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Introduction

Animals have a significant presence in human lives, with many human interactions involving animals. This role of animals in social life, however, has largely been ignored and marginalised. In the words of Tovey (197), "to read most sociological texts, one might never know that society is populated by non-human as well as human animals". Human-animal relations are evident in everyday human uses of animals as companions, pets, meat sources, and entertainment. This list is by no means exhaustive, but it does demonstrate how humans create and perpetuate systems of human/animal difference which are, at times, contradictory and ambivalent. There are no consistencies in how humans view and understand animal bodies. These differences matter, as they have serious consequences for how humans view and treat animals. It also has dire consequences for animals. While humans and animals are different species, we still live together, co-evolve, and create shared histories. We are, in the words of Haraway, companion species. This exposes that animals are not just nature, but culture.

It is often forgotten that one of the everyday uses of animals is as testing and experimental models in medical and scientific research. Hidden away in laboratories, these animals remain invisible, only to be discovered when the histories of innovations and breakthroughs are unravelled. Animals are veiled behind dissection, vaccinations, pharmaceuticals, insulin injections, deep brain stimulation, and so on. Of interest in this paper is one potential medico-scientific innovation that cannot disguise the animal body as it is central for the success of the technology, xenotransplantation (XTP; animal-to-human transplantation). This refers to "*any procedure that involves transplantation, implantation or infusion into a human recipient of cells, tissues or organs from a nonhuman animal source*" (Xenotransplantation Working Party 22, original emphasis). While many animals have been used historically in XTP, the choice animal source is currently pigs.

In order for xenotransplants to perform the required functions in a human body, the fragments of the pig's body must remain living. This fuses the living pig part and living human body intimately, where the embodiment and functionality of each relies on the other. Such practices theoretically break down the traditional dualisms between humans/pigs and self/other. However, XTP raises a number of scientific, ethical, and social hurdles that must be addressed. As Bijker, Hughes and Pinch indicate, technical innovations are not simply scientific endeavours but sociocultural issues where usage, design, and content can be contentious. In the case of XTP this relates to, amongst other issues, the explicit physical breakdown of the human/pig divide, yet boundary work still occurs in an attempt to symbolically maintain the divisions between self/other.

Drawing on the work of various cultural theorists, this paper presents a sociocultural approach to examine how XTP and the associated manufacturing of pigs, demonstrates the fluidity of science and culture. This is achieved by incorporating theoretical frameworks inspired by Durkheimian thought, such as the sacred and profane, and Douglas' use of pollution and dirt. This analysis reveals how classificatory systems of culture, such as the sanctity of the body and its boundaries, are powerful obstacles to the cultural acceptance of XTP.

The Sacred Body

In the work of Durkheim and his *Année Sociologique* colleagues, the sacred and the profane are distinct classifications attached to material objects. These binary constructs are the basis for religious life, as argued in *The Elementary Forms of Religious Life*. The Durkheimian tradition also argues that these building blocks of religion are apparent in secular cultural life. The world (the profane) drives people to engage with the sacred or those places, objects, and people that are collectively valued with high esteem. In contrast, the profane is marginalised. The narratives/myths which underpin the sacred provide a type of collective fervour that stands in opposition to the mundane flows of the everyday. Through this process, high or low social value is attributed. Durkheim later considered that this duality also existed within the human. Individuals experience a double-being, where the mind (soul) and the body are, repeating Cartesianism, radically different, opposed, and independent substances. The soul holds sacred qualities "that has always been denied the body" (Durkheim, *The Dualism of Human Nature and its Social Conditions*, 150-1), which renders the body profane and the soul divine.

In the contemporary West, however, there has been a significant shift away from the soul and towards the body. Turner argues that we have become a "somatic society", where increasingly this once profane site has become a cultural obsession. The body has become a site of performance and consumption, where the self is realised and practiced. This has led to intense rituals, such as disciplining the body through fitness training (Sassatelli) to personal grooming practices (Goffman), that seek to separate the body from polluting or profane influences. The body is no longer approached as sinful and demeaning to the soul. It has become culturally conceived as collectively sacred. At the same time, certain attributes of the body can and do signify disgust or profane qualities. As Kendall and Michael have argued, the body is a site of order and disorder. While our best efforts are implemented to ensure that the body's biological, social, and cultural features remain ordered, the natural processes of excretion, decay, disease, and other undesirable disorders, consistently impinge on and challenge the sacred body. Significant effort ensures, as Goffman argues, that these undesirable attributes are hidden or removed from public view through secular rituals of purification. We can relate this to the prominent use in the West of anti-ageing products to the compulsion to institutionalise the ill, diseased, and elderly.

Douglas follows this Durkheimian inspired tradition, utilising concepts such as purity, pollution, and danger. These are theoretically similar to the sacred/profane distinction, which we believe lends significant insight into the dialectic of human/animal bodies in XTP. To illustrate this further, we will briefly touch upon her contribution to cultural theory that serves as the basis for our arguments here.

Purity, Danger and XTP: Being 'Out of Order'

In her significant work, *Purity and Danger*, Douglas exposes the deeply embedded systems of classification that underpin social life. To exemplify this, she examines 'dirt' and questions why we feel it necessary to clean. Her answer is that dirt reflects a "systematic ordering and classification of matter", that is "matter out of place" (35). In other words, our social lives are ordered according to those 'matters' classified as belonging or coherent in the flows of everyday life. Dirt transcends this 'ordering' and creates disorder. This then requires action on behalf of the individual to 'reorder' their surrounds through purification rituals. Douglas is able then to extract this theoretical point into various examples, such as the cultural classifications and uses of pigs.

Culture categorises animals in relation to how they are to be consumed or enjoyed, as already stated. A range of relatively recent sociological projects, such as Zerubavel's cognitive sociology program, are revealing how the animal world is culturally determined. For instance, Zerubavel demonstrates that repulsion towards certain foods, especially animal, may cause physical distress to the individual. This is not linked to our gastronomies, but sociocultural perceptions

embedded in our individual minds (cf. Bourdieu's 'habitus'). This is also demonstrated by how classificatory systems deny the human consumption of certain animals. For instance, the taboo on consuming pork for Israelites rests for Douglas on the inability for the pig to be classified as a normal farm animal because it has cloven hooves and does not chew cud. Through this cultural perception, the pig is defined as pollution, impinging on the sanctity of the soul and sitting uncomfortably in collective thought. It resides on the margins and threatens our social order. In other words, what is safe and what is dangerous are differentiated culturally. What a pig represents in one culture can differ dramatically from the next. In the world of XTP, similar impressions remain embedded in the cognitive processes of individuals, thus creating conflict between cultural norms and values, and that of science (cf. Alexander and Smith).

A further important point needs to be considered before discussing XTP explicitly. As suggested earlier, Douglas argues that some of the most dangerous cultural artefacts/objects to our sense of order are those which impinge on the pure through their unclassifiable nature. However, partial objects from these polluted things can also cause distress. Contemporary examples are bodily fluids, excretions, and other naturally occurring by-products of the body. These are generally held as disgusting within cultural contexts once removed from the body. Douglas explains this through their symbolic connection to a 'human' identity. She writes that these mundane objects remain "dangerous; their half identity still clings to them and the clarity of the scene in which they obtrude is impaired by their presence" (160). Fluids, such as mucus, when found in the home or other 'ordered' situations are considered most disgusting not because of the substance itself, but because it remains connected to the embodiment and identity of the other. Until that substance is cleansed from view, or reordered, it impinges on order in the most dangerous ways because of its 'half identity'. It is still connected to its host.

From this perspective, we can begin to envisage why the consumption of animals is closely governed by specific classificatory systems. The presentation of whole animals cooked, with head and limbs attached, may invoke disgust through the inability to completely remove the animal's identity. Whole ducks, fish, or pigs presented at the dinner table, with their eyes gazing at the diners, can cause significant distress. The identity of the animal is reaffirmed and a reaction of disgust can occur. The reappropriation of animals as cuts of meat and meat-based products, can strip away the identity of the animal by dividing it into parts. This reordering makes it appropriate and pure for human consumption. By carving the body of an animal into pieces, it becomes a product that is removed from the living being. This is extended through 'meat discourses'; the pig becomes pork, ham and bacon, and an anaemic calf becomes veal. It is meat; just another object in the cultural universe.

In viewing XTP as a cultural artefact, these significantly stringent classifications of the pure and polluting remain deeply embedded and potent. Pig organs such as the heart remain, despite any cleansing processes undertaken by science and unlike the reappropriation of animals for consumption, linked to the pig's embodiment. The removal of this body part does not remove it from the pig's identity. It remains connected, clinging to its 'half identity'. Furthermore, unlike the meat industry or various other medico-scientific uses of animals, it is vital that the pig's body parts remain living. Xenotransplants would not function without, for example, the pig's heart continuing to beat, pumping blood around the new human body it inhabits. This creates cultural barriers that go beyond the ordered animal products that currently exist, which serves to threaten the acceptance and successful appropriation of XTP amongst society.

There is then a culturally perceived taboo on combining the self and other in XTP. Pig bodies must somehow be 'cleansed' by science, although, as we alluded to previously, this is not necessarily successful. These rituals of purification by science are undertaken for scientific and cultural reasons. For example, Cook outlines that scientists working in XTP go to great lengths to justify why the polluting other, the pig, can and should be used as the source animal. This involves a complex narration on the differences and similarities between humans and animals.

Significantly, XTP relies on and perpetuates the differential cultural worth that is placed on human life (high value) and animal life (low value), in order to justify XTP procedures. However, pig parts need to become worthy of being harvested for human bodies, meaning that pigs must be elevated from their lowly status to that worthy of being human. This leads science to engage in, according to Cook, a complex interweaving of desirable-similarity, desirable-dissimilarity, undesirable-similarity, and undesirable-dissimilarity, to establish continuities and disparities between pig and human bodies. This functions not only for the purposes of science, but to culturally justify the practices and artefacts of XTP. While XTP involves intimately mixing humans and pigs, these “science stories” (Cook) additionally work to maintain species divides. Simultaneously, these processes operate to justify that it is appropriate for humans to embody pigs. Hence, science attempts to mould the social into desirable ways of thinking about XTP, thus supporting it and the science behind it. This includes the experimental and therapeutic sacrifice of pigs.

At the same time, science cannot avoid that the practice and delivery of XTP involves the culturally pure/sacred human body coming into conflict with the polluted/dangerous ‘other’, pig part/s. The genetic engineering of pigs to express select human complementary regulatory proteins, which inhibit self-damage when the immune system reacts to the presence of a foreign body such as a transplanted organ, somewhat disintegrates the human/animal divide within the pig body itself. It is becoming human. However, science still faces a significant hurdle. Namely, “How can we physically mix (natural-technical discourse) if we’re so different (social-moral discourse)?” (Brown 333). Pig parts in human bodies, and pigs genetically engineered to be more ‘human like’, still involve pig parts being out of place and therefore disgusting. Despite the rituals employed by science to draw similarities between humans and pigs (and genetically engineered pigs), there remain cultural classification systems that compromise the normalisation of XTP. Hence, crossing the species divide in XTP is scientifically unproblematic (though getting XTP to work is another matter), but the fusing of human and pig bodies may still be culturally dangerous. In other words, cultural classifications may render pigs as incompatible with humans, despite any social constructions attempted by science. The body expresses these social values. In XTP, porcine genetics cannot be physically separated from their social and genetic being. Incorporating this with the human can cause disgust, even amongst those who have received xenotransplants: “I wonder how much from an animal can be introduced into my body before my humanity vanishes” (porcine cellular xenotransplant recipient qtd. in Lundin 150).

While science may reduce the body to mechanistic functioning and seek to objectify it, the body, be it human or pig, possesses material-semiotic importance. The heart is not simply a pump; it is symbolically powerful. A xenotransplanted pig heart challenges the sanctity of the human body and how the human body and its parts are culturally constructed. However, the potentiality of XTP to save a life may trump any individual concerns, even if an individual may reject it culturally (Lundin).

There still remains another dilemma that cannot be subsumed by such negotiations—the potentiality of cross-species viral infections (zoonosis) that could result from the embodied fusion of living pig parts and living human bodies. While a detailed examination of this is beyond the scope of this paper, it is worth noting that the social fears of zoonosis, such as avian influenza (bird flu) and swine influenza, have resulted in increased international collaborative efforts to study and halt the global spread of contagion. While there are a number of differences between these zoonotic infections and any unforeseen zoonotic consequences of XTP, what is of significance is the boundary pollution. That is, all forms of animal-to-human zoonosis involve a violation of the sacred human body by the dirty and profane other. For example, the recent outbreaks of swine influenza involved disparate species coming into contact with each other through disgusting body products, namely contaminated droplets emitted by infected individuals sneezing or coughing. The physical bodies of humans and animals, however, still remain

differentiated even if zoonosis symbolically challenges such classifications. XTP, on the other hand, is an intimate physical and symbolic fusion of these bodies. The human and the animal can no longer be separated as independent beings. Thus, the potential of pollution from XTP moves beyond the fear of the symbolically disgusting pig body and the symbolism of particular body parts, to include what the pig parts may actually physically carry with them. As a result, the cultural dangers of transplanted pig parts and their potential violations are not just symbolic, but also materially 'real'.

Conclusion

By categorising animals as a lower species, humans enable their exploitation and use in a multitude of ways. This process of cultural classification in the contemporary West means that we attribute a sacred, high value to human bodies, and a low, profane quality to animal bodies. While the scientific intermingling of human and pig bodies in XTP could be seen to present a cultural challenge to these species dualisms, it does not overcome such cultural classifications. That is, the interests and social constructions of pigs by science cannot overpower or suppress the sociocultural. The removal of pig parts from the pig's body does not eliminate its 'half identity'. It is still a living product from an animal's body. Unlike other pig products, life cannot be removed from the pig parts for XTP, as this is the vital function required for xenotransplants to (potentially) work. A heart needs to beat. Any purification rituals undertaken by science, such as using pigs genetically engineered with human proteins, cannot overcome this cultural construction.

While it may be argued that XTP will become culturally acceptable with time, this disrespects how social knowledges are as equally important as the scientific. This further disavows that cultural concerns over mixing pig and human bodies are as viable as scientific constructions. This is perhaps most potently highlighted by zoonosis. Thus, the pigs used in XTP have cultural-technical bodies that are materially and symbolically significant, which science cannot purge.

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