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Farm Animal Welfare: Origins, and interplay with economics and policy

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Introduction:

In this chapter we will look at the origins of animal welfare as a societal concern and the interplay between the concept of animal welfare, economics and policy. Much of the material will be drawn from Europe and particularly the UK. Whilst this may limit relevance to other geo-political areas, the UK and Europe have arguably the richest experience and history for exploring why animal welfare concerns have arisen and how they influence and are influenced by wider society.

The origins of Animal Welfare: The Standard View

The standard view for the origin of animal welfare is that it originated in the mid-1960s in the UK, directly from the publishing of Ruth Harrison's book 'Animal Machines' (Harrison, 1964). The book illustrated that animal farming had moved significantly away from the public's perception of a 'rural idyll' to what thereafter became known as 'factory farming'. It gave rise, almost immediately, to misgivings among members of the British public about conditions in intensive farm animal production. It is rather remarkable that the book had such immediate and profound effects, perhaps because of the public sensitivity to the animal issues, and perhaps because the 1960s had already seen increasing public alarm over other issues such as environmental pollution (Carson, 1962). One of the most significant and long-lasting impacts of Harrison's book was the forming by the UK Government of the Brambell Committee, whose purpose it was to investigate and report on welfare conditions in British livestock farming. In 1965, the Committee issued its "Report of the Technical Committee to Enquire into the Welfare of Animals Kept under Intensive Livestock Husbandry Systems" (Brambell, 1965).

The Brambell Report is often seen as another seminal point in the development of animal welfare because it introduced a broader idea of what animal welfare should encompass. Whereas previous anti-cruelty legislation had focused on preventing what was seen as pointless, or as it was said “wanton”, suffering without human benefits, this new development involved protecting animals against the adverse consequences of human activities even if the activities made food production more efficient. For example, although keeping sows confined using chains or crates or housing slaughter pigs at very high stocking densities could be seen as integral to the most efficient production of pork, these methods were still criticized for denying animals the fulfilment of their needs. The Brambell Report understood animals’ needs as requirements which, if they were not met, would cause suffering. Thus the Report insisted on a new and wider understanding of suffering, which went beyond persistent and significant pain to include the frustration of “behavioural urges” in the form of discomfort, stress, and by inference other negative mental states. This understanding of suffering made it possible, for example, to criticize the confinement of sows, not on the basis that confinement causes pain, but rather because confinement prevents animals from engaging in behaviours they are highly motivated to perform. Using these ideas, the Brambell Report formulated the general requirements that farm animals should be free to “stand up, lie down, turn around, groom themselves and stretch their limbs” (Brambell, 1965 p. 13).

The report also recommended the creation of a Farm Animal Welfare Advisory Committee (FAWAC) which was formed in 1967, to be superseded by the Farm Animal Welfare Council (FAWC) in 1979. It was FAWC which distilled the so-called Five Freedoms from the Brambell Report formalising the freedoms in a press release shortly after FAWC came into being (FAWC, 1979). Despite potential criticisms (e.g. McCulloch, 2013), and proposed alternatives (e.g. Mellor, 2016), the Five Freedoms have become the most widely used animal welfare framework globally (e.g. OIE, 2019), taking forward the broadening of animal welfare beyond prevention of cruelty. This includes the much discussed freedom ‘to express normal patterns of behaviour’ (e.g. Bracke and Hopster, 2006; see below).

Many of the socio-political activities relating to animal welfare can be seen to follow from the ‘Harrison-Brambell-FAWC’ (HBF) sequence. In the UK, for example, the Animal Welfare Act (2006) put the idea of animal needs into a legislative framework (House of Commons, 2006). The needs as expressed in the act — for: a suitable environment (place to live); a suitable diet; to exhibit normal behaviour patterns; and to be: housed with, or apart from, other animals (if applicable); and protected from pain, injury, suffering and disease — are strongly influenced by the Five Freedoms.

Science had an important role in these developments. The Brambell Committee was clearly influenced by the emerging fields of animal behaviour and neuroscience. For example in a footnote on p. 10 the Report states that the Committee were impressed by recent comments by Lord Brain (a neurologist) that he saw 'no reason for conceding mind to my fellow men and denying it to animals'. The committee also included W.H. Thorpe (then Director of the Animal Behaviour Department at University of Cambridge) as an animal behaviour expert. Thorpe wrote an Appendix to the report entitled 'The Assessment of Pain and Distress in Animals' in which he developed the argument that animals are capable of suffering based on their physiology and behaviour including those 'expressive movements' which are associated with deprivation and suffering. Dawkins (2016) argued that Thorpe set out an agenda for the future study of animal welfare that included the study of animal subjective feelings.

In fact, much of the research that was to help fulfil Thorpe's agenda was not directly related to animal welfare but came about through developments in main-stream science. Most notable was the so-called 'cognitive revolution' which led to consciousness and awareness being widely accepted as suitable for scientific study across a range of disciplines and areas (e.g. Sperry, 1993). One consequence of this was for studies of animal behaviour to begin to explore animal cognition and awareness refreshing the debate over animal mentality (e.g. Griffin, 2013). Thorpe's agenda was however also served by the more bespoke scientific area that we now refer to as animal welfare science. Animal welfare science is a loose amalgam of scientific disciplines ranging from the natural to social sciences and including philosophy that since the late 1960s has focused specifically on addressing animal welfare issues (Lawrence, 2008a). The subject matter of animal welfare science followed closely to Thorpe's agenda, particularly when scientists such as David Wood-Gush began to develop scientific approaches to study the 'animal's perspective' including studies of animal emotions such as 'frustration' (Duncan and Wood-Gush, 1971) and 'fear' (Hughes and Black, 1974). This early phase culminated in the publication of Marian Dawkins' seminal book 'Animal Suffering: The Science of Animal Welfare' (Dawkins, 1980), in which she argued for animal preferences to be applied as a method for objectively assessing animals' motivational priorities and by inference; their experiences.

Animal welfare science has continued to build on these early years through other innovative approaches to the study of the animals' experience (see Lawrence, 2016 for further details). For example, the development of judgement bias tests by Mike Mendl, Liz Paul and others is based on human psychology studies suggesting that underlying emotional states affect cognitive processing, for example with more depressed or anxious people judging ambiguous stimuli more negatively (e.g. Mathews and Mackintosh, 1998). The first

application of 'cognitive bias' (as it is often referred to), tested rats for their response to ambiguous stimuli following exposure to different housing (Harding et al., 2004), and has been followed by many studies applying cognitive bias across a range of species and contexts. Cognitive bias testing is supported by a theoretical framework aimed at understanding and interpreting research on animal emotions (e.g. Mendl et al., 2010).

Another example of innovation in animal welfare science that builds on the HBF sequence, is the development of qualitative behavioural assessment (QBA) by Francoise Wemelsfelder and colleagues, which directly fulfils Thorpe's aim to scientifically assess those 'expressive movements' which are associated with animal welfare. QBA arose from Wemelsfelder's position (part philosophical and part biological) that it can be legitimate to study animal behaviour from a qualitative perspective, and indeed that it may be essential to do so, in order to capture the subjective aspects relating to mental state that are of concern in animal welfare (Wemelsfelder, 2012). The result of this thinking led to the development of an approach to the recording of animal behaviour that focuses on expressive quality of the behaviour as opposed to the physical characteristics that are normally used in behavioural data collection (e.g. Wemelsfelder et al., 2001). Similar to cognitive bias, testing QBA is now widely used in animal welfare science across a range of species from farm animals (e.g. Rutherford et al., 2012) to elephants (Carlstead et al., 2013).

In summary the standard view sees the publishing of 'Animal Machines' as the essential primer to a sequence of events that was to define the development of animal welfare as a concept, as a public concern, and as an area for scientific study.

Adjustments and Additions to the Standard View

In this next section we want to suggest additions or adjustments to the standard view of animal welfare, partly to bring the standard view of animal welfare up to date with new evidence and also to better align the past development of animal welfare with the present.

The long view:

So far we have described the HBF sequence as marking the transition from an era where animal welfare was seen effectively as the equivalent of animal cruelty to one where animal welfare took on a broader range of issues and concerns (e.g. Woods, 2012). However, this is possibly to downplay gradual changes in attitudes to animal mentality that had been happening since at least the 18th century (Lawrence, 2008b). For example, the Scottish philosopher David Hume wrote in 1742, that '...animals undoubtedly feel...tho' in a more

imperfect manner than men' (Hume, 1987 (revised edition)). Perhaps the most famous early advocate for animals' moral status was Jeremy Bentham who wrote: '...the question is not, can they reason nor can they talk but can they suffer' (Bentham 1789).

Radford (2001) suggests that early philosophers such as Hume and Bentham were influenced by emerging scientific evidence of the biological similarities between human and non-human animals, which called into question the anthropocentric view that dominated at the time. Thus for at least 200 years the idea that animals are sentient with some capacity to experience or feel has been evolving in philosophical circles although how much wider these views were to be found in society is harder to judge. It does seem plausible that this early belief in animal sentience was at least partly responsible for the first early steps to protect animals in law. As described by (Radford 2001), the passing of the earliest animal protection legislation in the form of Martin's Act (1822) coincided with the writings of Bentham and others and the beginnings of a changing attitude to animals' moral status.

Lack of clarity over what animal welfare is about:

As we have seen, the standard view suggests that 'Animal Machines' was responsible for the idea of animal welfare becoming more than a simple prevention of cruel acts. Woods (2012) has explored the historical evidence for this and presents a more nuanced analysis with some conclusions that resonate to the present day. For example:

"Although she (Harrison) is often retrospectively credited with being the first to articulate the concept of welfare, it should be noted that she was not the only critic of intensive farming, and that her book did not actually use the term 'welfare'. Rather, she expressed her concerns in the existing vocabulary of cruelty and suffering, while attempting simultaneously to redefine them". (Woods, 2012; p. 17).

Woods (2012; p. 18) debates why the UK government ministry responsible (MAFF) at the time used the term welfare in the full title for the Brambell Report given that the term had previously been either little used or previously seen as a synonym for cruelty. One possibility suggested by Woods (2012; p. 19-20) is that MAFF were seeking to ensure they maintained responsibility for welfare over other departments (and particularly the Home Office), perhaps so they could continue to best protect farmers against claims from welfare groups. Most importantly Woods (2012; p. 21) concludes that MAFF, in the period 1965-1971, never properly resolved its' responsibilities for simultaneously representing farmers and farm animals. In particular this meant that the tension between a farmer-facing production-based view of welfare and the wider ethical perspective developed by Harrison remained unresolved. For Woods this has contributed to the continuing contentious debate over farm

animal welfare. Certainly, there is evidence that farmers see welfare more in terms of production efficiency and health than in the broader welfare concept as developed through the HBF sequence (e.g. Skarstad et al., 2007). Arguably in the current era with its focus on food security and even greater efficiency of production to 'feed the planet' (Thornton, 2010) this tension between different welfare perspectives is likely to be heightened. We will explore this issue further when we consider policy aspects of animal welfare.

The role of science is complicated:

(i) *Animal sentience:* The standard view tends to see science as facilitating and supporting the development of animal welfare (e.g. Radford, 2001). A closer look suggests that the role of science in animal welfare is more complicated. This is most evident with respect to concept of animal sentience (e.g. Duncan, 2006). Whilst much has been written in support of animal sentience and awareness (e.g. Griffin, 2013; Dawkins, 2006) there are also competing voices in science that deny either the existence of animal mentality or that it is not a subject open to scientific investigation (e.g. Macphail, 1998).

Whilst there are today relatively few dissenting voices that mammals and birds are sentient, the 'battle-lines' become clearer as we move down the phylogenetic tree. One of the features of the animal welfare debate has been the wider inclusion of species previously 'ignored' with respect to their welfare, initially to include reptiles (e.g. Burghardt and Ward, 1996) and fish (e.g. Mazeaud et al., 1977), but more recently also invertebrates (e.g. Jones, 2013). The proposed extension of animal welfare to cover fish and invertebrates has been supported by scientific evidence for sentience in lower animals mainly in relation to pain (e.g. fish: Braithwaite and Huntingford, 2004; crustacean: Elwood and Adams, 2015) but also more widely especially for cephalopods (e.g. Mather and Anderson, 2007) and more recently also for insects (Barron and Klein, 2016).

However, the extension of sentience to fish and invertebrates again exposes the scientific complexity and controversy over animal sentience. In fish, for example, alternative perspectives, largely based on neuroanatomy (e.g. Key, 2015; Rose et al., 2014), claim it is more plausible (or parsimonious) that fish do not experience pain. Honey bees have been shown display a negative cognitive bias when physically agitated (Bateson et al., 2011) which opens up complex questions including whether honey bees have emotions or whether instead cognitive bias is a relatively 'primitive' response that has little connection with conscious experience (see Mendl et al., 2011). Faced with such complex issues it is not unusual for scientific writings on animal sentience to conclude that we may never know for certain whether animals are sentient and if they are what the nature of their experiences are (e.g. Dawkins, 1993). For example, Bateson et al., (2011; p. 1072) write:

“Although our results do not allow us to make any claims about the presence of negative subjective feelings in honeybees, they call into question how we identify emotions in any nonhuman animal”.

Despite these complexities legislators have taken the step of enshrining animal sentience in law; firstly in EU law in the Treaty of Amsterdam (European Union, 1997) and then the Treaty of Lisbon (European Union, 2007). Interestingly in both cases as far as we are aware these treaties do not formally define what animals are covered. In the UK Animal Welfare Act (House of Commons, 2006) there is a clear definition of what is covered which makes direct reference to the role of scientific evidence:

“The Act will apply only to vertebrate animals, as these are currently the only demonstrably sentient animals. However, section 1(3) makes provision for the appropriate national authority to extend the Act to cover invertebrates in the future if they are satisfied on the basis of scientific evidence that these too are capable of experiencing pain or suffering.” Explanatory notes Section 1 (Defra, 2006).

The example of animal sentience rather clearly shows the complex interplay between scientific understanding of animal mentality and its further application in ethical debates relating to animal welfare and protection.

(ii) *Science as a cultural modifier:* Serpell (2004, p. S149) introduced the idea that science may have an indirect role in animal welfare development as a cultural modifier of our attitudes to animals. He had in mind the role of science in providing information on the ecology and life histories of animals which he suggested could help overcome indifference or dislike to specific animal species. He wrote about this just before the advent of internet based video sharing sites where the public have access to much larger amounts of video material on animals' lives that was previously not available. A study of the popularity of YouTube videos of animal behaviour (Nelson and Fijn, 2013) found evidence that selected clips of animal play behaviour were watched by large audiences. Similarly, news reports of scientific studies of animal capacities such as 'intelligence' are now to be found routinely on main-stream channels (e.g. Gill, 2018). However, as Serpell (2004) points out despite the potential value of the increased access of the public to scientific information on animals there is also the possibility that this maybe a double-edged sword not least if the public become disenchanted by scientists' emphasis on detached 'objectivity'.

(iii) *The debate over natural behaviour:* The idea that animals should be able to express their natural behaviour and live natural lives has been a major theme in the animal welfare

literature and also another major source of controversy. The origins are usually stated as being the Brambell Report (e.g. Bracke and Hopster, 2006):

“In principle we disapprove of a degree of confinement of an animal which necessarily frustrates most of the major activities which make up its natural behaviour”. (Brambell 1965, p. 13).

As a consequence much of the early research on animal welfare was focused on the importance of confined animals being able to perform natural behaviours such as dust-bathing in hens (e.g. Vestergaard, 1982) and nest-building in sows (Hansen and Curtis, 1980). One of the best known pieces of animal welfare research remains the ‘Edinburgh Pig Park’ study where researchers studied the behaviour of commercial pigs released into a large enclosure with the aim of studying how similar their behaviour was to wild pigs (Stolba and Wood-Gush, 1989). The idea that domesticated animals should be able to perform natural behaviours also resonates with what we understand to be public perspectives on animal welfare where the importance of animals living natural lives is a recurrent theme (e.g. Clark et al., 2016; Lassen et al., 2006).

Yet the focus on natural behaviour has also been controversial (e.g. Fraser et al., 1997). From a scientific perspective it has long been pointed out that natural living entails exposure to situations involving cold, hunger and predation which will result in unpleasant experiences and even death for animals (e.g. Hughes and Duncan, 1988). The development of motivational approaches such as ‘preference testing’ and ‘consumer demand’ to assess animals’ priorities and welfare was something of a reaction against the use of natural behaviour as the central core of animal welfare research (Dawkins, 1980).

Fuller discussions of the role of natural behaviour in the animal welfare debate are available (e.g. Fraser et al., 1997; Lassen et al., 2006; Bracke and Hopster, 2006). We want to make an additional point here that appears to have been missed in relation to the origins of the idea. Whilst the Brambell report refers to the importance of natural behaviour (see above) it does also write at length on the adaptations of domesticated animals to their current environments: e.g.

“We accept the view that domesticated strains in general, and certain strains in particular, are much better adapted to caging than their wild ancestors would be, and doubtless suffer correspondingly less frustration...” (Brambell, 1965, p. 19).

When it came to the distillation of the Five Freedoms by FAWC in 1979 (see above) the wording used was:

“Freedom to display most *normal* patterns of behaviour”¹

The use of *normal* rather than *natural* in the Five Freedoms seems to be almost entirely overlooked (e.g. Bracke and Hopster, 2006), yet seems to us to be highly significant particularly in the context of other writings in the rest of the Brambell report. For us, *normal* places more emphasis on the animals’ current ‘state’ than its previous (wild) ‘state’ allowing for the effects of processes such as artificial selection on the animals’ responses to its environment. Thus, domesticated animals often retain the genetic basis for evolved behaviours (and we presume underlying motivational and learning processes) (e.g. Stolba and Wood-Gush, 1989). Yet at the same time domestication has also led to adaptations of the animals’ responses to the environment as evidenced by the widespread blunting of stress responses in domesticated species (e.g. Kunzl and Sachser, 1999; Lepage et al., 2000).

The use of normal behaviour in the Five Freedoms is also consistent with later writings. For example the integrative model developed by Fraser et al., (1997) effectively makes the same point by talking about the animals’ adaptations however these have come about, for example, through evolution or domestication. Thus, we would argue in this respect that there is greater continuity than has previously been acknowledged between the Brambell Report, the Five Freedoms and more recent thinking on the relevance of domesticated animals’ behavioural adaptations to their welfare.

(iv) *Positive animal welfare*: A relatively recent development in animal welfare has been the concept of positive animal welfare, which FAWC (2009) describes as animals having a ‘life worth living’ or even a ‘good life’. There appear to be a number of different factors behind the rise in interest in positive animal welfare (see Lawrence et al., 2018) including the wider acceptance that animals can experience emotions including positive ones (e.g. Boissy et al., 2007). Most relevant here are the suggestions that positive animal welfare is a necessary addition to the HBF sequence which generally, if not wholly, focused on negation

¹ The current form of words used to the present day by FAWC (and repeated wherever the Five Freedoms have been used by other bodies such as the OIE)) is the ‘Freedom to express normal behaviour’.

of harms such as fear, pain and stress. In this sense positive animal welfare is similar to the arguments behind the growth in positive human psychology which has similarly been accused of being overly focused on negative states such as depression (e.g. Myers and Diener, 1995). Much of the concern that the HBF sequence was unduly negative in its approach is directed at the phrasing of the Five Freedoms including by FAWC itself:

“One criticism of the Five Freedoms is their focus on poor welfare and suffering. This focus was undoubtedly appropriate at the time they were devised but the requirement to provide for an animal’s needs in the new Animal Welfare Acts implies that good welfare should be an ambition too.” (FAWC, 2009).

In fact, looking back at the Brambell Report and searching for text on positive behaviours there are references to ‘positive behaviours’ such as animal play and curiosity. Some of these references to positive behaviours are made in the context of harms: e.g.

“Both young and adult pigs show a good deal of play behaviour, and it has been stated that a play object such as a chain or rubber hose in each pen will occupy the attention of the group so well that it will minimise destructive activities such as tail-biting”. (Brambell, 1965, p. 77).

However some references give indication of a nascent interest in behaviours such as animal play that appear to reflect positive emotional states:

“From the point of view of play, which is one of the best guides to the general intelligence level of a species, and which until not very long ago was regarded as peculiar to man...sheep rank very high probably higher than any other ungulate”. (Brambell, 1965, p. 77).

The other exception to the claim that the Five Freedoms are wholly negative is of course the Freedom to express normal behaviour which, as Yeates and Main (2008) point out, does introduce a more positive note whilst not specifically emphasising the positive experiences that result from the performance of normal behaviour (see also Bracke and Hopster (2006)²). There is some scientific evidence to suggest that conditions such as environmental enrichment which facilitates expression of normal behaviour are associated with positive emotions. For example, Douglas et al., (2012) found that in young sows (gilts) an enriched

² Note: Bracke and Hopster (2006) assume that the Five Freedoms use of normal behaviour is equivalent to natural behaviour; we do not agree as we explained earlier

environment was associated with an optimistic judgement bias, and that moving the gilts from an enriched to a barren environment induced a more negative reaction to barren housing than when experiencing only barren housing. However in general there is a need for further research to more fully understand the relationships between performance of normal behaviour and the brain systems underlying positive emotions and pleasure.

In summary, we have described the standard view of the development of animal welfare concerns as the Harrison-Brambell-FAWC (HBF) sequence. We have suggested adjustments and additions to the standard view including that development of animal welfare concerns pre-date the HBF sequence, that the HBF sequence did not result in a clear view of what animal welfare is about and that the role of science in development of the animal welfare debate is rather more complicated than often suggested. These perspectives on the development of animal welfare are the platform for our subsequent sections on the interactions between animal welfare, economics and policy.

Animal welfare and economics

Economics is a social science that studies the distribution of resources in the face of unlimited human demands (e.g. Lawrence and Stott, 2009). There are a number of ways in which economics has played a key role in the development of the animal welfare debate.

Counting the cost:

As we have seen the farm animal welfare debate from the mid-1960s has often focused on the lack of opportunities for farm animals to behave normally. This led to the development of 'alternative systems' which are designed to allow animals' greater opportunities to express normal behaviour. For example, the Edinburgh Pig Park study (Stolba and Wood-Gush, 1989) was used to develop the Edinburgh Family Pen system (Stolba and Wood-Gush, 1984) which was specifically designed to allow pigs to express their normal behaviour (as defined by how pigs behaved in the Pig Park). Almost immediately this approach raised the two related issues of the practicalities and additional costs imposed by such alternative systems. For example, with the Edinburgh Family Pen there were husbandry issues relating to piglet mortality, synchronisation of pregnancies and general management of the system (Kerr et al., 1988) which both practically and economically combined to prevent commercial uptake of the system.

The use of economics to estimate the costs of alternative welfare enhancing systems continues to the present. For example, one of the contentious aspects of modern pig production is the use of crates to house parturient (farrowing) sows. The widespread use of

such systems emerged in the 1950s, to ease the management of farrowing sows and specifically to provide protection to new born piglets. The Edinburgh Pig Park study (Stolba and Wood-Gush, 1989) showed that part of the normal behavioural repertoire of domestic sows is to build a maternal nest (from available substrates such as branches) in which they give birth and nurse their young before emerging some days later. This nesting behaviour (which is also seen in wild pigs; D'Eath and Turner, 2009) is triggered by the physiology that accompanies giving birth in the pig (Boulton et al., 1997). Consequently, even in the highly constraining farrowing crate, sows show increased activity and behaviour directed at the floor and the crate bars which is interpreted as modified ('frustrated') nesting behaviour (Lawrence et al., 1994). This frustrated nesting is accompanied by increases in the stress hormone cortisol (Lawrence et al., 1994; Jarvis et al., 1997) and research has concluded that housing sows in farrowing crates, by the thwarting or frustrating of nesting behaviour, is stressful and may also interfere with subsequent maternal behaviour (e.g. Ahlstrom et al., 2002; Jarvis et al., 1999) very much in line with conclusions of the Brambell Report. There is therefore a sound body of evidence to support the development of alternative farrowing systems that allow sows to express nesting behaviour but at the same time provide protection to the piglet.

There have now been a number of attempts to evaluate the costs of production in different farrowing systems. For example, to compare the welfare and economic aspects of different farrowing systems Baxter et al. (2012) developed a welfare design index (WDI) to account for the biological needs of sows and piglets at different points (pre- during and post-farrowing). Different systems were then ranked for how well the biological needs of the individual animal were met and then compared to the physical and economic performance of the different systems. Whilst acknowledging that the analysis was restricted by the lack of data, it did conclude that so-called 'designed pen systems' (e.g. PigSAFE) where there are defined areas for different sow activities and additional features to protect piglets, offered the best compromise between the competing demands of the sow, piglet and farmer. Subsequently Guy et al., (2012) found a range of production costs from outdoor production (the cheapest) to PigSAFE (the most expensive option). However the argument does not need to end with higher welfare systems being rejected because of their higher costs as we will see below.

More on compromises and trade-offs

Economics has more to offer than analysis of costs and benefits. As we mentioned earlier the study of economics is essentially about decisions over how 'best' to use scarce resources or the trade-offs that exist when we are trying to achieve more than one outcome.

McInerney (1994) first described the concern over animal welfare (as initiated by the HBF sequence) traded off against the human-based interest of increasing farm animal productivity (see McInerney (1994); Figure 1, p. 16). McInerney suggested that initially taking animals under human care or management would increase their welfare (a 'win-win'), for example by reducing predation risk or reducing suffering from disease. It was where human activity increased productivity beyond certain levels that farm animals would begin to experience reduced welfare as described by Harrison and Brambell. Farm animal welfare could eventually become so reduced that it could be described as 'cruel'. McInerney's model is based on animal welfare as a good desired by humans, indeed that animal welfare only exists because humans are able to describe and care about it. An alternative view was suggested by Christensen et al. (2012) in which animal welfare is seen as an intrinsic value independent of human interests. This is reflected in the recent challenging of the anthropocentric approach (i.e. only human utility has value) of welfare economics, (see Johansson-Stenman, 2018; McMullen, 2016). McMullen (2016), for instance, argues the demonstrated willingness of consumers to pay a price premium for higher welfare and opinion polls detailing that some individuals believe animals deserve the same rights as humans, indicates that people value animal welfare and well-being intrinsically, beyond its relevance to their consumption choices. However, the debate about how exactly animal welfare should be valued remains unresolved. Nonetheless the general principle of using economics to make animal welfare priorities transparent is a valuable approach albeit dependent on an understanding of what matters to animals (Christensen et al., 2012).

(i) *Farm level trade-offs*: Trade-offs potentially exist at different points in the supply chain between farm and consumer including at the farm-level. Taking the example of alternative farrowing systems, Ahmadi et al., (2011) used linear programming to explore trade-offs between economic performance and managerial and animal welfare constraints using available data and expert opinion. The results suggested that if the target is to optimise piglet survival and the costs associated with ensuring piglet survival for the different systems, then crates provided the best net margin. However non-crate systems were able to improve their net margin if account was taken of the extra welfare they provided for sow and piglets. This of course still begs the question of whether the value of the extra welfare will be recognised and paid for down the supply chain; we will return to this point.

Papers modelling the economics of alternative welfare systems often refer to the lack of available data (e.g. Baxter et al., 2012; Ahmadi et al., 2011). One aspect of the economics of alternative welfare systems that seems especially lacking in data are the biological interactions (trade-offs) between improving welfare and other biological functions which

could then have impacts on productivity and economics. There is something of a 'Catch-22' about this because without alternative systems being widely used by farmers then it is not possible to accurately estimate reciprocal effects of improved welfare on other biological functions. In one of the few studies using a large sample of farms, Barnes et al., (2011) used a variant of data envelopment analysis to measure the production efficiency of dairy farms varying in levels of lameness. They found that farms with low levels of lameness were technically more efficient than farms with higher levels of lameness whilst at the same time being inefficient in terms of their use of labour and stocking density. In other words the use of greater inputs to reduce lameness (and increase welfare) was outweighed by the gain in milk yield on low lameness farms. One explanation for this could be the greater use of grazing by low lameness farms which is known to help lame dairy cows recover (e.g. Hernandez-Mendo et al., 2007), combined with lameness being known to reduce milk yield (e.g. Green et al., 2002). Barnes et al. (2011) suggest that analysis of the farm-level efficiency of welfare traits should be done at the whole-farm level. Clearly there is a need for more commercial level data to explore the potential benefits (or disbenefits) of improved welfare on health and other functions.

ii) Animal breeding: A special case of farm level trade-offs: The use of artificial selection or animal breeding is an intrinsic aspect of modern farming (see Simm, 1998). Animal breeding is sometimes practised by the farmer but mostly by specialised breeding companies. Traditionally animal breeding involves selecting animals for production traits (a trait being a measurable characteristic such as milk yield or growth rate). To 'improve' a trait is to change the trait in the anticipated direction (e.g. to increase milk yield or to reduce lameness). Often animal breeding will select on more than one trait at a time which has given rise to multi-trait selection (see Lawrence et al., 2004 for a more detailed description). In brief multi-trait selection uses the individuals' breeding value (BV) for each trait multiplied by the traits economic value, individuals are then ranked on the sum of these values. Whilst the selection is aimed at measurable traits other traits may also be affected because they are genetically linked or correlated to one or more of the selected traits. As pointed out by Rauw et al., (1998) this can have undesirable consequences in terms of reducing the overall fitness of the animal. For example a narrow selection for milk yield in dairy cattle can lead to a genetic propensity for increased lameness and mastitis (Sandoe et al., 1999). Thus, animal breeding is another form of farm level trade-off where farmers (or breeding companies) make choices about the traits they want to emphasise in their animals given that selecting for improvement in one trait will usually mean less improvement or even loss of function in others. The trade-offs involved in animal breeding are more straightforward for conventional 'market' traits (e.g. growth) but become more complex when less conventional 'non-market' traits are

considered for example relating to animal welfare (Sandoe et al., 1999) or the environment (Wall et al., 2010). One reason that trade-offs are more complex for traits such as animal welfare is that the economic values are harder to estimate. Taking a trait such as lameness in dairy cattle, whilst the direct economic costs of lameness are built into multi-trait selection there is no estimate for the indirect cost to the cow in terms of pain and other relevant welfare experiences (e.g. Lawrence et al., 2004) and no way of knowing if the direct economic costs are also equivalent to the indirect costs. In general animal breeding again raises the question of how to 'value' animal welfare.

(iii) *Trade-offs beyond the farm level:* Trade-offs clearly also exist beyond the farm level, but there has been relatively little work to evaluate these trade-offs with respect to animal welfare. Toma et al., (2008) used a partial equilibrium model to show that improving piglet survival (arguably a welfare improvement) could have wider beneficial effects on trade and the environment. But generally there has been more focus on the potential negative effects of higher welfare standards in the EU either as an impediment to trade (e.g. Van Horne and Achterbosch, 2008) or as a driver for change in other countries such as the US (Mench et al., 2011). Finally of course consumers are likely to be making trade-offs in terms of their consumption patterns most notably in the well described gap between attitudes to animal welfare and buying of animal products (Vigors, 2018). Various studies suggest that although consumers may express concern for animal welfare in principle, when it comes to the point of purchase consumers will trade-off animal welfare for other attributes particularly price (e.g. Akaichi and Revoredo-Giha, 2016).

More on valuing animal welfare

The question of how to value animal welfare is clearly a central issue in relation to applying economics to animal welfare. As we discussed earlier one economic view of animal welfare is that it is a sub-set of our own perceptions and only indirectly to do with animals (McInerney, 1994). This view was based on the lack of evidence that animals are unlikely to make rational choices or that we cannot assess their welfare in other robust ways (see McInerney (1994), p.13). As previously noted, animal welfare science has developed a number of innovative approaches to assess animal welfare and today it is much harder to argue against the idea that animals have both good and bad experiences. In other words, animal welfare exists independently of humans for example as in the case of welfare of wild animals outside of our control or management (Sainsbury et al., 1995). Thus the development of animal welfare science has moved the argument closer to the position suggested by Christensen et al., (2012), that animal welfare is an intrinsic value with the consequence that the level of animal welfare that a society aims for should be based on

more fundamental principles (e.g. scientific understanding), and not only be determined by the way individual consumers trade-off animal welfare with other desirable goods. Consequently, there is a developing argument for the inclusion of a measurement for animal welfare's intrinsic value in economic models and a re-thinking of its anthropocentric approach (see Johansson-Stenman, 2018).

A related argument has been made by Buller and Roe (2012) that the 'selling' of animal welfare (e.g. through assurance schemes and labelling) is a commodification of animal welfare which focuses on those elements which can be commodified and may ignore equally important but less sellable aspects. This has some similarity to the problem we discussed earlier in relation to animal breeding where economic values are only applied to marketable traits (i.e. where welfare impacts on productivity) and not non-market traits such as the animals' experiences. There have been various suggestions about how to estimate economic values for non-market welfare attributes. For example Lawrence et al., (2004) pointed to the use of approaches such as 'contingent valuation' and 'willingness to pay' to estimate non-market ethical values (e.g. Bennett and Larson, 2006). A recent meta-analysis of willingness to pay (WTP) studies applied to farm animal welfare (Lagerkvist and Hess, 2010) does suggest a general WTP for farm animal welfare albeit with a number of complexities that warrant further research in this area. Notably, Frey and Pirscher (2018) recently put the intrinsic value of animal welfare to the test, and concluded that moral values, specifically altruism, reduced apathy and environmental concern, do influence and increase consumer WTP for improved animal welfare.

Changing human behaviour

The evidence of WTP for improvements to farm animal welfare suggests that incentives could be used to transfer benefits within the supply chain to encourage farmers to uptake alternative systems.

Christensen et al., (2012) discuss the use of incentives to ensure more even transfer of the benefits and costs of improving animal welfare across the supply chain. In some cases, the incentives to change farmer behaviour should reside at the farm level where improvements to welfare will bring with them obvious benefits; examples include genetic selection for health traits, improving neonatal survival and genetic selection for certain types of animal temperament (see Lawrence and Stott, 2009). However, even where there are clear economic benefits to farmers there may be constraints preventing uptake of improved welfare practices. One example of this is lameness in dairy cattle which as we have discussed is

well characterised as leading to loss of productivity (e.g. Green et al., 2002) and yet the levels of lameness on farms have remained at similar levels since the 1990s (Leach et al., 2010). In relation to genetic selection for animal temperament (e.g. increased docility) there maybe ethical constraints to be resolved (e.g. D'Eath et al., 2010).

In other cases, the incentives to change system or husbandry practice may not reside at farm level. Earlier we used the example of alternative farrowing systems to illustrate the application of economics to farm-level trade-offs. One of the conclusions of work in that area (e.g. Guy et al., 2012) is that alternative indoor designed pen systems such as PigSAFE are more expensive to run which suggests that a price premium maybe needed to encourage uptake (Cain et al., 2013). The obvious route for this would be through large retailers choosing to pay farmers to produce pork from farms that use alternative farrowing systems (Christensen et al., 2012). The limitations to this market-led solution to incentivising uptake of alternative systems is, as we have already discussed, that it will be variable with respect to the welfare issue and dependent on retailers being convinced that there is some market advantage in their support of the alternative systems.

The wider discipline of economics has undergone dramatic changes since the late 1970's, where the limits of normative economics to predict human behaviour prompted a merging with psychology to create the sub-field of behavioural economics (Mathis and Steffen, 2015). Within animal welfare economics, this is reflected in the increasing recognition that understanding and changing behaviour requires knowledge of the underlying motivations of stakeholders (Christensen et al., 2019). Behavioural economics suggests that, rather than being motivated by maximising benefits and minimising costs, an individual's decisions are driven by, for example; heuristics; how information is presented; past experiences; the context of the decision; the behaviour of others; and the cognitive reference points they draw from (Gigerenzer and Gaissmaier, 2011; Ratner et al., 2008; Thaler and Sunstein, 2008). The challenge is to unpick such motivations and influences in the context of animal welfare, and to determine how best to harness them to improve animal welfare-related behaviours.

Within the consumer literature, some research suggests that increasing the salience of product attributes desired by consumers can influence their choice. Akaichi et al. (2019) for example, found that demand for organic meat increased when its animal welfare and nutritional benefits were emphasised, while Carlsson et al. (2007) found that Swedish consumers, due to concerns with live transportation, would pay a premium for cattle slaughtered by mobile abattoir. In addition to emphasising specific food attributes, there is evidence that alternately describing the same meat product attribute positively or negatively changes consumer WTP (Fox et al., 2002). Such findings reflect insights in behavioural

economics that human choice is influenced by how information is conveyed (e.g. positively or negatively) and what attributes such descriptions make salient (e.g. Böhm and Theelen, 2016; Tversky and Kahneman, 1981). As such, how information is conveyed is argued to influence behaviour change (Thaler and Sunstein, 2008).

Farmer welfare-related behaviour can also be motivated by nuanced, intrinsic factors, beyond the extrinsic motivations (i.e. incentive) of enhancing profits. For instance, de Lauwere et al. (2012) found that farmers who had changed to group housing for sows, in part, felt that important stakeholders had expected them to, while those who had not changed were less likely to think this. Fear of a negative evaluation from others can also motivate farmers to change behaviours (Hansson and Johan Lagerkvist, 2012), particularly when there is potential for clear utility losses such as reputational damage in the eyes of consumers (Belay, 2018) or the loss in social status as a 'good farmer' (Te Velde et al., 2002). Christensen et al. (2019) thus note that having a 'social licence' to farm is increasingly recognised to have utility value, leading to the growing inclusion of reputational functions in economic analysis.

As is increasingly notable within the welfare economics literature, human behaviour is complex and often context-dependent. This has implications for how to motivate behaviour change and what interventions to use. Extrinsic incentives, for instance, may not be a useful tool in contexts where individuals are motivated by information salience and the expectations of others. An alternative to the use of incentives to change behaviour within the supply chain is the application of 'nudging', a set of behavioural change approaches derived from behavioural economics. Vigers (2018) recently suggested that nudging, which has been used successfully to better align individuals' intentions and action in other similar areas, could be applied to animal welfare. The attraction of 'nudging' is that it accepts the complexities of human choice behaviour and aims to work with these rather than against them.

In summary economics has been applied in a number of ways to the animal welfare debate. From an initial focus on the costs of alternative welfare systems it has been used to explore trade-offs including those involving consumer behaviour with respect to purchase of animal products. Amongst outstanding issues requiring further research are questions relating to the valuation of animal welfare and how to close the attitude-behaviour gap in order to more evenly distribute benefits and costs of improved animal welfare through the supply chain.

Animal welfare and policy

As we have discussed animal welfare in economic terms is a 'non-market' or 'public' good which means that it is incompletely reflected in the market and hence it is likely there will be 'market failure' where the market fails to provide as much animal welfare as society expects or demands (e.g. Bennett, 1995). The non-market or ethical aspects of animal welfare therefore demand attention by government on how best to deal with animal welfare as a public good. FAWC (2008) have produced a summary (from a UK perspective) of different policy options available to government specifically with respect to protecting and improving animal welfare. Here we provide a retrospective and prospective review of changes to animal welfare policy again through the lens of the UK and European experience.

(i) *The 19th and 20th centuries:* We have already seen that government from the 19th century was involved in attempting to resolve society's concerns over animal welfare. Although the first animal protection legislation in the UK (Martin's Act, 1822) was promoted by Richard Martin as a private member, within the next 50 years the UK government was to pass further acts in 1835 and 1849 to make farm animal protection more effective (Radford, 2001). Later in the 19th century the UK government was also drawn into the argument over the use of vivisection and in response passed The Cruelty to Animals Act (1876) to limit the uses of vivisection (Defra, 2019a).

Thus the initial response of UK government was the use of legislation in response to concern over animal cruelty and welfare and this pattern continued through the 20th century with the major proviso that from the early 1970s, UK animal welfare legislation has largely been taken from EU law. There have been occasional examples of the UK taking the legislative 'lead' over animal welfare, most famously with the banning of the use of stalls for pregnant sows in 1999 (Brooks, 2003), which was some years in advance of the EU ban on this housing system. However, largely as with other EU countries the UK has followed the EU lead including in the enshrining of animal sentience in law (see earlier).

Other notable policy developments in the 20th century were of course triggered by the publishing of *Animal Machines* (Harrison, 1964). We have already described how this led in the UK to the setting up of the Brambell Committee and later the Farm Animal Welfare Council. Woods (2012) historical account of how different UK government departments dealt with the developing debate over animal welfare between 1965-1971 is an example of how 'messy' can be the translation of a public interest issue such as animal welfare into policy. In particular as we have seen the conflicted position of MAFF resulted in the unresolved issue of whether animal welfare is about the animals' physical state and productivity or the ethics

of how we manage sentient animals which are capable of pleasant and unpleasant experiences (Woods, 2012).

(ii) *2000-2008*: In 2001 the UK suffered a widespread outbreak of Foot and Mouth Disease (FMD). The FMD outbreak was hugely damaging economically and socially (Woods, 2004) and as a result it ushered in a change of government policy that aimed to change the balance from government to shared responsibilities for animal health and welfare (The GB Health and Welfare Strategy: Defra 2004). Re-reading of this strategy provides justification for the perspective that UK government at the time remained conflicted in its idea of what animal welfare is about. Although animal welfare is introduced in the strategy in terms of the Five Freedoms, much of the text refers to animal health and welfare purely in terms of physical fitness and performance and the importance of animal welfare with respect to disease risk: e.g.

“Animals that are cared for appropriately and in accordance with acceptable welfare standards are more likely to be healthy, and less likely to contract or spread disease”. (Defra, 2004; p. 9).

“Fit and healthy animals which are appropriately cared for are likely to be higher yielding or remain productive over a longer period of time.” (Defra, 2004; p. 22).

Nonetheless, despite its rather superficial treatment of animal welfare, the GB Health and Welfare Strategy is an important document because it was an early signal of a wider change in government policy with respect to animal welfare, moving away from the almost total reliance on legislation to a range of other policy options (see also FAWC, 2008). This policy change is most clearly articulated in the EU’s own Strategy for Protection and Welfare of Animals 2012-2015 (European Commission, 2012) which clearly questions the use of a prescriptive legislative approach to improving animal welfare:

“...it has become increasingly clear that simply applying the same sector specific rules to animal welfare does not always yield the desired results. Problems of compliance to sector specific rules point the need to reflect on whether a "one size fits all" approach can lead to better welfare outcomes across the Union.” (p. 4)

As an alternative strategic direction, the EU 2012-2015 strategy refers to development of a revised EU legislative framework based on a holistic approach and specifically introducing science based welfare indicators based on outcomes as opposed to the use of inputs

(European Commission, 2012, p. 6). In other words, rather than prescribe the physical conditions in which animals are housed to ensure welfare, future legislation could allow the use of scientifically-based (biological) welfare indicators to assess animal welfare. We can see a common link between this proposal and the HBF sequence which led to the development of animal welfare science with its focus on the development of scientific welfare indicators. At the same time, such a policy shift could be seen as giving farmers greater freedoms in how they keep animals provided that animal-based welfare indicators are within certain bounds. In time there could also be concerns that through direct or indirect effects of breeding, animals become adapted to what might at the outset be regarded as poorer welfare conditions (see also D'Eath et al., 2010). The linkage of this approach to concerns over competitiveness (see p. 7 of the strategy) suggests again something of a conflict of interest in terms of policy representing the farming industry or representing the animals.

The other strategic direction proposed in the strategy, is a set of specific actions that include providing “consumers and the public with appropriate information” (see also section on Changing human behaviour). The concept of using market-led approaches to improve animal welfare can be linked to the creation of farm-assurance schemes in the 1980s. Although such schemes were originally devised for other purposes (e.g. to promote product provenance) by the early 2000s farm assurance schemes had already begun to take on animal welfare assessment (FAWC, 2005). Despite the apparent simplicity of using farm assurance to assure consumers over farm animal welfare there are in fact many technical, economic and ethical issues involved. The FAWC report on farm assurance and animal welfare provides a review of science based methods for assessing welfare on farms and specifically the development of animal-based measures (FAWC (2005), Appendix A, p. 51). In summary the main constraints relate to development of welfare measures which are reliable and valid and can be applied effectively in the brief period that inspectors are on farms. It has proved difficult to find measures that meet these demanding criteria. A related issue is the question of how to summarise and integrate information on welfare in ways that can be quickly assimilated by consumers given the multi-dimensional nature of animal welfare (FAWC, 2005; Blockhuis et al., 2010). In wider economic and ethical terms there is also the risk with market-led approaches of creating a multi-tier system where some animals are managed to minimum welfare standards whilst others live ‘a good life’ (e.g. Edgar et al., 2013).

In summary we can see the period between the publishing of *Animal Machines* to 2008 as representing a ‘golden era’ for animal welfare supported by a positive policy environment. We base this assessment on the substantial government activity in the forming of expert

committees and passing of substantial amounts of legislation which included the placing of animal sentience into legislative frameworks. This was followed by non-legislative government level strategies and action plans at national and international levels. Throughout this period there was also substantial research funding for animal welfare, much of it aimed at the development of scientifically valid methods for assessing animal welfare.

(iii) 2008 to the present and beyond: This last period starts with the financial crisis of 2007 where there is evidence that animal welfare has moved down the policy priorities at least in the UK and possibly at EU level as well. Evidence for this includes, at the UK level, a substantial reduction in research funding for animal welfare. At the time of the financial crisis the Department for Environment, Food and Rural Affairs (Defra) had a budget of over £3 million devoted to farm animal welfare, a sum that had remained stable since 2000/2001 (FAWC, 2008). Annual calls would go out on policy relevant issues such as the assessment of the welfare impacts of transport. Current levels of research funding appear to be substantially lower at less than £1 million and it has been a number of years since there have been the annual welfare research calls. The Defra web-site (Defra, 2019b) reveals that few animal welfare projects are currently being funded; indeed the Defra web-pages devoted to animal welfare have not been updated since December 2017 (Defra, 2017). In addition it would appear that the number of UK government personnel working on animal welfare has dropped substantially and there also has been a general loss of senior veterinary expertise in animal welfare. FAWC has been moved to a different arrangement with respect to government now being classed as a Committee as opposed to a Council which may have some implications for its autonomy. At the EU level, there has been no follow up to 2012-2015 animal welfare strategy (European Commission, 2012) although there has been other activity including setting up of an animal welfare platform (Ribeiro, 2017) and an EU Reference Centre for Animal Welfare (Binns, 2018).

The proposition that animal welfare has declined as a policy priority is based on discussions with policy personnel and a small amount of available data and must therefore be treated with caution. If there is substance to the proposition then possible reasons could be that this is mainly a UK issue brought on in part by the financial crisis and possibly now exacerbated by the complications surrounding BREXIT. More widely it could reflect the growth of other competing policy concerns, continuing concerns over the impact of farm animal welfare on competitiveness, the belief that UK (and possibly EU) standards are now sufficient, a growing reluctance to legislate on such issues and effective lobbying by agri-businesses. We would propose that a full review of animal welfare-policy interactions is warranted to better understand these trends.

Given our uncertainty over the current relationship between animal welfare and policy predicting the future is fraught with difficulties. However it seems to us that animal welfare will struggle to retain or perhaps regain the rather privileged policy position it has previously occupied in the UK and the EU into the future, for all the reasons we have listed above. Despite this the available evidence suggests that the public will remain highly sensitive to animal welfare (at least in the UK) and policy makers will need to operate with care. For example, in the parliamentary process of voting for EU withdrawal the UK government did not support the transfer of Article 13 of the Lisbon Treaty, recognising animals as sentient beings, into UK legislation (Ares, 2018). There are a number of interpretations of this move, but it raised considerable adverse public response which culminated in the government appearing to step back and sponsor the “Animal Welfare (Sentencing and Recognition of Sentience) Draft Bill” (Ares, 2018).

Conclusions

The aim of this chapter was to provide an overview of the development of animal welfare and its interactions with economics and policy. In describing the development of animal welfare we wanted to illustrate the value of going ‘beneath the surface’ of the standard view (which we referred to as the Harrison-Brambell-FAWC (HBF) sequence). For example we discussed the complexities of the relationship between scientific knowledge of animal welfare and policy. On the one hand whilst science continues to struggle with the subjective nature of animal well-being, the concept of animal sentience has been incorporated into law in the EU and the UK effectively avoiding the scientific arguments over the nature or even existence of animal mentality. We also used a recent historical analysis by Woods (2012) to illustrate how the translation of animal welfare into government policy in the UK in the period 1965-1971, was affected by inter-departmental rivalries and also by conflicted responsibilities to farm animals and to farmers. As a consequence it can be argued, the UK failed to emerge from this early phase with a clear idea in policy terms of what animal welfare was about, potentially exacerbating the contentious nature of the animal welfare debate. We then explored the relationship between animal welfare and economics from the use of economics to analyse the costs of animal welfare improvements to more recent work on trade-offs relating to animal welfare across the supply chain. Across this range of uses of economics relating to animal welfare we identified that the question of how to value animal welfare remains unresolved. We saw this specifically in relation to the application of economics to animal breeding, but also more generically in the question of whether animal welfare has intrinsic value separate to human preferences. The nuances of human

preferences and behaviours, as described by behavioural economics, were also noted to influence how individuals respond to animal welfare within the supply chain. The relevance of such innate features of human decision-making to changing human behaviour in relation to animal welfare was further discussed. Lastly we described a time line for policy developments in animal welfare from a UK perspective. We posited that the period 1965-2008 may come to be regarded as a 'golden era' for translation of animal welfare concerns into positive socio-political actions. We discussed a raft of issues which appear to have diminished the position of animal welfare in the UK policy 'pecking order'. We further suggested that this downward shift in the policy priority given to animal welfare may go beyond the UK and that it is unlikely that animal welfare will regain its previous policy position. To counter this however it seems that in the UK at least there will continue to be an underlying and widespread sensitivity to animals with a matched concern for their welfare. This societal concern will mean that government and others will need to be cautious of breaching 'red lines' and on a more positive note still provide the opportunity for policy and business innovations designed to improve animals' lives.

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