Dolly: a New Form of Transgenic Breedwealth

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ABSTRACT: Public debate in Britain surrounding the cloning of Dolly the sheep has primarily focused on the legitimacy of cloning humans, not sheep. This bracketing of the human question relies on a distinction between humans and animals belied by the very constitution of transgenic animals who are made with human DNA, such as Polly. Moreover, the ways in which human beings think about, manipulate and classify animals have distinct cultural consequences, for example in relation to cultural understandings of life, property, kinship and other forms of social interconnection. This article introduces the term 'breedwealth' to examine Dolly as a unique form of property in order to make some of these connections more visible.

KEYWORDS: cloning, transgenic animals, sheep, culture, property

INTRODUCTION: THE DOLLY DEBATE

When Dolly the sheep was introduced to the scientific community and the press (on February 23, 1997), public debate instantly crystallised around the ethical acceptability of cloning humans. Several scenarios repeated themselves with generic regularity, such as the possible cloning of 'evil' dictators like Hitler or Saddam Hussein, and the converse possibility of cloning 'geniuses', movie stars, or athletes, or the possibility for wealthy billionaires to clone themselves. The overwhelming opinion expressed by commentators, columnists and scientific journalists around the world was that human cloning is neither a realistic nor a morally defensible option. Dr Ian Wilmut of the Roslin Institute, as well as Dr Ron James of PPL Therapeutics, were both widely quoted expressing their opposition to the attempt to clone humans. President Clinton called for an immediate moratorium on such activities. As the former Archbishop of York, John Habgood, put the matter succinctly: 'I cannot see any morally convincing reason why anybody should want to clone a human being, and some good reasons why they should not' (*The Observer*, 2 March 1997, p. 27).

Not everyone agreed with this assessment. Writing in *The Sunday Times* (2 March 1997, p. 15), Princeton biology professor Lee Silver argued that human

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cloning could save lives, overcome infertility and provide a wide range of useful medical functions. Such views were, however, rare.

Schematically, the Dolly debate aligned along a number of significant axes. A primary division of opinion split off those who favoured the possibility of human cloning from those who did not. A second set of opinions polarised around whether the cloning of sheep or other higher mammals was acceptable in its own right. On this question, a majority of British and American commentators spoke enthusiastically in favour of its medical benefits, and only a minority of voices expressed opposition to the Roslin technique. MP David Alton called for a moratorium on cloning until a committee of inquiry could prepare a report for Parliament. John Habgood suggested that cloning 'might turn out to be biological folly', by reducing biodiversity, and he feared it was also morally degrading:

> To assimilate the world of living things into the mechanical model, and to manipulate it to fit the needs of machanised production, might on a superficial level seem to promise greater human freedom and prosperity. On the contrary, the more we treat animal life as being manipulable for human convenience, the greater the temptation to think of human life in similar terms. (ibid.)

From the Vatican came calls for the establishment of an international committee of inquiry to examine delicate matters of human morality and ethics raised by recent developments in the life sciences, epitomised by the Dolly episode.

In addition to these two axes of divergent views on human and animal cloning were other key lines of division in the Dolly debate at the level of the terms or contexts of argumentation. For example, a consistent effort was made to separate the question of whether humans should be cloned from whether this was in fact even possible. Many expert commentators, such as Ian Wilmut himself, emphasised that although the possibility that humans could be successfully cloned was strongly indicated by the Dolly technique, the practical obstacles to so doing were overwhelming. Such objections were primarily founded on technical details: human embryonic stem cells differentiate earlier than those of sheep, too many egg donors would be necessary, it would be illegal under the Human Fertilisation and Embryology Authority even to attempt such an experiment without a license, and so forth. As Robin McKie, who broke the Dolly story in *The Observer* on 23 February wrote:

> Human cloning, although now close to reality, would be illegal under the laws governing fertilisation research. No responsible biologist would support such work, say scientists. (p. 1)

Reporting on Ian Wilmut's testimony before the science and technology select committee in Parliament, Roger Highfield, science editor of *The Daily Telegraph*, quoted the Roslin team leader's opinion that 'most of the suggested applications for cloning of humans are non-sensical' and that all of the Roslin/

PPL team members would find any such research 'distressing and offensive' (*The Daily Telegraph*, 7 March 1997, p. 1).

Through such statements by Wilmut, issues of feasibility were used to underscore the unlikelihood of successful human cloning – in what might be described as the 'and besides, it wouldn't be feasible anyway' argument. Similarly, the pro-cloning views of the majority of commentators culminated in a list of medical benefits on offer through cloning: new pharmaceuticals, organs, plasma, skin grafts, and research possibilities for the study of ageing.

On the basis, then, of the British press coverage of Dolly, an extensive selection of which I have collected and read, the basic Dolly position can be summarised as follows.

Dolly represents a medical-scientific breakthrough because it was thought impossible for adult cells to be returned to a state compatible with undifferentiated embryonic cells. Her birth raises the possibility that humans could be cloned, but no responsible scientist would do such a thing, and besides, even if they tried they would probably fail. Plus it's illegal. However, the Dolly technique is undoubtedly a very welcome scientific advance, because it will lead to benefits for people, for animal husbandry, and even for sheep themselves, as their biodiversity can be better protected and managed.

Without intending to caricature the debate, I would argue this summary captures the gist of the British media 'position' on Dolly. Typically, and as is characteristically the case in Britain, where public opinion is generally favourable towards innovation in the life sciences, there was very little opposition to the Roslin technique. Overwhelmingly, opposition was focussed on the possibility of cloning humans, not sheep. Also typically British was the lack of any substantial, organised religious opposition to the Roslin cloning technique, and the general public acceptance of the moral legitimacy of the benefits it would bring.

ANTHROPOLOGICAL PERSPECTIVES: DOLLY AS PROPERTY

This paper is not concerned to take a position for or against cloning, and it is not my intention to enter the debate as such. In part, however, because I am sympathetic to the Habgood position, I would like to borrow some of the forms of cultural analysis specific to anthropology to examine some of the issues raised by Dolly's creation in more detail. In my own mind, it is an insufficient argument to say that animal cloning is acceptable simply because it brings medical benefits to humans. Prohibiting use of the technique on humans while extending its use on animals also neglects some important questions. To develop these, I propose to consider Dolly as a form of property – arguably a novel form of property. Since all forms of property are cultural inventions, my question is what it tells us to consider Dolly not only as a scientific invention, or as an ethical dilemma, but as a cultural product. One way of doing this is to consider Dolly from the

perspective of what kind of property she instantiates. If, as Renee Hirschon describes it, '"property" as an analytic category can be seen to link several conceptually distinct levels of social organisation' in part 'because property relations entail social mechanisms of transmission' (1984:5), then how might Dolly be seen as an assemblage of resources, practices and values integral to a wider social order? If, moreover, as Veronica Beechey suggests (1984), it is essential to treat the interrelationship of production and reproduction as a single process, then how does Dolly's status as a form of reproductive property figure in this analysis?

Breedwealth

To develop this line of argument I take as my starting point some general observations about British sheep breeding, and the development of what I will call here 'breedwealth'. Broadly speaking sheep breeding is an agricultural industry, practised for centuries in Britain by farmer-entrpreneurs, whose activities are focussed on the reproduction of sheep herds and the recovery of resources from them through markets and other forms of exchange. Sheep are not indigenous to the British Isles, and it is generally thought their domestication occurred in western Asia approximately ten thousand years ago (Henson, 1986). It is known that by 3000 BC, flocks of small, light-coloured sheep were not uncommon within western Europe and began to be imported to Britain (Russell, 1986). In Britain, it is believed that sheep were initially used primarily for milk and wool, and that they were useful for restoring areas of depleted land, where they were often put out to graze, their hardiness enabling them to prosper in conditions unfavourable for cows, pigs or horses.

The hardiness and intelligence of British sheep such as the Scottish Blackface (by whom Dolly was gestated) also favoured what has become recognised as the distinctive complexity and efficiency of the British sheep breeding system, whereby different varieties, or breeds, of sheep are raised in widely divergent ecologies – from the Scottish highlands to the lowlands of the far south. In turn, these different lines, or strains, are both inbred and cross-bred, producing a highly efficient and economical system with many benefits. Scottish Blackface ewes, such as Dolly's mother, are capable of straddling a partially 'wild' and semi-domesticated existence due to their highly valued skills of survival and social organisation. As breed historian Elizabeth Henson notes:

> [Mountain] breeds are very hardy and can withstand harsh weather conditions. They are intelligent sheep with a keen sense for survival. They carefully find shelter for themselves and their lambs and are aware of approaching storms. Female lambs which are to be kept in the flock are allowed to stay on the hill with their mothers. They live in a family group and learn the family's home range. Mountain sheep may travel many miles during a year but they have a clear knowledge of their home and are said to be hefted on to their hill. When a hill is sold, the hefted flock is sold with it. Should

> a new farmer try to buy ewes from his neighbour he would find them soon walking home to their own hillsides. (1986:11)

The most numerous breed of sheep in Britain is the Scottish Blackface, which makes up approximately a third of the total purebred sheep population, and epitomises the Mountain breeds in its ability to survive the harshest winters in some of the most inhospitable areas of Britain. Purebreeds such as these comprise an integral component of the stratified sheep breeding system, which is sometimes claimed to have been developed and preserved so successfully because of the number of distinct regional habitats, and island populations of sheep in Britain.

The distinctive integration of sheep breeding into agricultural development and efficient land management in Britain from the 1500s onward cannot be underestimated in its historical importance, and in particular for its role in precipitating the industrial revolution. Historian Fernand Braudel describes the sheep breeding as 'the key' to the 'vital transformation' in English agricultural production during the seventeenth century. Citing the increasing use of 'land previously regarded as poor, fit only for grazing sheep' he claims there was 'a rapid rise in the head of livestock, especially sheep, and [that] this in turn increased cereal yields' (1979:560). Historians who argue that a rate of agricultural production higher than population growth is the single most important precondition for successful industrialisation would agree with Braudel, who argues that the industrial revolution in Northwest England

> came not so much from machines or wonder crops as from new methods of land use; new timetables for ploughing; new forms of crop rotation which eliminated fallow and encouraged grazing, a useful source of fertiliser and therefore a remedy for soil exhaustion; attention to new strains of crops; [and] the selective breeding of sheep and cattle.... (1979:559)

In sum, without underestimating the complexity of the factors precipitating the unique industrial expansion in eighteenth-century Britain, it is clear that the importance of a highly specialised and densely integrated sheep breeding system was a significant precondition.

Perhaps it is merely prosaic, given the amount of speculation involved, to envisage links between the unique expansion of industrialised production in Britain in the seventeenth and eighteenth centuries, and the so-called industrialisation of reproduction which has also proven a distinctly British innovation in the nineteenth and twentieth centuries. I suspect it is not irrelevant from a cultural standpoint that Louise Brown was born in Oldham, Lancashire or that Dolly the Sheep was born from a Scottish Blackface ewe near Edinburgh. In any event, and leaving such provocative leaps aside, both the mechanical animation of the Lancashire mills, and the technologically-aided conception of Scottish sheep require not only particular cultural values, but also the more familiar economic kinds of value in the form of capital, commodities and monetary finance.

FROM INDUSTRIAL CAPITAL TO GENETIC CAPITAL

As machine-capital was essential to industrialised production, so is bio-capital integral to the industrialisation of reproduction, or of life itself. The form of ownership proper to both forms of wealth is the patent, understood as a form of intellectual property. The establishment of patent protection for innovation has its roots both in the formation of nation states, and the need to protect national wealth, and also in the link that connects ideas to persons as property – most notably copyright. The notion of literary property established in 16th century England is modelled on paternity, extending the analogy of a father's propriety in respect of his children to the 'progeny' of his mind. Male procreative agency is the model borrowed to establish literary propriety, and the subsequent development of the patent as a delimited form of ownership over inventions extends from the earlier model, as the scientist or inventor is seen as the 'author' of an original idea (see further in Rose, 1993).

Ownership of Dolly is thus quite complicated: to begin with, it is not so much Dolly herself, as the means of creating her, which is protected by patent. Once Dolly's patent has been granted, it will exist in the names of Ian Wilmut and his team at Roslin, but will be licensed to PPL therapeutics for their exclusive use. In turn, the form of protection afforded by a patent is essentially passive: it is only activated in the event that PPL Therapeutics decides to protect their rights in court. In this sense, the patent provides an entitlement to seek redress for infringement by a user perceived to have exploited the original invention under protection. There is thus no incentive to enforce a patent if the usurper is not also financially advantaged to provide remuneration in the case of a successful prosecution. Unlike copyright, which extends for the duration of an author's life and beyond, patent protection extends for a much shorter period, and is based on a presumed exchange: in exchange for sharing vital information that is novel, original and of utility, the patent owner is granted a priveleged entitlement to any profits the invention yields. In turn, this right can be exchanged for remuneration through licensing agreements, somewhat akin to the royalty arrangements through which a literary estate is marketed.

Dolly's patented novelty represents a new kind of genetic capital, or breedwealth. Such shifts have occurred frequently over time, and there are now a range of strategies available to secure and protect the commodity value of distinct varieties of animals, plants and microorganisms. At the time of the industrial revolution, to which, as we have seen, selective breeding of sheep is seen to be integral, the most important changes in English breeding practices are associated with the figure of Robert Bakewell. In her astute account of Bakewell's influence, historian Harriet Ritvo argues that it was his ability to reorganise the conceptual basis of livestock ownership which accounts for his unique legacy. Specifically, she suggests, 'he assumed it was possible for the improver to

redraw the conventional boundary between the sphere of nature and the sphere of agriculture' (1995:415). He accomplished this, she suggests, through successful entrepreneurial production of new property values in animals, what she denotes as their 'genetic capital'.

Previous to Bakewell's transformative influence, opinion varied among livestock breeders on the question of inherited traits. As Ritvo puts it simply 'there was no contemporary consensus about what could be inherited and how' (1995:416). Rather, she claims, 'the prevalent practices of mid-eighteenth century husbandry were based on other assumptions, particularly the predominance of such environmental factors as climate and diet' (1995:416). Bakewell, she argued, was able to increase by fourhundredfold within thirty years the value of his breeding livestock by essentially relocating the value of the animal at the level of its capacity to pass on genetic traits – to become, as Ritvo describes it, an individual template. This shift, she suggests, 'represented the entry of a whole new source of value' into the livestock market. It was 'a change in kind rather than (or as well as) a change in degree':

> Bakewell claimed that when he sold one of his carefully bred animals, or, as in the case of stud fees, when he sold the procreative powers of these animals, he was selling something much more specific, more predictable, and more efficacious than mere reproduction. In effect, he was selling a template for the continued production of animals of a special type: that is, the distinction of his rams consisted not only in their constellation of personal virtues, but in their ability to pass this constellation down their family tree. (1995:416, emphasis added)

The shift here could be thus be described as metonymic in the sense that the individual comes to be so closely associated with the breedline as a whole it can stand in its stead, or be substituted for it, implying they are isomorphic. More accurately, such a shift is synechdochic, in the sense that a part is used to stand in for the whole (as in hand for sailor), the specific is made to represent the general (as in line for telecommunications systems), or the substance from which it is made for an object (as in steel for sword). In the case of Bakewell's prized Dishley and Leicestershire rams, an individual specimen not only belonged to, or continued, a breedline – particular individuals could embody the very best traits of the breed and this capacity could be reproduced. What Ritvo describes as 'genetic capital' thus conjoins individual reproductive capacity (in this case paternity) with the value of the line as a whole.

Two additional features of this transformation deserve further note before returning to Dolly. One is that the accomplishment of the 'change in kind' argued by Ritvo to be at the heart of Bakewell's influence was achieved, like all such changes, through a set of specific practices, and in particular through the use of pedigrees. Although pedigrees of breedlines were well established among horsebreeders in the eighteenth century, they were less commonly consulted

among sheep breeders. It was Bakewell who instituted a much more rigorous application of pedigree record keeping and administration, through which he consolidated the value of his own breeds and rams.

Second, Bakewell achieved this shift to increasing reliance on pedigree without any systematic, or what might be called 'scientific' evidence, such as, for example, progeny tests. As historian Nicholas Russell points out, 'it is likely that Bakewell believed, with so many of his contemporaries, that sire line inheritance was all that really mattered'. Moreover, Russell notes, 'Bakewell's deliberate selection policy was based entirely on appearance' (1986:212-213).

FROM GENETIC CAPITAL TO GENETIC PROGRESS

Turning to Dolly, it is possible to suggest that the nuclear transfer technology through which she was bred effects a strategic and conceptual shift that builds upon Bakewell's earlier refinements. With the twentieth century confirmation of the mechanisms of genetic inheritance, Bakewell's assumption that the genetic capital of a breed can be narrowed to the conduit of an individual's reproductive powers is no longer either radical or controversial. If the vicissitudes of such inheritance patterns remain subject to dispute among breeders, the basic principle that certain elite individuals have greater value as breedstock is hardly contentious.

Bakewell's consolidation of a new form of breedwealth might be described as the individualisation of value, transforming an individual animal into a more valuable form of property or stock. Through selection of an individual animal to serve as what Ritvo describes as a 'template' for the breed, Bakewell effected a compression of genealogical time through pedigree selection. His sire lines recorded this reduction of the breed to its select few elite rams, and he eventually transferred this technique to cattle.

The Roslin technique effects a different set of transformations. Nuclear transfer also relies upon selection of prized individuals, but offers also the possibility to achieve a molecular specification to this transfer. Eliminating the genetic 'noise' of sexual reproduction, cloning narrows the conduit of genetic transfer more precisely to an exact replica of the genome of the nuclear donor. The mitochondrial genome is still provided by the egg donor, and the renucleated embryo is gestated by a surrogate – increasing the number of animals involved in the reproduction of an individual. Such a widening of genomic transfer is seen as beneficial insofar as it can be used for the transgenic production of sheep such as Polly, whose genome has been modified to include additional (human) genetic material.

According to the Roslin Insititute's own account of Dolly's importance, they state that:

> The main advantage of cloning would not be within selection programmes, but in the more rapid dissemination of genetic progress from elite herds to the commercial farmer. At present this is achieved through artificial insemination (which supplies only half the genes) and by limited use of embryo transfer. This process is not that efficient and recent estimates in dairy cattle suggest the performance of the average cow is some 10 years behind the best. With cloning, it would be possible to remove this difference. Farmers who could afford it would receive embryos that would be clones of the most productive cows of elite herds. In doing so, they could lift the performance of their herds to that of the very best within one generation. This would be a one-off gain, since from then on the rate of genetic progress would return to that of the elite herds. (Roslin Institute Web Pages)

This achievement is described by Roslin as 'transfer of genetic progress to the farm'. The shift in property value here is thus from 'genetic capital' to 'genetic progress' – and the added-value consists in the 'one-off gain' of a 'lift' in performance of the herd. The steps involved in the process are as follows:

a. selection of elite animals from elite herds

b. substitution of cloning for sexual reproduction

c. elimination of the genetic 'noise' of sexual reproduction

d. exact replication of desired traits

In turn, the technologically added value of nuclear transfer is essentially time compression: a speed-up, in the form of 'genetic progress' is achieved. The 'genetic capital' yielded by the Roslin technique is thus 'genetic progress'. It is not the genetic capital of the animal per se that cloning facilitates, but the ease, precision and speed with which the genetic progress the animal represents can be transferred into mass production.

Dolly thus condenses three kinds of value: the 'Bakewell value' of sheep breeding in the industrial era (its genetic capital); and the 'Roslin value' of genetic progress comprised of both precise replication and time compression. As a form of breedwealth, the Dolly and Polly products thus comprise significant intensifications in the reproduction of biogenetic value. The important point is that this intensification or compression is not only industrial, it is conceptual.

From an anthropological perspective, these shifts can also be considered from the vantage point of genealogy. Dolly's coming into being represents a departure from the assumed genealogical grid of biogenetic transmission in the sense that her parentage is no longer conventionally bilateral. Either her pedigree is unilateral (as a line of maternal succession), or it is bilateral (with an udder cell nucleus and a denucleated egg cell standing in as two gametes in a dual matriline), or it is trilateral if the surrogate mother is included (in what we might

call 'polymatrilineality'). It is less clear if lineality any longer equates to genealogical descent at all for the more recent sheep, Polly, whose DNA is transgenic, containing human genes. This addition confers a lateral dimension to Polly's pedigree. It could be said her genealogy has been respatialised.

In sum, both Dolly and Polly belong to the new kinship universe of transgenic animals whose existence must be understood in relation to an unfamiliar genealogical system made possible through molecular genetic technology. As live-stock they both embody the technological capacities which brought them into being, and are protected by intellectual property law as forms of biowealth. Both are clearly corporate entities, the animate equivalents of industrial machinery in their production and design as manufacturing technologies. The Roslin Institute web pages describe such sheep as 'bioreactors'. They and their progeny are designed to manufacture a range of goods including pharmaceuticals, so-called neutriceuticals (such as infant formula), organs for xenotransplantation, animal models for research, embryonic stem cells and, of course, other transgenic animals like themselves.

CONCLUSION

I began this paper by rehearsing the emphasis on human cloning in the initial public reaction to Dolly, and by asking whether the cloning of sheep can be so readily seen as a distinct ethical question. In the discussion and examples which follow, I have tried to argue that Dolly and Polly must be seen as forms of property which are inseparable from a wider social and cultural context. In conclusion, I would suggest that it is a mistake to see new forms of reproductive property in a distinct ethical domain simply because they are not human. Such a view rests on a presumed separation between the animal and the human belied by these very animals' transgenic constitution. If it is possible from the standpoint of public debate, or ethical principles, to imagine such a separation, I suggest it is less so, if not impossible, from an anthropological standpoint which presumes a number of cultural connections between Dolly and ourselves. It might seem such connections would be particularly obvious in a society such as Britain, where human reproductive models are self-consciously based on nature and biology. Yet, the reverse would seem to be true. In the very sphere of reproduction humans and other mammals are seen to share in common, biological reproduction, the question of what is done to sheep is considered an entirely distinct matter from what is permissible for humans. It is, of course, the paradoxical nature of this very proximity and disconnection which explains why Dolly's birth was immediately translated into an ethical dilemma concerning the possibility of cloning humans.

Culturally, such ricochets of connection and comparison between one domain and another can be understood as a kind of traffic in meanings, in which

biology and culture, nature and nurture, humans and animals rebound off one another. As Marilyn Strathern suggests,

> Comparative awareness is also cultural awareness. A comparative exercise throws into relief the kinds of connections people make between different parts of their experiences. How those connections are constructed, the ways fact and opinion are brought together, reveal possible limits in forms of representation.... [Anthropologists] would say that culture lies in the manner in which connections are made, and thus in the range of contexts through which people collect their thoughts. (1993:7)

This view of culture presumes that all human activities have a generic cultural dimension: that indeed meaningful human action is impossible without the construction of meaningful contexts of action through which it is understood – as ethical, purposeful, effectual, or pointless. This is why consideration of the ethics of cloning must attend to its cultural context, and why it is unethical for the scientific practices involved in such research to be seen as exempt from cultural scrutiny.

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