within the human mind, and hence is liable to be shaped as much by it as by the external world.

For my analysis here this second flaw is less problematic than the first, as entities of the social world, like 'palaeoanthropology', are prone to identifying, and classifying, themselves in a manner which the natural world does not (though

arguably there are exceptions in palaeoanthropological classifications, for example 'species'). Structures identified in the social world are 'constructs of the second degree' (Schutz 1973:6), being those already identified by other actors. Of course even utilizing the self-classified identity of a body at the meta-level of 'palaeoanthropology' and 'STS' does not remove the subjective role of the author, as they are still required to select from these vast bodies the particular elements that allow them to develop their argument. For the palaeoanthropologist and the social scientist alike, the selection of classifying criteria and the 'filtering' of reality does not preclude the production of valuable, useful, knowledge however. After-all classification is ever present in human behaviour and allows us to operate successfully in our everyday life-worlds;

> To classify is human… We all spend large parts of our days doing classification work, often tacitly, and we make up and use a range of ad hoc classifications to do so. We sort dirty dishes from clean, white laundry from colourfast, important email to be answered from e-junk. (Bowker & Star 2000 pp.1-2).

Classification should take its cues from its subject; as long as distinguishing criteria are anchored in the reality of the subject then the knowledge produced should be a useful reflection of it, whilst not being comprehensive. It must always be kept in mind however that, like all human knowledge, what is produced from classification is the shadows on Plato's cave wall, rather than reality per se. The danger arises when we fail to acknowledge the work of classification in producing these shadows. Classification works like a fairground mirror, expanding some elements of reality whilst collapsing others. This can allow us a clear view of the specific elements we are interested in, but it must always be kept in mind, and acknowledged, that what is produced is a human distortion;

> Each standard and each category valorizes some point of view and silences another. This is not inherently a bad thing – indeed it is inescapable. But it *is* an ethical choice, and as such it is dangerous – not bad, but dangerous (*ibid* p5).

Beyond this reflexivity, in the work that follows I attempt a more holistic recognition of my own role throughout the text, by the overt deployment of metaphors to elucidate the claims made. Metaphors are powerful tools for sharing meaning, yet they also, in their particular idiosyncratic reimaginings, inevitably reveal the fingerprints of the author. By flagging up here, and in the concluding chapter, this fact, I aim to underscore the author's influence on what is produced.

The acknowledgement of potentially diverse perspectives might seem to risk any hope of a productive account in favour of a chaotic one. However, recognition of the possibility of multiple perspectives does not exclude the possibility of coherent elements emerging; 'Although we emphasised that the multiplicity of voices with which scientists and other social actors speak makes traditional sociological objectives unattainable, we held fast to the assumption that interpretative regularities could be discerned behind the babble of tongues' (Gilbert & Mulkay 1984:188). It is these 'interpretative regularities' that this work shall attempt to identify.

4.2 Applying CDA

It should be clear from the discussion above that CDA is less a method of data analysis, than an epistemological framing of it. The research required an analysis of the discursive practices evident within the texts identified. This cannot be accomplished purely through a consideration of the text of the primary data however; the complex dialectic which exists between any text and the world in which it is embedded requires an analysis of the context in which the papers exist.

Fairclough refers to the way in which discourses are created, mutated and absorbed within specific contexts as 'meaning-making' (2003:10). The operationalisation of CDA relies on identifying the ways in which texts achieve meaning-making.

The analysis then involved first a literature review to provide the theoretical framework. A first reading was conducted of a sample of texts, in which prominent discourses were identified. The whole corpus was then coded within the Nvivo programme. Considering the data produced in light of the theoretical framework allowed me to connect these discourses with the wider contexts required by CDA. From the coding the specific threads which would form the data chapters were identified.

5. Ethics

As the source data for the project was be taken almost entirely from textual material already in the public domain there were few ethics issues to navigate. Where personal communications were quoted from the respondents were asked for their permission to reproduce their comments. The only other ethical responsibilities involved in the project were for myself, as author, to accurately report and reference any materials used.

There is a considerable moral dimensions to the human-animal boundary however, and so in the concluding chapter I shall consider the ethics of undermining the boundaries I have set out to critique.

Chapter 4: Piltdown Man: Boundary-Working the Human-Animal Binary

1. Introduction

Piltdown Man today has the dubious honour of being perhaps the most notorious scientific hoax of all time. Announced in 1912 by a team led by prominent British scientist A.S. Woodward and amateur geologist/archaeologist Charles Dawson, the fossilised figure – apparently a creature on the cusp of humanity, with a large human-like skull and an ape-like jaw – was heralded as 'the earliest Englishman' (Woodward 1948), and received huge scientific and popular interest. However, further discoveries during the 1920s and 1930s, notably *Australopithecus* in Africa and 'Peking Man' in Asia, made Piltdown appear as an evolutionary anomaly.

These other discoveries showed that in the human lineage the large ape jaw had shrunk before the skull had enlarged – the opposite of the development that Piltdown exhibited. This contradiction was not solved until 1953, when a team of scientists reappraising the discovery began to suspect foul play, and sent the remains for analysis. Tests showed that Piltdown Man was actually no more than a modern human skull and a modern orangutan jaw, the bones having been stained to give the appearance of age, and the teeth filed to appear more human.

In the years since numerous names have been put forward regarding the identity of the hoaxer(s) (see, for example, Wiener 1980, Blinderman 1986, Russell 2003), but for social scientists the case raises many other questions besides. Like all 'missing link' figures, Piltdown Man occupied the liminal zone between human and nonhuman animal, by definition neither clearly one nor the other. In a similar (but more literal) way to contemporary primates, missing links occupy 'the border zones between those potent mythic poles' (Haraway 1989:1) of nature and culture. Such figures refuse to comply with the common binary configuration with which Western civilisation has conceptualised the human-animal divide. Within this Judeo-Christian inspired system of thought human and animal are mutually exclusive absolutes: the

latter as distinct from the former as the former is from God (Thomas 1996). Darwin's theory of evolution, introduced in the seminal *On The Origin of Species* (1859), theoretically destroyed the notion that human and animal were entirely discrete entities. Yet almost 150 years later such divisions are still implicit in our culture; in our treatment of animals; in our very language where the term 'animal' commonly precludes humans.

Where science culture's classifications of nature meet popular culture's we can find overlaps, non-fits, lines criss-crossing. The case of Piltdown Man places this murky boundary zone under a microscope, a moment in time when an individual animal appeared to span the boundary: its jaw on one side, its skull on the other. As such Piltdown presented a monumental challenge to traditional binary conceptions. The efforts of scientists and journalists to respond to this challenge, evidenced in contemporary interspecialist, intraspecialist, and news media coverage, forms the subject of this chapter.

The consideration of the Piltdown figure's standing in relation to the human–animal boundary became subsumed within nationalist and racial discourses that drove its interpretation. British coverage of the discovery was unhesitating in declaring Piltdown to be human, but it was the figure's cultural standing, not its physical remains, that decided this. Meanwhile, so-called modern-day 'savages' were invoked in the effort to invest in Piltdown humanity, bringing the figure closer to us, whilst Piltdown was simultaneously used to move them further away. In such data we catch sight of prototypic classifications of the creature being shoehorned into Aristotelian classifications. Extant primates also suffered in this process, being denied humanness even whilst Piltdown was awarded equivalent scientific categorisation. Unsurprisingly, during this whole process the human–animal binary became mobilized as something more complex than a simple dichotomy, but only in an implicit manner that ultimately left the binary picture intact. In chapter five I will discuss why Piltdown's humanness took the particular form that it did, but here the focus is on how Piltdown became human in the first place.

2. The Piltdown Discovery

Piltdown Man was announced to the world in 1912 by a team of scientists led by the distinguished Arthur Smith Woodward, who was at the time campaigning to become Director of the British Museum of Natural History, and Charles Dawson, an amateur geologist/archaeologist. It was Dawson who had brought Piltdown to the attention of the scientific community, when he was handed two skull fragments by workers who were digging at the site in 1908. Dawson continued to investigate and in 1912 formed a digging team with the aid of two colleagues, Woodward and de Chardin[8]. The molar tooth of a prehistoric elephant species was the first notable find, soon followed by more hominan skull fragments and a lower jaw bone. These bones were to become Piltdown Man, announced to huge scientific and popular interest in December of that year. The find was sensational, essentially an anatomically modern human skull – though unusually thick – with an ape-like jaw. It appeared to be the missing link rendered physical. Crucially, the jaw had broken off at its joint, so it was impossible to confirm how it connected with this atypical skull. For some at the time, primarily foreign scientists, the juxtaposition between the two forms was such that they were convinced that the find was the result of two different skeletons buried within the same strata becoming accidentally mixed up with one another – the "dualist" argument. According to this argument Piltdown Man was actually the mistaken joining of two never-before-seen species - the skull of an archaic human and the jaw of an archaic ape (e.g. Miller 1915). The British palaeoanthropological community and media had fewer doubts however, and here the debate hinged on two different interpretations of the "monist" viewpoint. These competing interpretations came from the Dawson–Woodward (1913) team on one side, and

[8] Teilhard de Chardin was a French Jesuit priest and philosopher, as well as a palaeoanthropologist. Given that he did not author any work within the parameters of this study however, his own take on the find is unknown.

Prof. Arthur Keith[9] (1914), anatomist, palaeontologist and keeper of the Hunterian collection at the Royal College of Surgeons, on the other. The discrepancy between British and European/American interpretations is something I shall return to in Section 6.

From the fragments of skull collected, Woodward constructed an individual with a brain capacity of 1070 c.c., roughly halfway between that of modern apes and humans. Due to this small skull and the large jawbone, his figure had a backwards-sloping forehead and a pronounced muzzle: a distinctly apish appearance. The Dawson-Woodward team declared their figure to be a member of a species they labeled *Eoanthropus dawsoni*[10]. Their figure's species name was of course in honour of the discoverer, Dawson. "*Eoanthropus"* literally means 'dawn-man', and took its cue from the figure's intermediate skull size. This placed Piltdown outside the human genus *Homo*. Keith's reconstruction meanwhile resulted in a figure with a cranial capacity of 1500 c.c., slightly larger than the average amongst modern humans, and with an appearance similar to our own. Keith labeled his creation *Homo piltdownensis*, in recognition of its modern characteristics.

3. Boundary man

Piltdown Man was a chimera in a very literal sense; a figure born of the artificial conjoining of fragments of a modern human skull with the right side of a modern orangutan's jaw. To obscure the bluntness of their creation, the hoaxer placed two heavily filed human molars in the jaw. As such Piltdown straddled the human-animal boundary in a manner that refused to comply with binary discourses. In case one is

[9] Both Keith and Woodward were later Knighted, but as this occurred after the events detailed here they will be referred to by their contemporary titles.

[10] Under taxonomical naming conventions, the capitalized first word designates the genus, and the lower case second word the particular species within that genus.

tempted, in retrospect, to dismiss such a challenge as being merely the result of an artificial construction, a hoax, it is worth remembering that the existence of archaic figures that were neither obviously human nor nonhuman is unquestioned within evolutionary theory. At the turn of the twentieth century it was hypothesized that, in human ancestors, the brain had expanded before the jaw began to shrink[11], something that the Piltdown hoaxer took heed of. The genuine discoveries that followed Piltdown showed that the reverse was in fact true, which is why Piltdown had become such an anomaly by the time it was revealed as a fake in 1953. The precise order of the anatomical progression from animal to human form is not important to the project of understanding cultural responses to boundary challenges, so the fact that Piltdown was a hoax, and an imperfect one, can be ignored for the work at hand. Instead, the focus here is directed upon the question of how, given what the actors involved knew at the time, did they come to declare Piltdown human?

Piltdown Man's debut in the Guardian on the 19th Nov 1912 gave only small hints of the challenges this was to bring to the media. It appeared under the heading "The Earliest Man?", though the question mark in the title appears to be directed towards querying Piltdown's status as the earliest human, rather than its status as a human. Its account tells of the discovery of a "human skull," "by far the earliest trace of mankind that has yet been found in England." It goes on to state "The skull resembles the Neanderthal specimen, but belongs to a much lower and more primitive type of mankind even than that." In these opening statements there appears no awareness of Piltdown's ambiguities; he was "primitive", but he was human. In the second half of the article some confusion appears though;

[11] Prof. GE Smith, who wrote an appendix to the Dawson-Woodward paper announcing Piltdown, states "The apparent paradox of the association of a simian jaw with a human brain is not surprising to anyone familiar with recent research upon the evolution of man… The growth of the brain preceded the refinement of the features of the somatic characters in general" (Smith 1913:147).

> since Darwin's theory gained acceptance the need has been felt for discovering "the missing link" between the highest apes and the lowest men. The gulf between the two has not yet been bridged though we must wait for the judgment of the experts to know how much it has been narrowed by the discovery in Sussex. (19.11.12:8).

The use of bridging metaphors for 'missing link' figures is not uncommon. Talk of "highest apes" and "lowest men" gives this bridge a vertical, rather than horizontal, plane, much like a 'Lamarckian ladder' conception of evolution. This vertical bridge plays on a biblical conception of human-animal relations that sees humans as figures halfway between animals and God in a hierarchy of greatness, and as clearly delineated from the former as from the latter. It is this traditional binary understanding that the chimeric Piltdown causes such great problems for. In the metaphor's specific use here, the effect achieved is a semantic slight-of-hand. The first half of this quote seems to suggest that Piltdown Man is a link between the "highest apes" and "lowest men," a status that would seem to preclude him from either one and hence contradicting the article's attempts to claim him as human. However, the second line's reference to Piltdown narrowing the gulf could be read as meaning that this is a figure that exists on the shore of the human landmass, and that extends it backwards into the "gulf," so leaving a smaller gap for a missing link to span. Hence he might still perhaps be claimed as human. No resolution is offered, as the contradictions go unacknowledged.

This conceptual confusion is the result of a process we shall see repeatedly in our study – a prototypic classification of a figure displaying contradictory characteristics being explicated as an Aristotelian classification. This flags up the key question of this chapter: how was such a chimera of the human and the nonhuman reconciled with traditional binary understandings of the human-animal boundary?

4. The Challenge of a Non-fit

The official announcement of Piltdown Man's discovery took place at the Geological Society on the 18th December 1912. Dawson & Woodward's paper detailing the discovery assumes Piltdown's status from the very start, entitled "On the Discovery of a Paleolithic Human Skull and Mandible in Flint-Bearing Gravel…." Dawson gives little mention of the hominan remains in his section of the paper, but crucially he does mention finding both an "unusually thick human parietal bone" (1913:117) and "the right half of a human mandible" (p.121). In Woodward's section, the author repeats this claim; "The human remains comprise the greater part of a brain-case and one ramus of the mandible, with lower molars 1 and 2" (p124). On the subject of the jaw however, he appears to contradict his earlier claim:

> The great width of the temporal insertion, the situation of the mylohyoid groove behind rather than in line with the dental foramen… are all characters of the mandible in apes, not in man (p.131).

Of the teeth, he states "The molar teeth, therefore, although distinctly human, are of the most primitive type, and must be regarded as reminiscent of the apes in their narrowness" (p.132). In a final statement, on his decision to award Piltdown membership of an entirely new species;

> The brain-case alone, though specifically distinguished from all known human crania of equally low brain-capacity, by the characters of its supraorbital border, and the upward extension of its temporal muscles, could scarcely be removed from the genus *Homo*; the bone of the mandible so far as preserved, however, is so completely distinct from that of *Homo* in the shape of the symphysis and the parallelism of the molar-premolar series on the two sides, that the facial parts of the skull almost certainly differed in

> fundamental characters from those of any typically human skull. I therefore propose that the Piltdown specimen be regarded as the type of a new genus of the family Hominidae, to be named *Eoanthropus* (p.135).

Given the benefit of hindsight, much of Dawson and Woodward's paper is unsurprising: Piltdown had a skull that appeared very similar to modern *Homo sapiens* except for its size (according to Woodward's reconstruction) and a few minor details, and a jaw that appeared very similar to that of an ape, except the teeth, which in many respects were like those of modern *Homo sapiens.* Despite showing an awareness of these contradictions however, both authors label Piltdown as human. Even the features which appear ape-like become human once they are placed in the context of the whole being. This is perhaps fitting if humanity is tied to a particular taxonomic group, given that Linnaean taxonomy operates at the level of the organism, rather than sub-parts of it[12]. As I detail in Chapter 6 however, despite its usage by scientists, 'human' is resolutely a nonscientific category with no clear linkage to taxonomy. Here too, I show that human and *Homo* were by no means tied together (see below).

In addition, Dawson & Woodward's categorisation raises the question of why the being as a whole becomes human rather than ape - *or something else entirely* - when its constituent parts are so conflicting. Is it that greater importance is attached to the skull than the jaw - that a species essence resides in the skull that is not present in other bones? If so this would mean that, had the Piltdown hoaxer had the foresight provided by the later discoveries of Peking man and *Australopithecus*[13], and

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[12] For a more detailed appraisal of Linnaean taxonomy see Farber (2000).

[13] Peking man was discovered in China during excavations in the 1920s and was an example of *Homo erectus*. *Australopithecus* was discovered in 1924 in South Africa. Both showed that the modern human jaw evolved before the skull, opposite to the pattern of evolution implied by Piltdown Man.

placed a human jaw with an ape skull, then Piltdown would have been labeled an ape. Consideration of the scientific and media discourses around this figure suggest though that it is unlikely that Piltdown would ever be anything but human. This process is mirrored in Birke & Michael's (1998) analysis of another prominent boundary crosser – xenotransplantation animals. Referencing Douglas (1966), they refer to a "narrative of purification" which attempts to make such creatures more publicly acceptable. This discourse pushes chimeras towards a recognised, 'pure' state:

> For example, where media reports have described the scientific creation of a mouse with a sheep gene, it is described as just that -- a mouse with gene X. Or, it may be described as a cross-species mouse. But, when the transgene is a copy of a human gene, then the description changes: It becomes part human […] If what is transplanted is part-human, then boundaries are not being so blatantly transgressed. (p.254).

It is notable that in both Birke & Michael's example and my own, the pure state is that of human, reflecting the self-interested position we hold as classifiers. Forcing Piltdown to be human denies its uncomfortable transgression of boundaries. I will explore this process below, before returning to the question above – if Piltdown had to be pure, why pure human and not pure ape?

4.1 The Popular Reception

The opening metaphorical broadsides of islands of humanity and gulfs to be spanned, launched in the *Guardian*'s November announcement, preface the conceptual problems that Dawson and Woodward become enmeshed in. The media coverage following their official announcement fares no better, and as the debate

evolves the construction and attribution of humanity becomes increasing complex, and seemingly divorced from simple binary understandings of human and animal.

The *Guardian*'s report of the official announcement quotes Woodward as stating "the skull may be regarded as presenting a hitherto unknown species of *homo* [sic] for which a new name is proposed" (19.12.12:11). Here is an inherent contradiction: Piltdown is claimed to be a species of "*homo*" and yet Woodward places it instead in the genus "*Eoanthropus.*" This statement is not present in the published version of the speech, so it may be that Woodward was misquoted, or that he made an error which was corrected for the published account. However, in a later article, the *Guardian* quotes Keith as saying "Possibly he [Woodward] has been a little too precipitate in saying that it belongs to a new genus of humanity" (20.12.12:16), which suggests that the potential exists for humanity to be detached from the genus *Homo* (see sections 6 & 7).

These confusions herald a boundary debate which never materializes. The physical manifestation of the human-animal binary within one individual - what we know with hindsight to be a human skull with an orangutan jaw, and which was to all intents recognised as such at the time - might be expected to prompt a discussion of how this character challenged existing dichotomous understandings. One could imagine that such a figure would provoke considerable debate, especially arriving at a time when such figures were exceedingly rare – Piltdown's discovery having only been pre-empted by a handful of figures such as Neanderthal man and Java man. Despite the conflicting evidence though, Piltdown begins, and remains throughout the media coverage, strictly 'man'. Rather than attempting to weaken the rigid categories of human and animal, the consensus is to force Piltdown Man to fit accepted ideas, even if the results appeared self-contradicting. A typical example of such coverage comes from the *Illustrated London News* (28.12.12:950):

> the man (part of whose jaw and skull were found) was undoubtedly akin to the apes. The lower jaw is unmistakably ape-like, while presenting other features indubitably human.

In another example, the *Times* (11.08.13:3) states

> the oldest human remains yet discovered in Europe… a being that is partly ape, partly man.

From the *Express* (20.12.12:1):

> a new race of men, in points strongly resembling the apes, but still unquestionably "man", although devoid of the power of speech.

Repeatedly, a statement of Piltdown's humanity – usually implicitly in labelling the discovery "man," but also through explicit reference such as that in the *Times* quote above – is juxtaposed with a recognition of nonhuman features. As well as the ape mandible and the suggested absence of speech, these conflicting features include; that the skull was shaped like a chimpanzee's (*Times* 19.12.12:4); that the neck was like that of an ape (*ibid.*); and that it walked like chimp, with a shuffling gait (*Express* 23.12.12:1). Clearly, the physical contradictions identified by Dawson and Woodward were recognized too by the journalists involved, and yet no one sought to question the scientists' conclusion that here before us was a 'man'.

5. Forcing a Fit

Piltdown's positioning as human prompts two questions, namely; on what grounds was Piltdown's humanity constructed?; and why did its human status remain so untouchable? In response to the former question, all the evidence concerned had to be drawn from the very fragmentary sources that palaeoanthropology deals in. In Piltdown's case, these were anatomical (skull fragment and jaw measurements and reconstructions), abstractions from anatomical evidence (such as speech capabilities, posture), and lithic (both Eolithic and Chellean tools[14] were discovered at the Piltdown site). In consideration of the latter, one *Times* piece suggests that stone tools can only be an effect, not a cause of human status:

> the "humanity" of the Eolithic flints has for many years been disputed – one of the chief objections to their acceptance having been that they had never been found in intimate association with human bones. With this discovery that objection finally disappears (25.12.12:8).

The tools then became tools because they were discovered in association with human bones, rather than vice versa. As already shown, Dawson and Woodward's paper locates humanity in certain features of Piltdown's skull and teeth, which as we already know offer no clear answer to Piltdown's status as human or not. Unsurprisingly, the media too focus primarily on the skull, jaw and teeth. However, in a reflection of their position within popular culture, free of the constraints of the more cautious scientific realm, media coverage expands on the scientist's claims. One *Illustrated London News* piece discusses the possible lifestyle of Piltdown, including skills and tool use:

[14] Eoliths (literally "dawn stone tools") are crude stone flints, sharpened on one side. Chellean tools were slightly more developed and worked on both planes to provide a finer edge.

> He was a man of low stature, very muscular, and had not yet attained that graceful poise of the body which is so characteristic of the human race to-day. But he was by no means lacking in intelligence… He had probably inherited the use of fire from his forbears, and this useful ally served to harden the ends of his wooden spears and perhaps to cook his food (28.12.12:958).

Perhaps then Piltdown's humanity stems from tool and fire use? Such skills would seem to require language, or at least a developed form of social learning, which is one key attribute of humans. There is no sign of consensus on this however. The *Express* titles one article with the following header:

> The New Woman[15] (200,000 Years Ago). She Could Not Cook. She Could Not Talk. She Could Not Wash. She Could Not Light A Fire (23.12.12:1).

Here Piltdown is simultaneously claimed as human and stripped of many basic human characteristics. The article does go on to assert that Piltdown could use tools and clothe itself in animal skin, but here, as with all the coverage both popular and scientific, its humanity is not negotiated as an outcome of these skills, but is assumed from the start. Nowhere, in any of the literature, does there appear an

[15] "The New Woman" of the title refers to the possibly female gender of the remains of Piltdown, a suggestion made by Woodward on account of certain anatomical features of the skull. The other papers largely ignore this claim, but the *Express* makes great play of it. At this time of course the Suffragette and Suffragist movements were demanding that women be given the vote, and the *Express* was presumably playing on this theme. See Chapter 5 for further discussion.

explicit justification of Piltdown's human membership; the anatomical features are contradictory, as are the suggested skills; the tools are unsuited to conferring such status, and the general consensus is that it would have been unable to talk. Piltdown's humanness was then built on the most precarious of ground.

6. Species Boundaries, National Boundaries

This brings us to our second question - why was Piltdown's human status so unassailable despite the contradictory evidence? There are two answers, I would suggest. The first of these is simply that Piltdown the "backwards woman" (*Express* 12.08.13:1) is more exciting news than Piltdown the "forward ape" (*ibid.*). As a primitive human Piltdown takes on an immediacy, a relevancy, to popular culture that it would not have as an ape. Piltdown as a human "fit[s] well with media news values such as meaningfulness and relevance to daily life" (Cassidy 2005:136). Such 'human interest' stories have been an identifiable aspect of print journalism since the rise of the 'New Journalism' of the 1890s (Lee 1980:121). For scientists and journalists alike, such sensationalism (if that is not too strong a word) means greater public interest and hence greater rewards, whether in terms of status, resources or finances.

The second answer is related to this, but is both more complex and more interesting from a boundary perspective. It also demonstrates why the construction of the human-animal boundary impacts on us as humans, and not just on our treatment of those on the other side of the line. It is linked to the first answer by the fact that it concerns the anthropocentricism that makes Piltdown the human more interesting to readers than Piltdown the ape. As a human, Piltdown becomes one of "us", it joins humans on our side of the binary divide. Obviously, though, we do not construct our social alliances purely in species terms. Other important boundaries in the drawing of social alliances are the boundaries of nations and races, and both had an important role to play in Piltdown's attribution of humanity.

Piltdown was the first, and remains the only, major palaeoanthropological discovery to be found in England. He arrived at a time when Britain was, thanks to the likes of Darwin and Huxley, at the forefront of evolutionary theory. Great imperial rivals such as France (*Dryopithecus fontani*) and Germany (*Homo Neanderthalensis*)[16] had already enjoyed the discoveries of ancient evolutionary ancestors within their borders. Although the idea of relating a creature that lived hundreds of thousands of years ago to a particular nation state - that at best might claim a few hundred years contiguous history - is logically nonsensical, nationalists can still draw powerful historical discourses from them to support ideas of national greatness. Such themes were certainly present in the reception of Piltdown Man. The first report in the *Guardian* proclaims the find "quite as early as anything that has been found in Europe" (21.11.12:8), and later on declares "it is extremely satisfactory to English scientists that this find should have been made here and that it should have been made by two well-known English geologists" (20.12.12:16). Arthur Keith, in the same piece, states

> [A] pleasing fact is that this model has been prepared by an Englishman, for hitherto all these models have been done on the Continent. In all these matters we are regaining the prestige we enjoyed half a century ago in the days of Huxley and Prestwich – the heyday of English anthropology.

The *Express* meanwhile announces Piltdown as "Ancestress Of The English Race Today" (20.12.12:1), and the *Illustrated London News* refers to "this Ancient Briton" (28.12.12:958). Woodward's own memoirs of Piltdown, published only five years before the hoax was unmasked, are entitled *The Earliest Englishman* (1948).

[16] Remains of *Dryopithecus fontani and Homo neanderthalensis* were discovered in France and Germany respectively in 1856, and as such were the first recognized hominan discoveries.

Nationalist concerns were not restricted purely to the media and popular science however, but were present in the scientific realm as well. This theme even penetrates the intraspecialist science media: in the discussion section of a follow-up paper, a tool found with the remains is referred to as being that most quintessential of the English gentleman's trappings: a "cricket-bat" (Dawson and Woodward 1915:148). More tellingly, whilst the reception amongst the English scientific community was overwhelmingly positive (though not without exception[17]) towards the monist interpretation of Piltdown, in Europe and America reaction was far more mixed. Prominent American palaeoanthropologists Miller (1915, 1918), MacCurdy (1916) and Hrdlicka (1922) all expressed considerable doubts over the belief that the jaw and skull were from the same individual or species. Miller (1915) also provides a bibliography of papers in which European scientists give their opinions on Piltdown, and there is clearly a degree of scepticism not present in Britain. This impression is supported by the media coverage:

> German anthropologists, jealous no doubt for the superior antiquity of the Heidelberg and Neanderthal remains, have been especially skeptical (*Guardian* 12.08.13:6).

> That the original reconstruction of the Piltdown skull is open to criticism is evident from the proceedings at a meeting of German anthropologists held last week in Nuremburg [sic]. English anatomists were openly censured for giving their approval to the manner in which the Piltdown skull had been reconstructed (*Times* 11.08.13:3).

[17] A few British scientists, such as Professor Waterston, an anatomist at King's College, London, remained skeptical throughout the debate (see McCurdy 1916:230).

Outlining the respective cases of Woodward and Keith's models, the *Express* adds:

> There is even a third party, however, dimly heard from Germany, which suggests that the jaw does not belong to the skull at all, but to an ape who chanced to leave his remains close by (12.08.13:7).

Piltdown the earliest Englishman was far more appealing than Piltdown the earliest English ape, and this meant that English scientists and journalists alike were willing to weaken the requirements needed to cross the human-animal boundary. In fact, such was their keenness that no questions were asked of Piltdown upon its arrival, it was simply waved through the checks which one might expect.[18]

It could be argued that Woodward's decision to create a new genus for Piltdown was a recognition of its boundary-blurring characteristics; after-all "*Eoanthropus"* placed it outside the genus *Homo.* And yet in addition to the fact that *Eoanthropus* means literally 'dawn *man*,' repeated references to its human status undermines any attempt to argue that Piltdown's boundary-straddling nature was recognized in the discourse surrounding it.

The outcome of Woodward's taxonomic labelling is that humanity is exported beyond the confines of the genus *Homo*. There is, of course, no scientific definition

[18] Nationalism continues to play a role in many debates involving fossil ancestors, for example the argument between Native Americans and scientists over the ownership of Kennewick man (e.g. Thomas 2001), and elements of the dispute between Australian and Indonesia scientists over the Flores remains (e.g. Editorial, *Nature* 2006).

of 'human' in the way there is a biological definition for *Homo sapiens*, and yet within the Piltdown debate both scientists and journalists use the term repeatedly and unquestioningly. We, as modern *Homo sapiens*, are not alone within our genus; *heidelbergensis* and *neanderthalensis* (Heidelberg man and Neanderthal man respectively), as well as the recently discovered *flores*, are all prefaced by '*Homo*', as are several long extinct species[19]. As such, it is perhaps understandable that scientists might refer to these figures as human, taking the word to be interchangeable with the term *Homo*. When humanity begins to be applied by scientists to figures outside of *Homo*, as it is here, its definition - its distinction - becomes increasingly stretched.

However, this is not to say that there are not strategies available to mask such problems. In the Piltdown debate a prominent device for hiding the inconsistencies is the concept of a 'missing link'. Labeling Piltdown as a 'missing link', as it is in the first science journal coverage to appear (Haddon 1913:92), and as numerous media reports do, allows an escape from the human–animal dichotomy. A missing link is neither one nor the other, like Bauman's (1991) "third category"[20] it is the outcome of a disjuncture between our dichotomous constructions of nature, and the contiguous reality of it. A figure that is neither clearly human nor animal is either simply forced by will alone into one of the categories – as happens repeatedly in the case before us – or becomes something else entirely, in the case here a missing link.

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[19] There is no clear scientific consensus on the number of species within the genus *Homo* (it is hoped that this thesis helps show that no such agreement is possible) but some list as many as eight – *H. ergaster, H. erectus, H. habilis, H. heidelbergensis, H. neanderthalensis, H. rudolfensis, H. sapiens* (Wood & Collard 1999), plus newly discovered *H. floresiensis.*

[20] Bauman's "third category" refers to objects that refuse to comply with attempts at ordering the social and natural worlds. Bauman argues that the process of classification inevitably throws up cases – the "third category", that either straddle multiple classifications, or are not covered by any. Douglas' concept of the "purity rule" (1969) also covers such objects that transgress divisions of categorization.

However, for Bauman, these third categories are a threat to the status quo, as they reveal the dichotomy for the sham it is:

> They are waste, as they defy classification and explode the tidiness of the grid. They are the disallowed mixture of categories that must not mix. They earned their death-sentence by resisting separation (*ibid.* p15).

The missing link, in contrast, acts to protect the human–animal dichotomy. It allows a literal 'no-man's land' between the two frontlines, where a figure like Piltdown might safely shelter. In such a way the difficult questions – such as whether Piltdown was human, and on what grounds – can be avoided. It is telling of the failure of both scientists and journalists to really engage with the issue that they fail equally to recognize this as an escape route even when attempting to use it. Whilst they position Piltdown as a missing link, simultaneously he/she is being declared human, rendering the strategy useless.

7. Race and Species

Gieryn's (1983, 1999) model of boundary-work demonstrates how the boundaries of science are contextually dependent – where the aim is to protect itself from religion some element of it – say the scientific method – might be depicted as empirical and clinical; when demarcating it from engineering it might become almost philosophical in its pursuit of ideas. A similar process is visible at work in the drawing of human-animal boundaries in the Piltdown debate. Whereas the treatment of Piltdown expanded the limits of humanity, and so weakened its exclusivity, elsewhere in the same debate the division remains rigidly limited. Keith's quote regarding a "new genus of humanity" (*Guardian* 20.12.12:16), and Woodward's attribution of the human Piltdown to the genus *Eoanthropus*: both imply that humanity becomes a characteristic of all within the *Hominidae* family. This would mean that chimpanzees

(*Pan*), gorillas (*Gorilla*) and orangutans (*Pongo*) become eligible for human membership. Unsurprisingly though, despite repeated mention of chimps - and apes generically - in relation to the Piltdown jaw, there is not a single mention within the scientific or popular literature regarding the attribution of humanity to our contemporary relatives in the *Hominidae* family. Where Piltdown is waved through they are waved away. A crucial difference of course between contemporary primates on the one hand, and Piltdown and our fellow inhabitants of *Homo* on the other, is that the latter are all extinct and so their inclusion as human and/or *Homo* raises no practical issues regarding their treatment. Awarding contemporary primates the same classification would not only demand a reappraisal of our dealings with them, but also leave the binary nature–culture model entirely unsupportable and so would threaten, like the crack in the dam, to quickly bring down the entire edifice, as Cavalieri and Singer acknowledge when they discuss how awarding rights to apes could lead eventually to the extension of such protection to all animals (1996:304-311). It could carry then a considerable philosophical, as well as material (in terms of requiring ecological protection and ethical treatment) cost. The absence of any living Piltdown, Neanderthal or Flores means that their classification as human is easier to negotiate within existing boundary models (due to the lack of challenging empirical evidence) and poses no material threat to human economies.

There is a second process of boundary-working going on simultaneously. The process of stretching the definition of "human", of drawing its boundaries wider to encompass more landmarks, is used to distance white Europeans from indigenous groups – and non-whites generally - at the same time that it is allowing Piltdown to be brought closer to us. There are two elements to this. The first achieves its effect simply through the repeated comparison of Piltdown's primitive features with non-whites. In Woodward's (1913) paper, he states that Piltdown's intermediate brain size "equals that of some of the lowest skulls of the existing Australians" (p126).

Similar claims pepper the news coverage. On the subject of Piltdown's canines (only uncovered later), the *Illustrated London News* states that they would

have “an ape-like character met with in savage races to-day” (28.12.12:958). On the same page it offers up for comparison photos of three jaws, labeled “Kaffir”, “Chimpanzee” and “Indian” respectively. Below it, another picture compares three more, with “Chimpanzee” and “European” either side of a suggested intermediary: “Torres Strait Islander”. Also in this article, a metaphor regarding the Piltdown eoliths with the same message implicit in it: “they speak as surely as did the footprints found by Robinson Crusoe.” The footprints in question were of course those of the black savage, who Robinson called “Man Friday”; in this way another implicit link is made between Piltdown and non-whites. Continuing, of the brain, the *Express* says: “as large as that of the lowest type of savage – the Australian aboriginal or the Tasmanians” (23.12.12:1) and similarly, from the *Times* “the skull of *Eoanthropus*, though typically human, was as low in brain capacity as that of the lowest existing savages” (17.09.13:10). The *Guardian* quotes Keith as claiming “in size of brain it is human – at least equal to the brains of many individuals in living races” (20.12.12:16). On the subject of whether Piltdown could talk, the *Times* asserts

> In the jaws of Europeans there were distinct tubercles… Among the lower races, and particularly those with imperfect speech, the tubercle was practically absent (16.9.13:6).

The second element is more subtle, but just as effective. Throughout the debate there is a continual conflation of the terms “species” and “race” so that they become indistinguishable. Stocking”s (1994) work shows how “race” as a concept in the early 20th century was often blurred with others such as “nation”. The effect achieved in the Piltdown case is that species becomes weakened as a divider and race becomes strengthened. The *Express* describes Piltdown as “a race of men who could not talk” (20.12.12:1) and mentions “the monkey race” (23.12.12:1). From the *Illustrated London News* we have this theme rendered explicit in a suggestion that

Piltdown is no more different from modern *Homo sapiens* than we are from each other:

> these fragments of man from the Sussex gravel tell us that already at this early period the human race had begun to split up into different peoples (28.12.12:958).

The *Guardian* makes a similar link, stating;

> in Europe we have (in order of antiquity) the Chellean, Acheulean, Mousterian, Aurignacian, Solatrean, and Magdalenian classifications, based mainly on handiwork : and the Heidelberg, Gibraltar, Neanderthal, Grimaldi, Galley Hill, Krapina, Cro Magnon, and other categories based on an anatomical study of skeletons and skulls. We have by no means exhausted the bases of classification even now : there remain, for instance, the straight-haired, wavy-haired and curly-haired peoples, the peoples with projecting muzzles, the peoples with their heads set on like hammer-heads and many others (19.12.12:16).

Reconciling the formal Aristotelian classification of Piltdown with the more graduated, prototypic classifications used by agents during the episode to understand entities such as the 'savage' requires an expanding of the category 'human'. This creates space, it stretches humanity, and so allows a distance to be opened up between white Europeans and other *Homo sapiens*. This ape jaw and human skull has traveled from the "doubtful borderland between recognisable man and indubitable ape" (*Guardian* 19.12.12:16) to become a human no more remote from white Europeans than an Aborigine, and certainly residing much closer than the

great apes despite its apparently equivalent taxonomic status. It is a journey which shows how negotiations of the human-animal boundary can influence our treatment not just of animals, but of other humans as well. An ape jaw with a human skull passed through the boundary to become the earliest Englishman, on the basis that it (apparently) died where – millions of years later – the English nation was formed, whilst many contemporary humans were pushed in the other direction, condemned for lacking white skin and European language.

Remarkably, the binary conception of humans and animals emerges from this boundary exercise seemingly unscathed. Despite moving the boundary backwards and forwards, reinforcing it in places and pulling it down in others, no one in the Piltdown debate takes a moment to question its presence, or its implications, in the first place. The question of on what foundations this divider is being built is never asked. Much like the scientist who boundary-works their territory in public discourses whilst remaining wedded to the idea of a clear demarcation between science and other forms of knowledge (Gilbert and Mulkay 1984), the discourses surrounding Piltdown work the boundary without acknowledging the ambiguities they raise. The human-animal binary, which remains formally unquestioned, is implicitly supplanted by a "trinary" of white European/Piltdown & non-white "Savage"/Animal. It is into this space that I suggest the 'part human' mouse that Birke & Michael (1998) discuss in the quote given above is being placed. I will discuss this concept further in the forthcoming chapters.

8. Conclusion

The response to Piltdown Man's hybridity was, in many respects, rather blunt and brutal: to force the figure into the box marked 'human', regardless of certain features' protestations. Driving this action in part was a desire to ensure maximum public interest in the find, but more obvious was a nationalistic wish that Piltdown provide England with a glorious ancient history. Behind this scene however was a far more complex, subtle process of opening up space, of enlarging the box so that

Piltdown might fit. The careful positioning of Piltdown relative to prototypically conceived non-white 'savages' and extant nonhuman primates allowed this to happen, even whilst it was being fixed as human. The decision of scientists to classifying the find outside the genus *Homo* was a recognition of Piltdown's nonfit, yet in continuing to label the find human they called into question the boundaries of both categories, an outcome I shall return to in chapter seven.

In this chapter I have sought to shift Gieryn's boundary-work model from an ontology of cultural boundaries to an ontology of natural boundaries. Of course 'nature' itself, as this paper has sought to show, is a cultural artefact. Transplanting Gieryn's model in this way is useful not only because of the parallels between the science-culture and human-animal boundaries outlined in my introduction above, but also as it serves as a reminder of the strong relationship between the categorization of the social and natural worlds. As Douglas' (1969) work on the "rules of purity" demonstrates, social divisions are often justified via reference to the natural world, and the manipulation of the natural world (the removal of dirt from the home for example) is used to add coherence to the social world. At Piltdown we see this process working in both directions similarly – Piltdown as natural empirical fact is used to leverage "savages" away from white Europeans' humanity, whilst social relations with other nations act as a spur for British scientists to position Piltdown as human.

The boundary-work model also encourages one to consider the role of agents in boundary construction, and their strategic aims. The uneasy relationship that exists between a contiguous nature, our compartmentalized formal understandings of it, and the social world often results in a disjuncture. Where this disjuncture exists only those with considerable epistemic authority have the strength to force a fit. This power to reward or deny "humanity," and the status that came with it, to groups and individuals was wielded by the scientists and journalists in the Piltdown debate. Just as the drawing of science's jurisdictional boundaries are an outcome of the context in which they are drawn, so too is the human-animal division: Piltdown's

humanity is located not in its physical remains, but in its cultural standing. This boundary drawing is done not out of a concern for more accurately reflecting nature and our relations to it, but rather to support racist ideas of white superiority, and nationalistic concerns that Piltdown itself should provide England with an ancient history to match those of imperial rivals France and Germany.

Finally, we are reminded that at the close of this testing episode the binary model of human-animal relations remains in place. As with the science-culture boundary, the binary model of human-animal is exceedingly resilient, even when it is mobilized in contextually dependent discourses which implicitly rely on a more complex configuration, such as the trinary one present here. When considering why this is, it must be remembered that altering our models of the boundary would come with considerable practical and philosophical costs, not least because it would threaten the dominance of humans which is implicit in the binary model as it stands. Additionally, an apparent lack of awareness during the Piltdown episode - on the part of scientists and journalists alike - of the role cultural construction plays in concepts such as 'human' and 'nature' allowed the mutation of the binary model into more complex configurations to be done so in an unspoken manner. In this way, "Kaffirs," "Bushmen," "Aborigines," "Indians," "Torres Strait Islanders," "Tasmanians"… all are marginalized, pushed closer to the borderland, whilst Piltdown – half ape, but fully English – is welcomed in with open arms.

Chapter 5: Bringing Bones to Life: Why Science Made Piltdown Man Human

1. Introduction

In chapter four I sought to question why Piltdown Man came to be declared human by scientists and journalists alike, given its contradictory characteristics, but the focus of this chapter is on what particular form Piltdown's humanity took. The figure's humanity did not simply consist of the labelling of it as 'man' or 'human', but also of narratives that, if you will, put flesh on the bones of its humanness. Piltdown was brought to life not by cranial measurements and jaw x-rays, but by the stories told, and images drawn, of how this figure lived out its existence.

Where though did this work take place, and how was it evidenced? When reconstructing Piltdown's life for the public, why was any particular image used? In asking these questions I hope to find answers to questions about the relationship between the knowledge claims of science and of popular culture when dealing with such contested figures as Piltdown; to what degree are they independent of one another, and where there is dependence in what direction does it flow? To what degree do these claims originate from within science, and how much influence do ideas external to science have? The boundaries in question here are then those drawn between the categories 'science', 'popular science', and 'popular culture'.

The relationship between evidence and conclusion can be tenuous in a science such as palaeoanthropology, which must operate with fragmentary data that is dwarfed by the scales of time and space for which it speaks. Here the greatest ingenuity is required to extract the maximum information from the most meagre of evidence. It is difficult enough to determine a fossil's potential humanity from such limited material, but the focus of this chapter - on the realisation in some form of narrative of this posited humanity - requires an even greater leap from evidence to conclusion.

> [Fossils] constitute primary evidence for the history of life, but each fossil is an infinitesimal dot, lost in a fathomless sea of time, whose relationship with other fossils and organisms living in the present day is obscure (Gee 2000:1-2).

Gee argues that the fossil evidence is so limited, and the time scales so vast, that no attempt should be made to create narratives around these figures, as to do so would be to disregard the empirical requirements of science.

Using Hilgartner's (1990) work on popular science, I aim to demonstrate that whilst such narratives were constructed around Piltdown, they were presented as 'popularised' science within the mass media. In this way scientists' were able to sidestep the evidential requirements of 'pure' science[21] within the science media, whilst their ideas about how Piltdown might have lived were supported by the authority of science. They could then engage the public with the more relevant (to non-experts) questions raised by the discovery with all the status conferred by the label 'scientist', but without any of the obligations imposed by the science media, such as peer review, referencing, and empirical theorising. When scientists did engage the public via popular science, the claims they made may have been labelled 'scientific', but relied for their content upon the same 'folk'[22] knowledge that comprises popular culture, and that the public themselves used. By analysing the

[21] 'Pure' science will henceforth be deployed as a means of distinguishing from popularised science. This label is only applied reflexively however, as this work will aim to demonstrate how difficult it is to maintain any clear distinction between the two.

[22] 'Folk' knowledge is used here to refer to that knowledge which might be more frequently referred to as 'common sense', and what Berger and Luckmann refer to more analytically as 'the reality *par excellence*… the reality of everyday life' (1991:35).

discourses around Piltdown I hope to show that the traditional binary understanding of pure science and popular culture masks what is a far more complicated picture, in which the relationship between evidence, scientist and public is far from clear.

I will attempt to highlight this by comparing the narration of Piltdown's humanness in the science and popular media, and considering what drove the production of the images of how this figure lived. The argument will be made that the pure-popular distinction fails to reflect substantive differences in the texts analysed. Style, content and authorship all failed to clearly distinguish one from the other, and the label 'human' was used in both fora. For scientists, 'human' was a vital resource in engaging the public. The only stable distinction was that this label was only given any meaning within the popular media, where narratives allowed an exploration of the notions underpinning the claim. This fact is used to critique the pure/popular model's assumption that useful knowledge is solely the product of science. I will then support this further by looking at wider examples of how missing link figures have been imagined, paying particular attention to the 'Man the Hunter' repertoire which was palaeoanthropology's paradigm account of human development during the middle of the 20th century. I will use these examples to propose that the boundaries between scientific and non-scientific conceptions of missing link figures are far less clear-cut than the pure-popular model would suggest, and that popular science, like the missing link, acts as a trinary space, protecting the binary in which it stands.

2. The Pure-Popular Model

Hilgartner's paper challenges the 'culturally dominant view of the popularization of science… rooted in the idealized notion of pure, genuine scientific knowledge against which popularised knowledge is contrasted' (1990:519). He criticises both the conceptual grounds on which this distinction rests, and the simplicity of the model itself. The model's ongoing usage is attributed to the fact that the vague distinction between pure and popularised science protects the epistemic authority of scientists,

as where they engage with the public they only do so through 'distorted' or 'simplified' popular discourses. The vagueness of the distinction allows scientists to 'boundary-work' the division dependent on their particular needs in any given context (Gieryn 1983, 1999). By engaging with the public via popular science, scientists can ensure that where their own knowledge claims meet those of wider culture, it is only on a playing surface that favours themselves.

Popular science is then a buffer zone protecting science from external challenges; the public cannot engage with, or challenge, science directly, only a supposedly inferior version of it. However, at the same time that it acts to protect pure science, popular science also allows for a dialogue between scientists and the public, even if it is a relationship skewed towards the former. In this sense popular science acts as a 'boundary infrastructure' between the two (Star and Griesemer 2000:131), which is to say it is a network of objects whose meaning differs between the different groups (i.e. scientists, journalists, lay-persons) who conceptualise them. As the meeting ground for these disparate groups, it forms the locus of this chapter.

Although there is no precise distinction between pure and popular science (indeed, this ambiguity allows for boundary-working), generally speaking the distinction follows the medium in which claims are published: professional science media (i.e. science journals) contains pure science, mass media contains popular science. Using the Piltdown episode I will demonstrate that such a distinction largely fails to reflect any substantive differences in the texts produced around this discovery. The distinction in practice allowed scientists to discuss non-scientific concepts (e.g 'human' rather than '*Homo sapiens'*) with the authority of science but without the evidential requirements. Rather than reinforce the dichotomy I seek to critique by utilising agents' categorisations of 'pure science'/'popular culture', in the following analysis I will refer to the medium in which any claim was published (e.g. science/mass media), whilst showing how agents worked the boundaries of science around this distinction.

It should be stated that my aim here is not to prove the existence of the binary model of pure/popular science in the minds of the agents involved, and that for evidence of this I am content to rely on work by of others (e.g. Whitley (1985), Mellor (2003)). However, there is some evidence that the idea of popular science being an inferior distortion was present in the minds of scientists during the Piltdown debate. Spencer's (1990) collection of correspondences between the scientists involved in the Piltdown discovery reveals a letter from George Barrow (Geological Survey of England) to A.S. Woodward in which he states 'I congratulate you on the delivery of your paper which was so totally free from the newspaper style of the "armchair"' (p.43), a critical reference to Sir Ray Lankester's[23] prominent 'Science From An Easy Chair' column in the Daily Telegraph. Also, on the considerable time it took to become a member of the Royal Society, prominent Piltdown scientist Arthur Keith states in his autobiography 'Perhaps I had published too many lectures of a semi-popular sort to be counted a serious man of science by the Society' (1950:327), implying that such work was frowned upon amongst his colleges.

To evidence the authority which scientists utilised during the debate one only has to consider the fact that throughout the entire newspaper coverage the only visible agents (other than Piltdown itself) were scientists. The sole exception is the two occasions when journalists appeared as newspaper 'representative[s]' 'in conversation with' (*Express* 23.12.12:1) or 'in discussion with' (*Guardian* 23.11.12:11) scientists. Furthermore, on the debate held between scientists on the relative merits of Woodward and Keith's rival reconstructions of Piltdown Man[24], the *Guardian*

[23] Sir Ray Lankester was a zoologist and former head of the Natural History Museum (1898-1907).

[24] Woodward and Keith created differing reconstructions of the Piltdown figure – the former's had a skull capacity of just over 1000 c.c., intermediate between modern humans and modern non-human primates, and was given the taxonomic label '*Eoanthropus*' ('dawn man'). Keith's reconstruction gave a capacity of 1500 c.c., slightly larger than modern humans, and was placed in the species *'Homo'* (as modern humans are). The latter's reconstruction only appeared some months after the Dawson-

states ‘those of us who, with less knowledge, may have felt ready to go to the stake for *homo* or *eoanthropus* [sic], as the case may be, had perhaps better keep our opinions to ourselves’ (12.8.13:6).

In Britain both pure and popular science was quick to declare the Piltdown figure human. What would this label mean for a figure such as Piltdown though, who may have had a considerably smaller brain than ourselves, and may have lacked attributes that many would consider key to humanness, such as language[25]? Given the very limited evidence available, it is perhaps unsurprising that scientists during the episode chose not to engage explicitly with such questions within the pure science realm of journals and conferences. I use the word ‘explicitly’ here because of course scientists did engage with these issues the moment they declared Piltdown to be human, it is just that they did not attempt to justify the claim within the science media. Instead, there Piltdown’s humanity remained unproblematised and (largely) unjustified. In the original Dawson & Woodward (1913) paper both authors label the remains ‘human’, even whilst acknowledging the ape-like appearance of the jaw. No justification is given beyond the appearance of the fragmented skull.

Scientists did, however, deal with some of the issues raised in the mass media, via narratives about how Piltdown might have lived. This suggests that they were keen to promote themselves and the science to the public, and saw Piltdown’s declared humanity as an opportunity for engaging wider interest, or that they themselves, as scientists and fellow humans, were intrigued by the issue and saw the

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Woodward paper (and the first mass media coverage) by which time Piltdown had already been declared human, so cannot be said to have played a part in the awarding of humanity to Piltdown.

[25] No clear consensus existed as to whether Piltdown was capable of developed speech, but the considerable doubt of many involved was not enough to sway them from labelling Piltdown ‘human’. GE Smith (a scientist and Woodward’s most vocal supporter) argued that it was capable of at least some form of speech (1913). However, both Keith (1914) and Woodward (in conversation with the *Express* 23.12.12:1) believed it did not have such capabilities.

mass media as a creative space where they could develop their ideas free of the constraints of the science media (Cassidy 2006, Felt 2000). Most likely both factors played a part.

3. Testing the Distinction

3.1 Examples of Clear Difference

The narration of Piltdown's existence took place wholly within the mass media. Dawson and Woodward's original paper avoids the subject entirely, discussing instead the terrain in which the bones were discovered, the flints and animal remains found in situ, and the anatomical features of the fossils. In Woodward's analysis of the find we have then what we might consider the stereotypical features of a scientific text: impersonal, empirically focused, full of technical language and highly detailed. For example;

> The horizontal portion, or body of the mandibular ramus, measures only about 27 mm. in depth behind, but must have become a little deeper forwards. External to the first and second molars there is the usual prominent oblique ledge (b.) for one of the origins of the buccinator muscle; but this is the only feature visible on the outer face, a large flake of bone behind the position of the mental foremen having been lost when the anterior part was broken (Dawson and Woodward 1913:131).

This style is the 'literary technology' (Shapin and Schaffer 1989) found in Boyle's hugely influential experimental programme of the 17th century. In maximising circumstantial detail whilst minimising the presence of the author, this approach was central to Boyle's task of creating reliable 'matters of fact', and a development key to the creation of what we know today as science.

As detailed in the previous section, Dawson and Woodward's paper does feature some discussion of Piltdown's position relative to 'man' and 'ape', concluding that Piltdown was, phylogenetically, close enough to modern *Homo sapiens* to be labelled human. However, their awareness of the figure's chimeric qualities is revealed by Woodward's decision to create an new taxonomic species group within which to place Piltdown: '*Eoanthropus*' . This left it outside our own species *Homo*, and yet *Eoanthropus*' literal translation – 'dawn man' – leaves little doubt to how the author's saw this creature. The authors avoid any discussion of what such humanness might have entailed though – there is no consideration of how this creature might have lived, or what capabilities made it human (aside from the fact that it had a *relatively* large[26] skull), and how these related to our own capabilities as modern humans.

The text of some of the newspaper coverage is very different. Even though it was published a month before the official announcement, and presumably had very few concrete details to go on, the Guardian's first coverage claims

> It was the age when the cave bear, the woolly-haired rhinoceros, and the mammoth roamed over Europe, and man maintained a strenuous struggle for existence… Palaeolithic man was a river-draft hunter, and the Sussex skull was found in an old river bed. It is open to surmise that he met with his death while following his prey (21.11.12:8).

[26] Woodward's reconstruction of Piltdown Man had a large skull relative to non-human primates. It was considerably smaller than a modern human skull however.

W.P. Pycraft[27], writing in the Illustrated London News, considers how Piltdown might have lived in more detail:

> now a word or two as to his probable appearance and mode of life, and the creatures which he chased, and was occasionally, in turn, chased by. As to his personal appearance one would not like to dogmatise, but, with the help of Mr. Forestier, I have been enabled to make what is probably a near approximation to the truth. He was a man of low stature, very muscular, and had not yet attained that graceful poise of the body which is so characteristic of the human race to-day. But he was by no means lacking in intelligence. Living in a genial climate amid a luxurious vegetation and surrounded by an abundance of game, he may be said to have led a life of comparative ease. Of clothing he had no need; nor was there any reason to bother much about housing accommodation; though, for safety's sake, he may have been forced to devise some kind of shelter by night. Elephants and rhinoceros of species long since extinct roamed in herds all round him. These and the hippopotamus no doubt he killed for food, and, besides, he must have hunted a species of horse long since extinct, while the lion, bear, and sabre-tooth tiger afforded him plenty of opportunities for hairbreadth escapes. He had probably inherited the use of fire from his forbears, and this useful ally served to harden the ends of his wooden spears, and perhaps to cook his food (28.12.12:958).

The *Express*, suggesting that the find was a female (see below for discussion), gives a similar account of the possible circumstances in which Piltdown lived:

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[27] William Plane Pycraft was a zoologist and author of natural history books. He also worked as an assistant to Lankester both before and during his time at the Natural History Museum.

Woman Who Could Not Talk. Ancestress of the English Race Today. “Missing Link”.

A race of men who could not talk, who roamed about England before even the first of the several known glacial ages, who lived on roots and shellfish and wild fruit, and dodged the mastodon, the hippopotamus and the sabre-toothed tiger – such is the astonishing link in the story of the origin of man which leading scientist believe to have been discovered in the “Sussex skull” (20.12.12:1).

Also, from the same paper three days later:

Through the dark forests of our land there roamed, many hundreds of thousands of years ago, a strange, hairy ape-like creature, a female member of a curious race, from whom all other animals shrank. She was a new type, possessing a new cunning, and an amazing power over the other denizens of the forest, for she could do what they could not – use implements, and clothe herself in skins…

This ancestress of the human race in England had some resemblance to a chimpanzee, walking with a shuffling gait. Her body was probably covered with hair. She could not speak, but as she ambled along she uttered strange noises.

When she was hungry she dug roots and vegetables from the ground and devoured them just as they were. Living among the rocks, the only protection she possessed from the cold was a skin, rudely fashioned in the form of a cloak. When she hunted she used no dogs to help here track her prey; she

and her companions followed their quarry and killed it with a stone spear or hatchet (23.12.12:1).

The claims made here clearly go beyond the scope of those made in Dawson and Woodward's paper. Although the mass media coverage is as neglectful of justifying Piltdown's humanity as the science media is, it does at least engage with its humanness to the degree that it considers how this figure might have lived. Utilised as an unjustified, unexplicated category, as it is in the science media, humanity is an essentially meaningless label. Whatever the failings of the mass media imaginings of Piltdown's humanity, they can at least be seen as an attempt to give meaning to the word. Ranging from the fanciful ('he may be said to have led a life of comparative ease') to the farcical ('a strange [creature]… from whom all other animals shrank'), these claims have at best tenuous relations to the evidence uncovered, but give the human status of this creature meaning, by investing it with a narrative to which we might relate.

3.2 Between the Extremes

The differences between the content of Dawson and Woodward's paper and the mass media coverage reproduced above are very clear, but it is not the aim of this chapter to argue that there is no difference between the science that appears in science media and that which appears in mass media. As noted above, the empirical requirements for popularised science are less, there is no formalised system of referencing, and readers are not presumed to have an expertise of the area.

The focus instead is to show how the binary model of pure/popular science is inadequate for modelling the science-culture relationship, for a number of reasons. The first of these is of a practical nature - that it is impossible to clearly demarcate pure science from popular science in any substantive terms. The above examples show that clear differences of content and style are present at the extremes, but the

cases inbetween are far less clear cut. A paper delivered by Keith at the Winter Session in Medicine, 1913 (reproduced in the *Lancet* (1913)), in which he discusses Piltdown in the context of understanding the 'origin of modern races' (p1050), helps demonstrate this. Under the heading 'The World's Carpet of Humanity', Keith unveils a metaphor that appears closer to poetry than pure science. Returning to science's 'literary technology' for a moment, what is so striking about the following is the florid language used, a style that Boyle himself dismissed as equivalent to painting 'the eye-glass of a telescope' (Shapin and Schaffer 1989:66).

> As the western seaboard of Europe passes by and our own country comes in sight we shall suppose we are near enough to perceive that the human carpet along our Western coast is not quite of the same texture as that which covers the lands sloping down to the North Sea. When Europe itself comes under our gaze the pattern of the human carpet begins to change, and by the time the Far East has risen under the morning sun we shall admit, I think, that the change has become decided. A pall of smoke, the wreckage of a battle-field, the demarcation of new frontiers reveal to us one of the processes at work in modifying the pattern of our carpet. When we turn our eyes southwards and view Africa across the Mediterranean there is at first no marked degree of change – not until the great forest region beyond the Sahara comes in sight. A glance from Northern Europe to Central Africa reveals the extremes in the earth's covering of humanity – not the extremes of material – merely of pattern or design; European and African seem to be products of the same loom (Keith 1913:1050).

In addition, although I have reproduced a sample of Woodward's section of the paper authored by Dawson and himself as a classic example of what might be considered a pure science text, some of the text of Dawson's section - primarily the

opening paragraphs – features a first person narrative that admits a far greater role to the author than one might expect from such material:

> Several years ago I was walking along a farm-road close to Piltdown Common, Fletching (Sussex), when I noticed that the road had been mended with some peculiar brown flints not usual in the district. On enquiry I was astonished to learn that they were dug from a gravel bed on the farm, and shortly afterwards I visited the place, where two labourers were at work digging the gravel for small repairs to the roads. As this excavation was situated about 4 miles north of the limit where the occurrence of flints overlying the Wealden strata is recorded, I was much interested, and made a close examination of the bed. I asked the workmen if they had found bones or other fossils there. As they did not appear to have noticed anything of the sort, I urged them to preserve anything that they might find (Dawson & Woodward 1913:117).

In comparison, sections of the coverage from the *Times*, the *Guardian* and the *Illustrated London News* match any of the science media coverage for technical content and language. From the *Times*-

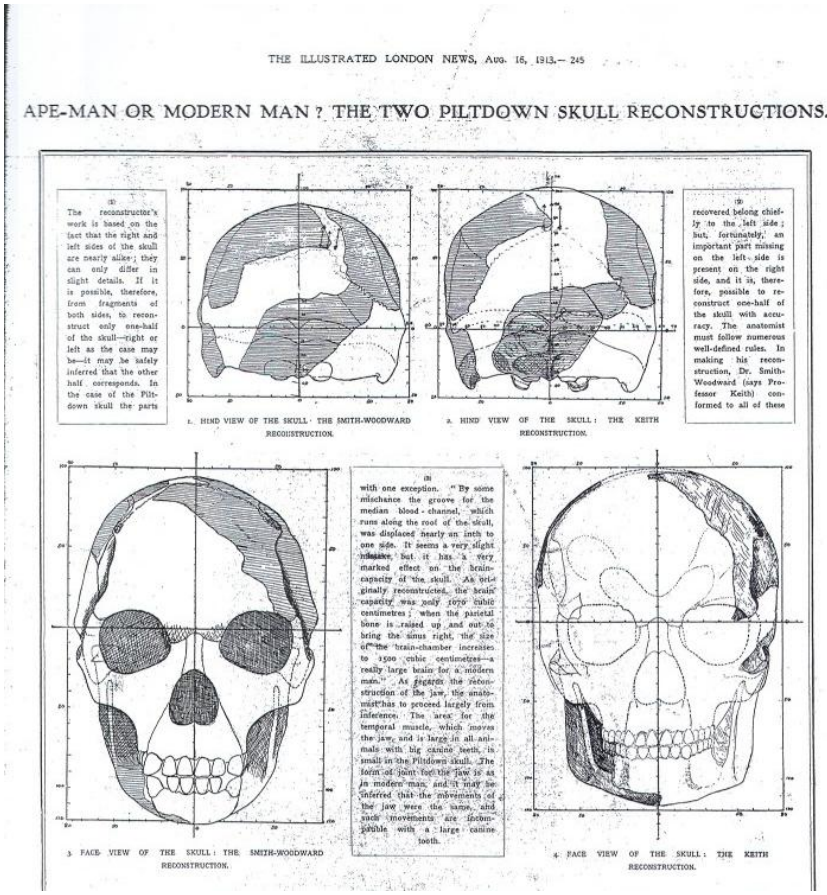
> Both behind and in front he [Dr. Smith Woodward] correctly identified the internal groove for the upper longitudinal blood-sinus which marked the middle line of the roof of the skull; and the reason why his adjustment of the occiput was not exact at first was that on the hinder part of the parietal region of the skull-roof he noticed a longitudinal ridge, which he supposed to be truly median, while the extraordinarily unsymmetrical development of the brain seemed to have pushed the longitudinal sinus at that part slightly out of its normal place. The change, however, only opened the top part of the skull behind to an extent of three-quarters of an inch, and there were

> compensations elsewhere through the necessary readjustments, so the total brain capacity remained nearly the same as that he originally stated (17.09.13:10).

Similarly, from the *Guardian*:

> He [Woodward] said that the skull (which unfortunately lacks the bone of the face) exhibits all the essential features of the genus *Homo*, with a brain capacity of not less than 1,070cc., but possibly a little more. It measures about 190mm. in length from the glabella to the inion by 150mm. in width at the widest part of the parietal region, and the bones are remarkably thick, the average thickness of the frontals and parietals being 10 mm. while an exceptional thickness of 12 mm. is reached at one corner (19.12.12:9).

The *Illustrated London News* features detailed technical drawings and photographs of Woodward and Keith's rival skull reconstructions (16.08.13:245):



THE ILLUSTRATED LONDON NEWS, Aug. 16, 1913.—245

APE-MAN OR MODERN MAN? THE TWO PILTDOWN SKULL RECONSTRUCTIONS.

(1) The reconstructor's work is based on the fact that the right and left sides of the skull are nearly alike; they can only differ in slight details. If it is possible, therefore, from fragments of both sides, to reconstruct only one-half of the skull—right or left as the case may be—it may be safely inferred that the other half corresponds. In the case of the Piltdown skull the parts

1. HIND VIEW OF THE SKULL: THE SMITH-WOODWARD RECONSTRUCTION.

2. HIND VIEW OF THE SKULL: THE KEITH RECONSTRUCTION.

(2) recovered belong chiefly to the left side; but, fortunately, an important part missing on the left side is present on the right side, and it is, therefore, possible to reconstruct one-half of the skull with accuracy. The anatomist must follow numerous well-defined rules. In making his reconstruction, Dr. Smith-Woodward (says Professor Keith) conformed to all of these

(3) with one exception. "By some mischance the groove for the median blood-channel, which runs along the roof of the skull, was displaced nearly an inch to one side. It seems a very slight mistake, but it has a very marked effect on the brain-capacity of the skull. As originally reconstructed, the brain capacity was only 1070 cubic centimetres; when the parietal bone is raised up and out to bring the sinus right, the size of the brain-chamber increases to 1500 cubic centimetres—a really large brain for a modern man." As regards the reconstruction of the jaw, the anatomist has to proceed largely from inference. The area for the temporal muscle, which moves the jaw, and is large in all animals with big canine teeth, is small in the Piltdown skull. The form of joint for the jaw is as in modern man, and it may be inferred that the movements of the jaw were the same, and such movements are impossible with a large canine tooth.

3. FACE VIEW OF THE SKULL: THE SMITH-WOODWARD RECONSTRUCTION.

4. FACE VIEW OF THE SKULL: THE KEITH RECONSTRUCTION.

Attempting to draw a clear separation of pure and popular science on grounds of the medium in which claims are published is then erroneous as it does not reflect consistent substantive differences in the texts. Additionally, there is no clear distinction in regards to authorship. Of the thirty-nine items of mass media coverage that featured in the study, eleven were letters written by scientists. Of the remaining twenty-eight articles, five were written by scientists, and two of the remainder were interviews with scientists. Of the other twenty-one articles, seven were merely news 'snippets' of two hundred words or less. Much of the mass media coverage came, then, directly from the pens or indirectly from the mouths of scientists. Even what is arguably the most populist piece to feature in the study, the *Express* (23.12.12:1) article quoted above, is attributed to Woodward despite being written by a journalist - 'This was the picture of the possessor of the Sussex skull,

drawn on Saturday by Dr. Smith Woodward, of the South Kensington Natural History Museum, in conversation with an “Express” representative’ it states.

There is then no clear, stable difference between the style of the claims presented in science media and conferences and those made in the mass media. In the Piltdown case the binary model masks the fact that there is often just as much variety of style within the newspapers and journals as there is between them. Many of the more outlandish claims present in the narratives of Piltdown’s life come from scientists rather than journalists, so authorship is also an unsuitable dividing principle. Regarding the content of the claims made, I have showed that some of the mass media coverage is just as richly detailed and technical as the most dense science coverage.

4. Science as Producer, Science as Consumer

The one stable difference that does remain then in the Piltdown episode between the science media and mass media coverage is the fact that in the former no narratives are attempted regarding Piltdown’s humanity. It is my argument then that only in the public realm was any attempt made to invest Piltdown’s humanness with any meaning.

This leads us to a further element of the binary model that I wish to take issue with, which concerns the conceptual implications of it. Such a model assumes that science is the sole source of knowledge, and that once produced in the pure science realm, such knowledge flows in a one-way manner into the popular realm where it is consumed by the general public. The only influence allowed by non-science knowledge in the model is a negative, distorting one.

Such a model may be more applicable to some branches of science than others. In palaeoanthropology I believe such an assumption can be highly problematic. The central theme of the Piltdown debate was essentially ‘what is humanness?’, or more precisely ‘what is it that makes this creature human?’. Though

it may have been more explicitly so in the mass media, the case was the same in the science literature, except that much of the debate was conducted around proxies of humanness, such as brain size and speech capabilities.

The awarding of sole epistemic authority to science is problematic in both its assumptions and its outcomes. The binary model's assumption of science's primacy in tackling the question of humanness fails to recognise the difficulties that science faces in engaging with such a messy, contested category. Whilst science offers the possibility of helping us understand the characteristics of humans, the degrees to which these characteristics are unique, and the evolutionary processes that drove their development, the scientifically-testable question of 'what is a *Homo sapiens*?' can very easily become 'what is it *to be* a human?'. Science's primary justification for its epistemic authority – its empiricism – is of limited use in tackling the latter, and this is before we take the meagre evidence that palaeoanthropology relies upon into account. Science may help us understand the qualities and capabilities of humans, but this does not tell us about the experience of being human[28]. Such a question is resolutely a subjective, emotive issue, one that is inevitably personal to all humans. As such it is inevitably a culturally constructed concept, which can be informed, but not determined, by science. In the case before us, the distinction between the two questions can be seen in the introduction to this chapter: cranial measurements and jaw x-rays on the one hand, images of a fearless, spear-welding warrior on the other. The question 'what makes Piltdown human?' quickly merged with the question 'what is *my* understanding of *being* human?', for scientists and journalists alike.

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[28] Recognising the distinction between the qualities and capabilities of humans, and the experience of being human remains important today, in the light of claims such as that made on a recent UK television show entitled 'What Makes Us Human?'. Presented by Dr Armand Leroi of Imperial College London, the answer provided by the show was merely to identify the location of some genes believed to be important in the evolution of humans.

It would be easy to separate these two questions into pure and popular science, however as I shall show the picture is more complicated than that, and scientists engaged with both questions equally, despite their formal expertise only applying to the former. Collins and Evans' (2002) recent call for a 'third wave of science studies: studies of expertise and experience', has as an aim the wish to cultivate a recognition of the validity not just of "contributory expertise" – being those who study a field as a profession (usually scientists), but also of "interactional expertise" - that is the expertise of those that interact directly with a field. To borrow an analogy from the authors' themselves, this is the distinction between art critics, and the artists themselves (p.244). Whilst only the former might be expected to have to formal training in the field, the latter's personal experience gives them too a knowledge worthy of recognition.

Applying this to Piltdown, we can say that the scientists involved had contributory expertise in respect of the first question, and interactional expertise in respect of the second. The problem is that every human – scientist, journalist or layperson – might well be said to have interactional expertise of the question 'what is my understanding of being human?. It was scientists who monopolised the debate however, by applying their (deserved) expertise in regard to answering 'what is a *Homo sapiens*?', to this second question of which they had no greater expertise than the metaphorical 'man on the street'.

A consideration of the hunter images present in the media narrations of Piltdown's life given above can demonstrate further that when dealing with issues that carry such far-ranging cultural resonances, science does not operate in a vacuum, upstream of wider culture, but instead operates right in the thick of the contested boundary zones that we are considering. The river metaphor assumed in Gieryn's (1999) model of boundary-work – of upstream scientific knowledge production flowing downstream to cultural consumption – is better replaced here by a lake, its banks populated by the multitude of organisations and individuals – natural scientists, social scientists, philosophers, theists, laypersons etcetera - with a

stake in the concept of humanness, drawing from, and adding to, the body of culture. As Whitley (1985) says, 'The closer scientific fields are to everyday discourse and concerns… the stronger the feedback from popularisation to knowledge production is likely to be' (p. 8). You cannot get much closer to everyday concerns than the subject of humanness. I will now use a discussion of the hunter imagining to support this picture.

5. Narrating Humanness

5.1 The Mighty Hunter

The media excerpts given above play on the heroic images - 'possessing a new cunning'; '[who] dodged the mastodon'; 'hairbreadth escapes'; 'met with his death while following his prey' - common in 'Man the Hunter' discourses. The term itself only came to prominence after the Piltdown episode, however the themes it plays on were already common in popular culture, as these quotes attest, and was present in scientific literature by the late 1800s (see below). Man the Hunter was anthropology's paradigm account of early human development during the middle of the 20th century. It placed male aggression and technological mastery as the driving forces behind human development. Although the *Express*'s 'New Woman' angle on Piltdown subverts the patriarchal element of the Man the Hunter template to some extent, 'she' is still identified as an individual from 'a race of men', and the other themes of Man the Hunter discourses (hunting large beasts; constant dangers; utilisation of technology) are present. This subversion highlights the contextual nature of such imaginings (see below).

It should be noted that the existence of hunting in early human behaviour is not unique to the Man the Hunter thesis, what is unique however is the suggestion that it was the hunting adaptation that was crucial in making us human. In the words of anthropologist Sherwood Washburn, one of the most prominent advocates of the theory:

> In a very real sense our intellect, interests, emotions, and basic social life – all are evolutionary products of the success of the hunting adaptation (Washburn & Lancaster 1968:293).

Although the image was already present in science in the late 19th century (see below), Haraway (1989) argues that Man the Hunter's elevation to scientific orthodoxy in the 1950s was a product of Washburn's time in the aftermath of World War II, at the height of the Cold War. Haraway views Man the Hunter as a prototype of 'universal man', the subject of the UN's 1948 Universal Declaration of Human Rights. Universal man was a replacement for the original subject 'international man', since *international* man invoked the potentially thorny issue of human rights requiring citizenship of a nation state. *Universal* man was felt to be 'more easily abstracted from the complications of history' (p.198). Archaic figures like Man the Hunter too offer a chance to escape from the complications of history, by allowing history to be reconfigured according to personal taste. For Haraway, Man the Hunter was the result of Western Cold-War scientists moulding these proto-humans into something like their own image:

> What it meant to be universal man and to be human generically turns out to look very much like what it meant to be western scientific men, especially in the United States, in the 1950s… Man the Hunter embodied a socially positioned code for deciphering what it meant to be human – in the western sense of unmarked, universal, species being - after World War II (pp.186-187).

Pre-historical figures like Piltdown are receptive to such abstractions, and so are open to being shaped by cultural discourses, such as that of the heroic, technologically-enhanced hunter. The *Illustrated London News* (28:12:12: iv-v) carried a large image of the figure, showing Piltdown Man striding purposefully across a lush landscape, a spear grasped in one hand, and a sharpened stone tool in the other, heading determinedly in the direction of a roaring hippo-like beast. Perhaps the best example from the Piltdown episode of how fragmentary evidence was contorted to fit such a picture comes from an *Express* article (23.12.12:1). The following is quoted in the article directly from Woodward himself, which is important as it shows that the hunter imaginings were not merely journalistic distortions of 'pure science'.

The thickness of the skull suggests outdoor life, and the teeth are ground down in a way that human teeth are not usually ground; they indicate a root and vegetable diet, mixed with dust and sand, accidentally introduced. The roots would be eaten just as they were taken from the soil, without washing or cooking. This race probably had no knowledge of fire.

> The stone implements found by the skull were rude in design, and were employed in preparing skins, also in cutting wood.
>
> It is pretty certain that this was a race of wandering hunters. They had no domestic animals, for no bones of any have been found (23.12.12:1).

What is most striking in this section is that Woodward's conclusion – 'It is pretty certain that this was a race of wandering hunters' – seems to contradict all the evidence he himself gives. The wearing of the teeth suggests a 'root and vegetable diet', there is no evidence of hunting weapons, or fire to cook meat, and no animal bones were found. One might suggest from such evidence that the figure was primarily a herbivore (perhaps even a fully committed vegetarian?) but this would

hardly be fitting behaviour for 'a new type, possessing a new cunning, and an amazing power over the other denizens of the forest' (first paragraph of the same article). Instead this was a member of a race 'from whom all other animals shrunk' (*ibid.*). Returning to Woodward's claims, one does not need to be an anatomist to question the legitimacy of the statement 'The thickness of the skull suggests outdoor life'. What is clear is that a pre-formulated image of Piltdown, based upon culturally-specific ideas of humanness, is leading the interpretation of evidence. Another example comes from the *Guardian*, which states:

> Palaeolithic man was a river-draft hunter, and the Sussex skull was found in an old river bed. It is open to surmise that he met with his death while following his prey (21.11.12:8).

Again, the conclusion – that Piltdown was 'a river-draft hunter' – leads the evidence. The location of the skull might well suggest that the figure drowned whilst crossing the river, or was washed into it by a flood perhaps, rather than being taken as evidence of a mortal struggle with some beast or other along its banks.

Elsewhere in the news media coverage numerous exotic beasts are invoked against which our brave hunter might prove his mettle: 'the woolly-haired rhinoceros, and the mammoth' (*Guardian* 21.11.12:8); 'the mastodon, the hippopotamus and the sabre-toothed tiger' (*Express* 20.12.12:1); 'the lion, bear, and sabre-tooth tiger' (*Illustrated London News* 28.12.12:958).

5.2 The New Woman

Returning to the *Express* article of December 23rd, 1913, one can demonstrate an important element of the Man the Hunter discourse which should not be ignored. Although there is much in common between the images Haraway discusses and

those present at Piltdown, they are also distinctions. Persistent themes running through the hunter discourse are mixed up with features relevant to the particular socio-historical context in which any particular account is written**.** The title of the *Express* piece subverts the 'Man' element of the discourse by linking the story to the woman's suffrage movement of the time. In the original Dawson and Woodward paper, the latter suggests that the Piltdown figure may have been a female (1913:138), a claim that was ignored by all the newspapers except the *Express*, presumably because it did not fit with the celebratory mighty hunter image. The *Express* was deeply critical of the suffragettes[29], and drew a parallel between them and a barely human Piltdown by entitling the article

> The New Woman (200,000 Years Ago). She Could Not Cook. She Could Not Talk. She Could Not Wash. She Could Not Light A Fire (23.12.12:1).

'New woman' was a commonly used parlance for suffragettes, and Piltdown's failure to cook, wash, or light a fire was presumably intended to reflect upon their own refusal to carry out domestic chores traditionally required of women. Compared with the reverent tone of much of the coverage elsewhere in the mass media, the *Express'* has a clear element of mockery. The *Illustrated London News*' mighty hunter lived in 'a genial climate amid a luxurious vegetation and surrounded by an abundance of game' (28.12.12:958). The game upon which he lived were the largest imaginable: 'Elephants and rhinoceros of species long since extinct roamed in herds all round him. These and the hippopotamus no doubt he killed for food' (*ibid.)*.

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[29] For evidence of the *Express*' stance on the suffragettes, see the edition 13.8.13:5, article entitled 'Suffragette Madness – Modern Epidemic of Mental Disorder'. See Clifford (2000) for further discussion of the *Express*' coverage of the suffragette movement around this time.

In contrast to this lavish landscape, the *Express*' 'New Woman' inhabited 'the dark forests of our land' (23.12.12:1), her prey the decidedly more mundane 'roots and shellfish and wild fruit' (*ibid*.). Instead of *hunting* the hippopotamus, she '*dodged* the mastodon, the hippopotamus and the sabre-toothed tiger' (*ibid.* my italics). The *Illustrated London News* describes the hunter thus: 'a man of low stature, very muscular, and had not yet attained that graceful poise of the body which is so characteristic of the human race to-day. But he was by no means lacking in intelligence' (28.12.12:958). Again, the *Express* has a less impressive image: 'a strange, hairy ape-like creature… Her body was probably covered with hair. She could not speak, but as she ambled along she uttered strange noises.' (23.12.12:1). The hairiness of the New Woman belies her lack of femininity, an image that is reinforced by the *Express'* pictorial reconstruction of the figure, strikingly different from one taken from the *Illustrated London News*.

The Mighty Hunter
Taken from *The Illustrated London News* 28.12.12

The New Woman
Taken from *The Express* 23.12.12

In chapter four, I identify the powerful influence of nationalism in shaping the British press' positive reception. Despite the *Express'* particular angle on the figure, it too shows patriotic persuasions, and so does not simply denigrate the find. In fact the discovery is hailed as an 'astonishing link in the story of the origin of man' and

claimed as 'Ancestress of the English Race To-Day' (20.12.12:1). A tightrope is walked between outright ridicule of the figure, and the celebratory tone seen in coverage elsewhere: despite, then, her dubious qualities she was still an exceptional creature – 'She was a new type, possessing a new cunning, and an amazing power over the over denizens of the forest, for she could do what they could not' (23.12.12:1). The lesson to be learned from this is that the hunting discourse is never simply one thing, but is better thought of as a template to which might be attached disparate elements depending on the situation in which it is applied. These disparate elements are particular social currents of that specific time and place, as the missing link is an imagining of *our* own past, not its.

5.3 Contextualising the Hunter

Cartmill's (1993) own analysis of hunting discourses supports this point, arguing that many scientific imaginings of Man the Hunter were not celebrations, but rather misanthropic warnings derived from the horrors of World War II. One such imaging comes from Raymond Dart, the discoverer of *Australopithecus* in 1923. In his early papers on the find, Dart declared this early hominan to be a scavenger who seemed more commonly to be the hunted rather than the hunter:

> [Australopithecus] had evolved an intelligence (to find and subsist upon new types of food and to avoid the dangers and enemies of the open plain) as well as a bodily structure (for sudden and swift bipedal movement, to elude capture) (1926:317).

By the 1950s however, emboldened by further discoveries in which *Australopithecus* had been found in the locale of big game remains which Dart believed to have been fashioned into weapons, Dart was claiming his discovery as a deadly hunter, whose skills drove his human development – '[*Australopithecus*] was

in the process of taking dominion over every beast of the field… and every creeping thing that creepeth upon the earth… The main food supply of the breccia-makers was venison' (1957:30). If this sounds potentially celebratory, then the language Dart used elsewhere in arguing that the hunting adaptation drove the development of humans was far from so:

> The creatures that have been slain and the atrocities that have been committed in the name of religion from Carthage to Mexico, the hecatombs of animals that have been sacrificed from the altars of antiquity to the abattoirs of every modern city, proclaim the persistently blood-stained progress of man. He has either decimated and eradicated the earth's animals or led them as domesticated pets to his slaughterhouses. The loathsome cruelty of mankind to man is the inescapable byproduct of his blood lust; this differentiative human characteristic is explicable only in terms of man's carnivorous and cannibalistic origin (Dart & Craig 1959).

Writing in the aftermath of WWII Dart saw a link between the barbarous events of his own time and the posited hunting behaviour of *Australopithecus* - this was Dart's particular version of 'universal man': not a celebration of aggression and technology, but a lament. In contrast, the Piltdown coverage seems to be of the former, but then this was prior to the horrors of the 20th century's world wars, and besides, British scientists and journalists lauded the figure for no greater reason than that he was found in their own backyard (chp.4).

5.4 The Birth and Death of the Hunter

Whatever the particular emphasis of any example of Man the Hunter discourse, it should be noted that both Haraway and Cartmill locate non-empiric, cultural factors as the impetus for it. Both authors give a role to scientific evidence in the

embracing of the Man the Hunter thesis by the science community from the 1950s through to the 1970s, but these too are tied up with cultural factors. Cartmill points out that the hunting adaptation had been suggested in the science literature as early as Charles Morris' (1886) work. Part of the reason that it was not accepted by the establishment until the 1950s, he suggests, is that the Man the Hunter thesis was strongly Darwinist at a time when such ideas were unpopular[30], and it was only after the neo-Darwinist revival of the 1930s that a receptive environment was present.

Where folk knowledge melded with science knowledge again was in dealing with the fact that Darwin's model undercut ideas of human uniqueness by suggesting a continuum between all animals, including ourselves. In chapter four I show how contemporary indigenous 'savages' were used by western scientists to protect themselves from the implications of Darwin's continuum, by acting as an intermediate link between human and animal during the Piltdown episode, allowing a bridge across the binary without threatening the uniqueness of white Europeans.

In the post-colonial, post-Holocaust era of the 1950s, this traditional link between animals and humans was no longer acceptable. In an era of universal man, a marked adaptive shift was necessary to provide grounds upon which Darwinists could clearly delineate human from beast, for which the hunting adaptation was perfectly suited, being apparently a trait unique to hominans, fitting both the scientific and the cultural mood of the time.

The fall from grace of Man the Hunter yet again attests to the mixing of scientific and cultural discourses that takes place in such human-animal boundary debates. By the 1970s it was clear from primatology studies that chimps practiced group hunting – no longer considered a unique behaviour to humans, hunting was unable to explain our unique developments. Additionally, the evidence Dart drew on

[30] Cartmill quotes Ernst Mayr on this point – "Up to the 1920s and 1930s, virtually all the major books on evolution… were more or less strongly anti-Darwinian. Amongst non-biologists Darwinism was even less popular" (1993:549).

to justify his claims – the bone 'tools' found in the vicinity of *Australopithecus* remains – were later shown to be just like the remains of prey left by big cats and hyenas (Brain 1981).

Although problematic, these were not fossilised 'smoking guns' that could kill the Man the Hunter thesis on their own. Just as damaging were attacks from those who failed to see their own experience of humanity catered for by the thesis. Morgan's *The Descent of Woman* (1972) tackled Man the Hunter with a critique of its patriarchal construction of human origins that found little or no place for females:

> Most of the books forget about her for most of the time. They drag her onstage rather suddenly for the obligatory chapter on Sex and Reproduction, and then say: 'All right love, you can go now,' while they get on with the real meaty stuff about the Mighty Hunter with his lovely new weapons (pp.9-10).

Similarly, former students of Washburn such as Zihlman (1978) used a 'Woman the Gatherer' thesis to challenge Man the Hunter:

> The usual question in most interpretations of human prehistory is "What were the women and children doing while the males were out hunting?" Here I ask instead, "How did human males evolve so as to complement the female role?" (1978:5).

Others meanwhile attacked its militarist implications (Boulding 1968), or saw it as an attempt at absolving us from blame for our actions by pinning the responsibility on our evolutionary heritage (Eldredge & Tattersall 1982). Scientists still search today for exclusive evolutionary pressures which might explain humans as unique, however

they are likely to evoke more prosaic explanations such as large group size driving social development (e.g. Dunbar 2004) or the adoption of an agrarian lifestyle (e.g. Mithen 2006) – what we might called the Mighty Socialite and Mighty Farmer. Within science at least, Man the Hunter is no more, but the impossibility of separating science from culture in respect of such a symbolic a figure as early human remains a pertinent lesson for tackling the binary pure-popular model.

5.5 Creating the Neanderthal 'Brute'

As a final example both of the role of non-scientific factors in the treatment of these figures, and also of the need to appreciate the context in which any particular discovery takes place, Sommer's (2006) analysis of the treatment of a Neanderthal discovery in France provides an interesting comparison regarding how these figures are reconstructed in the popular imagination. Sommer shows how politics and religion shaped understandings of the figure, which was uncovered at La Chappelle-aux-Saints in 1908. In contrast with my own work, which finds a singular image of Piltdown propagating (at least within the British media), Sommer finds that heterogeneous images spread across the French newspaper coverage of the Neanderthal specimen - some claiming the creature a savage brute divorced from humanity, whilst others saw it as domesticated precursor to themselves.

I suggest that the differences between these two figures' treatment was primarily due to the prominent role of the Catholic Church in the Neanderthal discovery. The find was uncovered by three priests, and the scientist given the remains, Marcellin Boule, was selected on the grounds that he was likely to be more sensitive to the Church's anti-Darwinian [31] stance than the more radical and

[31] The Catholic Church's relationship with evolution is more complicated than is often assumed. It has never officially ruled out the possibility that humans and other animals have evolved from other forms over time. It does however take umbrage at Darwin's attempt to remove any supernatural force from the process by positing purely mechanistic processes driving evolutionary change (Johnston www.catholic.net).

anticlerical Ecole d'Anthropologie. Boule found himself and his discovery wedged between a progressive evolutionist mainstream press on the one hand, and a defensive reactionary Catholic Church on the other. Sommer argues that Boule structured his account of Neanderthal in such a way as to accommodate both opposing viewpoints-

> The religious papers could read Boule's brutish reconstruction as symbolizing sub-humanity, therefore bringing Neanderthal into harmony with a non-literal reading of the biblical *Genesis*… On the other hand, most of the newspapers aligned with the dominant neo-Lamarckian discourse and could read Boule's emphasis on Neanderthal as anatomical link between *Pithecanthropus* and 'modern savages' (or Palaeolithic human races) as a true missing-link (p.231).

It must be acknowledged that the differing focus of Sommer's work (which specifically compared religious and mainstream news outlets) makes any direct comparison of the reception given to Piltdown and the Chappelle-aux-Saints Neanderthal difficult. One point that can be made though is that Woodward and Dawson did not face Boule's dilemma, and so could maintain a greater control over the image of the figure. Sommer suggests that in trying to keep everyone happy Boule gave a rather ambiguous status to the Neanderthal find and did not involve himself prominently in its popular imaginings, with the result that within the mainstream media the image of the figure as a brute took on a life of its own, or, more accurately, took on a life given to it by journalists. By the time Boule attempted to recover some control of the figure, and challenge the news media's brute image, it was too late - the idea had stuck in the popular consciousness.

In the Piltdown case however the scientists involved did not need to balance the desires of opposing groups, and so continued to play a proactive role in shaping the figure in the public realm. As a result it seems as though the French journalists in the Chappelle-aux-Saints case dominated the popular science far more so than their

British colleagues did during the Piltdown episode, where only the *Express'* New Woman demonstrated a clear independence from the scientists involved. The lesson here is that science's domination of popular science may be common, but is not universal. The unique circumstances of the Chappelle-aux-Saints find gave the Catholic Church enough leverage over the construction of the figure to limit the input of the principal investigating scientist, creating a vacuum which journalists filled - a variation on, I would suggest, the more common model found in the Piltdown episode.

6. Popular Science and Palaeoanthropology

Gee argues that such is the fragmentary nature of palaeoanthropology's evidence, scientists should refrain from attempting to form any sort of narrative around hominin remains-

> the evolution of Man is said to have been driven by improvements in posture, brain size, and the coordination between hand and eye… But such scenarios are subjective. They can never be tested by experiment, so they are unscientific. They rely for their acceptability not on scientific test, but on assertion and the authority of their presentation (2000:5).

Instead, he argues, palaeoanthropology should limit itself purely to cladistic arguments regarding species' relative relationships. Given my arguments above there is much to be said for Gee's standpoint as long as we remain wedded to the pure-popular model. His main complaint may lie with the dearth of evidence available for such claims, whilst my own focuses on the unacknowledged role of wider cultural knowledge, but both suggest the same conclusion.

Placing an embargo on such science is easier said than done however. Because figures like Piltdown offer up what are fundamentally 'human interest'

stories, asking scientists to avoid such meta-questions is no minor request: these are issues that are hugely beguiling to both scientists and laypersons alike. Few non-experts would be content to limit discussions to the exact cranial capacity of Piltdown, when they could consider instead how a figure that may have had a capacity for intelligence equal to our own, but was seemingly unable to speak, would have lived in a world populated by sabre-toothed tigers and the like.

The evidence from Piltdown suggests that scientists (fellow humans too lets not forget!) themselves were drawn to such matters. Much of the *Illustrated London News*' coverage, including that given above, was written by W.P Pycraft, a zoologist and associate of Woodward. As we have already seen, Woodward himself was the inspiration for the *Express*' tale of Piltdown's life 'dodging the mastodon'. His great rival in the debate, Arthur Keith, similarly engaged in bringing these figures to life, telling the *Guardian* during the Piltdown coverage that the Galley Hill man[32] was 'so modern in build that we might meet him on the streets of London to-day and pass him by unnoticed' (22.11.12:7). A second important point is that the silence of scientists on these topics would not guarantee the silence of others in the public realm, as Sommer's Neanderthal account attests. Given that European and US scientists are currently engaged in a struggle with proponents of creationism and other theologically informed claims on human origins, such a self-imposed silence could be hugely damaging to science's authority in the long term.

Finally, the argument made by both Cassidy (2006) and Felt (2000), that the public realm – in the form of the mass media – provides a useful creative space in which scientists can develop ideas and reach across disciplinary boundaries, should be remembered. Such an embargo could, then, damage science politically - in the loss of cultural authority; materially - in the loss of resources that would likely follow the loss of authority; and intellectually - in denying scientists an open space in which

[32] Galley Hill man, discovered in 1888, was then thought to be the oldest remains found in Britain prior to the find at Piltdown.

to test out their ideas. For the non-creationists amongst us, it would also be damaging to wider culture.

It should be noted that that within the palaeoanthropological community there is an awareness of what would appear as violations of archetypal pure science. Landau's *Narratives of Human Evolution* (1991) contends that investigations of human origins have consistently recycled a narrative structure similar to that identified in Propp's classic *Morphology of the Folktale* (1968). Just as Propp identified recurring units of narrative in the folktales he studied, Landau identifies repeated events in accounts of human evolution, such as terrestriality, bipedalism, encephalization and civilization (p.6), and then draws parallels between these and Propp's units where, for example, the hero experiences a change of situation, must leave his home, undergoes testing challenges, and is eventually transformed.

Landau argues that by recognising the role of story-telling in what they do, palaeoanthropologist will be better equipped to create new theories. A similar argument is advanced by Stoczkowski (2002**)**, but here it is not the structure of evolutionary accounts which is recycled, but the components driving evolution (bipedalism, language etcetera), going right back to texts from antiquity.

Bowler (2001) refutes both these claims, arguing that the authors fail to ground their evidence in their historical contexts, and that apparently similar motifs had very different meanings in their specific time period. Bowler acknowledges that elements of evolutionary accounts do appear repeatedly, but sees these – using an evolutionary metaphor – as homoplaises, rather than homologies[33]. In other words, evolutionary debates tend to fluctuate between a few set positions not because current scholars are returning to previous work, but because something pushes them

[33] Homology refers to similarity due to shared origins, whereas homoplasy refers to similarity due to convergent or parallel evolution.

into the same positions time and time again. Bowler sees this 'something' as the limitations of the conceptual frameworks we use:

> In effect, the alternatives are built into the very nature of the problem: if you have doubts about monophyly, for whatever reason, you have to jump to the alternative of polyphyly. This is exactly the characteristic that Gould identifies in his 'eternal metaphor': they keep resurfacing because we cannot think about the question except in terms of certain basic alternatives. It is like a dialectic that have become stuck in a groove, thesis and antithesis bouncing backwards and forwards because no synthesis is possible (1991:18).

In these debates we see an awareness of the point that I am making here, that the knowledge flow in palaeoanthropology cannot simply be understood by upstream science production and downstream culture consumption. Landau sees the science as being unwittingly structured by story-telling conventions, for Stoczkowski there is a reliance on the resurrection of historical ideas, whilst Bowler states that we can only understand scientific claims in the context of their 'social and cultural environment' (*ibid.* p11). All three authors aim to improve science by getting scientists to recognise non-scientific factors in their work.

7. Binaries/Trinaries

Agents operating with the two binaries which form this chapter's focus – human-animal and science-culture – have notably similar solutions for protecting their dualisms. Whilst apparently remaining wedded to the idea of a clear binary, a more complex trinary is unconsciously created by the addition of a 'third category' (Bauman 1991). For Bauman, third categories are an inevitable outcome of the non-fit between the contiguous natural world and the dichotomising human mind that

seeks to understand it. When a case appears that does not concur with popular binaries the result is a third category that straddles the division.

Piltdown's liminal nature resulted in such a category. 'Humanity' is utilised during the episode as an absolute, as it is in popular culture generally: humans have humanity, non-human animals do not. The existence of figures such as Piltdown transgress the artificial divisions we impose upon nature however. The sole justification given for declaring Piltdown human was its skull capacity. The team that discovered it gave it a skull of approximately 1000 c.c., roughly intermediate between modern humans and modern non-human primates. If anything, this implies that Piltdown would have been semi-human. What could such a category mean though in a system of absolutes? Such a question was never asked, and certainly never answered, explicitly at least. The resolution of this disjuncture can be seen in chapter four, in which I argue that the boundary remained explicitly a dichotomy of human-animal but was implicitly mobilised in the debate as a trinary of White European/Non-White Savage & Piltdown/Animal.

Similarly, a third category appears in the science-culture division, in the form of popular science. Having provoked the debate by unambiguously declaring Piltdown human (itself a decision based on no more scientific a criteria than nationalism), pure science was left protected in its self-constructed enclave of the science media, whilst its proponents ventured out to wow the public in the mass media. This engagement took place under the guise of popular science, at a safe distance from its pure brethren. Here scientists were shielded by pure science's authority, and yet wielded the very same folk knowledge as the lay public they engaged. It was such folk knowledge that they relied upon in trying to bridge the void between Piltdown's chimeric qualities and our own dichotomous expectations.

Where my own trinaries diverge from Bauman's third categories though is that the latter's entities are a threat to the system they are part of, as they reveal it for the sham that it is, and so imperil the entire edifice. In my own work however, trinaries act to protect the dichotomy. As in Hilgartner's work (1990), popular

science – the third category - allows the scientist to utilise the benefits of science when engaging with the public, without placing science itself in the firing line. Instead, the public can only challenge popular science, which if threatened can be discarded by the scientist as merely a distortion of pure science, much like the lizard might sacrifice its tail to escape from danger. Likewise, the human-animal binary is protected by a metaphorical (and in a sense literal) 'no-man's land' of non-white savage and Piltdown Man. Piltdown Man is positioned here so that his existence offers no threat to the existing binary.

In both cases, the trinary allows a middle ground where tensions between the world and our divisions of it might be resolved or, perhaps more accurately, avoided.

8. Conclusion

The stated aim of this chapter was to seek an understanding of how Piltdown's humanness was constructed and why it took the particular forms that it did. This in turn allowed a consideration of the link between the knowledge claims made of Piltdown in the science and popular realms. The material studied showed that any explicit discussion of Piltdown's humanness was strictly limited to the popular realm. True to the empirical requirements of their discipline, palaeontologists declined any attempt to make sense of Piltdown's humanness within scientific papers. They discussed skull capacities, reconstructions of the jaw, the possibility of tool use – all those subjects illuminated by the physical remains uncovered.

Where scientists stepped outside of their 'pure science' domain was in labelling Piltdown 'human' - a concept far too nebulous, and far too burdened by cultural imaginings, to be evidenced by nothing more than a handful of skull fragments. Scientists could have stuck with the more limited classification '*Homo*' – a term more abstracted from everyday usage than 'human', and hence less contested – but its very abstraction would limit its appeal to a general audience. In declaring

Piltdown 'human' they shifted the boundaries of science so that it incorporated popular culture concepts, an act that made their claims relevant to it. This boundary-shifting act went unrecognised by those involved however. The result was that Piltdown's humanity was 'black boxed' (Latour 1987) from the beginning.

Given the inability of the 'experts' in the episode to produce novel thinking which might resolve these tensions, it is perhaps no surprise that popular science – that is to say the mass media coverage of the find – was no more reflexive in its utilisation of humanness. Here too humanity was granted to Piltdown with no justification other than that the skull, although small, appeared anatomically like that of a modern *Homo sapiens*. As we saw however, the popular science did at least attempt to give Piltdown's humanity a narrative – if not justifying Piltdown's status then at least exploring it. This though left popularisers (both scientists and journalists) with the unenviable task of attempting to reconcile Piltdown's contradictory characteristics with a dichotomous view of the human-animal boundary. Their solution was to create the trinary detailed above which placed Piltdown with indigenous groups, somewhere between human and animal.

The racism evident in this trinary was not the only influence on the creature's reception. The *Express*' 'New Woman' angle imposed contemporary gender politics on the unfortunate muse, and is also perhaps unique in the entire episode as demonstrating a conscious effort to shape Piltdown's humanness.

Elsewhere, for example in the repeated comparisons between Piltdown's capabilities and those of indigenous groups, it appears as though the protagonists (scientists and journalists alike) are unaware of the political dimensions to their imaginings: that Aborigines were inferior to white Europeans was simply accepted knowledge – to the protagonists it was natural fact rather than imperial hubris. The *Express* on the other hand was clearly not simply following conventional wisdom when it implied a link between a proto-human and 20th century women's rights advocates. The connection invited in the 'New Woman' label was then the only time in the science and popular coverage of Piltdown during 1912-1913 that a reflexive

awareness was demonstrated of how Piltdown's humanity could be – and was – shaped by contemporary discourses. Whilst the *Express*' particular spin was no less repugnant for it, this unfortunate example is arguably the closest the debate came to realising that Piltdown's declared humanity was less a window onto the past than a reflection of 20th century social categorisations.

What does this tell us of the relationship between science and the mass media at this time? At times in the discussion above I have spoken of science and the media as though they were clearly separate entities, as the pure-popular model would suggest. However, the most prominent lesson from the affair was that in respect of knowledge claims any clear separation is exceedingly difficult, and that the pure-popular model of the relationship between science and wider culture masks a far more complicated reality. The trinary of pure science/popular science/popular culture was invoked not to better map the relations between science and wider culture, but rather to protect the former from the latter.

Although scientists refrained from expanding on Piltdown's humanness in the science realm, they were happy to do so in the popular realm, where they provided some of the most sensationalist material, either directly or in interview with journalists. This material relied far more upon preconceived folk knowledge than it did upon empirical, 'scientific' evidence. It is a similar conclusion that leads Haraway to state "Scientific practice is above all a story-telling practice in the sense of historically specific practices of interpretation and testimony" (1989:4). It might well be argued too that the desire amongst scientists to grab the news media's – and hence the public's – attention was as important as any scientific evidence in the decision to declare Piltdown human: Piltdown the "backwards human" was a far more salacious story than Piltdown the "forward ape" (*Express* 12.08.13:1). Its is easy to see figures like Woodward and Keith as the Robert Winston's of their time. Lord Winston, as scientist and television personality, has presented numerous shows dealing with scientific issues, among them the BBC series 'Walking With Cavemen', which used advanced animatronics and CGI to give an account of human history. The

role of the 'public scientist' remains an important one, as we shall see in the next chapter's discussion of *Homo floresiensis*.

Meanwhile, the absence of any form of expert discussion around the figure's humanness left the way open for journalists to manipulate the discovery according to their newspaper's particular contemporary concerns, although there rarely appeared evidence that they were aware of this freedom. Instead, most coverage relied on regurgitating accepted ideas of white superiority, and propagating images of this figure's human superiority over other life via heroic accounts of a mighty hunter. There is, regardless, nothing to suggest that had any explicit debate taken place in the science literature, it would have been any freer of the sexism, nationalism and racism that tainted the popular coverage of Piltdown. In fact in what discussion did take place the latter two were just as prevalent in the science coverage.

The picture of science and the media we are left with then is one in which scientists utilised their considerable authority to dominate the public discussion of Piltdown, and yet relied primarily upon the very same cultural ideas as the journalists involved to make sense of Piltdown. Although considerable skill was exercised in the anatomical reconstruction work of Woodward, Keith and others, this was of only limited relevance to the issues which were focused on within the popular realm - whether Piltdown was human, and what this meant. On these issues scientist drew their knowledge from the dominant popular discourses of the day. The boundary between science and the media then was every bit as blurred as the boundary between Piltdown's humanity and our own was.

Chapter 6: Hobbits, Hunters and Hydrology: Images of a 'Missing Link', and Its Scientific Communication

1. Introduction

The discovery on Flores - one of the larger islands of the chain that makes up Indonesia - of the remains of two small-bodied hominines was announced to the world at joint conferences in London and Sydney on the 27th October 2004. The events were hosted by the journal *Nature*, which carried two papers on the find in its issue released the following day. The discovery consisted of a near-complete skull and jaw, together with the right leg and the left side of the pelvis (Brown et al. 2004:1055). Most of the rest of the skeleton consisted of fragments. The discoverers argued that the evidence was strong enough to declare the find the type specimen of a new species, that they labelled *Homo floresiensis*. Remarkably, not only was this figure just 3ft high with a brain no bigger than a chimp, and yet showing evidence of complex human-like behaviours, but it was also still alive less than 15,000 years ago. The type specimen itself was called LB1, after the location of the find – Liang Bua. The left side of the jaw of a second individual, LB2, was also discovered.

The announcement received huge attention from the popular news media, and all seven newspapers featured in the study carried articles on the find in their 28th October editions. Two broadsheets, the *Guardian* and *Daily Telegraph*, even devoted front page space to it. Perhaps more remarkably, all three tabloids in the study covered the story, despite having little regular science coverage. The attention given demonstrates that the discovery, like that at Piltdown, had wide-ranging implications that took it outside the boundaries of what we might call 'routine science' – the everyday science of the mundane and uncontroversial that goes largely unnoticed by the media and wider public.

That media interest in the Flores' episode was markedly different from such science – the great majority of science – is a reflection not only of its unexpectedness and its importance to science, but also of the numerous connections that could be

made between it and non-specialist readers' lives – it was fundamentally a 'human interest' story. All manner of linkages were made to the figure of LB1 – to the popular fictional Hobbit character; to a reimagined and recontextualised 21st century Man the Hunter; to the 'Lost World' literary genre of far-away lands of mystery and danger; to the way we conceptualise humanity and our relationship with nature; to the animal rights debate. Such was the heady excitement brought by the discovery that the episode even witnessed respected scientists pondering whether the mythic beasts that cryptozoology concerns itself with might actually exist after all (*Nature* 27.08.04:online), and a (perhaps less respected) journalist declaring that

> after exploring regions where no scientist had ever set foot, I have to agree that yes, Hobbits could well be alive and well. Somewhere. (*Daily Mail* 06.08.04:12).

Like Piltdown then, Flores offers the opportunity to study the relationship between science and non-science culture at a time when the usual demarcations between the two were tested by the level of public interest in the story. In order to investigate this relationship, the coverage of the find by popular news media, and inter- and intra-specialist science media between October 2004 and June 2007 was analysed. The news media sample was made up of four UK broadsheets – the *Guardian* (including its Sunday sister, the *Observer*), *Daily Telegraph, Daily Mail* and *Times* – and three tabloids – the *Sun*, *Express* and *Mirror*. The four inter-specialist science media were *Nature*, *New Scientist*, *Science*, and *Scientific American*. Finally, the seventeen peer-reviewed science journal papers that had been published on the discovery were also studied.

Having focused in chapter five on Hilgartner's work, here I will begin by considering models of science communication more widely, before using a

chronological study of the knowledge claims that were made regarding LB1 to find out where such claims originated, and the routes they took from there. This will reveal that whilst some scientists' claims followed the route suggested by traditional, 'canonical' models of science communication, other scientists bypassed this route altogether, and made their claims directly to the popular realm. I will then analyse in detail how the discovery was discussed within the three forms of media to study the processes of change the story underwent as it moved between fora. Three repertoires in particular were crucial in how the find was made sense of by non-specialist audiences - 'Lost World' and 'hobbit' literary discourses, and the now familiar 'Man the Hunter'. Though the material both here and in chapter four broadly supports Hilgartner's (1990) analysis of popular science, the manner in which the Flores discovery was made sense of will be used to critique the uni-directional flow of knowledge that is implicit in continuum models like Hilgartner's. Finally, elements will be identified which only existed outside of intraspecialist science media. Using all this gathered data, I will then proceed to outline my own model of science communication.

2. Science communication models

Popular science journals draw heavily on popular metaphors and images when framing much of the science they cover (Petersen 1999), and science and science fiction have been found to have a dialectical relationship (Haraway 1992). Despite this, Bucchi (1996) has argued that routine science does often follow the 'popularization' model where knowledge only moves out of the domain of science and into the public domain once it has become relatively stable and uncontroversial. However, specific political, institutional or social pressures can result in 'deviation processes' in science communication. In such cases the forum in which scientific debate takes place can move out of the scientific journals and university departments and into the public realm. Cassidy (2005) finds that such was the case in the 1990s with evolutionary psychology. Here controversial claims such as there

being an evolutionary basis for rape cut across social and political concerns and resulted in public debate featuring both scientists and non-scientists. Through a citation study, Cassidy finds evidence that not only did debate within popular culture encourage the debate within science, but also that popular science books were influential on later discussions within science.

Among other things, such cases raise the issue of controversial versus routine science. Mellor (2003) makes the point that studies of science-popular culture interaction often focus on episodes of controversial science, and fail to acknowledge that the bulk of scientific output follows closer to the popularization model than that found by Cassidy. In my own work, the human-animal boundary occupies such a powerfully symbolic site that it could only be described as controversial science. Whilst acknowledging that the treatment of such science is likely to be different from the bulk of scientific claims, the relative impact that human-animal boundary science has on popular culture because it spans so many symbolic domains makes it all the more worthy of analysis:

> for citizens who want to take part in the democratic process of a technological society, all the science they need to know about is controversial (Collins and Pinch 1998:3).

The same reasons that make human-animal boundary science non-routine make it of great interest to popular culture, and the media specifically, as such cases 'fit well with media news values such as meaningfulness and relevance to daily life' (Cassidy 2005:136).

In my previous chapter on the boundaries between science and popular culture I used the case of Piltdown man to support Hilgartner's (1990) critique of the pure/popular model of science communication. Hilgartner's primary argument was that this commonly used dichotomous model was operated by practitioners as a tool

with which to protect their own authority as knowledge producers. Echoing Gieryn's river metaphor (1999:ix) for science communication, Hilgartner suggested that it should be imagined as a continuum between 'upstream' knowledge production and 'downstream' knowledge consumption (p528-529). The crucial distinction in Hilgartner's model is that no clear line can be drawn between 'scientific' and 'popular' knowledge, and my own evidence from the Piltdown case supported this.

There is, however, an element of this 'river' model that I wish to take issue with, which will form the basis of this chapter. Although it is not made explicitly clear, Hilgartner's (and Gieryn's similarly) visualisation appears to assume a one-way flow of knowledge from the science realm to the popular realm. In contrast, I wish to argue that, in the case of palaeoanthropology at least, a uni-directional flow of knowledge cannot be assumed. Instead, that the creation of figures such as LB1 relies on an exchange of knowledge claims from various sources, including both science and popular culture. Before I proceed to make this argument, it is worthwhile to consider the various attempts that have been made to chart the relationship between scientific and popular knowledge.

Hilgartner's river model was a response to the pure/popular dichotomy implicit in the 'deficit' account of public understandings of science. The deficit model, present, for example, in the Royal Society's report *The Public Understanding of Science* (Bodmer 1985), views any tensions present between science and the public as being simply the result of public ignorance. Building public trust in science is then a matter of educating the public better. The idea of a public deficit of knowledge is an outcome of the traditional, 'canonical' model of science that underpins it. This posits a clear, meaningful distinction between the entities of 'science' and 'the public', where the latter are simply passive consumers whose attitude to science merely reflects their level of scientific literacy. If visualised, this would appear like a very simple taxonomic chart, with a box marked 'Science' feeding into a box marked 'Popular Culture', via a third box 'Popular Science'. Whilst Hilgartner challenges the boundaries between these categories, in suggesting a one-

way flow of knowledge his river model does not directly challenge the categories themselves.

Building on Moscovici's (1961, 1998) identification of the processes by which unfamiliar knowledge becomes familiar through 'social representations', Lievrouw (1990) too suggests a one-way flow of knowledge, yet argues that the popularized science that appears within the public realm is shaped by the values and beliefs of that public during a process of 'anchoring' and 'objectifying':

> Representations [of scientific knowledge claims] are generated by a dual process of *anchoring* (classifying an unfamiliar phenomenon into a set of categories) and *objectifying* (converting the unfamiliar and abstract phenomenon into a familiar and concrete phenomenon by developing an image of it) (p.5).

To contrast this with Gieryn's river metaphor, we could picture here a river that flows into a tidal delta, so whilst science remains 'upstream', its downstream consumption becomes a two-way process, where knowledge can travel in different directions at different times.

Lewenstein (1995) goes further, and suggests that linear models of scientific communication be replaced by 'a circle or a sphere' (p.426), using the cold fusion saga as a case study. This is not quite as radical as it might at first sound however - Lewenstein's focus is on communication, rather than knowledge production. So then, whilst the public realm (in the form of the mass media) played an active role in the dissemination of knowledge regarding cold fusion – for both scientists and non-scientists alike – it did not necessarily have any impact on the actual content of any knowledge claims made:

> the media played a role in helping researchers exchange data, though with unclear results on the process of the research itself (p.428).

This unbounded model of 'communication complexity' (p.425) is nevertheless an important demonstration of the active role that forums traditionally viewed as non-scientific can play in scientific controversies.

Closer to my own interests lies Bucchi's work (1996). Whilst recognising the improvements they offer over the canonical account, Bucchi is critical of 'continuity' models like that of Hilgartner's for focusing too heavily on the science side of the dichotomy, with the result that the public is reduced to 'an external, monolithic, and taken-for-granted source of support' (p.386). Despite this, Bucchi concurs that much regular science does move in a one way process of diffusion from the esoteric (science journals) to the public (mass media), and that 'popularization' is an accurate term for this. However, in times of scientific controversies, when boundaries are in flux - perhaps because a new branch of science is trying to become established - scientists can circumvent the standard route, and proceed straight to public forums, in cases which Bucchi discusses as 'deviation(s)' (p.379), building on the work of Cloitre and Shinn (1985:31-60). During such episodes the content of scientific knowledge claims can be influenced by forums not considered 'scientific':

> I suggest that communication of science at the popular level may influence core scientific practice in many more different and subtle ways than simple support and reinforcement. As already shown, it can foster the inclusion or the exclusion of actors or theories from the specialists' discourse, and it can make room for new interpretations or confer a different status on existing models by linking them to other public issues and themes. The popular stage can in this sense provide an open space where stimuli, ideas and information may be merged and exchanged among different actors and across disciplinary

fields, in the absence of the constraints and conventions which bind scientific work and communication at the specialist level (p.386).

To what degree though could the Flores episode be said to fit the accounts given above? To answer this question, it is necessary to consider the chronological trajectory of the discovery, noting its appearance in intraspecialist, interspecialist, and popular media. In this way, particular knowledge claims can be traced back to their source.

3. Timeline of the Story

As already stated, following the opening press conferences on the 27th October 2004, all the newspapers in the study covered the story, as did all the interspecialist journals. Just over a week later, *floresiensis* was in the news again: the *Daily Mail* (6.11.04) carried a story from a reporter, Richard Shears, who had travelled to Flores Island in search of a living hobbit. It is testament to the credibility of science that this search was conducted in complete seriousness, when a week earlier such material could only have been published on April Fools day.

Obviously, other scientists too had access to such credibility however, and from them dissenting voices quickly appeared. On the 31st October a palaeopathologist, Maciej Henneberg, had a letter published in the Adelaide *Sunday Mail*, in which he dismissed the skeleton discovered as a being merely that of a microcephalic *Homo sapiens*. Then, on 5th November, Teuku Jacob, the 'undisputed king of palaeoanthropology' (*Science* 6.3.98:1482) in Indonesia, chaired a press conference where he too disputed the idea that the find represented a new species of *Homo*. *Science* (12.11.04) reported both these claims, and the *Guardian* (7.11.04) the latter.

Over the next month both *Science* (26.11.04) and *New Scientist* (11.12.04) reported a new twist to the story – Jacob had taken ownership of the remains to

carry out his own analysis, without the consent of most of the original team. In December 2004, the journal *Before Farming* published short arguments from three dissenters, including Henneberg, with responses from Brown and Morwood. However, these arguments were not peer-reviewed, the editor stating:

> Some might see this as a glorified chat room, but the issues raised by each of the contributors here are current, valid until proven otherwise and need a public airing (Barham 2004:1).

Brown and Morwood themselves were critical of this process in their response to Henneberg, in which they stated 'This is an extremely poorly informed, and ill designed, piece of 'research' and could not have been published in a substantial peer reviewed journal' (p.6). The lack of peer-review also likely determined the article's failure to leave any wider impression on the debate, going unreported by the interspecialist and popular media.

In January 2005, Flores returned to the newspapers, when the *Guardian* reported that Jacob planned to study a pygmy population living on Flores for evidence of similarities to LB1. In March 2005, a paper by Falk et al appeared in *Science* arguing that a virtual endocast[34] of *floresiensis*' skull supported the claim that it was a new species. This prompted coverage across all popular and interspecialist media, with the exception of the *Sun* and *Express*. The sceptics' rival claims were also widely reported at the same time. On the 10th March another scientist, Robert Martin, wrote an article published in the *Guardian* in which he too refuted the new species interpretation.

[34] An 'endocast' is a cast taken from the inside of a skull. 'Virtual' refers to the fact that the cast was created inside a computer, using lasers to take measurements from the skull.

In May, both the *Daily Telegraph* (3.5.05) and *Daily Mail* (7.5.05) reported Jacob's claims. In the latter's, Jacob's claims were included in a piece in which intrepid reporter Richard Shears returned once more to Flores Island to meet the local pygmy population which Jacob had identified. The piece was entitled 'I've Found The Hobbits', though the concluding sentence was slightly more circumspect:

> As I shook tiny hands and said goodbye, I felt I'd been touched by history. Very, very old history, recounted by very, very small people who may, just may, be descended from a Hobbit' (*ibid.* p.34).

(Perhaps unsurprisingly for those versed with the *Daily Mail*, anthropologist Gregory Forth (2006) reports that he later spoke to many of those interviewed by Shears, and that 'For the most part, their stories… were rather different from what was reported in the British tabloid' (p343)).

The publication in October of a new paper from the original team (Morwood et al. 2005), on the discovery of remains of nine more individuals, prompted further coverage from the *Sun, Times*, and *Guardian* (all 12.10.05).

On the 19th May 2006, the first peer-reviewed paper from the critics of *Homo floresiensis* appeared, over 18 months after the first dissent had appeared in the news media. Martin et al argued that LB1 was a microcephalic human, not a new species. A paper from Jacob et al did not appear until 23rd August 2006. By now only the *Times*, *Guardian* and *Daily Telegraph* were reporting events. A second paper by Martin et al, published 9th October, went entirely unreported. It appeared as though the news media had lost interest in the dispute, although a new paper by Falk et al (2007), again supporting the new species claim, was reported in the *Times* and *Daily Telegraph* (30.1.07).

What is most notable from this timeline is the degree to which the story of *Homo floresiensis* follows the route outlined in Bucchi's (1996) deviation model of science communication. Although much of the news coverage was prompted by claims appearing in peer-reviewed journal media, the arguments of dissenters to the new species claim were notable in their bypassing of regular channels. Teuku Jacob announced his criticisms at a press conference, whilst others like Henneberg and Martin published directly in the news media with their own claims. Peer reviewed papers did not follow from them for some considerable time.

Bucchi (p.382-383) suggests such episodes are most likely in cases where scientific boundaries are in dispute - for example when a new field is in its infancy - and public support is engaged as a means of proving the worth of a new boundary configuration. They can also occur when a shift of paradigm is sought. The Flores case was indeed debated between the supporters of two different evolutionary paradigms[35]. The dissenters' move into the public realm could be explained in such terms, of seeking public support for their paradigm, but significantly they did not frame their arguments along these lines. Additionally, palaeoanthropology is a mature discipline, and the differences between the two evolutionary paradigms long-standing and well recognised, so this was not an attempt to demarcate a new field. Alongside with these incentives to deviation, Bucchi also states that 'different aims and effects can be pursued' (*ibid.* p379), and Flores appears such an example.

Here the spur towards deviation is more likely to have been the combination of two more prosaic factors: the many news-worthy elements of the original claims which ensured that they were widely reported; and the discontinuity between the

[35] The most prominent dissenters, such and Jacob and Henneberg, supported the otherwise unpopular 'multiregional' model of human evolution, in which *Homo sapiens* evolved throughout its entire habitat, whilst the team of Morwood & Brown followed the dominant Recent African Origin model (popularly, the 'out of Africa' model), where development was limited to Africa (see Stringer & Andrews 2005:140-143 for more detailed description of the models).

near-instantaneous nature of modern news cycles, and the long, drawn-out process of peer review. This second factor meant that dissenters were left with the stark choice of either i) following the approved route of science communication, and remaining publicly silent for a considerable period of time, or ii) deviating from the approve route, and engaging their rivals immediately, whilst their peer reviewed response was processed. The reduced news media coverage given to the first peer-reviewed dissent that appeared 18 months later (Martin et al's paper (2006) was reported by three newspapers, as opposed to all seven who reported the original claims) appeared to justify their haste. Despite this, and the original team's own extensive use of the popular media via press conferences, interviews[36], television shows[37] and, later, books (Morwood & van Oosterzee 2007), there is evidence that, amongst the scientists involved, the dissenters' credibility suffered for their bypassing of approved routes. One such example is provided by Morwood & Brown's response to Henneberg's *Before Farming* piece reproduced above. Another comes from journalist Deborah Smith, who relates a conversation she had with Peter Brown following the publication of Henneberg's critique of LB1:

> I rang Peter Brown immediately and he was fantastic… he just hit me with this huge spray – "this is ill-informed, these people haven't seen the specimen, they haven't been to the site, *their comments aren't peer reviewed, they're not published*" (17.04.07, my italics).

[36] Morwood states that just one member of the Flores team – Peter Brown – conducted over 100 interviews in just the first three days following the press conferences (Morwood & van Oosterzee 2007:186).

[37] The Flores team co-operated with a *National Geographic* film crew even before the discovery was announced. The resulting film was shown on the *National Geographic* TV channel, entitled 'Tiny Humans: The "Hobbits" of Flores'.

This supports the argument attributed to Lewenstein (Gregory & Miller 1998:82), that scientists often criticise other scientists' popular activities, whilst acting similarly themselves. The content of the Flores story, and the original team's actions, had ensured that the episode was very much centred within the public, rather than scientific, sphere before the dissenters' appearance. They were left playing catch-up. The deviated route which they took did not move the story into the public realm - it was already there - but it did mean that scientists' claims began originating 'downstream', rather than flowing there from more lofty climes.

The arguments of the dissenters were not the only elements of the Flores story that originated in the public realm however, and so the deviation model does not explain events in their entirety. In the following section I shall show not only how, like Piltdown, much of Flores' interpretation was influenced by non-scientific culture, but also how many elements of the discovery only existed within public discussions. I will refer to these latter elements as constituting 'public science', being science which takes place - which originates - outside the recognised forums of academic departments, peer-reviewed journals, conferences etcetera. More will be said when I come to discuss such material, but first to those texts that demonstrate a dual heritage, being a blending of science and wider culture – the 'popular science'.

4. Popular Science

As with Piltdown, the discussion of Flores man within the popular media was very different from that within the intraspecialist journal media. The sixteen peer-reviewed journal articles included in the study discuss the anatomy of the discovery, its geological context, and the stone tools and other animal remains found in situ. One of the two original papers (Morwood et al. 2004) cites the stegodon remains found in the vicinity as evidence that they were being hunted by *Homo floresiensis*, but no further discussion of the figure's lifestyle or behaviour is given in any of the articles. The popular media's coverage of the figure is markedly different, reflecting their audience's diverse interests, and absence of specialist knowledge. Core

empirical facts taken from the intraspecialist media are given – location, age, dimensions etcetera – but greater efforts are expended in narrating the creatures' existence, giving it meaning by placing it within a framework of culturally relevant signifiers. As might be expected, the interspecialist media combined elements of both popular and intraspecialist media, often using a popular style in the opening paragraphs, then in the body of the text providing greater technical detail, and less explanation of techniques and systems of classification, than the mainstream media coverage. Analysis in detail of two key narratives used in the discussion of LB1 will highlight how the process of 'objectifying' (Lievrouw 1990) the creature within popular culture occurred.

4.1 Return of the Hunter

The first of these narratives is a familiar one - the Man the Hunter trope. However, differences in the actual realisation of the Hunter template compared to the Piltdown case demonstrates clearly how it is flexible and open to adaptation. The images given of the creature's life resonate strongly with those given of Piltdown's ninety-eight years earlier, with the common elements of hunting, technology, and terrifying beasts present again:

> On the island of Flores in the Malay Archipelago, scientists have found remains of a race of three-foot high humans who hunted pony-sized elephants and rats as big as dogs and who battled dragons with saliva laced with deadly bacteria. (*Observer* 31.10.04:21)

> a previously unknown species of HUMANS who lived in a lost world stalked by giant rats and mutant elephants. (*The Sun* 28.10.04)

> they used fire, made sophisticated stone tools, and hunted stegodon - a primitive type of elephant - and giant rats. (*Daily Telegraph* 28.10.04:01)

Just as Piltdown's life was narrated as a struggle against monsters given a semi-mythic quality by their absence from our contemporary world, Flores' existence is repeatedly built around bizarre adversaries – huge rats, tiny elephants, and "dragons" – i.e. large lizards related to the Komodo dragon (*Varanus komodoensis*). Despite these constants, there are deviations from the Man the Hunter template. These contemporary twists have at least two sources. The first of these is simply the particular physical characteristics of the discovery – Flores' diminutive stature provided a paradoxically vertiginous hurdle to clear for any scientists or journalist hoping to present the figure in the Mighty Hunter mould. Creating a three foot high fearsome warrior would be no mean feat. The mass media turns this challenge into an advantage however, and makes great play of contrasting Flores' stature with the fellow occupants of its island:

> THE remains of a diminutive cousin of modern Man ….. Also known affectionately as "Flo", it hunted pygmy elephants the size of ponies and giant rats as large as golden retrievers, while trying to avoid huge Komodo dragons and other predatory lizards that are extinct. (*Times* 28.10.04:6).

> A story of tiny Hobbit-like creatures battling giant, slavering dragons, of forest folk living in a tropical lost world, hunting miniature elephants and rats the size of retrievers (*Daily Mail* 28:10:04:24).

The interspecialist media too use the island inhabitants' novel dimensions to elicit interest:

> They may have been tiny, but the hobbits of the Indonesian island of Flores are still the focus of the biggest controversy in anthropology (*Nature* 1.06.04:559).

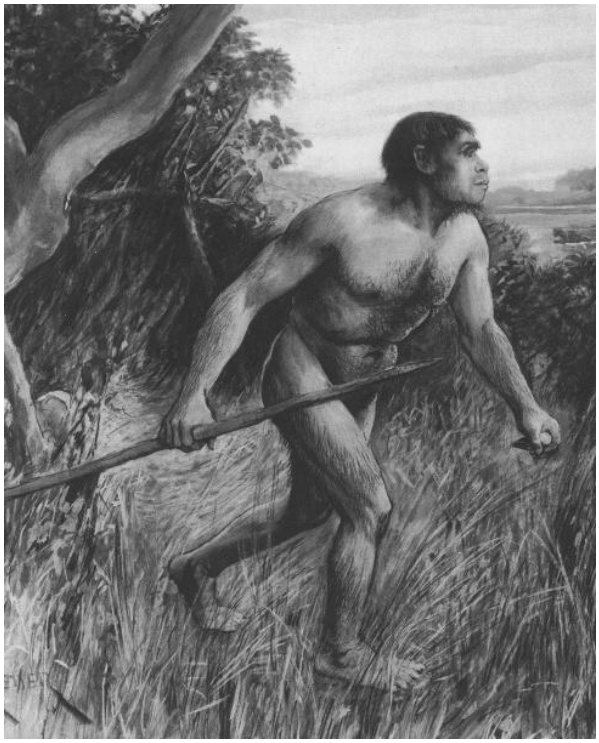
> SOME 13,000 years ago, on a tropical island at the heart of the Indonesian archipelago, an extraordinary group of dwarf-sized people lived alongside dwarf elephants and giant lizards. (*New Scientist* 30.08.04:8)

It is notable that even within the intraspecialist coverage, there is evidence that the stranger elements of the find were given greater prominence. Morwood el al.'s (2004) paper states within its text that 'associated small faunal remains include those of fish, frog, snake, tortoise, varanids, birds, rodents and bats' (p.1089). The paper's abstract however limits itself to only two of these species: 'Associated deposits contain stone artefacts and animal remains, including Komodo dragon and an endemic, dwarfed species of Stegodon' (p.1087). This suggests that the appeal to readers of the more unusual fauna was not limited to the popular realm.

Returning to the popular and interspecialist media, other labels attached to the figure include 'mini-men' (*ibid.*), 'the height of a three-year-old child' (*Daily Telegraph* 28:10:04:1), 'toddler-sized human' (*ibid*. 03.05.04:22), 'the half-pint human' (*Sci American* 02.05:62) and 'no bigger than a dwarf' (*The Express* 28:10:04:17). The *Times* described the tools found in situ as 'toy-size' (28.10.04:6). The image created then is more 'Cute Hunter' than Mighty Hunter, perhaps demonstrated best by artist Peter Schouten's iconic image of the creature shown below. Originally commissioned jointly by *National Geographic* and the University of Wollongong team for the former's initial coverage, the image was widely reproduced in the mass media. Notably, although it features a weapon-wielding figure engaged in hunting, as in Forestier's Piltdown image (*Illustrated London News* 28.12.12: iv,v),

the creature itself is markedly less imposing and is drawn post- rather than pre-hunt, in a relatively relaxed state.

Schouten's Cute Hunter
(www.studioshouten.com.au)



Forestier's Mighty Hunter
(*Illustrated London News* 28.12.12: iv,v)

The grim determination on the face of Forestier's figure is replaced in Schouten's by a somewhat beatific grin. The sizeable spear carried by Piltdown dwarfs the small club held by Flores. Interestingly, although Brown et al's paper – like that of Dawson & Woodward's – declares the skeleton to be most likely female, Schouten's Hunter – like that of Forestier's – is a male (see chp. seven). This repetition also flags up a note of difference, one that purely reflects changing cultural tastes – although both figures appear naked, Piltdown Man's modesty is maintained by a strategically extended thigh. Flores Man apparently has no such qualms, and appears 'full-frontal'. However, in keeping with the character's welcoming charm, the phallus itself is rather non-confrontational in appearance.

4.2 The Flores 'Hobbit'

The appealing image created of LB1 is reinforced by the most widely-repeated label attached to the find – 'Hobbit'. Appearing originally in the fictional work of J.R.R. Tolkien, the hobbits were a diminutive sub-species of human. Despite the enduring popularity of Tolkien's work, it is Peter Jackson's recent *Lord of the Rings* films that have cemented the Hobbit character widely within the contemporary consciousness. An often overlooked element of Tolkien's fantasy was that it is set on our own Earth, deep within pre-history:

> he did indeed create a new "mythology" (or at least mythical mode of thinking) not just suitable but deeply appealing for our time (Thomas 2006:83).

It is a pleasing irony that his work - creating an origins story suitable for contemporary interests - should be used to tell the tale of one of science's missing links.

The mass media's focus upon Flores' stature was not the inevitable outcome of the anatomy of the recovered remains, but was rather the conscious selection of a 'newsworthy' element. LB1's height, in addition to its fantastical fellow islanders, made a link with Hobbits easy, yet this link was not simply a matter of shared narrative elements. The connection of the discovery to a well known contemporary story allowed the overlaying of LB1 with a pre-constructed character and set of values. It is not coincidental that Tolkien's Hobbits were plucky underdogs, and the unlikely heroes of the *Lord of the Rings*. The narrating of LB1 was overwhelming positive, arguably to the point of condescending in its 'cutening', a process which did not go unremarked upon in the coverage given:

> Until just 12,000 years ago, there was a species of little people walking around who would have only come up to our waist. Finally they were wiped out, possibly following encounters with the much larger Homo sapiens who, it's feared, may have patronised them to death (*Guardian* 29.10.04:25).

LB1's dimensions were focused on because they aided in making the story newsworthy – they introduced a note of novelty, the importance of which cannot be overstated for a business concerned with creating new news. They also, of course, allowed for the Hobbit link at a time when Tolkien's work was enormously popular. This combination of new and old factors dovetails well with Galtung and Ruge's (1981) seminal analysis of what makes certain information newsworthy:

> The idea is simply that is not enough for an event to be culturally meaningful and consonant with what is expected -- this defines only a vast set of possible news candidates…. It is the unexpected *within the meaningful and the consonant* that is brought to one's attention, and by "unexpected" we simply mean essentially two things: *unexpected* or *rare* (p55. Authors' own italics).

The notion, as advanced by the canonical pure/popular model of science, that the mass media coverage simply regurgitates the claims of scientists, can be refuted by comparison of Flores' height with another prominent claim made of the find. Several groups of dissenting scientists (e.g. Henneberg 31.08.04, Jacob et al. 2006, Martin et al. 2006) declared that Flores was not a new species at all, but simply a modern *Homo sapiens* suffering from microcephaly. Whilst this claim was reported, it was entirely ignored in popular imaginings of the creature. No where did anyone attempt to narrate a character who suffered from mental retardation. The mass media did not simply reproduce the scientists' claims in a popularist style, but actively chose elements of the story to focus on, such as LB1's size. In this sense, the

popular classification of LB1 was a coconstruction of nature and society, not the determining of one by the other (Bowker & Star 2000:61).

It might be expected that the dressing of LB1 in the garb of a popular culture icon like the hobbit was the work of journalists**.** In fact the original connection was made by the scientists who discovered LB1, long before it appeared in the media (and so long before scientists took the route of deviation, see below). Peter Brown was against its use, but Morwood and the rest of the team had no such doubts:

> As it transpired, the matter was out of Peter's hands; my younger Indonesian colleagues liked the name "Hobbit" and had begun to use it affectionately for LB1. "Hobbit" stuck (Morwood & van Oosterzee 2007:153).

Such was the appeal of the hobbit connection that the team even considered naming the species *Homo hobbitus* (*ibid*. pp151-152). Brown's response to the idea highlights again the distain that many scientists hold for any actions that might weaken the boundary between scientific and popular culture:

> As the referees note, the lunatic fringe are going to have a field day with the Flores midget. The last thing I am willing to do is pour fuel on that particular fire. This is what any reference to hobbits or midgets would do […] Certainly would not help you and Bert [Roberts] get a job. Everyone would think you had gone nutty (Brown in *ibid* p.152).

The attachment of the Hobbit character to the discovery was not the only use of fictional material in realising this creature. A strong element of the 'Lost World' literary genre is also apparent. First made popular in Haggard's *King Solomon's Mines*

(1885), other notable examples include Kipling's *The Man Who Would Be King* (1888) and Conan Doyle's *The Lost World* (1912). More recently the genre has demonstrated its enduring popularity in the success of the King Kong film and its remakes, and the Jurassic Park trilogy (the second of which was entitled 'Lost World'). Inspired by accounts of white explorers discovering uncharted regions of Africa, South America and Asia, the genre became popular at a time when the mysteries of the world seemed to have been largely laid bare by Victorian science and industry, and succeeded in satisfying a yearning for the thrill of the unknown. In the words of Conan Doyle himself:

> There had been a time when the world was full of blank spaces, and in which a man of imagination might be able to give free scope to his fancy. But [...] these spaces were rapidly being filled up; and the question was where the romance writer was to turn to (in Daziell 2002).

This yearning for the mystery of the unknown is echoed in the *floresiensis* coverage:

> We think of our modern world as being totally explored, every inch trampled under the boots of countless surveyors, naturalists and map-makers (*Daily Mail* 28.10.04:24).

A brief consideration of Conan Doyle's novel allows one to identify several motifs common to the genre, and present in the mass media coverage of Flores. A maverick scientist, Professor Challenger (referred to, fittingly, as 'a primitive caveman in a lounge suit' (1995 [1912]:456)), leads a small party of British explorers into the dense jungle of the Amazon in search of a fabled plateau. Having scaled the great cliffs that had kept this land isolated from the outside world since time

immemorial, the explorers enter a forested country populated by all manner of beasts long extinct elsewhere. Living amongst the forms of numerous dinosaurs are two hominan populations, one of archaic ape men, and the other of modern humans, in the form of a native tribe that had sought refuge on the plateau. These elements - the discovery of fantastical, far-away lands; ancient human populations; mythical beasts – are prominent throughout the Flores coverage.

Nature's press release on the discovery, sent out to newspapers on 25th October (later than usual due to fears that excited journalists would break the embargo on the story) did itself make the 'Lost World' link:

> As a form of dwarf human, the new species fits right in with the bizarre extinct fauna of Flores, which until recently was a kind of Lost World (25.08.04).

The popular media took on this connection with gusto. All seven newspapers in the study use the adjective 'remote' in regard to the island of Flores, as did *Nature*, *Science*, and *New Scientist*. This itself is telling of the Euro-centric Lost World mindset with which Flores was interpreted – after all, the island is not remote for its 3,500,000[38] inhabitants. The *Sun* even describes the island as 'deserted' (30.04.05). The *Telegraph* adopts the voice of a Victorian narrator, speaking of a 'lost world east of Java' (3.05.05:22), and the *Observer* of 'a string of mysterious tropical islands' (31.10.04:21). Often the Lost World analogies are made explicitly, as in the *Nature* press release:

[38] Figure of 3,500,000 inhabitants of Flores taken from Jacob et al. (2006:13422)

> Flores until recently was a kind of lost world. It was home to a range of archaic creatures extinct elsewhere, often morphed into dwarves or giant forms (*The Sun* 28.10.04).

> a breathtaking journey into a lost world of mystery, suspicion and myth (*Daily Mail* 6.11.04).

> When the first human colonists arrived on the island of Flores in eastern Indonesia a few thousand years ago, they had no idea that they were treading on the remains of a lost world (*Nature* 27.08.04:online).

As with the Hobbit discourse, the parallels between the Lost World trope and the Flores discovery are not hard to see, but again the link reflects more than a coincidence of elements – it also serves a particular interpretation of events. Namely, Flores Island is some form of idyllic haven, cut-off from a world subjugated by modern humans. This interpretation leads us to the second inspiration for the contemporary reimagining of the Man the Hunter template that I mentioned above. This inspiration is the current of misanthropy within post-modernism that Franklin (1999) identifies in our changing relationship with animals. As he states:

> In the late twentieth century a generalized misanthropy has set in: according to this view humans are a destructive, pestilent species, mad and out of control. By contrast, animals are essentially good, balanced and sane (p3).

Along similar lines, Arnold (1996) states

> a sense of human beings as the guardians and destroyers of nature has only recently dawned upon us, and with it an awesome sense of our responsibility for the past destruction and the future survival of other species (p4).

We have already seen this within Dart's (Dart & Craig 1959) blood-soaked Man the Hunter, in which he grieves over a vision of humanness that revels in the slaughter of fellow humans and animals alike. Whilst the Lost World imaginings of Flores are less visceral, they do echo the notion that it is modern humans who are the Hunter. In the Hobbit label, and in Schouten's drawing, LB1's hunting behaviour has an endearing quality, especially when its stature is juxtaposed with that of the island's huge resident 'dragons'. As Garth's (2006) dissection of Tolkien's hobbit 'Frodo' states, 'He is heroic precisely because he is a *little* man taking on an *outsized* burden for the common good' (p.43, my italics). This hobbit is a plucky underdog, rather than the domineering killer seen in the Piltdown coverage, of which we were told

> Elephants and rhinoceros… and the hippopotamus no doubt he killed for food, and, besides, he must have hunted a species of horse long since extinct (*Ill. London News* 28.12.12:958).

Instead, in the twenty-first century version of the Hunter template, the killer has become us:

> Many of these [species of hominin] may have been exterminated by Homo sapiens, which is also suspected of genocide in the demise of Homo erectus and Neanderthal Man (*Times* 28.10.04:6).

> Discovering a tribe of these people [extant *Homo floresiensis*], though unlikely, would be a major boost for evolutionary science. However, it would most probably be a total disaster for Homo floresiensis. The eradication of the Tasmanian aborigine in the 19th century is a grim but fitting example (*Guardian* 31.10.04:21).
>
> [The division of human body lice into two species] could only have happened through some act of primal genocide when Homo erectus met Homo sapiens somewhere in eastern Siberia […] the lice must have come from very fresh corpses and it is hard to suppose that they had died peacefully just before the intruders turned up (*Guardian.co.uk* 01.11.04).

Keeping with the Lost World analogy, LB1's home was a innocent Paradise that remained unchanged whilst modern humans spread across the globe.

> Their Eden remained undisturbed while modern humans colonised the world (*Mirror* 28.10.04:24).

> We swept all before us. There was probably no deliberate conquest, just a steady outgunning by spear and arrow of precious resources from rival breeds […] safe in their lost world, the Hobbits lived on, undisturbed by the rise and rise of Homo sapiens (*Daily Mail* 28.10.04:25)

This theme is present too in the interspecialist media

> We know that full-sized H. sapiens reached Australia and New Guinea through Indonesia by 46,000 years ago, that most of the large mammals of Australia then promptly went extinct (probably in part exterminated by H. sapiens), and that the first arrival of behaviourally modern H. sapiens on all other islands and continents in the world was accompanied by similar waves of extinction/extermination. We also know that humans have exterminated competing humans even more assiduously than they have exterminated large nonhuman mammals. How could the micropygmies have survived the onslaught of H. sapiens? (*Science* 17.12.04:2048).

> H. floresiensis may have coexisted with modern humans for tens of thousands of years. How the two populations interacted remains a mystery. H. sapiens might have outcompeted H. floresiensis for food and other resources, and this could have played a part in the demise of the smaller species. But it is just as likely that H. floresiensis was killed off by a volcanic eruption on the island that occurred around 12,000 years ago. (*New Scientist* 30.08.04:08)

In another example of how recurring motifs can convey very different meanings in different times, Conan Doyle's explorers of the *Lost World* aid the modern human inhabitants of the plateau in annihilating the ape men, and so become the Hunter themselves. The manner in which the ape men's extinction is related reminds the reader though that this tale was published in the same year - 1912 - that the Piltdown hunter was brought to life. There is then no lament for their destruction:

> Thirty or forty [ape men] died where they stood. The others, screaming and clawing, were thrust over the precipice, and went hurtling down […] [T]he

> reign of man was assured for ever in Maple White Land. The males were exterminated, Ape Town was destroyed, the females and young were driven away to live in bondage, and the long rivalry of untold centuries had reached its bloody end (1995 [1912]:154).

The Hobbit and Lost World discourses then not only comply with some of the scientific claims made – e.g. LB1's dimensions; Flores' flora and fauna; its geographic isolation (at least from Europe) - but also structure the reader's interpretation of the discovery in a manner that reflects wider contemporary understandings of humans, and the human-animal boundary. There is, however, a tension between the two discourses that reflects the complex, multi-faceted nature of our understandings of the boundary. The Hobbit theme encourages us to empathise with LB1, and to connect with its almost-humanness. In a strong sense then it is a clear demonstration of anthropocentric speciesism - the Hobbit is the hero of this tale, not the dragon. In contrast, a contemporary reading of the Lost World theme leads us to see modern humans as the encroacher, which threatens to destroy LB1's lush idyll. The seed of this idea is present in the original Lost World texts which, after all, concerned the search for a world untouched by modernity. Here though the driver of this search is not the fear of modern human's capacities for destruction, which we see exercised without apology in the slaughter of the ape men, but quite the opposite: the search for the adventures that might come with conquering such an untamed place. In the years between its usage in the original texts and the treatment of Flores though, this seed has grown to dominate the diorama. For Flores, contact with modern humans does not bring adventure so much as destruction. It is a strongly misanthropic vision.

The popular interpretation of LB1 is built then within the scaffold of two fictional creations. This is not to say though that it was entirely disassociated from the scientific claims made, but rather it was co-constructed. The mass media took empirical material from the science (e.g. LB1's stature; mis-sized fauna), but made

sense of them by placing them into systems of meaning taken from fiction. Just as in the Piltdown case then, bringing LB1 to life involved a blending of science and nonscience culture. We can see this as a example of the 'traffic between' (1989:377) the dualisms of nature and culture that Haraway identifies and embraces. However, Haraway focuses more on the shared processes of creating both science and fiction - discussing both as acts of storytelling - rather than specifically the use of fiction to make sense of scientific knowledge claims. A closer analogy can be made with the use of metaphor in mainstream science coverage:

> metaphors are… organized in such a way that an area of knowledge or perception that is unknown to the common readers is being reconceptualised in terms of a more concrete, familiar area (Calsamiglia & Van Dijk 2004:378).

This brings us back to the process Lievrouw (1990) identifies, of 'anchoring' and 'objectifying' scientific knowledge claims in order for the public to make sense of them:

> in order for an idea to become the center of an issue culture, in order for it to become popularized, it must somehow fit into the values or beliefs of the larger culture that fosters it (p.9).

In the present study anchoring refers to the process by which missing links are made to fit within the animal/human binary of popular culture. I shall focus on this process in the following chapter. What we are concerned with here is objectifying - the creation of narratives around LB1 that act to cement its conceptually unstable status somewhere close to human, but not quite, by giving this status meaning to a wide readership. This is the role that hunters and hobbits played in the process. The

different meanings invested in the 'Man the Hunter' discourses built into the repertoires around Piltdown man and LB1 reflect the fact that such stories are always more of a mirror to contemporary ideas, rather than a window to the past. It is these contemporary ideas that the figures' narratives must appeal to if their position is to be fixed securely.

5. Public Science

There are elements of the Flores episode that were not only primarily influenced by popular - rather than empirical science – knowledge claims, but which only took place within popular and interspecialist media. These elements I will call 'public science', and they consist largely of the philosophical implications of the discovery, though this is not to say that some of them were not concerned with very practical issues, such as the LB1's implications for animal rights. Traditional canonical models might be content to label these discourses 'popular science', given their location solely within the public realm, but as I showed in chapter five, this label tells us more about the boundary-working actions of scientists than it does about the content of a particular discourse. Such a label connotes an inferior status to such knowledge, a status which is distinctly unwarranted. This material may not have the hard physical evidence that supports the anatomical reconstructions and carbon dating which comprise much of the intraspecialist science discourse, but restricting ourselves to such physical evidence would leave a great deal unsaid. It was partly on this basis that I discounted Gee's argument that such discussions are limited to cladistic analyses (chp. five), although his criticism was of narratives of how these figures lived *their* lives, rather than the philosophical questions of what these figures mean to how we live our *own* lives (though I would question whether the two can be separated). Finally, it is also worth noting that scientists themselves (Henry Gee – who himself warned against creating narratives around missing links (chp.1 , sec. 3) – included) were heavily involved in these discussions.

Such debates were not present in the coverage of the three tabloids included in the study, but within the four broadsheets analysed twelve of the thirty-eight articles on the discovery were partly, or wholly, concerned with these questions. Within the interspecialist media such articles were rare, but present, making up three of the forty full sized articles (i.e. not counting short news briefs). One of these was a column by Gee in *Nature*:

> [Flores] could change our view of ourselves in a fundamental way. As far as we know, *Homo sapiens* is the only species of human that yet lives on the planet. It is very easy to take this solitary estate (and our consequent separateness from the rest of the animal world) for granted, so much has it become ingrained in our philosophy, ethics and religion, even our science.[…] Until now. If it turns out that the diversity of human beings was always high, remained high until very recently and might not be entirely extinguished, we are entitled to question the security of some of our deepest beliefs. Will the real image of God please stand up? (27.08.04:online).

It is worth noting that, as further evidence of this piece's scientific credentials, it is fully referenced. A similarly-themed article appears in *New Scientist* entitled 'A Dent to Our Pride' (30.08.04:3). In *Science*, Jared Diamond[39]'s reflections on the discovery focus more on narrative elements than philosophical ones:

> At last comes the question that all of us full-sized *sapiens* wanted to ask but didn't dare: Did full-sized *sapiens* have sex with micropygmies? The difference in body size would not have been an insuperable obstacle: Some

[39] Jared Diamond is a professor of evolutionary biology and author.

> individual modern humans have sex with children or with domestic animals no larger than the micropygmies. I suspect that the answer is the same as the answer to the question of whether we modern humans have sex with chimpanzees. We don't, because chimps are too unlike humans to appeal sexually to most of us, and because chimps are much too strong, unpredictable, and dangerous to make sex a safe proposition for any individual humans who might find them sexually attractive. Ditto for *H. erectus*, even when dwarfed (17.12.04:2048).

Here too though Diamond considers the implications for our own world view:

> In situations like this one, I've found it useful to get the perspective of a green extraterrestrial friend visiting Earth from the Andromeda Nebula. My friend remarked, "Once again, you humans are prisoners of your ingrained species-centric biases. You already know that large mammals colonizing remote small islands tend to evolve into isolated populations of dwarfs [...] What's so astonishing? Since when aren't humans subject to natural selection?" (*ibid.* p.2047)

Again, this article is fully referenced.

Henry Gee is prominent too in the news media (as a *Nature* editor he was one of the presenters of the London press conference announcing the discovery), telling the *Daily Mail* 'It raises questions about the uniqueness of human lineage - which is the foundation of our society and our religions' (28.08.04:24-25); the *Daily Telegraph* 'Legends of "wild men of the woods", the "Orang Pendek" in Sumatra, giants, and other fabled creatures could be a word-of-mouth record of an astonishing diversity of human forms that lived on until recently' (28.08.04:1); and

The Times 'the emerging picture of densely packed twigs at the end of our family tree [will] profoundly change notions of what it means to be human' (28.08.04:6).

Gee was by no means the only scientist to purvey such ideas in the press. Chris Stringer[40] tells the *Guardian*:

> I think a lot of people thought that humans were somehow different; that we had this all embracing culture and this unifying adaptation, that meant that human evolution progressed in a somewhat different way, because of our technology and the way we probably vainly think we are partly controlling the world, now. So people project backwards and think humans are somehow special. The evidence shows us that our evolution was as complex and as undirected, I suppose, as that of any other species we have studied (19.05.05:8).

Charles Lockwood[41] states in another *Guardian* article: 'This discovery is a wonderful demonstration of the fact that there are many different ways to be human' (31.08.04:21), and in the same piece Yoel Rak[42] is quoted as saying

> We have got to get rid of the idea that because there is only one species of human being today, this has always been true. For most of our evolution the opposite was probably true. Think of that scene in Star Wars - in the bar

[40] Dr Chris Stringer is head of human origins at the Natural History Museum, and co-author of *The Complete World of Human Evolution* (2005).

[41] Dr Charles Lockwood is a biological anthropologist at University College London.

[42] Dr Yoel Rak is a palaeontologist at Tel Aviv University.

where you see all kinds of aliens playing and drinking and talking together. That image gives a better flavour of our evolutionary past (*ibid*.).

Scientists played a prominent role in these discussions then.

6. Modelling Science Communication

An important argument to make at this point is that the processes of popular and public science are not 'distorting' science, but *developing* it. Not only are scientists themselves just as involved in the popular science of LB1 as journalists are, but the discourses they construct expand on the core empirical evidence and, by building linkages between LB1 and already understood themes, allow it to be absorbed into popular culture. The act of popularizing science is simultaneously an act of creating science: "Popularization is part of the making of scientific knowledge, as well as of the sharing of it. Thus, scientists who popularize are doing science in public" (Gregory & Miller 1998:84). This science is science that originates 'downstream', and in the case of palaeoanthropological discoveries like *Homo floresiensis* there is a great deal of it. Such claims takes place exclusively outside of science's exclusive fora (i.e. intraspecialist peer-reviewed papers, university departments and conferences) because they *cannot* take place within them. This may be simply for logistical reasons, as in the case of the Flores dissenters' claims - the eighteen months required for a peer-reviewed response to be published arguably left them with little choice but to make their arguments in the public sphere. Often though it is because the arguments themselves, although beguiling to scientists as much as public, are simply deemed unsuitable for coverage within a discipline that sets great store in its empiricism. These cases show how interspecialist and popular news media provide spaces in which scientists can creatively explore the wider implications of their claims (Felt 2000, Cassidy 2006).

What does the Flores case show in regards to models of science communication then? Hilgartner's continuum model is as appropriate as it was in the Piltdown episode for describing the lack of any clear division between scientific and popular media, whether in terms of style, content or language. In its idioms of 'upstream' science production and 'downstream' popular consumption it is unsuited however to explaining the degree to which the creation of knowledge around missing link figures was the result of a process of exchange between science and wider culture, as seen in the deployment of the Lost World trope. Bucchi's deviation route certainly covers aspects of the debate, in regards to how the dissenters' claims bypassed the usual stages of scientific knowledge production, by going directly to the popular media, but not all of the scientific claims followed this route – the original team's claims were peer reviewed before anything appeared in the popular press. Lievrouw's dual process is telling of how the creature was made sense of through the use of narratives, but in her own work – using a continuum model like Hilgartner's - this only occurs 'downstream'. The hobbit label however is a concrete example of how, during the Flores episode, popular culture ideas were circulating within science *before* any steps were made to engage the public. Whilst this label might not have influenced the Morwood & Brown team's empirical results, it certainly cannot be separated from the environment in which this data was interpreted and explicated in the narratives and debates which followed (including those around the creatures' potential humanness, see next chapter). Going beyond this, there are elements of the debate around Flores that *only* existed in the interspecialist and popular media, those 'public science' discourses around the philosophical, conceptual implications of the find, and these too pose difficulties for models of science communication.

Several analyses of scientific communication, outlined above, are revealing of elements of the Flores episode. None of them, however, truly captures the degree to which the knowledge claims and discourses created around LB1 were a hybrid of science culture and popular culture ideas, and not just 'downstream', but at almost all stages of the episode. The 'literary technology' (Shapin and Schaffer 1989) utilised

by scientists in their peer-reviewed work excels at removing any hint of external, non-empirical influence, and certainly one is hard-press to find such influences in Brown et al. (2004) and Morwood et al. (2004) (though hints are present, as in Morwood et al's selection of particular island fauna to reference in their abstract). However, to see these papers as isolated, 'upstream' producers of knowledge is to ignore how the scientists digging at Liang Bua cave christened their discovery the 'hobbit'[43]; to ignore the *Nature* press release announcing the Brown & Morwood papers that references a 'Lost World'; to ignore Henry Gee's simultaneously-published *Nature* column entitled 'Flores, God, and Cryptozoology' (27.08.04:online). Both Nerlich (2003) and Millburn (2004) identify a similar process – of popular culture influencing science – in reproductive technology and nano technology respectively:

> The mythologized order of precedence is therefore reversed, for it becomes evident that speculations of nanotech were freely circulating in the discourse of science fiction long before science 'grabbed the idea.' If we really want to locate an origin to nanotechnology, it is not to [scientist Richard] Feynman that we must look, but to science fiction (Milburn 2004:123).

Recognising these influences is important not only in moral terms, but practical too: the failure to recognise the value of external influence can lead to mistrust of the kind Wynne (1992) details in his account of scientists' interactions with sheep farmers.

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[43] "You wont hear Peter [Brown] talking about hobbits, he's very much against hobbits. But in the field, all the people that had been digging it up - Peter never came to the field with us – we'd always been calling it the hobbit" - Bert Roberts, of the original Flores team, on the hobbit label (17.04.07).

The Flores episode may be very far removed from routine, everyday science, and so it is perhaps not surprising that models of science communication struggle to accommodate it. This merely reflects the heterogeneity of science, and the need for models to be flexible enough to accommodate the multiple routes taken, and processes undergone, of knowledge claims in their journeys back and forth between the many sites that are collectively termed culture.

> one requires precisely to avoid imposing (as the canonical and the continuity models sought) a general pre-determined outcome to the process of public discussion of scientific issues. Efforts should instead be devoted to describing it in terms of an open-ended negotiation of ideas and related interests (Bucchi 1996:384).

The metaphor of a river in flow, of 'upstream' science production and 'downstream' popular consumption, is not without its truths. Much regular science may indeed follow a similar path, and the uplands are certainly a much more sparsely populated place than the crowded lands downstream. It is, nevertheless, a very constraining metaphor if we are to indulge in a spot of 'cultural cartography' (Gieryn 1999), and we would do better to take a more holistic perspective, to draw out the view to see full process of the hydrologic cycle, and not just a subsection of it. Here water does not simply materialise upstream[44], before flowing downstream and disappearing into the oceans. Instead, through evapotranspiration and then

[44] It is important to underscore this point. It has been suggested by some readers of this work that the model used fails to escape from one of the flaws of the continuum model: that knowledge production still 'begins' upstream. The disagreement stems, I suggest, from differing understandings of the hydrological model on which the metaphor is based (a warning of the limits of metaphorical explanation perhaps). In the author's own conception, there is no one beginning or end, but rather a cycle where knowledge is constantly recontextualised and evolving.

precipitation, the water continually circulates, following regular patterns, but always with the possibility of 'freak' behaviours. As the water moves downstream the river may cut back on itself in many places. Additionally, water will not always flow along the recognised river channels, but can also 'deviate' along different paths - perhaps feeding into bedrock to reappear downstream as a spring. Continual processes of upheaval and erosion change structures of land, and hence patterns of flow, over time. This was evident in the enhanced literary technology deployed during the LB1 debate where, in contrast to Piltdown, the stylistic differences between intraspecialist and mainstream media were much clearer. This temporal dimension addresses Mellor's criticism (2003:529) of Gieryn's (1999) cartographic metaphors – that they fail to reveal change over time.

There are three key elements to this cycle metaphor then that build upon that of the river metaphor. Firstly, that though knowledge claims may generally be seen to flow from science out into wider society, there is also a feedback mechanism, whereby popular culture informs science with its own ideas and beliefs. Incorporating Lievrouw's argument, we can say that the further we go downstream the greater the process of exchange becomes between an ever growing number of influences, both through the meandering of the river cutting back and forth, and the eventual presence of tidal deltas, where the direction of flow changes repeatedly.

Secondly, that no two episodes can be assumed the same, that although there are regular patterns, there is also an inherent contextual instability both within single time frames, and across multiple frames. Most science, certainly routine science, might appear closer to traditional images of communication: something nearer to a ruler-straight, concrete-lined storm drain than the more organic picture above. When science is non-routine however, as it is here, it is disproportionately influential, and such accounts need recognition.

Finally, retaining the lesson of the continuum model: although we can define multiple regions and processes, these are only ever a taxonomic abstraction, and few, if any, clear demarcations exist, as is the case in nature. Such a metaphor would

provide a more telling picture of science-nonscience culture relations, than those outlined above.

7. Conclusion

The Flores episode demonstrates the multifaceted nature of the knowledge created around scientific discoveries that catch the attention of the popular media and the public. No single figure or culture had monopoly over the construction of LB1, instead the figure was a hybrid of science culture and nonscience culture, scientists and journalists. There were many others whose input was crucial too, like graphic artist Peter Schouten, who may have only produced one image of *Homo floresiensis*, but it was one that spoke as strongly as any 1,000 words written about this creature**,** and was recycled endlessly in the popular coverage. Other artists too had a role, as the find was amplified through the literary work of Tolkien and Conan Doyle among others. Finally, the nebulous amalgam of ideas and beliefs that constitute popular culture, and the general public that embody them, were fundamental.

Homo floresiensis appeared to the world simultaneously in both intraspecialist, interspecialist, and popular media in a minutely planned operation that itself is telling of how such 'missing link' figures are far from being the exclusive property of any one domain, scientific or not. An already shot *National Geographic* film was on the way, and a book was to follow. The science journal coverage kept true to its empiric conventions, and so limited its discussion to the physical data uncovered in Liang Bua cave. As with Piltdown however, it was the stories told and images drawn in the interspecialist and popular media that brought the figure to life, and gave the find a relevance beyond the small subset of culture that is palaeoanthropology. This material I was content to label 'popular science', given that it primarily expanded on the empirical claims of the find. That the claims expanded upon were selectively chosen reflects though that this was not merely a passive process, but the active construction of a figure that would attract widespread interest. Other material was a step further removed from the intraspecialist claims,

not attempting to interpret them for a wider audience, but rather considering their implications for areas the intraspecialist media did not even touch on. Such material I labelled 'public science'.

I believe such entities should be spoken of in celebratory tones, for they are just as worthy of respect and study as the empirical claims of the intraspecialist media. However, whilst empirical material itself is certainly not immune to the influences of ideology, popular and public science are by necessity open to contemporary currents of ideas, as it is these that they must appeal to and reflect. This is not problematic per say, but if these imaginings are treated as being no different from empirical data, then there is the potential for them to carry greater persuasive force than they perhaps should. In case this warning is latched upon as proof that popular and public science is in someway inferior to a 'pure' brethren, it most be noted that the most obvious example of ideology leading empirical evidence in the two case studies is that of Man the Hunter, a figure whose original configuration – empirical evidence and all - was promoted by scientists themselves.

The picture we are left with is one which refuses to rest easy with the constrained images of the canonical model's taxonomic chart, or the continuum model's river. Instead, taking inspiration from both the river metaphor, and Gieryn's 'cultural cartography' project (1999), a more comprehensive, complex, hydrologic cycle is suggested. This aims to incorporate the lessons of the continuum model, whilst building upon it, by incorporating systems of feedback between science and wider culture, and introducing an inherent instability, signalling that no two episodes will be identical. No greater example of the worth of metaphors and allusions in our attempts to order and make sense of our world need be made than the story of how '*Homo floresiensis*' became 'the Flores hobbit'.

Chapter 7: Reifying 'Human': LB1 and the Human-Animal Binary

1. Introduction

To say that the existence of a creature like LB1 came as a surprise to experts in the palaeoanthropological field would be a somewhat casual understatement. An informal arms race quickly developed, with scientists competing to out-exclaim one another. Peter Brown, one of the scientists involved in the discovery, proclaimed "I would have been less surprised if someone had uncovered an alien" (*Guardian* 28.08.04:4), and told *Nature* "My jaw dropped to my knees" (28.08.04:1029). Meanwhile, fellow team member Bert Roberts was "'simultaneously gobsmacked, puzzled and amused" (*Guardian* 28.08.04:4), whilst Prof. Chris Stringer was "frankly astonish[ed]… Some of my colleagues' view was disbelief that this thing could have existed" (*Times* 28.08.04:6). Not to be out done, *Nature* editor Henry Gee was nothing short of "flabbergasted" (*Daily Mail* 28.08.04:25).

The qualities that brought such star struck, laudatory declarations from scientists are the same elements that make LB1 such a fine specimen for boundary analysis. Here was a creature with a skull shaped similarly to that of a modern human, apparently capable of tool-use, fire, and perhaps even boat-building, yet with a brain no bigger than that of a chimpanzee. She (the specimen was female) walked upright, and hunted a species of small elephant, but fully-grown was no more than a metre tall. Her hands were anatomically much like our own, but she had large teeth and no chin. Perhaps most challenging of all, she lived just 18,000 years ago, barely pre-dating the historical record. LB1 then was every bit the boundary-straddling figure that Piltdown Man was, mocking the dichotomy of human and animal.

Here, as in chapter four, I analyse how a missing link, an entity denied a categorical position by its own name – a name which leaves it suspended in the ether somewhere between the recognised states of human and animal – was given meaning through the boundary-working and category-working of scientists and

journalists. Though LB1 was declared human by both parties, there remained inescapable elements of otherness to her. Alongside limited capabilities and contradictory characteristics, there was her taxonomic positioning as *floresiensis* - outside our species *sapiens* - and her physical appearance as given by artists' reconstructions. How, then, could this creature's status as human, but not human like us, be fixed? As was the case at Piltdown, the answer relies on the attachment of such creatures to pre-existing cultural figures that already inhabit a conceptually ambiguous position. The 92 years between the two discoveries are, of course, not incidental however, and so where 'kaffirs' and 'Torres Strait islanders' were sacrificed to bring Piltdown closer to us, LB1 required the form of a fictional creation – unencumbered by notions of universal human rights and 'political correctness' - to make sense of its hybridity, by allowing an implicit prototypic classification whilst an explicit Aristotelian classification was being made.

As before, the affixing relied upon notions of 'humanness' for its glue, and so inevitably other contaminants associated with self-identity were introduced to the process. At Piltdown, these included nationalism, gender, race, and anthropocentricism, all elements in how the minds of those involved in the 1912 discovery concocted who they themselves were, and so in turn what humanness must be. Again, the march of time brought with it changes, changes reflected in the contaminants present in LB1's reception. Race, then, went unmentioned, and the role of gender was less obvious too, yet strong echoes remained: once again a female fossil was resurrected as a male hunter in an artists' depiction. Though nationalism was mobilised differently this time, it appeared to be just as potent a force. Whatever the precise deployment of these elements, the tendency for missing links to forge connections far more numerous than simply those of ancestor and descendant clearly remained strong.

In addition to asking of LB1 what was asked of Piltdown man – that is, how it was positioned within popular culture's binary system, here I wish to add an additional element to the analysis, considering in more depth how LB1 was

positioned within intraspecialist science, and the transition of the figure as it moved from science's system of ordering, taxonomy, to popular culture's. Firmly fixing such a conceptually unstable category as a boundary-spanning missing link requires the combined efforts of both scientific and popular systems of meaning. For the public to recognise the figure as one of *us*, or more accurately not one of us, but inhabiting *our* side of the boundary (and hence worthy of attention), LB1 needed to be more than '*Homo*': it needed also to be 'human'. Analysing the manner in which the categories of human and *Homo* were used in the debate is revealing not only of the process of positioning LB1, but also instructive in understanding the wider relationship between scientific and popular culture which I considered in the previous chapter. Despite sharing basic Aristotelian principles, the additional flexibility of science's scheme, plus the differing circumstances of the cultural contexts in which they are used, means that spanning the two systems poses considerable challenges. Analysing this challenge begins with a consideration of the contested origins of *Homo* and its subsequent black-boxing. The box is placed under strain by linkages between *Homo* and human, resulting in problems like the 'Cerebral Rubicon' concept: an empirically testable point at which the nonhuman becomes human. The incompatibility of the two categories is discussed, and why LB1 was declared human regardless.

One of the principal scientists in the Flores find, Mike Morwood, himself touches on the troublesome nature of this meeting of scientific and popular systems of meaning, when in his account of the discovery he states "The definition of genus *Homo* has always been difficult because it is closely tied to the concept of "being human"" (Morwood & van Oosterzee 2007:97). This difficult relationship is the key interest of this chapter.

2. The Act of Taxonomy

The category '*Homo sapiens*' was created by the father of scientific taxonomy, Carolus Linnaeus, the genus *Homo* meaning 'man', and the species *sapiens* 'wise'. In

a forerunner of later uncertainty we were not alone in this genus, but joined by *Homo troglodytes* ('cave-dweller'), which comprised anthropomorphic apes of which Linnaeus had received reports (Marks 2003:21). Now known as chimpanzees, these animals have long since been removed from *Homo* to their own genus, *Pan*, but the source of Linnaeus' confusion – the combination of similarity and difference that marks our relationship with both extant non-human primates and extinct missing links – remains all too evident. So much so that recent genetics research has called for a reversal of this classification: for humans, common chimpanzees and bonobo chimpanzees to be placed within the same genus once more, on the basis of their genetic closeness comparative to other apes (Goodman et al. 2003). The fact that there appears little support for such a move, despite the evidence, reminds one that scientific classifications are not free from the influence of popular classifications:

> technical classifications grow out of and have to answer to our common sense, socially comfortable classifications. It just would not be socially feasible to call a donkey a fish, no matter how good your scientific grounds (Bowker & Star 2000:67).

These problems are not unique to *Homo sapiens* and their phylogenetic relatives, since all attempts to categorise nature, as scientific taxonomy does, face the problem of a disjuncture between the ruler-straight demarcations of Aristotelian classification, and the ebbs and flows of the natural world. Despite what is implied to the uninitiated by the clean lines of taxonomic charts, there is no missing link between any two species, but rather innumerable missing links. The act of taxonomy shrinks all these links down to the width of a single line. In the face of similarity and difference, the decision as to what goes on which side of the line can rely as much on value judgments as it does on empirical evidence.

Dupre (2001) argues that the classical teleological 'tree of life' image of evolution, as consisting of sharply defined channels splitting cleanly at various nodal points, must be rejected, and that instead evolution would be better thought of as an estuary at low tide. The image of evolution given in his quote reproduced in chp. 2, sec. 2, is a picture much closer to Rosch's (1978) model of prototypic classification.

Even those tangible divisions that separate contemporaneous, analogous species, such as reproductive incompatibility, disappear once viewed from the perspective of evolutionary history, a perspective which the missing link demands. Here all species are interconnected through unbroken chains of progenitor and descendant. When you add in to this mix the self-interested role that modern *Homo sapiens* hold when drawing lines separating or joining ourselves and our evolutionary relatives, it is unsurprising that the categorisation of missing links as *Homo*, human, or neither, can become highly contested.

3. *Homo*/human

As so often is the case with science, glimpsing Linnaeus' act of classification 'in-the-making' - before it is black boxed – reveals origins that are far messier, far more political and culturally specific, than the clean, sanitised picture drawn in scientific textbooks decades later. Linnaeus named the class into which he placed humans '*Mammalia*', meaning 'of the breast', a name which it bears to this day. In doing so Linnaeus overlooked other possible defining characteristics, such as hair. Given that mammalia are only functional in the females of the class, and not present at all in some males (i.e. horses) the decision appears a strange one. Schiebinger (1993) shows that Linnaeus' decision was as much a matter of eighteenth century politics as it was empirical analysis – in choosing mammalia as a defining characteristic, not just of humans but of their entire class, Linnaeus was lending support to a contemporaneous movement arguing against the practice of wet nursing in upper- and middle-class European families. As was the case with the racism of the Piltdown man episode, once drawn, Linnaeus' culturally-influenced picture of nature acted

back upon that culture, justifying its beliefs. His act "helped legitimize the sexual division of labour in European society by emphasizing how natural it was for females – both human and nonhuman – to suckle and rear their own offspring" (*ibid*. p409). This act was by no means unique – Bloor (1982) identifies a similar process in 19th century physics and chemistry: "the classification of things reproduced the classification of men" (p. 291). We see in these examples scientific and popular classifications acting back upon one another.

Despite these contested origins, science *has* long closed the box marked *Homo sapiens*, obscuring its beginnings, refining its definition, and successfully maintaining ownership of the term since its inception. It remains separated from common language not only by its history and usage but also by its capitalisation and italicisation. In this sense it is clearly distinct from the category 'human', a category which no one culture can lay claim to. Monopolisation of a categorical system has important outcomes – it allows a management of '*Homo sapiens*' that is impossible of 'human'. The control science has over it, and taxonomy generally, means that the category can be moulded according to scientists' favoured paradigm, opening up new definitions whilst old ones are closed off. As a result, the possible definitions of 'human' are far more numerous than '*Homo sapiens*', encompassing all number of concepts – souls, 'human nature', morality, intelligence, technology, language etcetera – because no single culture has the authority to control it. Additionally, the proximity of 'human' to everyday, mundane classification means, inevitably, that its interactions with prototypic classifications are far more numerous than those faced by *Homo*. The borders of human are then considerably more fuzzy than *Homo*, and they are allowed to be, as they are not required to appear empirically testable.

Conversely, the same lack of ownership makes fundamental changes to the binary system in which human stands exceedingly difficult. 'Human' has, then, a considerable inertia, which is only added to by the inevitably personal nature of the term, being a cornerstone of self-perception. Removing a block from the base of a tower is never a task to be taken lightly. In fact, the weight of modernity itself rests

on the distinction contained within human, helping to keep separate culture and nature (Latour 1993). This can be sighted in the following dictionary definition:

> **Human: 1.** Of, belonging to, or characteristic of mankind, *distinguished from animals* by superior mental development, power of articulate speech, and upright posture (*Oxford English Dictionary* 1989, my italics).

Whatever criteria are used to define human, all are obliged to honour the category's fundamental quality: 'distinguished from animals'. Hence the common usage of 'human-animal boundary', when only 'human-nonhuman animal boundary' should strictly be acceptable. Unlike *Homo sapiens* then, its meaning is entwined with both the category 'animal', as its opposite, and the boundary between them. Taxonomy on the other hand is nominally free of the constraints of the human-animal boundary; such a boundary only makes sense within a binary system. The multiplex nature of taxonomy renders it meaningless: *Homo* is simply one category amongst millions, no more unique than *Felis* or *Streptococcus*. Additionally, the temporal dimension of the taxonomic system means that figures which appear neither exclusively human nor animal, figures which must be brushed under the carpet in the binary system, instead can be recognised with their own formal category, making the maintenance of any strict division nonsensical: it would cut straight through such classes.

The use of the word 'nominally' in the preceding paragraph is crucial however, for despite the impossibility of reconciling science and popular systems of ordering, there is in fact a very powerful linkage between them. There is a great deal to be gained from defining a 'natural' representation of humans, but it requires authority – such as that granted by science – to do so. The gain was evident in Linnaeus' decision to classify us as *mammalia*. The act granted him the power to define what was acceptable behaviour for a specific female subset of the population.

Washburn's Cold-War vision of Man the Hunter is demonstrative that the power Linnaeus wielded is not absent from twentieth century palaeoanthropology, and it was available too to agents in both case studies. Just as important an influence on the conflating of the two categories is of course the wish to capture the attention of the general public, a public far more interested in matters 'human' than '*Homo*'.

Homo sapiens is then connected to the boundary through its own close ties with 'human', ties I shall return to in section four. There is of course a price to be paid in this connection of two mutually-incompatible systems, tensions that are hinted at in Morwood's quote above on the 'difficult[ies]' caused by the close ties between the two. This leaching between the categories leaves scientists attempting to find physical evidence of an intangible concept – what makes a human 'human'? The 'Cerebral Rubicon' that I discuss below is demonstrative of the difficulties scientists face in attempting to attribute humanness on the basis of limited physical evidence – it requires a reifying of humanness. Morwood's response to the idea that we can tie humanness to a specific brain capacity is telling:

> But should size matter? I thought. Surely, it is more a question of cognitive capabilities – and there was abundant evidence that the Liang Bua hominids were smart. While they did not make adornments, paint, or bury their dead, they made use of fire, and were handy with scrapers, anvils, points and assorted stone implements (Morwood & van Oosterzee 2007:110).

There is no hard, empirically-valid point at which the nonhuman becomes human. For Morwood, humanness is not apparent from brain size, but rather from capabilities and behaviours. He himself acknowledges here however that LB1 lacked many human behaviours, a reminder that these criteria suffer the same problems as brain size in determining humanness:

> In reality, many of these features [in human ancestors] evolved gradually, and at different rates, and it could not be expected that they evolved suddenly as a 'package'. Thus recognizing the first 'humans' is likely to remain a matter of great controversy, as it was for most of the last century (Stringer & Andrews 2005:131).

The 'Cerebral Rubicon' attempts to do just that though. Intelligence has long been considered to be a critical quality of humanness (e.g. Lynch & Granger 2008[45]), and so the confusing of *Homo* and human leaves palaeoanthropologists with the task of defining a specific brain capacity at which the non-human becomes human. In their original submission to *Nature*, the team which discovered LB1 placed her within a new genus, *Sundanthropus* (meaning 'man[46] from the Sunda region'). Morwood was desperate to label the find *Homo*, stating:

> Selecting the right name [*Homo*] for the species was important scientifically and politically, to ensure that LB1 was not regarded as just some Southeast Asian oddity of little relevance to the understanding of hominid evolution and dispersal generally (Morwood & van Oosterzee 2007:100-101).

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[45] It should be noted that though Lynch & Granger (2008) see intelligence as crucial in the development of humans, they do argue that its role as a driver of human evolution has been greatly overstated, and that it is, in fact, a product of other, more mundane developments, such as the expansion of the female pelvis which allowed larger brained children to survive childbirth.

[46] Sundanthropus means literally 'man from the Sunda region', though Morwood translates the label as "*ape-man* from the Sunda area" (& van Oosterzee 2007:100, my italics) – perhaps a further reflection of the confusion regarding this creature's status.

However, fellow scientist and team member Peter Brown refused on the grounds that its skull capacity, at 380 c.c., was significantly below the 'Cerebral Rubicon' of 600 c.c., considered mandatory for inclusion in the genus *Homo* (Wood & Collard 1999). Modern *Homo sapiens* have a cranial capacity of around 1400 c.c. Prominent Piltdown scientist Sir Arthur Keith had set the Rubicon at 750 c.c. (1949), whilst Franz Weidenreich declared it to be 700 c.c. (1943), at least in part because this ensured his discovery, *Pithecanthropus*, was on the human side (Krantz 1961:86). In the 1960s, the discovery of the smaller brained *Homo habilis* by Louis Leakey (1964) led him to lower the bar further, down to 600 c.c. This is the figure that Wood and Collard cite in their influential[47] (pre-Flores) paper, which Brown used to justify LB1's status outside *Homo*. The *Nature* referees sided with Morwood however and LB1 was declared *Homo*, bringing the Cerebral Rubicon, a major criteria for admission to the genus, down to just 380 c.c. That chimpanzees qualify on this most recent redrawing is demonstrative of the difficulties of attempting to reify humanness in a meaningful way. This process of repeated regrading to allow new discoveries to qualify for humanness also demonstrates that value judgments become as important as empirical evidence in the drawing of demarcation lines around missing links, and the influence that (potential) popular interest can have on such classifications.

Whilst the bar is moved ever lower, there are further issues raised at the top end of the spectrum. Lynch & Granger (2008) recount the fascinating tale of the Boskops, a series of fossilised remains discovered in Southern Africa around the same time as Piltdown man. Incredibly, these figures had skull capacities nearing 2000 c.c., around 25% larger than our own. If humanness can be conferred by skull size, then what of the Boskops? Were they *more* human than us: might they push us out into the trinary? If intelligence confers dominance, and they had so much of it, how could they have become extinct? It is perhaps the uncomforting nature of these

[47] Wood and Collard's paper is recorded by the Web of Knowledge (http://wok.mimas.ac.uk/) to have been cited by 164 articles in the last eight years.

questions that led to their discovery being almost entirely neglected within both science and popular culture over the last century. Thus today they are largely unheard of. Lynch & Granger's reasoning for this is a reminder of how such discoveries connect with us on a very personal, emotive level:

> Some of our ancestors are clearly inferior to us, with smaller brains and ape-like countenances. They're easy to make fun of and easy to accept as our precursors. In contrast, we've pointed out that the very fact of an ancient ancestor like Boskop, who appears un-ape-like, and in fact in most ways seems to have superior characteristics to ourselves, was destined never to be popular (p.164).

The Cerebral Rubicon speaks of the tension *between* the taxonomic and popular systems of ordering. When the fuzzy, ill-defined concept human is confused with the ostensibly precise *Homo* the result is that scientists are left interrogating data for answers it cannot hold.

Before moving on, a further point can also be made, concerning the relationship between categories *within* the two systems. The re-grading of this definer of *Homo*, from 750 c.c. to 380 c.c., was no doubt not achieved without argument amongst scientists, but it did happen, and in a relatively short 50 year time span. The unchallenged ownership science has of taxonomy gives it a flexibility the popular binary does not, as does its multiplex configuration. A discovery like LB1 – one that surprises scientists and public alike - can simply be placed into a new, formally recognised category, one that includes in it its relationship with pre-existing categories such as *Homo sapiens*. A similarly fundamental regrading of 'human' within the same period of time would seem to be impossible. Without the control of a single, broadly homogenous community, it is exceedingly resistant to such dramatic reconfigurations. It also lacks the capacity to formally recognise additional

categories. The result of this inertia is that nonfits require the delicate process of creating a trinary space, a third category that exists only implicitly, and so does not threaten to shatter the grid which holds it.

In modern palaeoanthropology, *Homo* is applied to modern humans and to our ancestors of the last two and half million years. Following on from the *Australopithecus* line, the earliest *Homo* was *habilis,* meaning 'handy', in reference to its use of tools. At the time of its discovery, in 1960, tool use was believed to be a trait unique to humans, as it was not yet known that other animals such as chimpanzees and New Caledonian crows could utilise them (Stringer & Andrews 2005:130-132). With this validation weakened, there is little to justify the awarding of a new genus to *habilis*. There is no great paradigmatic leap between late *Australopithecines* and early *Homos* that might justify the identification of a sudden dawning of humanness:

> there is no reason to expect an early Habiline [i.e. *Homo*] to be separate from its predecessor by a bigger gap than from its successor. It might seem tempting because the predecessor has a different generic name (Australopithecus) whereas the successor (Homo ergaster) is 'merely' another Homo… But it can't work like that for fossils, if we have a continuous historical lineage in evolution… These are evolutionary regions into which our zoological naming conventions were never designed to go (Dawkins 2004 pp.96-97).

Some creature must bear the mantle of 'earliest *Homo*' however, and *habilis* is perhaps as good a choice as any. Regardless, the point I am trying to make here is that *Homo* is not a natural kind that encapsulates humanness. If thought of as a group of closely related species that share a number of traits, it has a level of coherence. If considered a scientific categorisation of humanness, it quickly unravels.

4. Categorising *floresiensis*

In addition to *Homo*, the two original *floresiensis* papers, by Brown & Morwood et al., discuss LB1 as a 'hominin', meaning a member of the lineage that had split from our closest living ancestor, the chimpanzee (*Pan*), some 5-7mya, and that later gave rise to ourselves, *Homo sapiens*. Members of the linage existing before this split are labelled 'hominine'. It must be noted that this categorisation does not imply any particular relation to modern *Homo sapiens* beyond the fact that such creatures are closer to us, in evolutionary terms, than any other *living* ape. Functionally speaking, the category is entirely arbitrary, created to distinguish between the ancestors of the only two hominine species that survive in the present day, rather than reflect any substantive qualities of its occupants. The idea that hominin implies a privileged relationship with *Homo sapiens* can be further tempered by the fact that the hominini group includes at least eight different species of *Homo* (see chp. four, footnote thirteen), as well as several other genuses as well, including *Sahelanthropus*, *Orrorin*, *Paranthropus* and *Australopithecus* (Stringer & Andrews 2005:12-16). The qualified vagary of those figures reflects not only the lack of certainty borne of extremely fragmentary evidence, but also the intangibles inevitably associated with the act of drawing dividers across continuums alluded to in my introduction.

Where then, in this 'estuary' of life, do palaeoanthropologists deliminate 'human'? Wood & Richmond (2000) tie humanness to the criteria upon which hominin is based:

> Several classes of evidence, morphological, molecular, and genetic, support a particularly close relationship between modern humans and the species within the genus Pan, the chimpanzee. Thus human evolution is the study of

> the lineage, or clade, comprising species more closely related to modern humans than to chimpanzees (p19).

This stance conceptualises human as being that which separates us from other extant species, and as such is similar to the term's usage in popular culture. As with the term hominin however, the difficulty when applying this to evolution is that creatures who existed perhaps 5mya, and who might well have been functionally less similar to us than living chimpanzees are, become eligible for humanness purely by dint of their distant descendants.

A more common stance within the discipline is to use human as synonymous with *Homo*. Andrew Stringer [48] supports this definition (2008: personal communication), and Wood & Collard's (1999) paper *The Human Genus*, on empirical characteristics of the genus *Homo*, implies that it – rather than hominins generally - is the true locale of humanness. Bernard Wood's decision to give two slightly differing answers to this question in papers published just one year apart can perhaps be explained by Chris Ruff's – editor-in-chief of *American Journal of Physical Anthropology* – consideration of the *Homo*/human relationship:

> There is no simple answer to [palaeoanthropologists' use of human], and I imagine that any answer would depend on whom you asked, and perhaps the specific context […] If you are discussing specific taxa among earlier human ancestors, such as australopithecines, then you would normally use the currently accepted taxonomic designations, and probably "hominin" to refer to them all. If you simply wish to refer to general evolutionary events since

[48] Andrew Stringer is a palaeoanthropologist and co-author of *The Complete World of Human Evolution* (2005).

the split of our lineage from the great apes, then "human" is probably fine (2008:personal communication).

In terms of 'general evolutionary events' then, human is applicable to all hominini. When discussing specific taxa however, it is better reserved for members of *Homo* only. The reason for this is presumably that whilst the tensions between human and the rather abstract entity hominin are manageable – or, perhaps more accurately, ignorable – it would be to stretch credibility too much to discuss the more concrete entities *Orrin* or *Paranthropus* as human. Regardless, journal papers discussing particular fossils broadly follow this tacit rule. As they are concerned with specific taxa, they avoid labelling as 'human' discoveries that are placed outside *Homo*, for instances finds that are positioned as *Australopithecines* (see, for example, Suwa et al. 1997, White et al. 1994). Such papers might still however identify 'human-like' features (Asfaw 1999:629) or, in keeping with Ruff's principles, discuss the finds as being on the 'human lineage' (Brunet et al. 2002:145, Haile-Selassie 2001:178). They do not, however, refer to the figure itself in its entirety as human, which contrasts with papers discussing *Homo* discoveries (Vekua et al. 2002:86, Leakey et al. 1965:427).

5. Was LB1 Human?

5.1 Intraspecialist media

Brown & Morwood's papers are not alone in limiting their categorisation of LB1 to scientific classifications: in striking contrast to the intraspecialist coverage of Piltdown man, only four of the fifteen[49] journal papers included in this study (Jacob

[49] Seventeen journal papers were included in the study, but two of these only used *floresiensis* obliquely, in support of other arguments. As they were not concerned with the status of *floresiensis* specifically they have been excluded from consideration of how the find was labelled.

et al 2006, Martin et al 2006 a & b, Herschkovitz 2007) actually apply the label 'human' to LB1. Furthermore, all four of these papers dissented from LB1's classification as *Homo floresiensis*, instead claiming it as a modern *Homo sapiens*, albeit one suffering from some form of disease – this I shall refer to as the 'pathological *sapiens*' argument. As such, their usage of human does not require the conceptual leap that Dawson & Woodward's application of it to their ape-jawed figure was.

What factors can explain this difference in terminology? The obvious answer - that 'acceptable practice' within palaeoanthropology over the last century has changed as taxonomy has become more professionalised - is at best no more than a partial one. Whilst the criteria upon which classifications are based has no doubt become more clearly defined and rigorous, the quote from Ruff given above shows that usage of 'human' is still rather a grey area. I have also shown that there remains a widespread acceptance within palaeoanthropology of the usage of human to refer to fossils classified as *Homo*, as LB1 was. In regard to Brown & Morwood et al.'s papers, a more compelling answer is simply that, faced with such a unique hybrid of primitive and modern features, the authors were too unsure of the figure's scientific classification to stake a claim for LB1's humanness. In their original submission to *Nature*, the team responded to LB1's chimeric qualities by placing it in an entirely new genus, *Sundanthropus* ('*anthropus*' meaning 'ape') (Morwood & van Oosterzee 2007:149-150), much as Dawson & Woodward had with their creation of *Eoanthropus*. It was only in discussion with the referees of *Nature* that LB1 became *Homo*. That Brown & Morwood's team chose not to export humanness beyond *Homo* when Dawson & Woodward had, likely *is* a reflection of the presence of more rigorous classificatory standards.

There is an additional element to consider – that whilst Piltdown man was declared human as a means of drawing it from its liminal position to more conceptually solid ground (and in particular ground that held greater scientific and public interest), it may be that LB1 was conversely already *too* human to be declared

human. Within days of the announcement of the find, dissenting scientists such as Teuku Jacob and Maciej Henneberg were making their own claims: that LB1 was actually a modern *Homo sapiens* (see chapter six). This highlights an important element in the boundary-working of missing links – that their 'otherness' is just as crucial to their newsworthiness and scientific importance as their humanness is. This is the 'unexpected within the meaningful and the consonant' (Galtung & Ruge 1981:55) that I discussed previously. Once the rival claims became known, it became a strategic imperative for supporters of the *Homo floresiensis* thesis that they emphasize LB1's nonhumanness, lest the find simply become 'just another one of us'. In this way the boundary positioning of LB1 was determined by agents' strategic requirements (Gieryn 1983). Whilst Piltdown the 'backwards human' was more interesting than Piltdown the 'forward ape', LB1 was in danger of becoming simply a 'forward human'. Here scientific taxonomy's flexibility provided opportunities which popular culture's classifications could not, at least formerly that is: 'hominin' and '*Homo*' allow the figure to be declared close enough to us to become popularly relevant, whilst still potentially far enough away to register as novel. For the discovery to really interest the general public however the more meaningful 'human' was still required.

5.2 Popular media

If, within the intraspecialist scientific media, LB1 was only claimed as human on the basis of actually being a modern *Homo sapiens*, how was its hybridity dealt with in the popular realm? The answer, in many respects, is 'very similarly to how Piltdown man was dealt with'. The popular media in the study is unhesitating in declaring the discovery to be human, whilst simultaneously acknowledging contradictory characteristics. In doing so, it follows the tone set by the original *Nature* press release:

> The discovery of a new species of human living on the Indonesian island of Flores as recently as 18,000 years ago demonstrates that human diversity in the recent past was much greater than expected. The biggest surprise about the partial skeleton, discovered at a cave site called Liang Bua, is that it belonged to an individual who, while fully adult, was barely a metre tall and had a skull the size of a grapefruit (2004).

The picture of a boundary-challenging figure, declared as human, occurs repeatedly:

> the discovery of the remains of a cousin species to Homo sapiens, a bizarre dwarf human, neither ape nor true man, which survived on a remote island for thousands of years after it was thought the last of our shaggy ancestors died out (*Daily Mail* 28.08.04:25).

> [HEADLINE] Scientists find new species of 3ft humans
>
> [BODY] Dr Morwood hailed the find as one of the most important of the past century. "It is a new species of human who actually lived alongside us, yet was half our size.
>
> "They were the height of a three-year-old child, weighed around 25kg [4st] and had a brain smaller than most chimpanzees.
>
> "Even so, they used fire, made sophisticated stone tools, and hunted stegodon - a primitive type of elephant - and giant rats. We believe their ancestors may have reached the island using bamboo rafts" (*Daily Telegraph* 28.08.04:1).

> [HEADLINE] From 18,000 years ago, the one metre-tall human that challenges history of evolution
>
> [BODY] Australian and Indonesian scientists have identified a new and completely unexpected species of human. It was only a metre high, had a small brain but a distinctly human face. It made delicate stone tools and it shared the planet with Homo sapiens at least 18,000 years ago (*Guardian* 28.08.04:1).

> TOLKIEN would have been thrilled - real-life human hobbits lived happily on a remote lost world until 12,000 years ago.
>
> In a breathtaking discovery, scientists have found the remains of a new species of ancient pygmy on an island in Indonesia.
>
> The little fellas, around 3 to 4ft tall and with grapefruit sized brains, lived on jungle-covered Flores surrounded by giant lizards and mini elephants (*Mirror* 28.08.04:25).

As was the case with Piltdown, additional conceptual weight was required, not simply to force this square peg into the round hole marked 'human', but to force it into the space *between* the round holes of 'human' and 'animal'. To make LB1 matter required the opening up of territory between these absolutes. This was achieved via the utilisation of pre-existing trinary characters, a process which began as early as the *Nature* press release:

> As a form of dwarf human, the new species fits right in with the bizarre extinct fauna of Flores […] Although marooned on its island home, this newly found species of human lived at a time when relic populations of full-sized H.

> erectus may still have been living in nearby Java, and when the entire region had in any case been colonized by H. sapiens. Modern humans have been in New Guinea for at least 50,000 years, and in Australia for a comparable period of time (2004).

These quotes succeed in the critical task of positioning LB1 where it needed to be to achieve popular interest, namely: as an intermediate, a third category – not as human ('modern') as ourselves, but certainly not an animal, or 'relic'. It also makes steps towards anchoring this nebulous position, by linking the figure to pre-existing characters who occupy liminal positions within popular classifications. One of these – the dwarf – appears in the quotes above. Although applicable to modern humans in regard to sufferers of dwarfism (ironically, very similar to what dissenters were later to claim of LB1), the term originated, and is best known, for the diminutive mythical characters of folk legend, the *Lord of the Rings*' Gimli being one such example. It was another *Lord of the Rings* character alluded to in the *Nature* press release that dominated the popular coverage of the find however. The release is headed by a quote: 'In a hole in the ground…'. This references the opening line of Tolkien's *The Hobbit* (1999 [1937]), the tale of a character that was cresting a wave of popularity at the time of LB1's discovery thanks to Peter Jackson's *Lord of the Rings* film trilogy. I have already discussed the parallels between the Hobbit character and LB1 in chapter six, but here my interest is in the Hobbit not as a popular motif, but rather its role as a prototypic locating device (henceforth 'locator'), a burning beacon somewhere in the borderlands.

In chapter four, I discussed the prominent role that race played in making sense of Piltdown man's almost-humanness. At the time of Piltdown's discovery, figures that were semi-human - i.e. human but less human than white European scientists and general public - were readily available, in the form of various 'races'. Linnaeus' (1735) own classification separated humans into four 'subspecies': black Africans, red Americans, yellow Asians and white Europeans, although the scientific

usage of 'race' only really took off towards the end of the eighteenth century in works such as Blumenbach's division of *Homo sapiens* into fives races (Marks 2003:61). Stocking's (1994) work shows that the concept of race at this time was a hybrid of various schools of thought, and Linnaeus was not the only figurehead of the biological sciences to be implicated in its production:

> when in the peroration of *The Descent of Man* Darwin linked himself to the Fuegian and baboon, in effect placing the Fuegians and other living savages in a chain that ran from ape to European, the racial hierarchy of nineteenth-century polygenism and the cultural hierarchy of the eighteenth-century social theorists became part and parcel of one scheme of universal organic evolution (p13).

This hierarchy was rendered pictorially by the *Illustrated London News*' (*ILN*) coverage of Piltdown Man which placed the jaws of chimp, Torres Straits islander and European in an ascending chain of development (28.12.12:958). By the time of Piltdown's discovery, racial science had its own established field in the shape of physical anthropology, led by prominent scientists Hrdlicka (one of the American 'dualists' of the Piltdown debate) and Hooton (Marks 2003:61). The multifaceted conception of race remained however, bringing together and blurring differences physical, cultural, linguistic (Stocking 1994), and in doing so becoming tied to some of the most potent, all-encompassing edifices with which we define our modern-day tribal identities, namely civilisation and nation. Hence the *ILN*'s pictorial juxtaposition of species and nationality.

In the Flores case, occurring almost a century after Piltdown, there was no such living human figure available – to try and claim any living *Homo sapiens* as examples of semi-humanness would be politically unacceptable. Instead, a figure was needed that existed outside the protections of our culturally and ethnically

sensitive times. The answer: a fictional creation: the 'hobbit'. It provokes no political sensitivities, but serves the same role as the savage perfectly – its anthropomorphic form brings it close to us, whilst its diminutive dimensions and hirsuteness keep it distant. Not only does a fictional locator avoid the risk of causing offence, but it also potentially has the benefit of a more universal appeal, a distinction which Daston & Mitman make in a similar context regarding the appeal of animals for advertisers:

> Striking images of animals are in great demand by global advertisers because – in contrast to equally striking images of humans – age, race, class, and culture do not interfere with identification and the desire to acquire (2005:6).

In Tolkien's work, the hobbits were referred to as being one of the 'races of men', reflecting that the work was authored closer to Piltdown's timeframe than LB1's (and meaning of course that the media's adoption of the hobbit as an explainer of LB1's differentness unwittingly conflates species and race once again). It was used extensively in the media coverage – all seven of the UK newspapers included in the study adopted the hobbit label. Its usage in the texts analysed is threefold, and any single example may operationalise the label in two or more of these usages simultaneously. The first of these – as a popular motif to attract non-specialist's attention – has already been discussed in chapter six. The second usage is where 'hobbit' is used to contextualise a particular detail of the creature, as in the first two examples below, but more common is the third usage: as a shortcut through the potentially labyrinthine process of positioning the figure conceptually, as in the latter two quotes below:

> "We now have the remains of at least seven hobbit-sized individuals at the cave site, so the 18,000-year-old skeleton cannot be some kind of freak that we just happened to stumble across first," said Bert Roberts, of the University

of Wollongong in New South Wales, one of the authors (*Guardian* 28.08.04:1).

Professor Brown complains that the PNAS paper is "unsupported by any published research". He says that Jacob's inability to point to a modern skeleton that matches the stature of the hobbit proves that LB1 deserves a hominid classification all of its own (*Times* 28.08.06:17).

[HEADLINE] Hobbits join the fellowship of humans as brain reveals they are a new species (*Daily Telegraph* 04.03.05:07).

REMAINS of nine "hobbits" have now been found by experts - confirming a new species of human (*Sun* 12.10.05).

The possibility does arise during the coverage of the discovery for alternative locators to be used – chimpanzees, and microcephalic and pygmy humans are all discussed in relation to LB1's characteristics. As modern *Homo sapiens* these latter two categories are clearly distinct from the former, and from the already discussed hobbit, with their status bringing them under the protection of norms of political correctness, and their usage as potential locators in the debate reflects this. The most noteworthy element to their deployment in this respect is that linkages drawn between LB1 and these categories are only made in claims attributed to scientists:

After the skeletal remains of the 18,000-year-old human were discovered in the Indonesian island of Flores in 2003 some scientists thought that it must

have been a pygmy or a microcephalic - a human with an abnormally small skull (*Daily Telegraphy* 30.01.07:15).

Henneberg argues that the skull of the Flores hominid is very similar to a 4,000-year-old microcephalic Minoan skull found on Crete in 1975 (*Guardian* 13.01.05:4).

The researchers compared the Hobbit endocast with others including those from chimps, an adult female Homo erectus, a present-day woman, an adult female pygmy, and a microcephalic person with an abnormally small skull.

Professor Falk said: 'The scaling of brain to body isn't at all what we'd expect to find in pygmies, and the shape is all wrong to be a microcephalic (*Daily Mail* 04.03.05:35).

This virtually rules out the possibility that they were like modern humans but suffering from microcephaly, which stunts brain growth, as some scientists have argued (*Times* 12.10.05:25).

This guarded usage – giving responsibility for the claim solely to scientists – is a reflection of the risk associated with claiming a connection between a less-than-human, or at least differently-human, missing link, and a human microcephalic or pygmy. Even if this challenge could be overcome, the simple fact is that the popularity of the hobbit at the time of the discovery, and the associated recognition of its trinary characteristics, made it a far more suitable locator for public audiences.

A low popular profile is not a problem that could be said to hold back use of chimpanzees in the debate however. Chimpanzees, and the great apes more

generally, have long been used as extant missing links, employed as unwitting boundary explorers *par excellence* (Haraway 1989, Marks 2003). Where chimpanzees are used in the debate it is only in the sense of the second usage I identified with the hobbit label – namely in terms of a direct comparison of features.

> Independent experts said they were astounded by the find. "That a human only 3ft tall and with a brain the size of a chimpanzee lived less than 20,000 years ago is frankly astonishing," Professor Chris Stringer, of the Natural History Museum, said (*Times* 28.08.04:6).

> Several features point to brain development more advanced than in Homo erectus or chimpanzees, indicating an ability for sophisticated reasoning and planning. This could explain the complex tools and evidence of fire found around the hobbit fossils; a small brain was not necessarily an impediment to refined thought (*Times* 04.03.05:29).

The chimp too is unsuitable as a locator, because it is - despite its status as our closest extant relative - just not human enough. This is not to deny its role in contextualising LB1's conceptual position, but rather to recognise that this role is in demonstrating what LB1 is not. In this sense it is used in much the same way that scientists use the chimp – more accurately the diversion from it - as the beginning point of human evolution with the category 'hominin'. In other words, the chimpanzee can be seen as a lighthouse, providing a reference point that LB1 might pass close to, but never too close lest it beach itself. The hobbit meanwhile is the harbour tug guiding it towards public interest. In the following quotes then, 'chimpanzee' is used either to provide a relatively less-human comparison to LB1 (first quote below), or to highlight (only) specific features of LB1 that are non-human (latter three quotes):

"We're not talking about a chimpanzee, we're dealing with a smart creature who could hunt in packs and light fires," says Bert [Roberts]. "Village elders still tell of local legends in which hobbit-like creatures survived nearby until quite recently" (*Sun* 30.04.05).

HUNDREDS of tiny, delicate stone tools were found alongside the bones, strong evidence of the creatures' skill and intelligence, although their brains were the same diameter as a chimpanzee's - roughly the size of an orange (*Daily Mail* 28.08.04:25).

The cave on the Indonesian island of Flores, where scientists found the fossil, also contained remnants of stone tools, fire, and a pygmy elephant, suggesting but not proving that Homo floresiensis may have had surprisingly advanced cognitive abilities given its chimpanzee-sized brain. (*Daily Telegraph* 08.10.05:14)

LB1 is an adult and its pelvic shape suggests that it was female. Its teeth are quite worn and the growth lines on the skull are well knit. It had long arms, and its legs were light, and seemingly chimpanzee-like, but it walked upright (*Guardian* 28.08.04:1).

Neither the chimpanzee, nor the microcephalic or pygmy, were used in the manner, and to the degree, that hobbit was in positioning LB1 with the trinary. For the reasons given above, they were simply no match for the hobbit's suitability.

6. Contaminating Factors

If race was largely exorcised from LB1's reception, what of those other elements of identity that intruded upon Piltdown's journey towards humanness? Analysing these discourses is useful not only because it gives a better understanding of the manner in which the boundary positioning of missing links is achieved, but also because it reminds us of how the human-animal boundary intersects with many other systems through which we define who we are. Beginning with nationalism, directly comparing the reception of Piltdown man and LB1 is largely impossible due to the limits of my primary data. A fossil recovered from the Indonesian archipelago is rather less likely to elicit feelings of ownership in a London-based journalist, than one recovered from the green and pleasant lands of Sussex. From secondary sources there is evidence however that LB1 did become embroiled in these discourses.

6.1 Nationalism

Franklin (1999) suggests that the strength of the modern connection to animals, symbolically and emotionally, is in part due to ontological insecurity – the breakdown of old community and family ties, for which animals become surrogates. If this is the case it is unsurprising that missing links continue to exercise great appeal in their provision of a sense of belonging. Nationalism was certainly present in LB1's reception, yet became operationalised in a somewhat different manner from that seen at Piltdown. For a start, the team that uncovered LB1, vanguard of the 'new species' camp, was largely led by Australian scientists, supported with Australian funds. Against them, the 'pathological *sapiens*' camp included amongst its most vociferous members Prof. Teuku Jacob, the 'king of Indonesian palaeoanthropology', and a hero of the wartime resistance movement against the Japanese occupation. Jacob's argument essentially denied Indonesia an ancient ancestor, so one might suggest that the roles were a reverse of those taken by the 'monists' and 'dualists' of the Piltdown case. As always, the picture was more complicated than this. The discovery team was the product of a collaborative agreement between Australian

and Indonesian institutions; one of the principal members was Prof. Thomas Soejono, a contemporary of Jacob's, and the excavation team was largely staffed by junior Indonesian scientists. Jacob's own contrary stance was, by his opponents at least, put down to the fact that he was an advocate of the 'multiregional', rather than the 'out of Africa' paradigm, and LB1 was interpreted as supporting the latter[50]. By suggesting that modern humans developed in multiple locations, rather than simply evolving in Africa before beginning an outward migration, the multiregional thesis offers support to nationalistic discourses. It is ironic then that the same paradigm might have prevented Jacob from embracing LB1 as an important discovery.

It was in how the controversy played out, rather than the original line-in-the-sand exercise between believers and deniers, that nationalism was mobilised in a coherent manner. Although Jacob was not claiming LB1 as an 'earliest Indonesian', he was keen to claim the fossils themselves, and an extraordinary tug-of-war over ownership developed between himself and the discovery team. Making great use of old-boys' networks, Jacob convinced his long time colleague Soejono to allow his lab to take the bones away, without the permission of any of the Australian scientists, who had shared legal ownership of the find with Soejono's institution. Confusing the issue, it seems as though the particularly hierarchical nature of Indonesian academia prevented any of the junior Indonesian researchers on the discovery team from publicly backing Morwood and company. It was at this stage that nationalism came into play. Anthropologist Gregory Forth, who has spent decades studying the living population of Flores, had access to local, as well as international, media during the controversy, and states:

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[50] It is suggested that the fact that LB1 was part of an apparently isolated population challenges the multiregionalism hypothesis by undercutting arguments about widespread interbreeding between archaic human populations. LB1 would have need to be the opposite of what she was – i.e. older, and yet more like modern humans – to lend support to multiregionalism.

> it is not difficult to discern a strong dose of nationalism. Describing Morwood and his fellow-nationals as 'scientific terrorists' (mainly, it seems, because it was Australian members of the team, rather than Indonesians, who announced the discovery to the media), a critical attitude specifically towards 'Australians' is also apparent in several pronouncements of Professor Jacob (2006:339).

Morwood makes a similar accusation, here specifically referring to claims Jacob allegedly made in the *Guardian* which implied colonialist behaviour on the part of Morwood's team:

> he not only restated that LB1 was a modern human male with microcephalia, but that there was now a battle raging between him and the Australian researchers, who could not tell Indonesian scientists what to do; could not play the role of "sheriff" – a reference to Australia's role in East Timor (2007:215).

If Jacob did make this claim to the *Guardian*, then it was not published, although the following did appear:

> Prof Jacob, who has been accused by the Australian scientists who led the excavation of "kidnapping" the bones from Indonesia's centre of archaeology, said the Australian team had "rushed" their work and lacked expertise (*Guardian* 13.1.05:2).

This discourse came to a head when a collaborator of Jacob's, Jean-Jacques Hublin of the Max Planck Institute in Leipzig, wrote a letter to the rector of Jacob's university, Gadjah Mada, attacking Morwood's team:

> I see this whole story as a pure example of scientific neo-colonialism, western arrogance and simply using people. It is also a lesson on the role of the media in our field and how cultural, linguistic and nationalist issues can interfere in a very negative way with science (reproduced in Morwood & van Oosterzee 2007:233).

This letter was later used to support the successful motion to suspend all access rights to the Liang Bua site by the discovery team for a year.

Aside from this very knowing mobilisation of nationalist sentiments in the battle for the bones of LB1, there is also the reaction of the local people of Flores themselves. This cannot be accessed from my primary data, but fortuitously anthropologist Gregory Forth (2006) has carried out his own research on local reactions to the discovery. His account shows that tribes in the region from which LB1 was recovered were unwilling to link *Homo floresiensis* to their own histories. A good deal of the reason for this was that LB1 became tied to specific local dimensions of nationalism, or at least the same sense of belonging which underpins it. One such example relates to the claims of Jacob and the pathological human camp. In light of Jacob's argument that LB1 was a diseased member of one of the local pygmy populations, some saw the categorisation of the find as a new species – *floresiensis* - as an attempt to drive a wedge between inhabitants of the island:

> To paraphrase one opinion: the skeleton dubbed 'Homo floresiensis' reflects nothing more than the fact that the modern population of Flores is made up

> of short, including very short, individuals as well as taller people; they are all equally human and Florenese, and not a member of different species. What one appears to confront here is an ideological reluctance to countenance an interpretation of human (or hominid) remains on the island that threatens modern Florenese unity – a threat which perhaps takes on a political relevance in the present era of 'regional autonomy', when Flores as a whole is being promoted as a natural unit of governance' (Forth 2006:340).

This is another example of how missing links, separated from us by inconceivable periods of history, can nevertheless appear close enough to stir up personal sentiments which cut across numerous domains.

An additional local dimension involves the long reach of the Catholic Church, and its considerable following on Flores (>90% of the populous (*ibid*. p338)). In the 1950s, a Dutch missionary archaeologist, Theodor Verhoeven, uncovered the remains of several short individuals from around 2000 BCE. Florenese Catholics, viewing Verhoeven as one of their own, have adopted his discoveries as part of their own histories. By contrast, the potentially conflicting *Homo floresiensis* is consistently connected with the Australian scientists involved in the discovery. As such it is viewed as being the claims of outsiders (p339), and so discounted in a not dissimilar way to how the British media of 1912 largely ignored foreign dualist interpretations of Piltdown. Forth's account brings to mind Sommer's (2006) analysis of the La Chappelle-aux-Saints Neanderthal discovery discussed in chapter five, where the circumstances of the discovery resulted in the Catholic Church taking on a prominent role in the figure's conceptual positioning. As religion had no explicit presence in the Piltdown debate, its role as a 'contaminant' is one that I have ignored, yet it is clear that in certain circumstances it is no more insoluble to mixing with missing links, and the process of making sense of them, than race or sex is.

If the nationalism seen during the Piltdown episode was largely unreflexive, during the Flores case its greatest use in the debate was clearly as a deliberate

attempt to whip up popular and political opinion in Indonesia against the Australian members of the discovery team. That its mobilisation here was more complicated, and more knowing than it was in 1912 Britain, reflects both changed times and changed circumstances.

6.2 Gender

LB1 was, like the figure recovered from the soil of Piltdown, believed to have been female. In the coverage of the latter this was largely ignored however – narrations of the creature's existence concerned themselves with a male protagonist (e.g. *ILN* 28.12.12:958, *Guardian* 21.11.12:8). The sole exception was the *Express*' 'New Woman' swipe at the Suffragettes, which was no more a recognition of Piltdown's sex than Nov 5th is a celebration of Guy Fawkes' attempted iconoclasm.

Again, the coverage of LB1 reflects the changed world which was imagining this figure, but the picture is not as different from 1912 as one might expect. All reports acknowledge the find as female, but when narrating there is clear preference for gender neutral pronouns:

> Australian and Indonesian scientists have identified a new and completely unexpected species of human. It was only a metre high, had a small brain but a distinctly human face. It made delicate stone tools and it shared the planet with Homo sapiens at least 18,000 years ago (Guardian 28.08.04:1).

> Also known affectionately as "Flo", it hunted pygmy elephants the size of ponies and giant rats as large as golden retrievers, while trying to avoid huge Komodo dragons and other predatory lizards that are extinct (*Times* 28.08.04:6).

> Their Eden remained undisturbed while modern humans colonised the world. It was finally wiped out by a volcanic blast (*Mirror* 28.08.04:24).

There are exceptions to this, and the *Daily Telegraph* in particular acknowledges LB1's sex, as shown in the first quote below. However, for the tabloids in particular it seems as though old habits do indeed die hard. The latter two quotes below show the *Mirror* and *Sun* reverting to Edwardian-like discourses:

> The near-complete, 3ft-tall skeleton with a human face was found in a cave by Indonesian and Australian scientists on the island of Flores, where the woman and her fellow tribe members hunted dwarf elephants and lived alongside full-sized Komodo dragons and an even larger species of lizard (*Daily Telegraph* 28.10.04:1)

> Just how Flores Man - who used tools and hunted for meat in groups - hung on and whether he met modern humans is uncertain (*Mirror* 28.08.04:24).

> Now scientists believe thousands of hobbits lived at the same time as modern man in a bizarre "lost world" inhabited by rats the size of golden retrievers, giant Komodo Dragon lizards and pony-sized elephants - thought to have been EATEN by the new species of *man* (*Sun* 12.10.05, my italics).

Such descriptions are admittedly rare, and overall it is certainly the case that there is more sensitivity towards LB1's femaleness, and less of a sense that this creature was being steamrolled into the mould of male figure. There is one clear-cut case of parallelism between the two missing links though. It concerns what is surely the

most influential imaging of LB1 of all – namely Peter Schouten's drawing that is reproduced in chapter six. Just as Forestier's depiction was of a male Piltdown, Schouten chose to draw a male *Homo floresiensis*, the reason for which is given in Morwood's account of the find:

> Imagine my surprise, however, when I first saw the painting of LB1 a couple of days before the *Nature* publication date. The figure was professionally done and looked very lifelike with a dead giant rat casually draped over one shoulder, but the painting was clearly male – the penis and testicles were a dead giveaway – while the real LB1 was probably female. Apparently, hunting giant rats was thought to be more of a male activity, hence the sex change. It was too late for me to change it back (Morwood & van Oosterzee 2007:192-193).

Of course what Morwood skips in his explanation is why – even if we are to accept that 'giant rat hunting' was a strictly male pursuit – the figure had to be hunting anyway. Despite increased awareness of sexual politics, its seems as though the allure of the (Male) Mighty Hunter remains too great to resist. This should come as no surprise, for the qualities that Haraway identifies in the trope continue, in many respects, to be harmonious with scientists' own experiences. To these we might add the highly competitive nature of modern science in which access to research funding can be a near daily struggle, as has been observed in ethnography studies (Dingwall 2008: personal communication). The 'kill or be killed' nature of the Hunter image may well have familiar echoes in light of this.

6.3 Anthropocentricism

The influences upon LB1's reception that I have discussed above are rather different from anthropocentricism, for although they are all key elements in how we

construct our own identities, they are influences more on *how* a missing link's humanness is shaped, rather than *why* it is shaped as human in the first place. I have already discussed the Cerebral Rubicon's downward trajectory as scientists sought to admit more figures to humanity, and Morwood's own keenness to label the find *Homo* for reasons both 'scientific and political', so here I shall merely revisit the argument briefly.

Anthropocentricism was a necessary force for claiming LB1 as human, for although Morwood cites *floresiensis*' ability to use fire and basic stone tools as reason for its declared humanity, at the same time he acknowledges that it lacked several key human characteristics:

> [not] the least hint of symbolic behaviour, such as pigments, art, adornments or formal disposal of the dead, which are core characteristics of all modern human cultures (Morwood & van Oosterzee 2007:114).

This keenness to label LB1 human reminds us that discoveries of 'backwards humans' are bigger news than discoveries of 'forward apes'**.** This attitude encourages both scientists and journalists alike to categorise a find not just as '*Homo'*, but also the more emotive, the more personal, 'human'. It quite literally gives a discovery more 'human interest' and so fits well with "media news values" (Cassidy 2005). The recollections of Australian science journalist Deborah Smith, who won a Eureka Science Prize for her coverage of *Homo floresiensis*, hints at this too with the particularly humanising way she discusses the creature, and the editor's response:

> I can remember the look on my editors face when I went up and said 'now I've got a very good front page story here, its about *a little person*, they hunted pygmy elephants, giant rats, they lived on Australia's doorstep until 12,000 years

ago, they fended off Komodo dragons, they been found by Australian's, and we got all this fantastic graphic material', and she just looked at me and said 'Deborah, *this story has everything*' (2007. my italics).

7. Conclusion

Two threads were spun out in this chapter, and here the task is to bring them together. One of those threads concerned how LB1 specifically was positioned relative to the human-animal boundary, the other the wider relationship between scientific and popular categorisations of the boundary. Test subjects are often referred to as 'guinea pigs', and the zoomorphic label seems particularly apposite to LB1 in the present account. As we follow her through the maze of connections leading back and forth between science and popular culture, we find gaps, overlaps and tensions both within and between category systems.

Within the intraspecialist media, and in contrast to Piltdown man, LB1 was only declared human when she was claimed as a modern (pathological) *Homo sapiens*. In part this appeared to be because, in light of those claims just referred to, LB1 was in danger of losing her otherness entirely. Scientists supporting the new species classification operationalised a popular culture concept through its absence to aid a scientific debate – by not labelling LB1 'human', they lent support to the idea that this was a new, unique figure worthy of scientific attention.

This otherness was sought out in the popular realm too. Here 'human' was applied universally in the coverage of the figure – without it, LB1 was restricted to arcane scientific classifications that were simply not meaningful enough to really grab the attention of non-specialists. Yet here too there was a battle to position the figure somewhere outside the usual demarcations of human, so simultaneously with the application of human there was talk of 'chimp gaits', 'grapefruit-size brains', and a tiny stature. The crucial role of otherness in a missing link's appeal could be hypothesised as suggesting that people are stimulated by figures which dovetail

more easily with the prototypic classifications used in everyday actions, rather than the more abstract Aristotelian picture. Perhaps excitement follows directly from such entities' accordance with our most immediate, episodic understandings of the world we experience. Regardless, central to LB1's otherness was the hobbit, a locator that already occupied the trinary space between the recognised classes, human and animal. Free of the moral concerns that made the 'savages' of the Piltdown debate unavailable, and immensely popular too, the use of the figure was a masterstroke of scientific popularisation.

As was the case at Piltdown, imagining LB1's humanness involved an interrogation of agents' own mundane classifications of humanness, and so inevitably the creature's identity was filtered through contemporary dimensions of self-perception. Only by exploring her humanness in this way could it be made compelling. Gender and anthropocentricism were present once again in the figure's treatment, the former determining LB1's particular humanness, the latter the fact that LB1 was declared human in the first place. Nationalism too reappeared, both as an influence on Florenese willingness to accept the find as a human ancestor, and as a tool in the dispute between scientists over access to the fossils and the dig site. The considerable cultural changes that have occurred over the 92 years between Piltdown and Flores were evidenced in different nuances to these connections, yet certain images, such as the male Hunter, proved resistant to change.

The key interest of the chapter though was what, in light of both Piltdown man and *Homo floresiensis*, we can say about the relationship between science and popular culture's systems of classifying humans. Missing links are but one example of countless nonfits, yet their resonant role as proto-humans makes the challenges raised by them particularly acute. These challenges are evidenced in the tangled relationship between science's category '*Homo*' and popular culture's 'human', a relationship LB1 allowed us to analyse.

Within science, protagonists refrained from labelling the find human, except when claiming LB1 was a pathological modern human, though only because the find's otherness was in danger. Instead, *Homo* and hominin were used to place the find in an ordered system of meaning. As examples of the discrete units mentioned above, both classifications suffer when confronted with the seamless flow of evolution. However, if these difficulties become overwhelming a new category can be created to release tensions. Thus early in LB1's analysis, the new class *Sundanthropus* was created when it seemed impossible to force the creature to fit *Homo*. Eventually it was decided a new species name was enough to recognise LB1's contradictions.

The category 'human' is very different. Unlike *Homo* it is not part of a multiplex system, but an apparently far simpler binary one. Though it might be defined in countless ways, its fundamental criterion is its distinction from the other class of the binary: 'animal'. It is then irrevocably tied to the human–animal boundary. Without the control of a monopolising cultural group, as in the case of *Homo*, it is exceedingly difficult to limit and refine possible definers of human, and so a profusion of images exist. Specific deployments of the term are however fortified through the use of particular narratives and tropes, as detailed in chapter six.

Problematic cases, whether they be the fossilised bones of LB1 or the literary creations of Tolkien, are conceived of prototypically, yet making sense of them for a general audience requires their integration with the formal system with which popular culture conceives of humans' relationship with nonhumans, i.e. the binary. This can be achieved by immersing their difficulties in the space of the trinary, with the meeting points between it and the categories it separates ill-defined and subject to constant revision. Tacit redrawings of the human boundary were observable in both case studies, as missing links were brought closer and unwanteds moved further away.

Human is then given meaning by the human–nonhuman boundary, a boundary which is irreconcilable with scientific taxonomy, where *Homo* is nominally

just one genus among thousands. Despite the conflict between these categories, and between science and popular systems of ordering, there is a very powerful linkage between them, spurred on by multiple elements. Firstly, a scientific representation of 'natural' human behaviour can carry a great deal of force. We have seen this force wielded in the work of both Linnaeus and Washburn, both of whom, consciously or not, sought to shape nature according to their own cultural beliefs. In doing so they naturalised those beliefs such that their claims no longer relied on their own mortal authority, but Mother Nature's. Peter Schouten's drawing of a hunter, and Morwood's justification of LB1's humanness by reference to fire and tool use, were part of such a process. Secondly, it is only with the label 'human' that scientists can ignite popular interest in their discoveries: '*Homo*' is too esoteric for this task, and if LB1 was to be a media sensation and so guarantee the future status and research budgets of the scientists involved, it had to be human. Thirdly, I have suggested that it is both appealing at a personal level, and potentially helpful at a creative, intellectual level, for scientists themselves to interrogate such discoveries in terms of humanness. This is supported by the use of the term human within intraspecialist science media in spite of the fact that it lacks any clear scientific definition.

There are dangers in this blurring of scientific and popular classifications, leading to the 'difficult[ies]' that Morwood alluded to when trying to define *Homo*. For society, perhaps the greatest danger lies in the naturalisation of social divisions of which Linnaeus and Washburn were but the most overt examples. For science, it is the danger that conflating *Homo* and human leaves both categories corrupted. The clotheshorse nature of human – a rather blank template ready to don whatever attire is required – relies on "objectification" (Lievrouw 1990) to give it meaning. This is not possible within the carefully mediated "literary technology" (Shapin & Shaffer 1989) of science. The result is that human is essentially meaningless in its scientific usage, as we saw in both case studies.

Furthermore, within taxonomy there is no human-animal boundary, and the object which has such unique status within popular culture is here simply *Homo*

sapiens, a binomially classified entity like any of the millions within taxonomy. Here there cannot be the fuzzy demarcations of popular culture to reconcile our prototypic experiences and our Aristotelian orderings, as these represent disorder, and so the lines separating *Homo* from other categories are sharp. When missing links betray the certainty of these divisions the taxonomic response is to grant them their own territory with its own clear borders. The danger for *Homo* is that its proximity to human leads to more being asked of it than it – than any sharply defined category – can possible fulfil, a danger seen in the Dawkins quote given above on the gap between Habiline and Australopithecus.

We can derive from these points that in this context human is very much a boundary object, conceptualised differently by science and popular cultures, yet retaining enough integrity that scientists can use the label to communicate successfully with the public and, perhaps less visibly, draw on popular tropes and discourses to help shape their analysis. More than this though, there is a fuzziness to human *within* the single field of science considered here. We saw then that palaeoanthropology has no clear definition of the category, yet generally used it in association with *Homo*. Whilst there are dangers in the intermixing of the two, scientists' continued use demonstrates that the benefits more than compensate. They would do well to recognise though that it is precisely human's opacity that holds its rewards. Its blurred boundaries mediate between what must be pinned down (*Homo*), and what cannot be (the personal, emotive aspects of humanness). Such definitional opacity is an anathema for science culture, yet attempts to fix the category in position result in impossibilities like that of the Cerebral Rubicon, where scientists search for physical evidence of an intangible concept – what makes a human 'human'?. Despite then disorder being seen as a threat to science it is clear it cannot escape it, and given its usefulness in allowing scientists to operationalise valuable, nonscientific concepts like human, they should be thankful for this.

Chapter 8: Conclusion

1. Introduction

In chapter one the three key research questions of the thesis were set out as follows:

> **What shapes the positioning of missing links relative to the human-animal boundary?**
>
> **What do we learn about the communication of knowledge between science culture and popular culture during these episodes?**
>
> **How do scientific and popular classification systems interact during these episodes?**

The thesis identified a locale at which the boundaries of human-animal and science-nonscience crossed – namely the missing link – and placed the site under observation so as to understand both better. For both binaries, the missing link is a threat which refuses to comply with the dichotomising mind that seeks to order it. It is detailing this threat, and the categoriser's response, that the thesis has sought to elucidate over the previous four chapters, and it is this material that I now proceed to recount.

Bowker and Star's (2000) sociology of classification was useful in structuring the analysis, primarily in highlighting both the manner in which social boundaries become embedded in acts of classification, and also the powerful influence of socio-cultural ideas on these seemingly technocratic acts. Aristotelian dichotomies abound in Western thought: good-evil; alive-dead; mind-body; gay-straight; science-art. Very real consequences issue from these boundary-drawing acts, as is the case with all conceptual divisions, for they do not only divide, but also order: they determine the status of protagonists, and the relations between them. Despite then, their presentation as natural facts, they are laden with cultural values. The binaries interrogated here are no exception. The first, human-nonhuman animal, is as universal, as fundamental, in its scope as any imaginable, singling out one species from all those other millions that share with it the Earth's ecosystem. The structure of this binary's ordering grants those that use it a dominance over all nonhumans. The second binary, science-nonscience culture, acts similarly: both separating off one subset of culture from all others, and granting it a dominance evident in its untouchable authority.

The use of Gieryn's (1983, 1999) model of boundary-work emphasised the parallels between these two orderings. Both are discursively produced, often by agents identified as scientists; both are theoretically weak in justification, yet extremely durable in practice; both enable the dominance of the few over the many. Though both divisions are culturally situated, the human-animal boundary is ostensibly different in that it prescribes a natural division rather than a social one. One is reminded, in different ways, of the work of both Douglas (1969) and Latour (1993): that to consider nature and culture separately would be a fallacy. Divisions of culture and nature act back upon one another in human societies, mutually reinforcing one another, whilst it is only their conceptual separation in modernist thought that allows contemporary society to so successfully intermix them in practice. My own work during this thesis is no different – extensive use is made of particular conceptions of the physical, 'natural' world, to produce what I hope are illuminating metaphors of cultural processes. The hydrologic model of science

communication is a fine example. I believe such parallel thinking is not only beneficial, but fundamentally unavoidable, as such metaphors exist in even the most basic, apparently literal, statements (Lakoff & Johnson 2003). The key though is to recognise when such linkages are taking place, and to remember that the pictures of nature used are no less cultural than those processes they are used to illuminate. The challenge of interrogating these binaries side by side is then a worthy one.

Lievrouw's work (1990) was helpful in unpacking this process:

> Representations [of scientific knowledge claims] are generated by a dual process of *anchoring* (classifying an unfamiliar phenomenon into a set of categories) and *objectifying* (converting the unfamiliar and abstract phenomenon into a familiar and concrete phenomenon by developing an image of it) (p.5).

Obviously the two processes are interlinked, for categories bring within them particular images, and vice versa. That said, answering the first question above, with its focus on the categorisation of missing links as 'human', is primarily concerned with the means through which Piltdown and LB1 were anchored. This makes up section two below. Here we see the symbolic role unwittingly played by missing links, influencing both their scientific and popular classification. The careful working of boundaries is also apparent, as some figures are granted access to categories whilst equivalents are chased away. In this way the boundaries of human are repeatedly redrawn. The uncomfortable meeting of scientific and popular classifications is also discussed, as is the reasons why scientists continue to encourage such intermingling, despite the problems it brings.

Section three, tackling the second question above, deals more with the process of objectifying the finds. Studying how images of these figures were developed allowed us to consider the process of scientific communication.

Hilgartner's (1990) analysis is used to explore how scientists used the concept of 'popular science' to engage the public with these discoveries, protecting their authority whilst using many of the same discourses as nonscientists. The unidirectional 'continuum' model implicit in Hilgartner's work is itself criticised for failing to reflect the huge influence that popular culture had on science culture's knowledge claims of both finds. It also fails to recognise the value of the public realm as a creative space for both scientists and nonscientists. This section finishes with an alternative model of science communication which seeks to encompass the lessons learnt.

In section four I detail the trinary concept utilised in understanding both missing links and popular science, and its relationship with both Gieryn's and Bowker & Star's work. I end by considering hints in the coverage of LB1 which suggest that the strains placed on the human-animal binary may be beginning to take their toll, and that there is a growing awareness of its frailty.

Finally, in section five, I briefly consider the ethical implications of the boundaries considered, and for the need for humans to justify the dominance it awards us.

2. What shapes the positioning of missing links relative to the human-animal boundary?

Both Piltdown Man and LB1 were declared human, despite their obvious contradictions. In the intraspecialist paper that announced the find, the discoverers Dawson & Woodward claimed Piltdown Man as human as early as the title of the paper, but no justification for this act was forthcoming. Though the skull "could scarcely be removed from the genus *Homo"*, the jaw was "completely distinct" from it. Its brain size too defied binary divisions: at 1070 c.c, it was roughly halfway between human and chimp. The authors did show recognition of these complexities in their classification of the find, creating the new genus *Eoanthropus* ('dawn man')

in which to place it. The chimeric qualities which justified this new genus were not, in the eyes of its patrons, enough to dent its humanness however.

The mainstream media was no different in shoehorning Piltdown. The first coverage, in the Guardian, was typical, acknowledging that the figure had as many ape features as it did human, yet not hesitating to celebrate its humanness. In an oft-recurring example of conceptual confusion, the article utilised a metaphor in which Piltdown was placed between “the highest apes and the lowest men” (19.11.1912) – presumably meaning it was neither – and yet was still claimed as the latter.

Within the intraspecialist media, LB1 was *not* declared human, except where dissenters claimed it to be a pathological modern *Homo sapiens*. The decision of the discoverers not to use the label in the original two papers may be explained by the fact that it was only classified as *Homo* following the input of peer reviewers – previously Brown & Morwood et al had been ready to grant it a new genus *Sundanthropus* ('Sunda man’) due to its contradictions. It was decided instead that a new species name – *floresiensis* – would be enough. The decision of later papers to avoid human is more telling for the answers we seek, for it is best explained as a response to the dissenters’ claims that this was simply a diseased modern human. In light of these arguments, the usual imperative – to declare the find human – was replaced by its opposite: to downplay the figure's humanness, lest it simply became one of us. For scientific as much as popular interest then, the otherness – that is to say, the novelty – of a missing link is as crucial to its importance as its sameness. Perhaps the fact that missing links speak so directly to the prototypic classifications through which we experience the world directly, and challenges more abstracted Aristotelian conceptions, helps explain their popular appeal and symbolic richness.

In the mainstream media, there was little more questioning of LB1's humanness than there had been of Piltdown's. From the *Nature* press release announcing the discovery onwards, the creature was – despite being unlike any known previously – undeniably human.

The status of both Piltdown Man and LB1 as 'one of us', was key to their reception. In both case studies, scientists and journalists alike were driven to declare the figures human despite their many nonhuman characteristics. Without the declaration, these creatures were simply animals like any others, and without any particular relevance to the general public they were no more worthy of attention. The links these figures forged with contemporary individuals were not limited simply to this most fundamental of identifiers, but included many, in a reminder of the interlinking of natural and social boundaries (Douglas 1969). Most obvious of these was nationalism, which in an age of imperialism, in a Europe on the precipice of devastating interstate conflict, was particularly powerful in determining Piltdown's reception. Where German, French and American scientists saw a mistaken confusion of ape jaw and human skull, its discoverers saw nothing less than the "Earliest Englishman" (Woodward 1948) and his "cricket bat" (Dawson and Woodward 1915:148)**,** whilst the British press celebrated "regaining the prestige we enjoyed half a century ago in the days of Huxley and Prestwich – the heyday of English anthropology" (*Guardian* 20.12.12:16). Notions of a particular geographic tie to a fragmented, ancient fossil were present too in Indonesia 92 years later, when nationalist sentiments were mobilised in successful efforts to ban "neo-colonialist" (Hublin in Morwood & van Oosterzee 2007:233) Australian scientists from the site of their discovery on Flores.

Gender, race and speciesism too became connected to these figures through the discourses which made sense of them. Both creatures were believed, on the basis of their physical remains, to have been female. For the patriarchal society that received Piltdown *Man*, this was an easily ignored detail, and the creature was reanimated as a male Mighty Hunter. The only exception was in fact no exception at all: the *Daily Express* hailed the find as "The New Woman**"** (23.12.1913)**,** drawing a mocking parallel between its imagined lack of femininity, and the suffragette and suffragist movements of the time. Such overt sexism was unacceptable in the 21st century case study, yet the masculising language of old occasionally crept into the tabloid coverage of the find, and Schouten's iconic recreation of LB1's deep time

took a detour through Edwardian England with its direct echoes of the *Illustrated London News*' (28.12.1912) weapon-wielding male hunter.

The presence of race in the Piltdown case meanwhile was a further reminder that society, as well as nature, was being shaped in the discourses around these figures. Numerous non-European 'savages' were used in the effort to make sense of Piltdown's otherness. Their humanness was expended for the sake of Piltdown's, not only naturalising England as a timeless entity, but simultaneously justifying its subjugation of the colonies. Furthermore, these unfortunates shouldered a burden that the Man the Hunter trope would later carry forward: protecting Europeans from the implications of Darwin's theory – that there was no binary, and no boundary to justify our dominance, only instead the seamless sweep of evolution. For the agents at Piltdown, these people *were* the boundary: a buffer between the animals and themselves. Meanwhile contemporary primates, also utilised in positioning Piltdown Man, were left out in the cold, turned away for their lack of English pedigree, and for having the temerity to remain extant.

When, post-1945, it became no longer possible to sacrifice the humanity of foreigners for this task, Man the Hunter was invoked as a new line of defence. As a popular trope, it was already present at Piltdown, seen in the *Illustrated London News*' depiction (28.12.1912) and the accounts of its lifestyle given by scientists and journalists alike. Now though it became a formal scientific account too. This imagining provided not only a naturalising of techno-militaristic patriarchal society, but offered a clear adaptive shift to neuter the implications of evolutionary theory. The same skills that granted scientists dominance in Western, Cold-War society then also granted humans uniqueness in – and so dominance of – the animal world.

By the time of LB1's arrival, Man the Hunter too had been worn away, eroded both by new social currents that could not see their own existence echoed in the aggressive image of the Hunter, and by zoological research which showed that group hunting and tool use were far from being skills unique to ourselves. To make sense of this new discovery's semi-humanness required a figure that – like the savage before

it – already occupied the boundary, but which did not have the basic protections that all humans have (discursively at least) in an era of universal human rights. The answer was the fictional Hobbit character, one of Tolkien's 'races of men', whose liminal characteristics – anthropomorphic yet hirsute and mis-sized – were already well recognised.

Unlike its frontline forbears however, the fictional nature of the Hobbit offered little protection for the boundary, and the new instability of this division was reflected more widely in the discourses around LB1. Far greater reflexivity was present than was the case at Piltdown, with scientists and journalists alike questioning the borders of human, explicitly redrawing the boundary where it was only previously done so unseen. Such is the conceptual inertia of the binary however, that agents preferred – in the absence of a sacrificial lamb like the savage, or a bulwark like the Hunter – to surrender some of our humanness in making sense of LB1, rather than attempt to overrun the boundary itself. Further evidence of a more complex relationship with the boundary was derived from contradictions between the use of the Hobbit as a locator on the one hand, and a particular reading of the Lost World literary trope on the other, both of which were used in "objectifying" (Lievrouw 1990) the find. The usage of the Hobbit character revealed an anthropocentric speciesism, yet in the Lost World discourse was a misanthropic vision of modern humans as the Hunter, encroaching on LB1's innocent paradise. These contradictions went unresolved.

Central to understanding the positioning of missing links are the categories 'human' and '*Homo*', and the relationship between them. At the heart of both case studies, though it often went unsaid, was the question 'what is humanness?'; 'what makes this creature human?'. This was true of both intraspecialist and mainstream media, the only difference being that within the former it was asked through proxies such as skull capacity and tool use. It should be no surprise that at the heart of all enquiry into our evolutionary ancestors lies this most self-centred of questions, and

it is one that evolves quickly into ‘what is *my* understanding of *being* human?’. In this lay the appeal of Man the Hunter for twentieth century Western scientists.

The attraction of human is such that it distorts the sharp lines of science's taxonomic system, bending them around itself. LB1 discoverer Mike Morwood acknowledged this influence: “The definition of genus *Homo* has always been difficult because it is closely tied to the concept of “being human”” (Morwood & van Oosterzee 2007:97). The reason for this mixing is hinted at in his explanation of why he wanted LB1 to be categorised *as Homo*:

> Selecting the right name for the species was important scientifically and politically, to ensure that LB1 was not regarded as just some Southeast Asian oddity of little relevance to the understanding of hominid evolution and dispersal generally (Morwood & van Oosterzee 2007:100-101).

Behind these careful words is an admission that human status is not simply a lure for the general public and journalists, but one which attracts scientists too. Though professions are notorious for their disavowal of popular language within their identified domain (Abbott 1988, Shapin & Schaffer 1989), such is the draw of 'human' that scientists use it even within their intraspecialist work. Although its usage is somewhat undefined, here it is generally taken as being synonymous with *Homo*. The fact that in both case studies scientists were ready to create new genuses outside *Homo* in which to place a “human” creature shows that this relationship is far from concrete however. Furthermore, the differences between the systems in which *Homo* and human exist mean that it cannot be concrete.

Homo is a taxonomic category. Cultures adopt categorical systems which suit their specific requirements. For science, taxonomy's utility lies in its powerful combination of Aristotelian immutability and multiplex flexibility. Science culture's *raison d'etre* is one of control: to master chaos by ordering it. This task can only be

achieved by the distillation of complexity. Taxonomy achieves such an act by shrinking countless generations of individuals down to the width of a single line, such as that between *Homo* and its progenitor *Australopithecus*. This particular line holds no special status, being no different from the multitude of other lines separating multitude other genuses. As a property of science, *Homo* can be defined with whatever specificity is required, and according to whatever evidence is most current and most accepted.

Human is a popular classification which is easy to example but impossible to define comprehensively. Its key role in self-perception, its immediacy to everyday experience, means that the influence of dynamic, prototypic classifications is considerable. Furthermore, without the ownership of a particular cultural group, there is little to prevent its meanings and definitions propagating freely in a disordered manner. Conversely, this lack of control means the binary system in which it operates has a great deal of inertia. If human does have one fundamental quality, it is that it distinguishes from animal, and so it is irrevocably tied to the boundary, and the binary system. The binary system is not tasked with creating accurate, ordered maps, but with the more pragmatic goal of enabling its users to successful negotiate through their everyday (nonscientific) pursuits.

Missing links, by their very nature, challenge the Aristotelian basis of both taxonomic and popular systems. Taxonomy is designed with such challenges in mind however, and so can respond either through the creation of a new category, or – making use of science's monopoly – the redefining of an old one. Without the flexibility to cage and neutralise the challenge, but also without science’s fear of disorder, the popular binary is content to lose its troublesome monsters somewhere out in the shadowy borderlands between human and animal, or, simply ignore their questions, and address them as one or other recognised category.

The conflation of human and *Homo* creates problems. Starting from a theoretical standpoint, human is tied to the boundary yet this boundary is senseless when placed in the context of the taxonomic system, where the division between

Homo and *Australopithecus* is nominally no different from any other division between genuses. *Homo* cannot then be thought of as a natural kind encapsulating humanness. The conflation also results in scientists attempting to reify humanness. The 'Cerebral Rubicon' is such an example, an attempt at a empirically valid criterion – i.e. skull capacity – for humanness. Between the 1940s and 2004 the Rubicon was reduced from 750 c.c. to 380 c.c as new finds appeared which scientists wished to declare human. LB1 was the most recent muse for this regrading, her skull so small that we are left with the illogicism that chimpanzees now qualify for humanness. Finally, the personal interest invested in human influences *Homo* too, so that chimpanzees are kept from *Homo* despite being close enough genetically (Goodman et al. 2003), and suitable according to the Rubicon. Meanwhile, the Boskops, a species of human discovered in South Africa around the time of Piltdown who had skull capacities 25% bigger than our own, are ignored by both science and popular culture alike due to uncomfortable implications for ideas of our uniqueness.

Despite these troubles, the case studies show that scientists continue to court the category human, for it allows them great authority in defining 'natural' human behaviour; it attracts popular interest and the resources which come with it; it is stimulating for scientists themselves when interrogating their work. These benefits rely on the ambiguity of ‘human’, the same ambiguity science sees as a threat, so revealing the paradox at the heart scientific orderings of our ancestors.

3. What do we learn about the communication of knowledge between science culture and popular culture during these episodes?

The starting point for the thesis in regards to this question was Hilgartner’s (1990) critique of the pure/popular model of science. This ‘culturally dominant’ model claims a clear distinction between ‘the idealized notion of pure, genuine scientific knowledge’ (p.519) on the one hand, and inferior, unreliable popular science on the other. Hilgartner argues that this is a crass simplification of a complex reality, in which clearly separating the content of the science that goes on within laboratories

and university departments from that in the public realm is impossible. The success of the model is attributed the protection it affords scientists: it allows a boundary between themselves and wider society which they can cross at will, but which nonscientists cannot.

Both missing links provided an opportunity to chart the relationship between science and nonscience culture at a time when the usual boundaries between the two were tested by the level of public interest in the story and, interlinked, the cultural relevance of the subject matter. This was not then ‘routine’ science, but the very thing that made it unusual meant also that it was particularly worthwhile to study: its cross-cultural impact was inversely proportional to its perceived normalcy. This opportunity was used to critique the pure/popular model, and then, in turn, question Hilgartner's own 'continuum' vision of science communication.

Gee's analysis (2000) of “deep time” shows that whilst fossil remains allow us fascinating glimpses of the past, they are just that: glimpses. Both debates journeyed far beyond the limits of what was empirically supportable, but this material was not worthless, it is simply that it was telling of ourselves, not of Piltdown and LB1. Missing links offer an irresistible chance to draw ourselves on our past and so naturalise a particular view of the world. Both debates hinged on contemporaneous perceptions of identity, and scientists and journalists alike were subject to these influences. As a result a militaristic Hunter image dominated Piltdown's humanness, whilst the discourses around LB1 centred on a less aggressive 'cute' underdog. Here the dangerous Hunter was modern *Homo sapiens*, and it was not a status that was celebrated. These figures are also telling, again as I've shown above, of how we conceptualise our relationship with other life.

Studying the process of science communication during the two episodes, a key interest became that of the category ‘human’. It is on this contested ground that scientists could engage the public’s interest, and in this sense human provided a classic example of a “boundary object” (Star and Griesemer 1989), that allowed movement between different domains whilst holding different meanings for each of

them. Human was used in all three media studied to anchor the finds (the absence of it in the intraspecialist coverage of LB1 was due purely to the argument of dissenters). Referred to above was the absence of any clear definition of the term within both its popular and scientific usage. Going beyond this though, prominent in the case studies was the fact that intraspecialist texts were unable to use many of the techniques that could be used by mainstream media to "objectify" (Lievrouw 1990) the finds, and in doing so pin down the meaning of human. These techniques largely revolved around narration, whether in terms of creating a image of how this human lived (i.e. the Hunter); linking to pre-existing narratives (i.e. the Lost World literary genre); or locators like the Hobbit which brought with them their own narratives. An additional element, just as worthy and yet just as galling for notions of pure science, was the philosophic reflections on the implications of the discoveries for our conceptual systems. Such material is liable to dismissal as distortion by the pure/popular model, yet it arguably produced the most revealing knowledge claimed during either episode.

Contrary to the claims of the pure/popular model then, the absence of objectifying was the only meaningful difference between intraspecialist media on the one hand, and mainstream media on the other. Scientists were actively involved in non-intraspecialist accounts during both case studies, even involving themselves heavily in narration: both the Hobbit and Lost World tropes were introduced before journalists even heard of the LB1 story, and it was Woodward and Pycraft who spun Piltdown stories of heroic "wandering hunters". Authorship, then, provided no grounds for division. During the Piltdown episode there was no stable separation on grounds of style or content either. The maturation of media niches during the years between the studies was evident in the clearer stylistic differences in coverage of LB1, yet apart from the afore mentioned narrations, key claims remained equivalent across domains. As Hilgartner argues then, there is no clear separation of science and nonscience, but rather a relationship that more closely resembles a continuum.

The pure/popular model grants solely science the status of knowledge producer, yet its "literary technology" (Shapin & Schaffer 1989) means that only interspecialist and mainstream media were able to engage with the central question of humanness in a worthwhile manner. This meant that the public domain was a much-needed creative space within which scientists and nonscientists alike could tackle such issues. As shown above, human is not a scientific concept, and for all the undoubted value of the data produced by scientists of the two missing links, scientists could claim no more expertise in the question than anyone else. This is the distinction between "contributory expertise" and "interactional expertise" (Collins & Evans 2002). Despite this, they used their authority – that granted by the pure/popular model – to dominate both episodes. By using the distinction, science itself could remain protected as a separate enclave. Anyone wishing to challenge a scientist's account could only do so in the popular science domain, which scientists could abandon if necessary, and dismiss as a distortion.

On a more practical level, the popular realm proved its worth too as a means of sidestepping logistical problems, namely the discrepancy between the near instantaneous news cycle and the exceedingly long cycle of peer reviewed science. During the LB1 case, some dissenters made their claims directly to the mainstream media. Such a move was attacked as a deviation from proper procedures, not least because it meant that scientists' claims were being made public before they had been peer reviewed. However, an analysis of coverage of the find showed that scientists who stuck to the science cycle received less media coverage than those that shortcut straight to the mainstream media. Given that the discovery team were themselves working with a film crew long before the find was announced (at press conferences in London and Sydney), the dissenters' actions are difficult to condemn.

The picture we are left with is one very different from the pure/popular model's. Hilgartner's continuum model too was flawed however, as, whilst the Gieryn-esque river metaphor on which it was built avoided the clear demarcations of the pure/popular model, it internalised the idea of isolated, upstream scientific

knowledge production and downstream popular knowledge consumption. The work of this thesis directly challenges such an assumption: some scientific claims appeared directly within the popular realm; popular tropes were present before any public engagement with the finds; scientists were actively involved in popular 'distortions'; these distortions were in fact an integral part of the investigation; many knowledge claims appeared only in the popular realm, in the form of reflections of the conceptual implications of the finds. Popular influence was not then a *distortion*, but rather a *development* of the claims made with intraspecialist science. All in all, the 'upstream' metaphor in the continuum model is little less problematic than that which it seeks to replace:

> the progressive concept of “upstream engagement” (Wilsdon and Willis 2004) is itself curiously resonant with linear notions of innovation. For all its value as a “boundary object” (Gieryn 1995) enabling effective critique, the term “upstream” also displays the deterministic connotation of a necessary direction of flow. If engagement processes are to escape instrumental use as “technologies of legitimation” (Harrison and Mort 1998), then this unidirectional stream metaphor is revealingly unhelpful (Stirling 2008:264)**.**

In response to this, I suggested an alternative model which mirrored more effectively the complexity of scientific communication seen here, inspired in part by Dupre’s (2001) estuary metaphor of evolution. I referred to this as the 'hydrologic model', for it took the logical step of envisioning the entire process of the water cycle, rather than just a subsection of it, as the river metaphor did. Information then circulates, through a variety of routes which can, over time, change direction or position. Some of these routes appear routine, others more surprise deviations. As we move downstream the process of exchange becomes greater, as information meanders across the cultural landscape, and tidal influences switch the direction of flow. This metaphor stresses the instability of science communication - that though

there are regular patterns, no two episodes are identical, and the potential for extreme behaviours is always present. These cases of missing links may well be such extremes, but their existence is a call to recognise the heterogeneity of science, rather than to dismiss them as aberrations. A final element of the metaphor retains the successes of the continuum model, using an example from nature to remind us that although we can categorise multiple cultures and processes separately, these are but a taxonomic abstraction of a world that exists as flows; currents; eddies.

It may appear as though such a metaphor implies that no new information is created, that it simply recycles endlessly, but this would be a mistake. Instead, it suggests that new knowledge is created not through acts of isolated genesis within the minds of geniuses, but through the evolution of thought: the adaptation of knowledge to novel contexts.

4. What is the relationship between scientific and popular classification systems during these episodes?

Throughout the thesis, I have referred to parallels between the human-animal and science-nonscience dichotomies. As the thesis has progressed, a final parallel has become increasingly obvious: both dichotomies are protected by what I have labelled 'the trinary'. I began by formulating this as a hidden “third category” (Bauman 1991) between human and animal, in which lurked the missing link, and other chimeras of science fact and popular fiction. Such troublesome figures are the outcome of the stresses placed on formal, Aristotelian classifications by everyday overlapping, prototypic classifications. Missing links can be easily assimilated within prototypic classifications, joining other grey cases such as savages and hobbits. In contrast to Bauman's conception however, the trinary is not a threat to the binary, but its protector, hiding its inconsistencies. Here goes the nonfits who refused to comply with the fallacy that evolutionary theory could explain the nature of life without saying anything of the position of humans in nature.

In chapter four I discussed the missing link itself as if it *was* the trinary. Additionally, as the trinary went unacknowledged during the Piltdown episode, and furthermore *needed* to go unacknowledged if it was to successfully fulfil its task of protecting the human-animal boundary from the transgression of monsters, I suggested that such opacity was a fundamental characteristic. Applying the concept to the science-nonscience boundary allows us to develop this original formulation however. The missing link of the science-nonscience binary – i.e. the boundary transgressor – are scientists themselves, whilst the trinary is popular science. This distinction reminds us that whilst the *concept* of a missing link is an *example* of the trinary, the actual creatures LB1 and Piltdown Man are simply boundary-crossers: the figures that create the need for the trinary. Returning to popular science as another example of the trinary, we find a legitimating space in which scientists can engage in popular discourses whilst protecting the idea of a distinct enclave called 'science'. Far from being hidden, this trinary is embraced by scientists, as chapters five and six show. The fundamental characteristic then is not that the trinary is unseen, but rather that it protects the binary system. The crucial difference between the two is that, unlike the human-animal trinary, the presence of popular science does not threaten to undermine the binary in which it stands.

The reason for this lies in the strategic requirements of the agents drawing the boundaries. For scientists wishing to engage popular culture, keeping with them their scientific authority whilst simultaneously preventing nonscientists from travelling in the opposite direction, the answer is the creation of a third space which fulfils these requirements. To be able to reference this space in justifying their actions, this boundary drawing must be explicit. Boundary transgressors like LB1 and Piltdown Man by contrast have no say in their positioning. Here the boundary is drawn by extant *Homo sapiens* (scientists and nonscientists alike), whose overwhelming priority is to protect the dominance awarded to them by the division between themselves and animals. For those controlling this boundary then, there is little to be gained from granting the transgressor a formal ‘third’ position.

A further development of the trinary concept is apparent in the final chapters of the thesis. I introduced the trinary as a third category between two absolutes, but it is better thought of not as a category at all, but rather as a *space between*: a conceptual void into which categorie*s* (plural) can go. Describing the trinary as a category risks confusion: it could imply there is only one such class when there are in fact innumerable possible heterogeneous categories occupying the same space. Furthermore, these conceptual voids exist between all Aristotelian categories, and in scientific taxonomy that is a great many (I refrain from labelling these particular voids trinaries for reasons detailed below). It also allows us to utilise more appropriate metaphors. To elucidate these points, I will refer to the role of the trinary in two relevant systems: science's taxonomy, and the folk system of indigenous tribes on the island of Flores, accessed via Forth's (2006) work.

(It is not my aim here to present an in-depth investigation of folk categories in the manner that I have attempted to do with science and popular cultures throughout this thesis. Instead, this is merely an opportunistic analysis of Forth's account of the local inhabitants of Flores' reaction to LB1, conducted through the framework I have applied elsewhere.)

The indigenous groups on the island of Flores have, like Western popular culture, a strictly dichotomous division of human and animal, and the trinary is similarly evident here too. Despite having no conception within their own origins stories of the gradual transition from nonhuman animal to human animal form that is contained within evolutionism, both the Nage and Manggarai tribes have characters in their folklore that muddy the clear division of the human and nonhuman. For the Nage, these take the form of hairy wildmen called *ebu gogo* (whom some scientists and journalists were keen to connect to LB1), whilst the Manggarai have the story of Empo Paju, a hairy figure that became human after being taught the use of fire by villagers (providing yet another example of how humanness is conceived). Both hold an ambiguous, liminal position, and yet their influences on the reception of LB1 are very different for their respective tribes. Empo

Paju's instantaneous leap from non-human to human gives the Manggarai a template for the transition required for the semi-human *Homo floresiensis* to be connected to them. Forth finds a correspondingly greater acceptance of LB1 as *floresiensis* amongst the Manggarai than the Nage, whose own liminal protagonist never makes the transition to full humanness, and so is left forever wandering the no-mans land. The result is that the Nage are much more accepting of the idea that LB1 was already fully human (as Jacob's hypothesis suggests):

> Inhabitants of Flores are able to appreciate a creature named 'Flores man' […] as an ancient inhabitant of their island only insofar as the figure can be understood as being specifically 'human' (Indonesian *manusia*) and, more particularly, as a distant human ancestor. It is not difficult to see why people would be disinclined to identify *Homo floresiensis*, considered as a possible ancestor, with figures like the Nage *ebu gogo*. For Nage describe *ebu gogo* as hairy wildmen who were not fully human, or were at best ambiguously human, and thus definitely not like themselves, and who moreover are supposed to have survived, as a separate population, until just a few generations ago. Relevant here is the essentially descriptive and non-evolutionary nature of Nage and other Florenese ethnozoological knowledge, particularly in regard to how relations among animal categories are conceived. Whilst this knowledge allows for a hypothetical transformation of one animal kind into another in the course of a single life cycle (Forth 1998), it does not recognize the possibility of humans deriving, over long periods of time, from non-humans. Thus, to the extent that they are considered non-human, or imperfectly human, *ebu gogo* cannot be conceived even as distant relatives – and nor, for that matter, can monkeys or apes (Forth 2006:340).

The point I wish to make from this brief account is the heterogeneity of trinary categories. Intermediates inhabiting the space will not necessarily make it

easier for subsequent nonfits to bridge any gap between human and animal. Instead, they may in fact inhibit them. The trinary is then a pluralist space, that does not determine the nature of the categories it holds.

The reaction of science culture to missing links is very different to that of popular culture, and it mirrors wider differences in responses to conceptual voids. Whilst popular culture is content to leave transgressing figures anchored amongst pre-existing liminals that litter the water between human and nonhuman like abandoned shipwrecks, science responds to nonfits such as LB1 by confronting them head-on. Given the primary motivation of science – control through ordering – this is hardly surprising. Instead of leaving such figures floating semi-submerged, science constructs a new bedrock, and raises an island on which they can stand, one that can be clearly seen by all. True to the industrial age of which science is a part, the boundaries between this man-made creation and its surrounds are hard and sharp, like ocean meeting concrete. Here order is created, through the compression of complexity: time; generations; differences – all are compacted into the small mass of the island.

These islands are formally recognised categories: in scientific taxonomy there are many, potentially infinite, as it is a multiplex system. Those categories I have focused upon – hominin; *Homo*; *Homo sapiens* – all concern the same subject – humans – at differing levels of resolution. The latter is the most fine-grained of these, and around it, at ever increasing distances, lie islands labelled *Homo neanderthalensis*, *Homo erectus*, *Homo habilis*, *Australopithecus afarensis,* and many more besides. In 2004 LB1 forced itself into this picture, its novel features reflected in the surprised exclamations of scientists recounted in chapter seven. To incorporate it into their system of knowledge required the creation of a new landmass, *Homo floresiensis*.

Through this process the conceptual void is pursued, for it represents that most galling of states: disorder, the absence of scientific control. Science then abhors the trinary, and here it is not a protector but a threat. For this reason I do not use the

more specific term trinary here. Despite its pursuit, the void remains however, as for every island to be an island – that is a distinct, separate entity – there must be a gap between it and the next landmass, and inevitably it is into this space that the void is squeezed. Here it lurks until the uncovering of the next nonfit, when the process of eliminating space and constructing solid ground begins again.

In popular culture's ontological system there are only two islands, designated 'human' and 'animal'. As if the product of an organic process, here the shoreline is – despite its durability – flexible and prone to constant implicit redrawings. In contrast to science culture, popular culture's ontologies are not shaped by the specific aim of creating order. Rather, they are shaped by more pragmatic concerns: allowing their adherents to operate successfully in their everyday (nonscientific) activities. Of greater interest here then is protecting the human-animal boundary that awards us carte blanche in our interactions with nature, rather than forensically charting the relationship between it and ourselves. Accordingly, the void here is not a threat – quite the opposite in fact, for it allows the disarming of those troublesome cases that threaten the status quo – and so is not pursued, but rather left as a repository for all non-fits. Here they lie semi-submerged, visible to observers - and so navigable – but not accorded landmass status, a status which would challenge the integrity of the divide between us and everything else.

As an aside, the difference in the response of popular culture and science to the trinary may help explain the discrepancies between Bauman's third category and the trinary used here – specifically in regards to whether such an entity is a threat (as it is for Bauman) or a protector. Bauman's concept was inspired by the persecution of the Jews at the hands of Nazi Germany, and the adoption of certain scientific principles by the Nazis is well commented on (e.g. Aly et. al 1994), and Bauman himself makes such a connection (1991:39). My own work, in comparison, is as interested in nonscientific as much as scientific responses, hence the different formulating of these boundary entities. The "third category" is then a particular form of conceptual void, as the trinary is.

Despite science's assaults on the void, it profits from it as popular culture does. All creative acts require space, and popular culture can use the trinary not only as a conceptual shortcut, attaching nonfits to pre-existing liminals, but also as a space in which ambiguous boundary figures like Dr Frankenstein's monster or the inhabitants of Dr Moreau's island might be created. For boundary-crossing scientists, this innovative space lies between human and *Homo*, discussed in chapter seven. For science culture, if we imagine the taxonomic system on a horizontal axis, then there is a second axis too, separating *Homo* and human, which we can picture vertically. Whilst science pursues the void on the horizontal, it is the vertical space allowed by it that lets scientists utilise the *Homo*/human distinction so rewardingly. In chapters five and six it is this space which scientists boundary-work in their courting of popular interest in these figures, as Woodward did with his *Earliest Englishman*.

No doubt it is more interesting, and meaningful, for scientists themselves to think about these creatures in terms of human, as well as *Homo*, too. The choice of two fictional scientists – Frankenstein and Moreau – as examples is not by chance. When scientists must think creatively, whether it is Washburn creating 'the Mighty Hunter' or Dunbar 'the Mighty Socialite', this ambiguous connection between human and *Homo* is as invaluable as the trinary was to Shelley or Wells. The science of *Homo*'s evolutionary history is inevitably influenced by scientists' experience of being human. This is obvious in Granger & Lynch's (2008) discussion of the Boskops and their giant brains:

> Each of us balances the world that is actually out there against our mind's own internally constructed version of it. Maintaining this balance is one of life's daily challenges. We bask in barely perceived attention, and rage at imagined slights […] Our big brains give us such powers of extrapolations that we extrapolate straight out of reality, into worlds that are possible, but never actually happened. Boskop's greater brains and extended internal representations may have made it easier for them to accurately predict and

> interpret the world; to match their internal representations with real external events. Perhaps, though, it also made them excessively internal and self-reflective. With their perhaps-astonishing insights, they may have become a species of dreamers, with an internal mental life literally beyond anything we can imagine (p.175).

These arguments bring us, once more, to Latour's identification of the contradiction underpinning modernity. Whilst modernity – with science in the vanguard – seeks to maintain a rigid separation between the worlds of nature and culture, human and animal, its production relies on a mixing of those very categories. Whether imagined hybrids like those above, or physical hybrids like the cow-human embryos created in advanced laboratories, the trinary spaces between categories, and crucially between category systems, are every bit as fundamental to their creation as the technologies used. Furthermore, the use of hybrids here, at least in the case of LB1, to explore notions of humanness (see below) offers support for Birke and Michael's (1998) addition to an element of Latour's analysis, specifically that sometimes hybrids are used specifically to think with:

> the discursive invisibilization of hybrids is not something that is always routinely, almost automatically, accomplished. Elaborating Latour's story, we might suggest that for some hybrids, there is great argumentational effort put into working through their implications for human identity vis-a-vis the nonhuman "other" (purification) (pp.255-256).

The analysis conducted here has been framed through Gieryn's (1983) notion of boundary-work, and Bowker and Star's (2000) sociology of classification. Usage of the latter in the context of boundary analysis tends to focus on the concept of "boundary objects" (Star & Griesemer 1989), being "categorizations as objects for

cooperation across social worlds" (Bowker & Star 2000:15), and their higher level, more complex configurations, "boundary infrastructures" (*ibid*.). These objects hold differing meanings for the various domains that perceive them, yet retain enough essence to allow these domains to interact with one another productively. As boundary-work is based on how cultures are demarcated, and boundary object on how cultures cooperate, the two are at times contrasted, rather simplistically, as being two sides of the same coin. The relationship between them is more complex however. Boundary-work deals with the explicit drawing of boundaries by individual agents, through the study of micro-level discourse. Bowker and Star's project is concerned with boundaries at the macro-level, and how they are embedded in, and managed productively through, systems of classification. From Gieryn's work I have taken the idea of boundaries as analytic categories, and an interest in how different cultures demarcate themselves. Going beyond this, Bowker & Star's work has provided a model for the ways in which cultures interact more generally, and the vital role of categorisation in this process.

Despite their valuable contributions, neither framework can single-handedly encompass the findings presented here, and for this reason I have developed the trinary concept to describe both popular science and missing links. In performing strategies of boundary work, an agent is liable to draw on the flexibility presented by the trinary to manipulate boundaries, yet beyond this fact – that trinaries can be utilised in demarcation (as, for example, popular science is used to demarcate science and popular cultures) – boundary work has little further to add. Trinaries also have elements of boundary infrastructures, for they exist between different cultures, and allow cooperation between them. We saw then both the missing link and popular science allow for information to be exchanged between science and nonscience. However, Bowker and Star state:

> Boundary objects arise over time from durable cooperation among communities of practice. They are working arrangements that resolve

> anomalies of naturalization without imposing a naturalization of categories from one community or from an outside source of standardization. (They are therefore most useful in analysing cooperative and relatively equal situations; issues of imperialist imposition of standards, force, and deception have a somewhat different structure) (p.297).

Here then they differ from trinaries, for we have seen that the authority wielded by scientists allowed them to monopolise public discourse around the finds (regardless of the origin of the knowledge claims they used) – in fact the popular science trinary's primary purpose is to protect this monopoly, as the missing link's purpose is to protect human dominance of the natural world. The trinary then allows both demarcation and cooperation between cultures, by creating a dynamic, prototypic flexibility between apparently immutable Aristotelian binaries so that they might be safely transgressed without threatening the whole system. This flexibility is controlled by the dominant interest however, so it is utilised in a manner which maintains a power balance in one side's favour. Finally, in keeping with the theme of undermining notions of nature/culture separation, the trinary has been applied to both a social and a natural boundary.

Having attempted to develop the trinary concept, it is necessary in this final section to consider the notion that certain elements of the *floresiensis* debate might render elements of the trinary hypothesis null and void, at least in respect of missing links. The discovery of LB1 prompted a bout of self-reflection that was entirely absent from the Piltdown discovery. The idea that a 'human' population, which could utilise several oft-quoted trademarks of humanity - fire-use; tool making; organised hunting – and yet was different enough physically to be categorised as a different species, is a profound challenge to the human-animal binary. The dating of the find, bringing it almost within the historical record, only sharpened the discomfort brought to the dichotomy. Whereas Piltdown's challenge was buried somewhere out

in the hinterland of the trinary, LB1's resulted in considerable debate and philosophic reflection regarding what we are, and where we stand in relation to the world around us. It was a debate that scientists and journalists alike joined. Given that a fundamental question of the thesis is how the cultures popular and scientific engage with these very issues, I have chosen to reproduce several of these discussions in detail:

> Until very recently, evolutionary thought was couched in terms of a linear, progressive trajectory rising from lower life forms and culminating in man. I have argued elsewhere that this view is not, regrettably, as extinct as it should be.
>
> In palaeoanthropology, this idea is seen in the view that only one species of hominid has existed at any one time, each one succeeding the next in a scheme of orderly replacement. This idea began to crumble in the 1970s, since when discoveries of ancient relatives of humans have revealed a marked diversity of form. Human evolution is like a bush, not a ladder.
>
> But these discoveries concerned the more remote reaches of human ancestry. Despite the fact that some of our relatives, such as Neanderthal man and *Homo erectus*, are thought to have become extinct in relatively recent times, our complacency that this view holds for recent history has not been shaken.
>
> Until now [LB1's discovery]. If it turns out that the diversity of human beings was always high, remained high until very recently and might not be entirely extinguished, we are entitled to question the security of some of our deepest beliefs. Will the real image of God please stand up? (Gee in *Nature.com* 27.10.04).

WHAT are we? Well, we are human beings, members of the genus Homo, the species sapiens. We are mammals, like the horse, whale, pig and mouse. More specifically, we are rather odd, upright, mostly hairless, huge-brained, walking, talking apes.

We can build and use tools, from simple stone axes to robotic machines. We are - or rather our species is - capable of producing works of sublime beauty and performing acts of incomprehensible evil.

No other creature in the history of our planet has produced a Beethoven or a Bach, a Michelangelo, a Newton; nor, for that matter, a Hitler or a Stalin.

Nothing, not even the brainy bonobo chimps nor the clever dolphins, comes close. We are, surely, unique - or at least we thought we were until this week.

The sensational discovery of the remains of a dwarf humanoid - nicknamed, predictably enough, the Hobbit - in a cave in the tropical wilderness of Indonesia's Flores Island challenges our uniqueness. It raises some profound and difficult questions about where we come from and what we are.

Because the popular account of human origins now turns out to be rather different to what we had thought. […]

For here we would have, in our midst, a thinking, reasoning, toolbuilding, talking, fire-using being, human in all the ways that matter and yet a being of a completely different species.

Psychologically, this would be profoundly unsettling. Every society on Earth, every religion, every creation myth and legend, teaches us that Man is unique. The Judaeo-Christian tradition, for example, stated that we were all descended from two humans - Adam and Eve. It is a long time since most people believed this to be literally true but the idea that Homo sapiens is a species apart is still cherished (*Daily Mail* 28.10.04:48).

> The idea that our ancestors had contact with other human species is a profound and disturbing one. The whole term "human species" begs the question. If they are other species, can they really be what we mean by "human"? Human is a moral category as much as a biological one. That's why it is such a useful weapon word in the debates about abortion. To call someone or something human is generally meant as praise, and implies that they should be treated as we treat ourselves (*Guardian.co.uk* 01.11.04).
>
> What can Ebu [LB1] teach us? As yet we cannot be quite sure, because the potential implications of her discovery are so profound. For example, the existence of the new species she represents, dubbed Homo floresiensis, throws into doubt many of our assumptions about intelligence[….]
>
> And Ebu could teach us an even deeper lesson. Many of us have yet to appreciate the complexity of our past, and remain wedded to the idea that Homo sapiens evolved along a simple, linear path that began in Africa and ended with us conquering the planet.
>
> That may be partly true, but what is not is the notion that we are somehow unique and special for having done so. While some Homo erectus went on to become Homo sapiens, others went on to become an altogether different species. And in evolutionary terms, they were very successful.
>
> For that reason, the discovery of H. floresiensis is not only startling, it is humbling. It means we now know that until very recently we were not alone but shared the world with people of another species. That realisation may give us a renewed sense of what it means to be human (*New Scientist* 30.10.04).

In light of these reflections, is there any conceptual space left for the trinary? Certainly, the boundary appears a less imposing obstacle in their wake. However, as I have already pointed out in my discussion of science culture's response to trinaries,

where there is any gap – i.e. any demarcation – there is always space. For the trinary to be destroyed in its entirety there can only be a continuum covering all animal forms: as in Dupre's estuary, the categories of the system must become currents, eddies, vortices, not discrete boxes. For this to happen the boundary must be destroyed. The quotes above bring the boundary into question only tangentially: they do not challenge it directly, but rather the demarcations of one of its categories – 'human'. We see 'human' being expanded by these discussions, projected out into the trinary so that LB1 might rest upon it. This act in itself is not novel however, in fact we witnessed it in the Piltdown debate, when humanness was expanded so that Piltdown could be brought closer whilst 'savages' were moved away. In effect, what we saw was humanness being granted to the trinary, and such is the case with the quotes above: the status 'human' is not unique to *Homo sapiens*; our evolutionary history is not one of linear progression towards our "divine" form, but rather a "bush" of interlinked species that we just happen to have outlived; LB1's intelligence shows that large brains are not a pre-requisite of human-like behaviour. The expansion of humanness for Piltdown was a temporary construction, like a jetty stretching out over the water from the human landmass, easily decommissioned once the ship had sailed. Whether LB1's landing will prove to be permanent remains to be seen. These quotes are all still framed by the dichotomising mind, and while the dichotomy remains, so will the trinary space.

That said, the debate *has* advanced. Whilst the expansion of humanness was conducted implicitly during the Piltdown debate, here it is done so explicitly. This is not to say the trinary itself is rendered explicit – that LB1's non-fit was recognised – but rather that the process of reconciling LB1 with the binary was more overt. This is enough to weaken the system, as is the fact that whilst the humanity of 'savages' was weakened during Piltdown, here it is the humanity of *Homo sapiens* generally that is sacrificed to incorporate the non-fit: we are all moved closer to the borderlands. I have previously suggested that part of the human-animal binary's durability comes from the carte blanche it grants us. If, however, figures like LB1 succeed in loosening our monopoly over human, and so make it more porous, the

superiority of the category over its opposite might become a moot point. Human might remain a kind apart, but we, the species *Homo sapiens*, might not. The result would be that we had less reason to hang on to the binary so dearly.

Perhaps more likely however we shall see the human-animal binary moving towards a status like that of the science-culture binary, where the void between is openly acknowledged, and yet the boundaries remain entrenched.

There are though a small number of statements from the *floresiensis* coverage that hint at going beyond the binary, and I have saved these until last:

> Descartes held that speech and reason set man apart from all other animals, and thus non-human animals were beyond ethical consideration. The slow erosion of this approach is one of the most important societal changes of the past 40 years. While there are still arguments over what a fox feels as it is chased by hounds, almost nobody would now argue that animals are beneath moral consideration. True, we remain deeply confused in our attitudes: the number of animals used for research is sharply down, but the hideously cruel foie gras industry has doubled in size over the past 14 years; few still wear fur, but we choose to ignore the often unspeakable conditions on factory farms. Yet the general trend is undoubtedly towards humane treatment of animals, and greater humility in human beings: less, and less cruel experimentation; food raised without suffering […]
>
> The change springs not from mere sentimentality or anthropomorphism, but a realisation, powered by scientific discovery, that the distance between animal and human being, between us and them, is far smaller than tradition and religion have asserted. That gap grew narrower still this week with the discovery of Homo floresiensis, or Flo, the miniature cousin of man, 18,000 years old and 3ft tall (*Times* 28.10.04:28).

> [E]vidence for the diversity of human species through time has been downplayed, first by the cultural inertia of stories of an upwards progression towards the human state; second, by the curious chance that Homo sapiens happens to be the only species of human around today - a situation probably unprecedented in 7m years. The evidence for the coexistence of humans and Neanderthals in Europe for at least 10,000 years until Neanderthals disappeared around 30,000 years ago, and the fact that anthropologists have known for years of the multiple lineages of prehumans living in Africa between 4-2m years - has done little to dent the robust idea that humans are so distinct from the rest of the animal world that they rule the earth by virtue of inherent perfection, or divine fiat.
>
> The Flores finds could change all that with a single stroke.
>
> For one thing, they underscore the fact of human diversity until very recent times. "Maybe little folk from Flores will hammer the point home more effectively because they are so different in anatomy but so close in time," says Tim White [palaeoanthropologist]. "How will the creationists cope?" For another, the evidence challenges the human-centric idea that humans characteristically modify their surroundings to suit themselves, rather than allowing natural selection to adapt them to their environment. If the Flores skeleton is evidence of the kind of evolutionary size change more associated with animals such as rats and elephants, this, says Brown [one of LB1's discoverers] "is a clear indicator" of human-like creatures "behaving like all other mammals in terms of their interactions with the environment". "Darwin and Wallace would be pleased," adds Tim White. "What better demonstration that humans play by the same evolutionary rules as other mammals?" (*Guardian* 28.10.04:4).

In both these excerpts there is evidence of the process I have already identified, questioning the trinary tangentially whilst remaining wedded to a binary framing.

The *Times* then speaks of the gap between human and animal 'narrowing', yet a smaller gap is still a gap. The *Guardian* expands the boundaries of humanness, whilst leaving the value of its distinctiveness unquestioned. There is another element in both though. The *Times* places LB1 in the context of human-animal difference, and though a gap remains, the process of convergence this piece identifies hints at the possibility of that not always being the case. The *Guardian* too brings the category of 'animal' into play, noting that LB1's stature suggests 'that humans play by the same evolutionary rules as other mammals'. In these words at least, there is no gap.

5. The Ethics of Undermining Boundaries

In chapter three, whilst discussing the ethical dimensions of the thesis, I flagged up the implications of my conclusions. It is clear that there is a very strong normative dimension to both boundaries I have analysed, with the human-animal division of particularly wide-ranging influence. The arguments put forward here have attempted to weaken the ground on which this binary stands, if only by reflecting but a glint of the enormous complexity placed in the shadows by this monolithic wall. One might argue however that, for all its problems, the boundary's moral dimension contains a powerful discourse of human betterment – encouraging us to shun 'bestial' behaviours in favour of more enlightened, noble actions; to demonstrate our 'humanity'. Weinrich pithily observes the form this discourse takes:

> When animals do something that we like we call it natural. When they do something that we don't like, we call it animalistic (1982:203).

The contention that we should see animals and humans as no different is one taken by philosopher John Gray in his polemic *Straw Dogs* (2002), which argues that humans are only different from other animals in that they require "a purpose in life" (p.199). From this position he directs a highly misanthropic attack on religion,

science, morality and progress, savaging them for being nothing but comforting lies. I reject both arguments. For all the boundary's failings, it does reflected an elemental truth: that humans are, in certain important respects, entirely unique amongst biological organisms. Whilst some mammals appear capable of self-awareness, no other creature can even begin to comprehend their environment in the manner that *Homo sapiens* have attempted to throughout their existence. Such are the possibilities of our mental powers, both demonstrated by and amplified through technological advance, that it is easy to see us as occupying an entirely separate plain from other life. None other could detect the existential threat, to all life on Earth, of an incoming asteroid, and attempt to nullify it. None could consider the possibility of life on other planets, let alone attempt contact. None could devote several years of their life, and 80,000 words, to the most esoteric of socio-philosophical excursions (and let us be thankful for that).

This difference does not however justify how the boundary is used. The *carte blanche* awarded by it is mistaken, not least because when this dominance is exercised we see humans at their furthest removed from notions of humanity. The ecological destruction inflicted daily on our surrounds; the industrialised brutality of much of the meat and dairy industry; the imminent cataclysm of mass species extinction: these might be made possible by our unique capabilities, but they are driven by that most instinctual, 'animalistic' behaviour: greed. Beside moral condemnation, such actions must be denounced pragmatically, for their self-destructive madness – for the barren soils, rising seas and lost biowealth which will blight our future existence. Are these the actions of a species worthy of unaccounted stewardship of life on Earth?

Undermining the boundary is not, as Gray would have it, a call to abandon the principles for which it nominally stands, but a demand that we live up to them. By questioning it we see its weaknesses, and the need either to abandon it, or act as it would have us act. It is a challenge that we justify its continued existence. Without

such awareness and appropriate action the binary is doomed regardless, for very little from either side of its division will survive.

What goes for humans goes for scientists specifically regarding the other boundary we have considered. The weakness of the science-culture distinction requires recognition, and acknowledgement that the authority granted by it to scientists should be wielded sensitively. A good beginning would be to pay appropriate deference to the wider culture in which science operates, and which, as we have seen, provides so many of the ideas for which scientists take sole credit.

Missing links provide stories about ourselves, as do, ultimately, both boundaries which we have observed the link transect. We would do well to evolve a greater awareness of what we lose sight of when constructing such divisions.

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