PERCEIVING IS BELIEVING

UNDERSTANDING PUBLIC PREFERENCES FOR DAIRY COW MANAGEMENT IN THE UK

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Perceiving is believing: Understanding public preferences for dairy cow management in the UK

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Publications

Chapter 2

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Chapter 4

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Chapter 5

Jackson, A., M. Green, and J. Kaler. 2022. Fellow Cows and Conflicting Farmers: Public perceptions of dairy farming uncovered through frame analysis. *In review*

Abstract

Economic pressures imposed on the dairy industry since the mid-20th century have resulted in intensification at farm level, with expansions in herd size, increases in milk yield and the uptake of technology. However, this has moved dairy farming, and specifically the care of the dairy cow, out of alignment with public values, risking both future dairy consumption and social licence to operate. Understanding how the public perceive dairy farming and prefer the dairy cow to be managed would provide the dairy industry with opportunities to improve engagement and adapt systems to better meet societal expectations, thereby building a more secure future.

First insights came from novel use of the discrete choice method 'best worst scaling' within a quantitative survey of 2,054 UK citizens, described in Chapter 2, which provided a scaled ranking by importance of 17 different attributes associated with dairy cow management and milk production. Through hierarchical Bayesian analysis, grazing, cow comfort and health & welfare were established as the three equal top priorities for the sample. However, these belied six underlying and characteristically distinct 'citizen groups', identified through latent class analysis and multinomial logistic modelling. Each group had very different preferences, suggesting significant diversity of preference for dairy cow management within the wider UK population.

While the discovery of this diversity was novel, it did not explain the understandings the preferences were based on, or why. Therefore, from this, further aspects of public perceptions and preferences were explored in more detail through analysis of qualitative data. As described in Chapter 3, this was collected from face-to-face interviews with a subset of 60 participants from the sample in Chapter 2.

The study described in Chapter 4 used mixed methods analysis of these data to determine public preferences for three dairy farming systems with differing access to pasture. Through integrating the results of reflexive thematic and linguistic analysis, strong preferences were established for a mixed system, grazing cows in summer and housing them in winter; this system matched a 'dual vision' of the cow's domesticity and wildness, but was also shown to generate most confidence and positive emotion.

The fully housed system was rejected by most, failing to meet the cow's 'wild' persona and giving rise to negative emotions and denial. By contrast, the fully grazed system appeared aspirational, but its lack of protection produced linguistic discrepancies, signalling doubt. In conclusion, the mixed system best delivered the naturalness and care participants wanted. However, a lack of knowledge of the cow's needs meant participants also deferred to others to choose, including the cow herself.

Recognising that people process new information through interpretive lenses or 'frames' formed from memories and experiences, frame analysis of the qualitative data, as described in Chapter 5, indicated how the public might perceive dairy farming, and therefore how they might understand care of the cow. Through inductive thematic analysis, three frames developed for the cow presented her as enduring, a fellow, and a force of nature. Two frames described the farmer as traditional or modernising, but through positive and negative narratives which depended on the treatment of the cow, causing confusion about what actually happened on-farm. Reflecting on the impact of the frames, the evident connection participants felt with the cow explained public interest in her wellbeing; confusion about the motives of the farmer indicated a need for more overt illustrations of care.

'Natural' is an aspiration many have for the lives of farm animals – yet the term remains broad and ill-defined. Therefore, what people mean by 'naturalness' in dairy farming was explored in Chapter 6 by first identifying what participants deemed natural (or unnatural) by applying an adapted framework to the qualitative data, then reflexive thematic analysis to explain these perceptions. A wide range of topics including farmer behaviour, use of technology, and familiarity or normalcy indicated naturalness or unnaturalness; these were explained by the need for the cow to 'be cow'; discomfort with excess; and the accountability of the farmer. Context determined whether 'natural' was actually detrimental, or 'unnatural', beneficial.

The application of novel methods within this research has added new depth to understandings and fresh insight into public perceptions about dairy cow management in the UK. The findings offer opportunities to change how dairy farming practices are communicated, and to consider how dairy systems can be adapted to better meet changing societal needs.

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Lastly, big thanks to my long-suffering family. I am very honoured that my mum Janet Patterson – a talented professional artist – understood my studies in her own unique way and created the fantastic cover for this thesis. And my particular gratitude to my partner-then-husband Greg who supported me all the way, and especially in the last six months as it all came somewhat haphazardly together. I will remember the scrutiny of my time plan and the pointed questioning, and I look forward to reciprocating just as rigorously on his forthcoming academic adventures.

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Animals first entered the imagination as messengers and promises. For example, the domestication of cattle did not begin as a simple prospect of milk and meat. Cattle had magical functions, sometimes oracular, sometimes sacrificial. And the choice of a given species as magical, tameable and alimentary was originally determined by the habits, proximity and “invitation" of the animal in question.

John Berger (2007). Why Look at Animals?

Chapter 1: Introduction

1.1 Background

1.1.1 Perceptions, preferences and the public – some definitions

This thesis aims to build on current knowledge of perceptions and preferences held by the public towards the management of the dairy cow. Before we embark on a summary of what is known in this area and define the research gaps, it is worth defining 'perception', 'preference' and 'public' within the context of this thesis.

'**Perception'** is defined in the dictionary as "*a belief or opinion, often held by many people and based on how things seem"*, "*the quality of being aware of things through the physical senses, especially sight*", and "*the way that someone thinks and feels about a company, product, service, etc*." (Cambridge English Dictionary, 2022a). It is also described as an "act of categorisation" by Bruner (1957), who asserts perception is as much about the mind's processing and categorising of stimuli according to experiences and memories, as it is about the senses (Bruner and Postman, 1949).

While '**preference'** can be defined as having an advantage, within this thesis we use the definition meaning to "*like something or someone more than another thing or person*" (Cambridge English Dictionary, 2022b), from which we construe an individual is more likely to think positively about it or select it over alternatives.

Lastly, '**public'** is defined as "*relating to or involving people in general, rather than being limited to a particular group of people*" or "*all ordinary people*" (Cambridge English Dictionary, 2022c). Within this thesis, we use 'public' to mean people in general, who might have a societal interest in the wider impact of livestock production methods whether they consume dairy products or not. While the term 'citizen' has commonly been used in literature, as can be seen in the review in Chapter 1 (Section 1.4), 'public' has more recently been observed within this field of interest, and has been mostly used in this thesis in the belief it is more familiar to non-academic audiences. It is also worth noting that within social science and communications, reference to 'publics' (plural) is normal (Burns et al., 2003), but here, as we are not distinguishing between established public groups, we will use the singular.

1.1.2 A brief history of cow and man

Humans have a long and deep shared history with cattle, starting long before their domestication when bulls were revered symbols of fertility or earthly embodiments of gods, and cows were sacred providers (Velten, 2007). However, since the ancient aurochsen (ur-oxen) were tamed around 10,000 years ago, cattle have also been bred to provide power, nutrition, and raw materials for clothing, tools and household implements (Roberts, 2018). The word 'cattle' itself comes from the same origins as 'chattel', meaning possession, and 'pecunious', meaning moneyed, is derived from the Latin word *pecus* denoting a head of livestock such as cattle (Velten, 2007). Hence, the lives of cows and humans have been interwoven through the fundamental concepts of faith, subsistence and prosperity for millennia.

Within this story, milk in particular has been instrumental in facilitating the survival, spread and dominance of man. Studies of teeth in human remains from the Bronze Age suggest the genetic mutation allowing people to digest lactose into adulthood – estimated to have first occurred around 9,000 years ago in Europe and 4,000 in Africa (Roberts, 2018) – conferred a considerable survival advantage to certain populations, not only as a source of clean liquid, but for its carbohydrate, fat and micronutrient content (Cochran and Harpending, 2009; Warinner et al., 2014; Wilkin et al., 2021).

Evidence of the nutritional advantages of dairy products persists today, for example in improving cognitive health and reducing stunting and wasting in low income countries (Adesogan et al., 2020), or increasing odds of survival against certain health challenges such as vascular disease, diabetes and cancer (Elwood et al., 2008). While only a third of the global population is estimated to have the ability to digest lactose – mainly within northern Europe and specific pastoral countries within Africa, and to a lesser extent in North America and Oceania (Storhaug et al., 2017) – many others can consume dairy products in the form of yogurt and cheese, thanks to the way in which fermentation reduces lactose content (Alm, 1982; Polowsky, 2022). This has helped global milk production more than double over the past 50 years to its current annual output of almost 850 million tonnes – equal to an average consumption of almost 100kg fresh milk per person per year (Ritchie and Roser, 2017a).

Milk in Bronze Age times could have come from a variety of animal sources, but cows have lent themselves particularly well to domestication (Moran and Doyle, 2015) and are today responsible for 81% of dairy production globally, or around 720 million tonnes of milk annually, and produce almost all milk in developed countries (FAO, 2022a). Certainly, cows underpin the vast majority of all milk production in the UK, which is one of the world's largest per capita consumers of dairy products (Ritchie and Roser, 2017b). However, the UK does not just have a long tradition of milk consumption – it also has deep cultural connections with dairy farming. This spans the milkmaids of the 17th and 18th century, who – if the story is to be believed – may have played a role in the development of the first vaccine through illustrating that cowpox infection could result in immunity to the deadly disease smallpox (WHO, 2016; Brink, 2018); the city dairies in London through the 18th and 19th centuries which grazed cows on Hyde Park and Green Park and fed them grain by-products from the breweries (Atkins, 1977); the pulsating milking machines, milking parlours (in the form of mobile milking bails) and pasteurisation developed in the early 20th century (Fussell, 1963; Atkins, 2000); closely followed by the launch of the Milk Marketing Boards in the 1930s, which prominently marketed the benefits of milk until their dissolution over 60 years later (Empson, 1998).

1.2 Changing times

1.2.1 An evolving dairy industry

While humans share a rich cultural history with dairy cattle, since the middle of the last century, the dairy farming industry has also reflected a global trend to become both more efficient and more productive, creating a safe and abundant food supply (Godfray et al., 2010; FAO, 2017) which uses less energy, water and manpower per unit of output (Curry, 2002; Wik et al., 2008; Development Economics, 2017). For example, a review of modern practices in the United States concluded that dairy farming in 2007 utilised just 21% of the animals, 23% of the feedstuffs, 35% of the water, and 10% of the land it did in 1944 to produce a unit of milk (Capper et al., 2009). These are not the only changes. It is worth noting that over that same period,

US national milk production doubled (USDA, 1946, 2009) and the industry underwent a rationalisation in dairy holdings so extreme that only 1% of the numbers of dairy farmers existing immediately post-World War 2 (WW2) now remain (Blayney, 2002; USDA, 2021). Such changes are the very definition of the type of agricultural 'intensification' – as in the production of the same or greater output while employing fewer resources (FAO, 2004) – seen in many countries since the middle of the last century.

Similarly, in the UK, while numbers of dairy farmers and cows have fallen significantly, both yield per cow and herd size have compensated to the extent that now, post-EU quotas (Colman et al., 2002; O'Brien, 2015), 1.9 million dairy cows on around 12,000 farms produce over 15 billion litres annually, accounting for 16.4% or £4.4 billion of the UK's total agricultural output (Uberoi, 2021). The culmination of this is that in 2018, the UK produced 30% more milk than 1960, but from 60% of the cows and just 8% of the farmers (AHDB, *personal communication*, 4 March 2022). Such efficiencies should indicate a positive future for UK dairy farming, especially given predictions from OECD/FAO (2021) that global consumption of dairy produce will continue growing by around 2% per annum over the current decade. However, a number of factors could still affect the UK dairy industry's prospects, and a key one of these elements is questions over the treatment of dairy cows.

1.2.2 Growing concerns

Twenty years ago, Harper & Henson (2001) reported increasing disquiet among consumers in the EU about farm animal welfare; today, the treatment of animals remains an extremely emotive issue to many observers of livestock production, to the extent that it is a leading concern in consumer surveys (Bashi et al., 2019; Stannard & Randall, 2019) and a key motive for conversion to veganism (Rosenfeld and Burrow, 2017; Schenk et al., 2018; Kalte, 2020). In a recent survey, the humane treatment of farm animals was found to be among the subjects of most concern to consumers, alongside Covid-19, climate change, pollution from plastics and rising energy costs (Stannard, 2021 – Figure 1). The subject of farm animal treatment is discussed frequently on public platforms, for example in online activist campaigns (Stevens et al., 2018; Rodak, 2020; Wonneberger et al., 2020) and through the exchange of pro- and

anti-livestock farming messages between farmers, animal welfare advocates and lay citizens on social media (Buddle et al., 2018; Stevens et al., 2020). It is also the focus of a growing number of documentary films (Webber, 2020) which spark debate, shape public opinion and can even influence policy (Nisbet and Aufderheide, 2009).

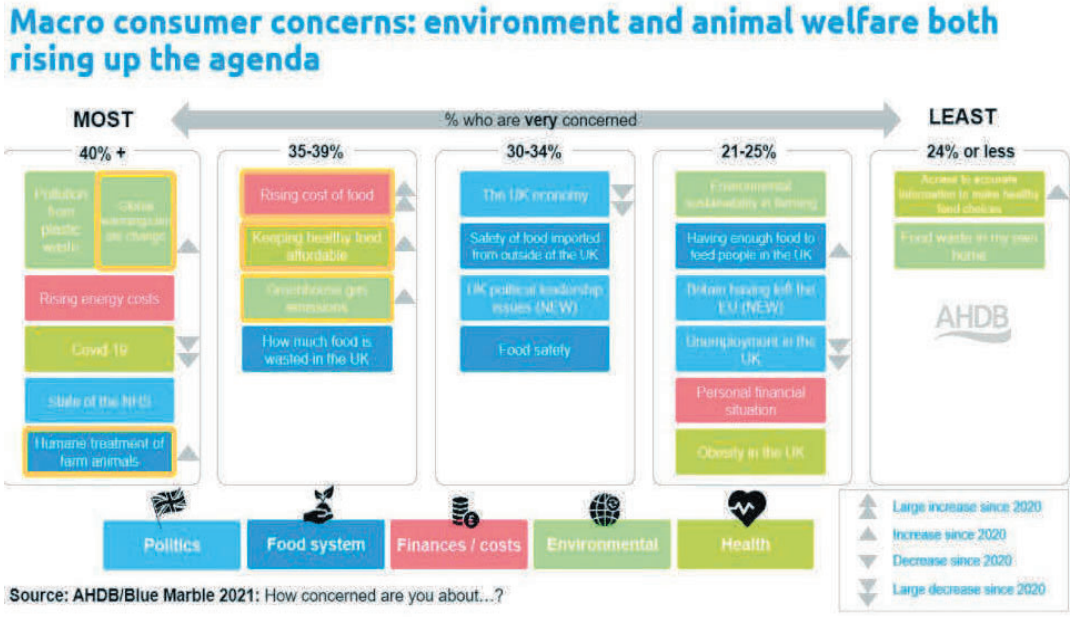

Figure 1. A survey of 1,501 UK consumers has found humane treatment of farm animals now ranks among the biggest concerns (Stannard, 2021)

A common concern raised about modern livestock farming is a perceived lack of transparency about how animals are reared and managed, exacerbated by rapidly changing farming techniques (Johnson and Hamernik, 2015), the movement of animals from fields and into buildings (Sweeney et al., 2022), and – in some cases – efforts by farm businesses to withhold information for fear it will be used against them (Robbins et al., 2016a). 'Factory farming' remains a particularly contentious yet ill-defined concept, often combining larger scale operations, higher stocking densities, or greater levels of confinement (Lusk et al., 2007). It is also the subject of a number of campaigns led by civil society organisations or individuals who wish to draw attention to such practices. Examples include a teenager who succeeded in petitioning the UK's leading food retailer to stop selling eggs from hens in colony cages (Press Association, 2016), and – specifically concerning dairy farming – the unprecedented opposition to a

proposal to set up an 8,000-cow dairy farm in Lincolnshire (Ipsos/WSPA, 2010; CIWF, 2011a). Again, transparency is a theme in these and other cases, where groups have promoted the disparity between what people might think they are buying and what they actually get (e.g., World Animal Protection, 2015), culminating in growing support for method-of-production and sustainability food labelling (Stannard, 2021 – Figure 2).

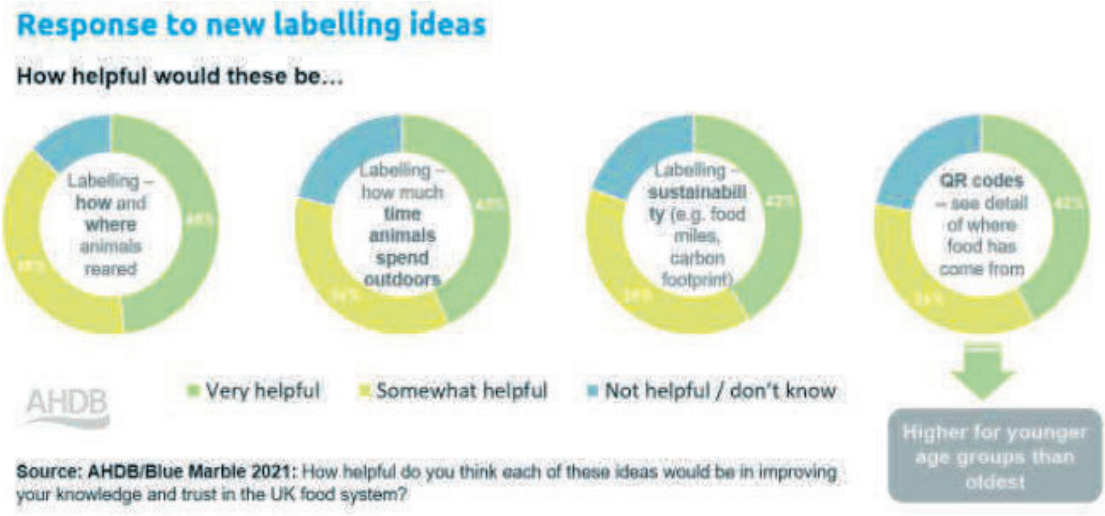

Figure 2. A survey of 1,501 UK consumers suggests support for transparency of production system and sustainability through labelling (Stannard, 2021)

Concern has been reflected at an economic level too. The Business Benchmark on Farm Animal Welfare (BBFAW – www.bbfaw.com), set up by the World Society for the Protection of Animals (now World Animal Protection) and Compassion in World Farming in 2012, aims to bring transparency to the food supply chain's use of farming systems deemed incompatible with animal welfare. The benchmark, which audits over 150 food businesses annually for policies including use of medicines, confinement, enrichment, and transport (Amos et al., 2020), has the potential to reduce company profits by impacting reputation and standing in the eyes of shareholders and the public. Farm Animal Investment Risk and Return (FAIRR – www.fairr.org), founded in 2015, applies similar economic levers by raising awareness of ways in which intensive livestock production and the treatment of animals can expose financial markets to environmental, social and governance risks which, again, can damage reputation and shareholder perception.

The issue of farm animal welfare is also becoming more of a political preoccupation. The US has seen a number of state-wide propositions emerge in recent years focused on the treatment of farm animals, such as Proposition 2 in California which bans the use of cages for laying hens, gestation crates for sows and veal crates for calves, and the more extreme Initiative Petition 13 in Oregon which seeks to criminalise hunting, fishing and the killing of animals for food, as well as ban most breeding practices including artificial insemination (Michelson, 2020). While not on the same scale, the UK's proposed Animal Welfare (Sentience) Bill, in its reporting stage in the House of Commons (UK Parliament, 2022) at time of writing, aims to replace Article 13 of the EU's Lisbon Treaty (recognising animal sentience), which was not transferred into UK law when the UK left the EU. However, sentience is already recognised under UK animal welfare law and the proposed Bill "*appears to go further than Article 13 in as much as it applies to all government policy rather than certain areas*" (Ares, 2019). Hence, this has raised concerns from some Members of Parliament that the Bill will facilitate more extreme animal welfare agendas (PA Political Staff, 2022; Smith, 2022).

1.2.3 Societal shifts

The increasing attention paid to how farm animals are kept may be due, in part, to a range of societal shifts. One of these is rising per capita income, which has been directly correlated with growing concern for animal welfare (Frank, 2008). This would not only explain an increasing focus on this issue as standards of living and disposable incomes rises in many countries, but would sound alarms too for developing countries which, in their haste to meet rapidly growing demand for animal protein, move directly from subsistence agriculture to large-scale intensive systems people then reject (von Keyserlingk and Hötzel, 2015).

Another shift is urbanisation, which can contribute to increased disposable income in its own right but also reduce familiarity with, and understanding or acceptance of, farm animal management practices (Boogaard et al., 2006). Globally, the urban population is expected to rise from 55% to 68% by 2050 (UN News, 2018), but it is already greater than this in the UK – for example, only 17% of the population in both Scotland and England now lives in rural areas (RESAS, 2021; Defra, 2022). Associated with this is the continuing decline in numbers of people directly connected with

farming. Between 1980 and 2019, this more than halved from 2.6% of the labour force in the UK to just 1% (Ritchie and Roser, 2022), meaning progressively fewer people gain familiarity with livestock farming through neighbours, friend or relatives.

Alongside this, surveys carried out by industry groups suggest there has been a decrease in understanding of the provenance of food (Preece, 2012; British Nutrition Foundation, 2017), which could be linked to both urbanisation and reducing agricultural workforce. Here, generational changes may also be having an impact. 'Generation Z', denoting those born after 1997, now form 25% of the global population (Patel and Morrison, 2018). While this generation will – by dint of the aforementioned urbanisation and distance from farming – be less familiar with farm livestock practices than their parents, they are also believed to represent significant attitudinal change, expressing noticeably more concern for animal welfare than their predecessors (Bogueva and Marinova, 2020; Food Standards Agency, 2020).

1.2.4 Changing diets

A further significant and pertinent change concerns diet, particularly the boom in the development of alternatives to meat and dairy, ranging from plant, fruit, fungus or insect-based foods to laboratory-cultured meat fibres (Stannard, 2018; Bashi et al., 2019). These innovations address many of the barriers previously identified to adopting a vegetarian or vegan diet, which include reservations about taste, expensiveness and convenience (Fehér et al., 2020; Rosenfeld and Tomiyama, 2020). This is so much the case, sales growth in this whole sector has been estimated at as much as 15% per year (Geller, 2020) – although expectations have recently been revised downwards following a slowing in growth (Randall, 2022; Terazono, 2022). Nonetheless, there is clear evidence of people's attitudes changing with more intending to either adopt a vegan or vegetarian diet, or reduce meat and dairy intake in the future (ProVeg International, 2021; Prescott-Smith and Smith, 2022).

Evidence of this taking hold more widely is the plateauing of demand for dairy products anticipated in developed countries over the next decade, reportedly due to health and environmental concerns (OECD/FAO, 2021). This means the forecast

increase in global demand of around 2% reported earlier overlays more complex changes, including growth mainly centred in lower income countries (Rusk, 2019).

Indeed, Western demand does appear to have matured, for example with per capita milk consumption in Europe increasing just 25% over the past 60 years. By comparison, consumption in Asia rose 170% over the same period – albeit from a lower starting point – and has been particularly driven by three countries holding two-thirds of the Asian population: China, which experienced a nearly 13-fold increase in milk consumption (although starting at just 2.3kg/person/year); India, which saw a rise of 120%; and Pakistan, which increased consumption by 67% (Ritchie and Roser, 2017b). Looking ahead over the coming decade, much of the anticipated growth in demand is expected to continue to come from these three countries (OECD/FAO, 2021). This might explain why they, too, have increased their own milk production capacity significantly over the past 60 years, with China's domestic dairy sector expanding output almost 20-fold; India, nine-fold; and Pakistan, six-fold (Ritchie and Roser, 2020). Hence, this signals a significant difference in dairy consumption predictions and opportunities between mature and developing markets for dairy.

As a last point, it is worth noting that within this paradigm, China's exponential growth in production was curtailed by the melamine scandal in 2008 (BBC, 2010; Wang et al., 2021), which led to a drop in demand for domestic product as concerned Chinese consumers turned instead to imported dairy produce (Mccullough, 2019). This has facilitated significant growth in New Zealand and European dairy exports in intervening years, but future opportunities are reliant on domestic Chinese production failing to regain market share (Guenther et al., 2016).

1.2.5 Social licence to operate

It is clear that a number of challenges lie ahead for the UK dairy industry related to levelling off in domestic consumption and concerns about sustainability; on the other hand, robust growth is forecast globally, with the prospect of export opportunities far in excess of domestic potential. However, sales are not the only determinants of the industry's future. Alongside changes in public attitudes and diets, we are seeing increased evidence of challenges to livestock farming's 'social licence to operate'.

This was a term first used in connection with the mining industry in Australia, where social licence was identified as 'going beyond' compliance needed for a legal permissions with the aim of being seen as legitimate, credible and trustworthy by external stakeholders, primarily communities (Boutilier, 2014). It has more recently been applied in an agricultural context to farmers' tacit permission to utilise land and resources, and undertake a variety of other activities in pursuit of their farming objectives – with consequences for the operation of the business if that trust is breached and stakeholders withdraw their 'permission' (Martin and Shepheard, 2012).

While social licence is a concept founded in the conduct of individual businesses, reputational harm arising from breaches of trust can be used to evaluate or characterise entire sectors (Hampton et al., 2020). Hence, dairy farming's success is no longer predicated simply on its economic viability and the continued purchase of its products. As illustrated throughout this section, dairy farming now has a broad range of external stakeholders beyond those who simply consume dairy. Civil society organisations, politicians, financial institutions, food businesses and local communities now, to a greater or lesser extent, express views about how farm animals – including dairy cows – should be managed; and where they dislike what they see, they can exert pressure on dairy farming's social licence to operate, whether through legislation, censure or supply chain demands. Within these dynamics, public perceptions remain a key factor, as while these groups are stakeholders in their own right with their own areas of interest, they are also formed from or influenced by members of the public, who themselves become vehicles for action through, for example, promoting viral social media content, signing petitions, investing more consciously, complaining more frequently or voting more politically. Hence, operating in a way which may not meet the expectations of the public could reduce the industry's 'licence to operate', and along with that, bring significant business disruption.

1.3 The industry response

1.3.1 Assessing farm animal welfare

We have looked at economic-driven changes in the dairy industry post-WW2, the concerns raised by these, and coincidental societal shifts. It is now useful to revert to the dairy industry to understand how it has assimilated and responded to these issues. In her seminal book *Animal Machines* (Harrison, 1964), Ruth Harrison drew attention to growing intensification in farming, which was resulting in what she saw as inhumane and sometimes intolerable treatment. Her concerns succeeded in catching the attention of the then-government, with the Brambell enquiry convened in 1965 as a result (Brambell, 1965). This culminated in the publishing of the 'Five Freedoms' (Table 1) – now the bedrock of animal welfare standards globally (Veissier et al., 2008).

Table 1. The Five Freedoms, originally defined in Brambell (1965) and revised by the Farm Animal Welfare Council in 1979 (FAWC, 1979)

'Freedom'	Provision
Freedom from hunger and thirst	By ready access to water and a diet to maintain full health and vigour.
Freedom from discomfort	By providing an appropriate environment including shelter and a comfortable resting area.
Freedom from pain, injury and disease	By prevention or rapid diagnosis and treatment.
Freedom to express normal behaviour	By providing sufficient space, proper facilities and appropriate company of the animal's own kind.
Freedom from fear and distress	By ensuring conditions and treatment which avoid mental suffering.

In 2009, while acknowledging the significant progress made through the establishment of the Five Freedoms, the UK's Farm Animal Welfare Council questioned whether the ambitions of the Brambell Report had been met, in that the Five Freedoms focused on preventing negative animal welfare states rather than offering an ambition for good welfare (FAWC, 2009).

Instead, it proposed moving to a 'Quality of Life' model (Figure 3) that could seek to eliminate factors which made an animal's life 'Not Worth Living' and progress through a 'Life Worth Living' to positive interventions that could provide a 'Good Life'. How this might work in practice or be assessed has not yet been determined other than in

laying hens, for which a working 'Good Life' framework has been developed (Stokes et al., 2020). Therefore, the model has not, as yet, gained the widespread traction enjoyed by the Five Freedoms.

Other examinations of what animal welfare means and how it can be assessed have been proposed through the years, all of which aim to evolve the Five Freedoms to better reflect changing scientific knowledge and societal expectations. In fact, the EU's Welfare Quality® project (Blokhuis et al., 2010), which ran from 2004 to 2010, had a principal aim to address growing concerns raised by EU citizens about animal welfare (e.g., Eurobarometer, 2007). In this way, the project sought to better understand public concerns and work with public stakeholders to co-design new ways of identifying and assessing positive welfare states. Importantly, the resulting list of 12 criteria for good animal welfare, grouped into four main principles (Table 2), "*…built on and extended the 'Five Freedoms*'" (Blokhuis et al., 2010). However, while some elements of Welfare Quality® have been integrated into discrete standards and policies, it too has yet to gain the widespread uptake of the Five Freedoms.

Table 2. Principles and criteria for good welfare within the Welfare Quality® project (Blokhuis et al. 2010)

Principles	Welfare criteria
Good feeding	1 Absence of prolonged hunger 2 Absence of prolonged thirst
Good housing	3 Comfort around resting 4 Thermal comfort 5 Ease of movement
Good health	6 Absence of injuries 7 Absence of disease 8 Absence of pain induced by management procedures
Appropriate behaviour	9 Expression of social behaviours 10 Expression of other behaviours 11 Good human/animal relationship 12 Positive emotional state

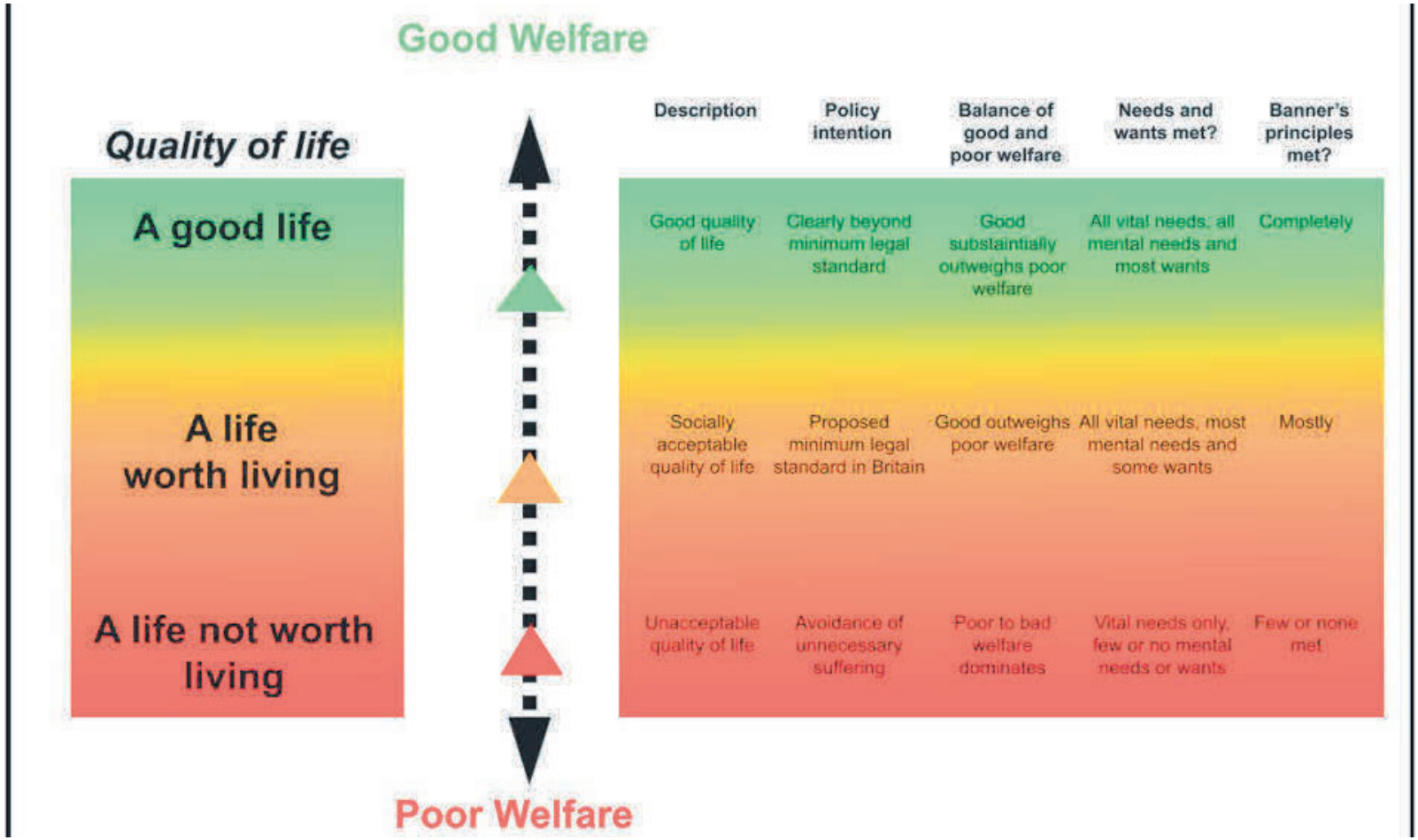

Figure 3. The 'Quality of Life' concept proposed by FAWC in 2009

The same is true of the 'Five Domains' model first developed in 1994 (Mellor & Reid, 1994) and updated periodically over the subsequent 25 years. This, too, seeks to address deficiencies in the Five Freedoms model and provide a device for facilitating systematic, structured, thorough and coherent assessments of animal welfare. Concerns expressed by David Mellor (2016) included the interpretation by some that the Five Freedoms are absolute (i.e., that welfare is not good unless absolute freedom has been obtained) rather than a journey towards an ideal. Furthermore, he contended that freedom from some affective states (e.g., hunger) may be detrimental as these states are survival-based, thus overcoming them is actually rewarding to the animal. The Five Domains approach distinguishes between survival-related factors (i.e., nutrition, environment, health), situation-related factors (behaviour), and mental states, describing both positive and negative outcomes for each (Figure 4). The latest iteration of the model was published in 2020 and, for the first time, included the ability to assess human-animal interactions (Mellor et al., 2020) (Figure 5).

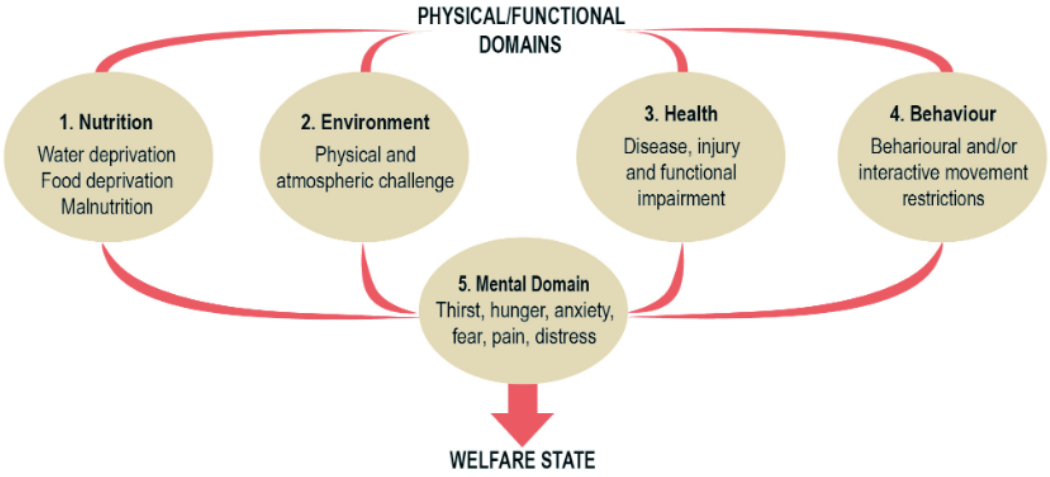

Figure 4. The 1994 Five Domains Model, as illustrated in Mellor et al. (2020)

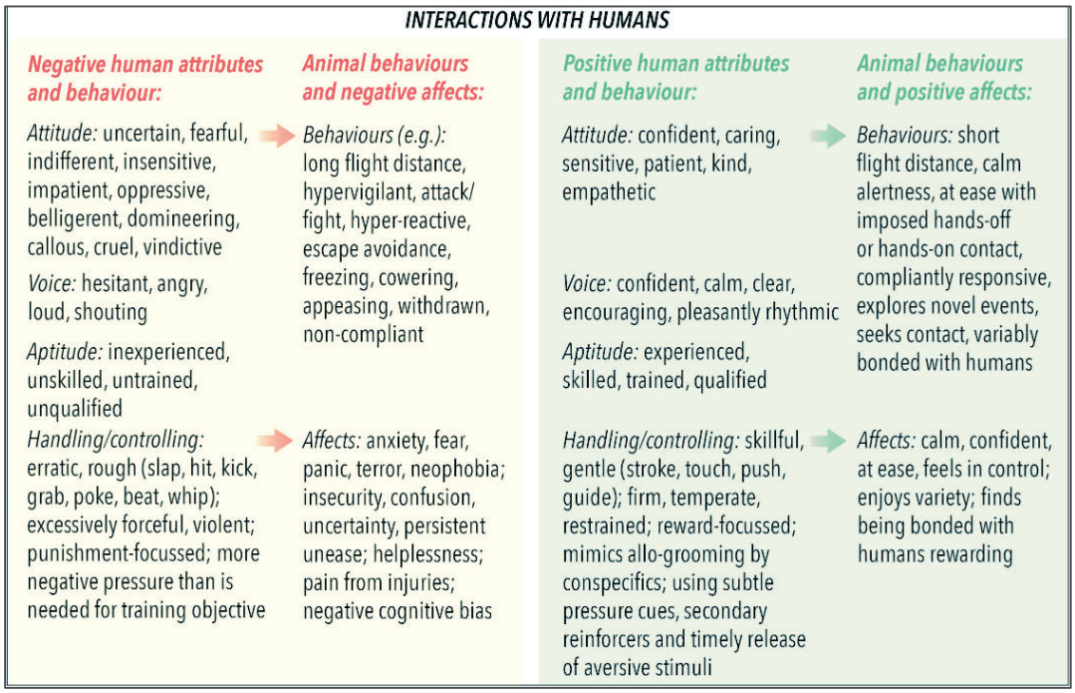

Figure 5. The newly-introduced human-animal interaction element of the behaviour domain within the Five Domains model (Mellor et al., 2020)

AssureWel (www.assurewel.org) is another welfare assessment protocol, this time developed jointly by the Royal Society for the Prevention of Cruelty to Animals (RSPCA), the Soil Association and University of Bristol between 2010 and 2016. It aimed to establish a practical system of welfare outcome assessment for the major farm animal species which could then be used in farm assurance schemes. The measures have since been incorporated fully into RSPCA and Soil Association organic standards, but these cover a relatively small part of the farming industry. By contrast, Red Tractor farm assurance for pigs, covering 95% of the pig industry in England, Wales and Northern Ireland, and Red Tractor farm assurance for dairy, covering 95% of the UK dairy industry, have adopted selected aspects of AssureWel, but neither has adopted the whole assessment (AssureWel, 2016a; b).

Lastly, it is worth noting that one 'Freedom' within the Five Freedoms (FAWC, 1979) – the freedom to express **normal** behaviour – is often presented as the freedom to express **natural** behaviour. This is an important distinction, yet the origin of the change remains unclear. There is considerable debate over the meaning of 'natural' (e.g., Nuffield Council on Bioethics, 2015; Siipi, 2008; Yeates, 2018), and, in fact, as

Marian Stamp Dawkins (2008) pointed out, natural behaviours can include suffering, such as fleeing a predator, so naturalness may not always be desirable or beneficial.

One of the ways of addressing this, suggests Dawkins, is to reduce the question of animal welfare to two questions, which cover both the Five Freedoms and all 12 of the criteria expressed in Welfare Quality®: 1) Is the animal healthy?; and 2) Does the animal have what it wants? John Webster (2016), one of the original authors of the Five Freedoms, takes a different approach, and concludes that this problematic freedom might have been more neatly expressed as "*Freedom of Choice*", meaning freedom to express natural behaviour with regard to choice of diet, environment, social contact, comfort and security (with a caveat for activities which cause material harm). Finally, Heather Browning (2020) offers a third solution, proposing that naturalness is not necessary to achieve good welfare, and instead the focus should be on creating positive mental states in the animal by, for example, allowing it to carry out preferred activities and those that create enjoyment.

In summary, while there have been a range of different proposals to update, extend or build upon the Five Freedoms over the years to address changing scientific knowledge and societal pressures over farm animal welfare, these have received only partial uptake at best within industry. In the meantime, the Five Freedoms continue to provide something of an international baseline through their use as guiding principles to the World Organisation for Animal Health's (formerly OIE) work on animal welfare (WOAH, 2022).

1.3.2 Changes on-farm

In Section 1.2, we reviewed the ways in which the dairy industry has evolved over the years. The increases in herd size and yield per cow implicit within such rationalisation and efficiency improvements have – through necessity – been reflected in changes to dairy cow management, including: a rise in non-family staff, with corresponding requirements for training and standard operating protocols; the use of technology, automation and data-based diagnostics; changes in breeding approaches, technologies and priorities; and use of antimicrobials (Barkema et al., 2015). Herd expansion creates its own logistical challenges in ensuring grazing cows take in sufficient dry matter each

day, given they may spend longer walking to pasture further afield. Hence, farmers in some parts of the world have resorted to housing cows for longer and feeding off-pasture, for example in the US (USDA, 2008; Barkema et al., 2015) and parts of Europe (van den Pol-van Dasselaar et al., 2014); but in other countries such as New Zealand or Ireland, the trend has been to grow herd or margins through better utilisation of pasture, meaning cows are generally grazed for longer (van den Pol-van Dasselaar et al., 2014; Luo and Ledgard, 2021) but also, by the same definition, more intensively (FAO, 2004).

Any material impacts on dairy cows arising from such management changes are not within the scope of this thesis. However, public perceptions of the management of the dairy cow are, and as perceptions are created when information interacts with memories and 'cues' (Bruner, 1957; Bargh and Pietromonaco, 1982), the reality of what happens on-farm and the status of animal welfare are likely to have a bearing on perceptions. Therefore, it is worth summarising briefly what is known about any material effects these management changes have had on dairy cows. Here, we particularly focus on those changes and trends relevant to the UK.

Due to a likely combination of accommodating larger herds, achieving economies of scale in tough markets and simply growing businesses (e.g., as suggested in Shortall, 2021), both year-round housing and – to a lesser extent – extended grazing have increased in the UK, although the majority of dairy farming remains a 'composite' system of housing in winter and grazing in summer (DairyCo, 2012; March et al., 2014). Several reviews have assimilated health and welfare outcomes depending on the dairy cow's environment, with housing year-round found to present a greater risk of mastitis, lameness, metritis, mortality and reduced longevity (European Food Safety Authority (EFSA), 2009; Arnott et al., 2017; Mee and Boyle, 2020), and pasture more likely to risk malnutrition and poor body condition score, exposure due to lack of shade and shelter (European Food Safety Authority (EFSA), 2009; Mee and Boyle, 2020), and harm from flies or endoparasites (European Food Safety Authority (EFSA), 2009; Arnott et al., 2017). The scientific reviews conclude there are a number of potential positive and negative outcomes whether cows are at pasture or housed year-round – a position supported by the Animal Welfare Committee, which noted that

when well-managed, both pasture-fed and continuously housed systems can bring different welfare benefits (Animal Welfare Committee, 2021).

Regarding affective behaviours, the constraints of an indoor environment are found likely to reduce behavioural repertoire and lying comfort compared with pasture, and also have the potential to increase stress; however, experiences and familiarity with the environment (e.g., field or building) impact the animal's preferences for being inside or out, as do a range of other factors such as time of day, season and where adequate nutrition can most efficiently be obtained (Charlton and Rutter, 2017). Natural forms of enrichment are found to be less available or entirely lacking in housed environments than at pasture, and a range of interventions are recommended to improve social, cognitive, physical and sensory stimulation or enjoyment (Mandel et al., 2016).

Increased milk yield or genetic selection for yield over the years has been proven to accompany a reduction in fertility and longevity and an increase in lameness and other production diseases (Oltenacu and Broom, 2010). However, changes to UK genetic indexes in 2007 mean bulls are now valued by their ability to transmit a combination of production and 'fitness' (resilience) traits to offspring rather than their ability to increase production alone, which was the previous focus (Winters, 2007). Production now forms just 30-35% of the indices used (AHDB, 2022a) and there have been corresponding improvements in lifespan and fertility reported (AHDB, 2022b), also benefitting farmers. Such changes through breeding support the proposal in Britt et al. (2018) that while milk solids production per cow might rise at an accelerated rate over the next 50 years, it is likely that dairy cows will also become more robust with improved health and longevity, driven mainly by improvements in breeding.

An aspect associated with breeding is the use of hormones for reproduction; there is little information about the use of these drugs in the UK, but a recent study from the Netherlands suggests level of use increases with the application of technologies such as pedometers and sensors, suggesting that they remain central to proactive efforts to improve reproductive performance (van der Laan et al., 2021).

Reviews of the impact of farm size in all livestock sectors find little evidence of a direct relationship with welfare, concluding there are, again, pros and cons to management

outcomes in large and small farms alike, and that quality of management remains the main determinant of outcome (Wathes, 2010; Robbins et al., 2016b). That said, a negative correlation has been made between extensive sheep enterprises and welfare, with lower labour and input costs increasing profitability but reducing welfare (Stott et al., 2012). However, it is unknown whether a similar effect is found in extensive dairy systems as by its nature, dairy farming requires more hands-on management of the animals. Increased risks from larger herds are identified in Broom (2013), especially in terms of secondary effects of the types of high-yielding dairy cows often kept in larger herds, but these are described as solvable with good management, and benefits as well as disadvantages to large herd sizes are described.

While automatic (robotic) milking systems hold a potential to increase milk yields, reduce labour and improve opportunities for cow choice, contradictory findings in a review of the technology suggest that differences in management and variables from farm to farm have the greatest impact on outcomes for the cow (Jacobs and Siegford, 2012). It is also pointed out that while automated milking systems have traditionally been installed in fully housed systems, they are being increasingly successfully used within grazing systems (Jacobs and Siegford, 2012).

In terms of on-farm measurement of welfare, while national data are lacking in the UK, smaller datasets included in the Cattle Health & Welfare Group (CHAWG) report (2020) suggest long term downward trends in mastitis incidence and somatic cell counts, infertility, culling rates and antimicrobial use, but little change on levels of lameness and infectious disease (aside from some geographically specific disease eradication programmes). The report also discusses two industry initiatives: the first is the Dairy Cattle Welfare Strategy aimed at addressing a range of issues including lameness, calf mortality and the cow's environment (CHAWG, 2018); and the second is the Dairy Calf Strategy which seeks to eliminate the euthanasia of dairy-bred bull calves shortly after birth when they have no viable market (NFU/AHDB, 2020). While an estimated 60,000 calves born from the UK herd (representing around 3% of all calves annually) have been euthanised for this reason in recent years, interventions such as the use of sexed semen, which now forms more than half of all bull semen sales, is part of plans to end this practice (CHAWG, 2020).

Further studies have examined whether there are trade-offs between farm efficiency and welfare, or whether they complement each other. Dairy farms with lower levels of lameness have been found to operate at better technical efficiency than those with higher lameness levels, despite having less efficient use of labour and lower stocking densities (Barnes et al., 2011). A study into technical efficiency of farms with different levels of 'welfare', identified in terms of different lengths of day at grass or housing permanently, established no trade off in technical efficiency with the incorporation of grazing (Schulte et al., 2018). Finally, a number of putative welfare 'indicators' assessed against technical efficiency did not find consistent correlation; however, some measures such as milk yield and calving interval were ambiguous in terms of their relationship to welfare, and so it could be questioned whether the correct indicators were used (Allendorf and Wettemann, 2015).

Hence, the picture overall is that intensification and its impacts have led to changes in dairy cow management: some changes have been positive developments, and others present risks to cow health and welfare. However, where these risks exist, it appears they can – from the perspective of the scientific community at least – be mostly mitigated through good management. Trends in the UK on health and welfare are hard to determine due to lack of comparable data, but appear to be moving in a positive direction in some areas, with less or no progress in others. While initiatives are in place to address some reputational concerns such as bull calf euthanasia, these are still largely being implemented.

Given efforts over the years to address the way farm animal welfare is assessed, and the changes made on-farm to accommodate any impacts from the trend towards intensification, it is now useful to examine how public audiences perceive the management of the dairy cow, and what we know about how they would prefer cows to live.

1.4 Perceptions and preferences – what do we know?

1.4.1 An overview of relevant research

A significant amount of research has already been undertaken exploring public, citizen and consumer perceptions and preferences for different farm animals systems and practices. Not all research was pertinent to our area of interest, especially within consumer studies because of the dichotomy between the perspectives of a citizen/member of the public when considering the life of a farm animal on one hand, and that of a consumer considering the purchase of a farm animal product on the other (Verbeke, 2009). This is due in part to the distorting impact of other factors on decisions to purchase food, including price (Pirog, 2004; McEachern et al., 2007; Aerts, 2013), taste (Pirog, 2004; McGarry Wolf et al., 2009), quality (McEachern et al., 2007) and safety (Heleski et al., 2004; McGarry Wolf et al., 2009), all of which can override how the animal was reared and its perceived welfare. This has been known to manifest in a disconnect between what people say and what they do when they select and purchase the product (Aerts, 2013), especially in willingness-to-pay (WTP) studies where a stated intention may not be followed through at point of purchase due to a number of confounding factors (Clark et al., 2017).

Further complications within consumer studies include conflation between concerns over welfare and aspects such as health, quality, taste and price (de Graaf et al., 2016; Vanhonacker & Verbeke, 2014). A helpful explanation of these considerations is provided in Caswell & Mojduszka (1996), in which they define: ‘search attributes’ where information is on the pack or easily ascertainable; ‘experience attributes’ established while consuming the product; and ‘credence attributes’ (including animal welfare) which can only be believed and usually not verified or experienced. They indicate that because consumers cannot determine the product's quality based on credence attributes, even after they buy, proxies such as quality or taste can then be used. For this reason, economic models of quality (and, by inference, ‘willingness to pay’ studies in the area of animal welfare) are confounded. Indeed, ‘selling’ animal welfare is a difficult exercise, as established in both McEachern et al. (2007), where survey participants in the UK expressed limited willingness to buy branded high

welfare produce, and Nocella et al. (2010), in which consumers surveyed across five European countries expressed lack of trust in the farming and food chain over compliance with animal welfare commitments.

Another challenge with both consumer and citizen research is social desirability bias where respondents – consciously or otherwise – provide answers that make them feel more socially aligned with others, particularly when ethical issues are at play (Chung and Monroe, 2003). Animal welfare and the treatment of animals are seen as questions of morality and ethics (Bennett and Blaney, 2002), hence some studies control for this bias through adapting how questions are presented or methods are applied (Nederhof, 1985; Norwood and Lusk, 2011; Larson, 2019). For example, Wolf et al. (2016) found that while most members of the US public participating in their survey about dairy cow welfare prioritised animal welfare over a low milk price, they also said most Americans would not agree with them. As attribution to third parties is a known way to indirectly convey one's own views (Lusk and Norwood, 2010), this suggests participants themselves would not back up their concerns by paying more for higher welfare milk.

A number of studies have examined perspectives on farm animals in general, and also on specific animal species such as beef cattle or pigs as well as dairy cattle; research in these was considered relevant if there were broader implications to the findings despite a focus species other than dairy cows, or if they used a useful method for eliciting responses. In a similar vein, some studies examining outcomes in other countries were instructive, although differences in cultures, attitudes and farming systems affected their relevance; for this reason, studies taking place in the UK were of particular interest.

Therefore a search for relevant studies to identify research gaps was narrowed down to those within this broader area that specifically concerned: i) farm animal welfare and quality of life; ii) farm scale, systems and practices; iii) dairy cows; iv) naturalness; and v) the UK. These five areas all have both distinct and overlapping areas, and are summarised in Figure 6.

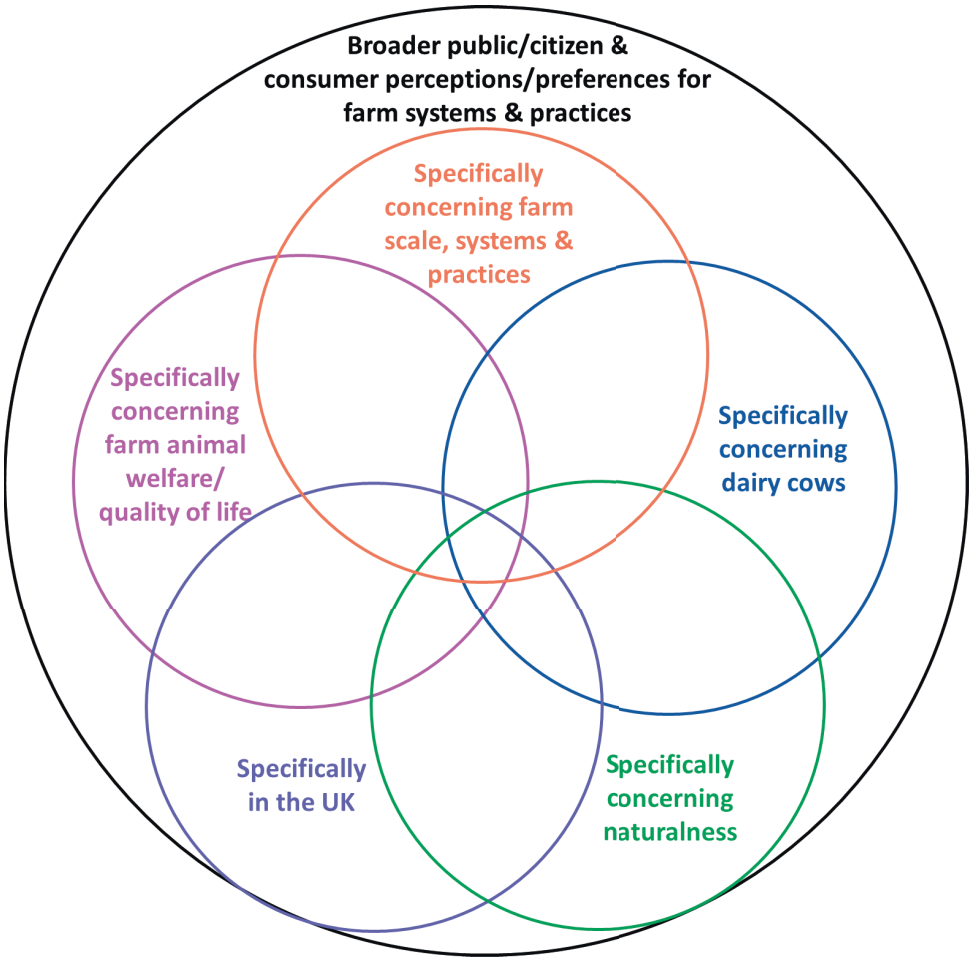

Figure 6. Visualisation of the literature researched to establish current knowledge and research gaps

1.4.2 Farm animal welfare and quality of life

In 1997, Fraser et al. proposed that to satisfy societal concerns about animal welfare, scientific study should focus on addressing the relevant ethical issues. These were summarised as three overlapping concerns comprising: biological functioning; natural living; and affective states – all implicitly addressed in the Five Freedoms, yet as outcomes rather than underlying intentions. The later examination of dairy cow welfare from this perspective in von Keyserlingk et al. (2009) helped to first conceptualise the overlapping nature of the three concerns (Figure 7) and second, identify that the differing amounts of subjective importance placed on each concern

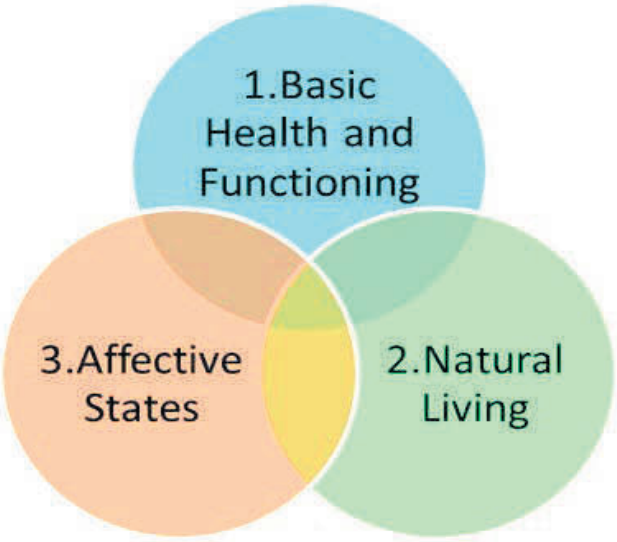

Figure 7. Three overlapping 'quality of life' circles based on Fraser et al. (1997) and von Keyersingk et al. (2009)

by various groups meant that disquiet about animal welfare could only be fully satisfied if all three areas of concern were addressed.

De Greef et al. (2006), too, distilled evidence from a range of studies to conclude that arguments around farm animal welfare were mainly due to differences in how the subject was embodied by different stakeholders; they identified that farmers prioritised regular care based on habit and good intentions; scientists focused on biological functioning; animal welfare organisations called for maximal care and a natural environment; and the public valued icons like space, straw, and outdoor access as indicative of good welfare and appropriate living. As a further illustration, a comprehensive survey conducted in Belgium found the main differences of opinion between citizens and farmers about farm animal welfare concerned debate over the animal's ability to engage in natural behaviour, with discord also identified around emphasis on natural behaviour, stress, pain and space (Vanhonacker et al., 2008). A similar disparity in priorities has been illustrated within studies of attitudes to pig farming. For example a quantitative study in the Netherlands (Bergstra et al., 2017) and a qualitative study in Denmark (Benard and de Cock Buning, 2013) both discovered that public preferences for the animal to have a natural life were not shared by farmers, who instead focused on optimal health and efficient rearing. Similarly, a large qualitative study in Brazil asking for visions of an ideal dairy farm established that farmers and their advisors referred to animal welfare in terms of

biological functioning, whereas 'lay citizens' focused on positive emotional states and naturalness; even when pasture was identified as important by all, it was for reasons of naturalness among citizens but economics among farmers (Cardoso et al., 2019).

These insights into perceived farm animal quality of life indicate the pitfalls faced by those in farming when they attempt to establish public priorities through the lens of their own subjective views. Reflecting on the changes the dairy industry has made to address welfare concerns (Section 1.3.2), many measures are clearly focused from the industry's perspective – for example, the fitness traits prioritised in new genetic indexes which are nonetheless tailored toward economic viability of the animal; and the use of milk yield as a welfare indicator (Allendorf and Wettemann, 2015), which subscribes to the common farming 'script' that only a 'happy animal is a productive animal' (e.g., Vigors, 2019; Buddle et al., 2021). However, it also raises the question of whose views about farm animal quality of life farmers should pay heed to, and whether – in such a highly technical industry – input from the 'lay' stakeholders described in Section 1.2 can be accommodated without compromising the biological functioning and care of the cow that veterinary surgeons and farmers prize.

Therefore, given the challenges the dairy industry faces (summarised across Section 1.2), gaining better insight into society's understandings of – and preferences for – the care of the dairy cow will be fundamental if expectations of all are to be reconciled and a more secure future built for the industry. This is explained in no uncertain terms by Weary and von Keyserlingk (2017), who propose that agreeing a welfare-positive vision for the future which fits societal expectations will, in fact, be necessary if dairy farms are to survive.

To look more specifically at welfare, in an extensive project across five European countries combining qualitative and quantitative elements, Harper & Henson (2001) established that consumers defined farm animal welfare as "*natural lives and humane deaths*", which meant animals should be reared, fed, housed, bred and behave in as natural conditions as possible.

At the simplest level, McKendree et al. (2018) identified in a survey of the US public that access to clean feed and water was most effective and practical in the welfare of beef cows and calves, along with shade, shelter and ventilation. Frewer et al. (2005)

also proposed from a survey of Dutch consumers that animal welfare is considered in terms of two broad categories associated with the animals' health and living environment, but consumers do not think about welfare at a more detailed level.

However, other studies have elicited more specific views. For example, Clark et al. (2016) found respondents in the studies they reviewed supported farm animals having space and freedom to move, as there were concerns that cramped facilities led to higher levels of disease and the preventative use (or even overuse) of antibiotics – although use of antibiotics to treat injury and disease was seen as good practice. Access to natural light and cleanliness were also preferred as they helped to support animal health and the meeting of basic physiological needs (Clark et al., 2016). In a Swedish choice experiment study examining public preferences for pig production, Liljenstolpe (2008) concluded that housing systems incorporating deep litter or the ability to go outside were very important, alongside humane handling from birth to slaughter, with slaughter on-farm through a mobile facility also preferred. Focus groups conducted in Scotland by Vigors (2019) defined 'positive welfare' as animals having positive experiences in outdoor environments and open spaces, with naturalness, some choice over their environment, and a positive relationship with the farmer; often, this was against the backdrop of a smaller, traditional farm.

In addition to scientific studies on public perceptions of farm animal welfare, surveys such as Eurobarometer, conducted periodically by the European Union, give an indication of opinions. The latest found that 82% of European respondents and 76% of those from the UK believed farm animal welfare should be better protected than it was, and 64% (48% in the UK) wanted more information about how farm animals are treated (Eurobarometer, 2016). Another survey conducted by AHDB in 2020 found that consumers perceived higher animal welfare involved outdoor access and was associated with certain methods of production, for example, outdoor-reared or bred, free range, and organic; the term 'free range' was also associated with higher welfare standards by more than half of respondents despite lack of clear definition on 'free range' outside of poultry production (AHDB/YouGov, 2021).

1.4.3 Farm scale, systems and practices

A comprehensive review of research into public attitudes conducted by Clark et al. (2016) established that common perceptions of modern, efficient farm animal production systems were "*bad, cruel, and unnatural*", with more traditional, small and extensive farms viewed more positively. Other research agrees; for example, in Lusk et al.'s (2007) telephone survey of just over 1,000 US consumers, participants took high animal welfare to mean a pasture production system and small, non-corporate farms; and Danish focus groups discussing pig production indicated that organic and free range equalled 'good' because animals could indulge in their natural behaviours, whereas large-scale or industrialised farming equated to 'bad' due to more clinical and unnatural management (Lassen et al., 2006).

Concern about the scale of the farm was a recurring theme; focus groups held across seven different EU countries (including the UK) as part of the EU Welfare Quality® project favoured small-scale production, linking it to better care and individual treatment of the animal (Miele, 2010). In a mixed methods (survey and focus group) study in Ireland (Sweeney et al., 2022), concern over the living conditions of animals was higher with larger and more intense farming. Canadian focus groups favoured small family farms, while objecting unanimously to confinement systems and questioning how standards could be maintained in "*large, profit-oriented units*"; however, they were sympathetic to the pressures on producers which might lead to such developments (Spooner et al., 2014a). In a survey questioning residents in the US state of Ohio, Sharp & Tucker (2005) confirmed that those expressing greater animal welfare and environmental concern were sympathetic to smaller farms, whereas those who agreed that large-scale livestock or poultry units contributed to the local economy showed lower levels of concern overall about animal welfare. In a survey of Spanish citizens, María (2006) established that the perception of livestock farming was generally more negative if production was seen as more intensive.

Boosting production through use of chemicals was another controversial practice. In a survey of US consumers, Ellison et al. (2017) used the discrete choice method best worst scaling (BWS) to determine that across a range of species, participants did not

support use of growth hormones, with 'humanely raised' the next most important criteria for milk production – although it was not specified what this was taken to mean; notably, a grass diet ranked relatively low priority for milk production in this study. In Wolf et al. (2011), a choice experiment suggested US consumers would be willing to pay more for milk produced without the use of recombinant bovine somatotropin (rBST – a growth hormone used in some countries but banned in the UK and EU, and associated with more intensive systems as its use increases efficiency of milk production); they also claimed to be willing to pay more for milk from local family farms, and for milk with assured safety and Government certification. However, these preferences appeared to be linked more to food safety rather than concerns for the cow. A further survey of the US public found 63% were concerned about dairy cow welfare, and from specific questions asked about practices, most supported banning non-therapeutic use of antibiotics – but also mandating pain relief at castration of male calves (Wolf et al., 2016).

1.4.4 Dairy cows

To now turn to dairy cows specifically, a qualitative study published in 2016 asked how the US public – unprompted – imagined an ideal dairy farm (Cardoso et al., 2016). The results indicated welfare was a key topic, with the humane or even 'kind' treatment of the cows among the most prevalent themes, followed by space or freedom to roam, access to grass or pasture, naturalness, minimal hormone or antibiotic intervention, and the ability for the calf to stay with its mother; also of relevance were preferences for a local family-run farm which was smaller and more vested in both cows and the community (Cardoso et al., 2016). A second, mixed methods investigation into perceptions about dairy cow welfare among the Brazilian public found that participants held similar unprompted expectations of dairy farms; however, in the quantitative part of the same study examining awareness of contentious practices, most participants were unaware of early cow-calf separation, housing year-round (i.e., zero-grazing), bull calf euthanasia and dehorning without pain relief, and almost all rejected these practices once they had been described to them (Cardoso et al., 2017).

Indeed, a number of common practices in dairy farming appear problematic to the public, with studies on attitudes to cow-calf separation, bull calf euthanasia and

disbudding increasing in recent years, possibly as these practices become more publicised through either campaign groups or media (e.g., Levitt, 2019). A review of studies by Placzek et al. (2021) found there had generally been a lack of awareness of these practices among study participants, but once they were informed, they mostly rejected them, particularly disbudding and calf euthanasia. While cow-calf separation also met with rejection, the level was lower and mainly on grounds of unnaturalness (Placzek et al., 2021).

A Canadian study took 50 members of the public to visit a dairy farm to determine whether doing so addressed common misperceptions about the industry; while this resolved some concerns participants expressed beforehand, new concerns were raised about practices with which the participants were previously unfamiliar, mainly cow-calf separation and lack of access to pasture (Ventura et al., 2016). Another qualitative study conducted in Brazil sought to investigate these same two issues through a questionnaire providing information about housing year-round and cow-calf separation; again, while around a third of participants were aware of each practice beforehand, most still rejected both on grounds of impact on animal welfare and product quality, as well as loss of naturalness (Hötzel et al., 2017). A survey of attitudes towards early cow-calf separation conducted with German and US citizens also found most opposed the practice, despite being given explanations why it might be preferable in comparison to leaving the calf with its mother for longer (Busch et al., 2017). Similarly, a recent mixed methods survey with Canadian and US participants examined preferences for different ways of managing the dairy-bred calf after birth; it indicated that leaving the calf with its mother was significantly more popular than separating the calf and either single-housing, pair-housing or fostering it to another cow, as separation from its mother was seen to breach a duty of care (Sirovica et al., 2022).

Access to pasture for dairy cows remains a major issue for the public across different countries. Schuppli et al. (2014) proposed that the vast majority of the public participants within their US and Canadian survey wanted the cow to enjoy an outside environment – but it was about more than grazing alone, as it included the cow being able to have her choice of environment and: "*...feel sunshine on her back, to feel earth*

beneath her feet, to breathe fresh air…[and]…roam on pasture". A survey of the US public suggested that from a range of 12 management practices in dairy farming, the cow interacting with its own kind, having access to pasture and being fed a diet it would naturally choose were met with most positivity (Widmar et al., 2017). In line with these aspirations, both Weinrich et al. (2014) and Kühl et al. (2019) uncovered strong support for grazing, alongside reservations about housing year-round, within their picture-based surveys of the German public. From a broader perspective, while citizen panels taken to dairy farms in the Netherlands and Norway raised issues around how farming could combine naturalness with modernity and tradition, they, too, expressed concerns about increasing trends to house cows year-round (Boogaard et al., 2010). A survey of Dutch citizens published the following year also questioned the way animals were perceived to be treated in modern farm production, as well as the appropriateness of increased use of technology (Boogaard et al., 2011) .

To turn to the question of automation, technology such as automated (robotic) milking can – in theory – enable cow choice through allowing the cow to be milked when she chooses. While little research has been conducted on public attitudes towards use of technology on dairy farms, automated milking systems were found to be relatively unpopular with the public in one UK survey, securing support from less than 40% of participants (Millar et al., 2002), and they were similarly unpopular in a more recent German survey (Pfeiffer et al., 2021).

Finally, at a more general level, perceptions of dairy cow welfare were the most positive of all species examined in the recent mixed methods research conducted across the Republic of Ireland and Northern Ireland, discussed earlier (Sweeney et al., 2022), which concurred with findings in the review by Clark et al. (2016). While welfare for dairy cows was believed to have improved most among all species in Sweeney et al. (2022), and had the most positive ratings, concerns were also raised about the cow's quality of life – especially as she had to produce milk most of the year, was forcibly impregnated, and had her calf removed.

1.4.5 Naturalness

Naturalness is a recurring topic within research of public preferences for the management of farm animals. However, definitions of 'natural' remain broad and somewhat undefined, as we will illustrate.

Te Velde et al.'s (2002) qualitative study of Dutch citizens suggested that while farmers and citizens agreed animal welfare meant good health, good nutrition and protection, participants also wanted animals to be able to fulfil 'natural desires', which was taken to mean fulfilling natural behaviours. Similarly the Europe-wide focus groups discussed by Miele (2010) indicated that citizens felt quality food and water, and protection from injury and harm, should be a 'given' for farm animals, and that good welfare related more to higher level experiences such as naturalness and behavioural expression.

Living in conditions as close as possible to nature was one vision for animal welfare expressed by participants in the large European multi-dimensional project run by Harper & Henson (2001); and support for naturalness in a Belgian quantitative study manifested as freedom to move, natural growth, and the expression of natural behaviours (Vanhonacker et al., 2008). Qualitative interviews conducted with Canadian citizens also referred to naturalness as consistency with the animal's natural inclinations – such as being outside, having its feet on grass or grazing, breathing fresh air, 'feeling' daylight, and having an element of choice over how and where it spent its time (Spooner et al., 2014a).

Participants in Yunes et al.'s (2017) survey of Brazilian citizens preferred free-range, cage-free production systems which were 'more natural', as they were concerned about systems limiting the expression of natural behaviours. In Clark et al.'s (2016) review of public attitudes towards farm animal welfare, naturalness was a priority because it was believed important for the animal's physical and psychological wellbeing. Similarly, in Sweeney et al. (2022), discussed previously, a 'natural life' for dairy cows was preferred by participants because of the perceived inherent benefits of 'nature', and nature's ability to support natural behaviours in animals.

However, in dairy farming, 'naturalness' has been commonly taken to mean access to pasture or grazing, as illustrated in both a large a qualitative study of Brazilian citizens

(Cardoso et al., 2019), and a quantitative survey of Dutch citizens (Boogaard et al., 2011) – although in Sirovica et al. (2022) and Placzek et al. (2021) (discussed previously) it also meant leaving cows and their calves together.

Naturalness is not necessarily paramount, however. A large mixed methods survey of the US public identified that while participants preferred the naturalness of dairy cows having access to pasture, if heat stress was a risk, they would rather the cow was inside in a more unnatural environment but with fans and artificial cooling (Cardoso et al., 2018). Similarly, Vigors et al. (2021) found the public did not prioritise naturalness over animal health, but instead saw them as complementary. Despite this, a simulation model developed by Bergstra et al. (2020), examining public attitudes towards pig rearing, indicated that welfare was measured more by features that were symbolic of naturalness (e.g., daylight, space and straw), than by piglet mortality, suggesting that naturalness might sometimes more important than life and death.

1.4.6 The UK

Lastly, very little research has been conducted into the UK public's perceptions of dairy cow management. The last major study was a quantitative survey from Ellis et al. (2009), where good dairy cow welfare was established as appropriate feeding, skilled stockmanship, space, freedom to roam, and cleanliness. Most respondents in this survey claimed to be willing to pay more for good welfare, but overall, half rated dairy farming animal welfare as positive against 22% who viewed it negatively. Vigors (2019) also explored meanings for 'positive welfare' with UK citizens, as covered earlier in this section, but this was specific to the use of the terminology, not dairy farming.

The only other pertinent research is the mixed methods study of animal welfare perceptions across Ireland concerning a range of species, which included Northern Ireland (Sweeney et al., 2022). In this, dairy cows were perceived more positively than other species, although concerns were raised about modern practices (see previously). One explanation for this favourability was the continued visibility of cows in fields, which gave physical confirmation of the wellbeing of the animal compared with pigs or poultry, both of which remained largely out of sight (Sweeney et al., 2022).

No other research has, to our knowledge, been conducted in this area in the UK, which is problematic given the inherent difficulties with extrapolating learnings from other countries, cultures, demographics, species and even dairy farming systems to the UK situation – especially where the increasingly overt pressure being placed on dairy farming within the UK (e.g., Webster, 2015; Levitt, 2019; Blythman, 2017) suggests a significant changes of approach may be needed in the future.

1.4.7 Factors affecting perceptions and preferences

In examining what is already broadly known about public perceptions and preferences for farm animals management, it was noted that many studies established heterogeneity within interviewees or survey samples, which was explained by a number of factors. Here, we will briefly identify some of the characteristics found likely to influence the range of perspectives and preferences summarised earlier.

One of the most common characteristics found to influence perspectives on farm animals is experience, particularly experience of rural life. People in rural areas are known to perceive the quality of life of farm animals more positively (Boogaard et al., 2006, 2011; Vanhonacker et al., 2007), and have less concern or assign a lower importance to farm animal welfare (Kendall et al., 2006; Vanhonacker et al., 2010; Cornish et al., 2016). Related to this, experience of farming or farms reduces concern, whereas experience of keeping pets increases it (Boogaard et al., 2006; Ellis et al., 2009). Wolf et al. (2016) also established in their survey that members of the US public with more exposure to materials from animal welfare campaign groups were more likely to want regulation in dairy production such as restrictions on antibiotic use or mandatory pain relief at castration.

Sociodemographic factors have been widely proven to correlate with concern for farm animal welfare as well, for example, younger people, women, and those who are less educated have demonstrated a greater level of concern (Kendall et al., 2006; Cornish et al., 2016). Diet is an indicator, as a vegetarian or vegan diet – or the consumption of dairy alternatives – is likely to be indicators of greater concern for farm animals (Ellis et al., 2009). Knowledge can be a factor too, with Vanhonacker et al. (2007) and Ventura et al. (2016) finding both objective or self-rated knowledge correlates to

different attitudes to farm animal welfare, but not always in a consistent way. Attitude towards animals was also established by Hills (1995) as relevant, especially the level of belief that animals have their own 'minds' and can, for example, understand cause and effect, or experience emotions, with greater belief linked to greater concern.

There is also a considerable body of work around the impact of values on attitudes towards and concerns for animals. Te Velde et al. (2002) used values to explore perceptions of welfare among farmers and consumers; this was further developed in Boogaard et al. (2011) where values identified through Schwartz's (2012) theory (grouped into four 'themes' representing openness to change, self-transcendence, conservation and self-enhancement) helped to explain different attitudes towards traditionalism and modernity in dairy farming, which included treatment of animals.

The last pertinent area to touch upon is different ethical stances on animals. In its simplest form there are two key opposing positions: one is the 'animal rights' or abolitionist position, where any exploitation or use of animals, including the keeping of pets, is seen as morally unacceptable due to the fact all animals (human and non-human) are equal and share equal rights (Francione, 2003); the opposite, which is anthropocentrism, in its original form legitimises the use of animals by man in any form the human wishes because humans are separate from and superior to nature (Boslaugh, 2016). However, there is a range of positions between these two extremes. For example, moving from original anthropocentrism to utilitarianism (where the interests of every creature affected deserve equal consideration – see Sandøe & Christiansen (2008)) can be equated to moving from Rene Descartes' (Cartesian) view of animals in the 17th century where animals were little more than automatons unable to feel pain or emotion (Descartes, 2007), to one where animals are still utilised by humans, but deserve respect and a duty of care as part of that – more in line with the thinking of Jeremy Bentham, who famously asked : *"The question is not, "Can they reason?" nor, "Can they talk?" but "Can they suffer?""* (Bentham, 2007). These and other variations on these positions, such as 'contractarianism' (based on an agreement to act morally towards animals for (largely) self-interested reasons – see Sandøe & Christiansen (2008)) have been applied in research of public attitudes towards farm animal welfare (e.g., Hölker et al., 2019).

1.5 The research questions

This examination of the scientific and social environment surrounding public questions over the management of the dairy cow now leads us to define our research questions (RQs) for this thesis. To summarise, we have established that man shares a deep tradition and history with dairy production and the dairy cow, particularly in the UK. However, times are changing and the necessities of economic efficiency have brought significant changes to dairy farming, with consequential expansions in herd size, increases in yield and uptake of technology. This has served to move dairy farming out of alignment with changing societal expectations, and increasingly distanced from a range of external stakeholders. While the consumer, as a key stakeholder, could stop purchasing dairy products produced in ways they do not support, the possibly more important concern is withdrawal of dairy farming's 'social licence to operate' by wider stakeholders through, for example, community-led, political and economic censures. The public remain a key audience within this as they are part of, are persuaded by, or directly influence these groups.

While the industry has attempted to address concerns through programmes to improve welfare and changes to the ways in which animal quality of life are assessed, there remain fundamental differences in how the industry and key external stakeholders perceive the 'good care of the cow'. To address this disconnect in views, it is important to gain a better understanding of what the public currently perceive dairy farming to be (i.e., their frame of reference), and how they would prefer dairy cows to be managed. However, our review of the literature demonstrates significant gaps in knowledge in these areas – around the heterogeneity of perspective and preference people have for dairy production specifically; why people express the preferences they do; what people envisage certain attributes entail; what they deliver; and particularly, what the UK public want in terms of dairy cow management.

In considering these gaps, we first address the lack of depth and clarity around the relative importance individuals place on various features of a dairy cow's environment or her management, whether there is heterogeneity of preference, and how different

characteristics such as sociodemographic, attitudes and experiences might inform such preferences and affect opinion. Therefore our first research question is:

RQ1: "How important are different aspects of dairy cow management to the public, how uniform are these views, and what might contribute towards them?"

Secondly, the preferences expressed for how dairy cows should be managed remain narrow and ill-defined, with research typically focused on features and 'headline' rationales expressed by the public, rather than identifying the experiences and motivations underlying the preferences. If the industry is trying to address prescriptive demands, then it risks failing to address the underlying 'asks'. Therefore our second research question is:

RQ2: "What can we learn about the underlying motivations and context behind public preferences for different dairy cow environments, for example, access to pasture?"

Thirdly, our knowledge of the perceptions people hold for dairy farming are very limited. Understanding the cognitive lenses through which dairy farming is interpreted by the public could aid better communication of purpose and better identification of interventions and adaptations to system to meet expectations. Therefore our third research question is:

RQ3: "What can we understand about the interpretive lenses through which the public view dairy farming and our care of the cow?"

Lastly, naturalness and 'natural living' clearly remain an important goal within public minds. Yet what is meant by the term is unclear and somewhat fluid. If naturalness is such an important feature of how the dairy cow is managed, better clarity around what specific forms this might take on-farm, and how can these be reconciled with modern production methods, would help the industry to move closer to societal expectations. Hence our fourth and final research question is:

RQ4: "What do the public perceive as natural and unnatural in dairy farming, and why?"

1.6 Approach to addressing the research questions

The first research question aims to determine relative preferences among the public for different aspects of dairy cow management, investigate homo- or heterogeneity of preference, and explore characteristics associated with any heterogeneity. This is a positivist, deductive approach to discovering knowledge that already exists, and from which we wish to obtain generalisable results to indicate the views of the wider population. For these reasons, a quantitative approach is required (Tavakol and Sandars, 2014a). However, the other three research questions seek to expand on existing understanding around: the public's motivations for expressing the preferences they do; the perceptions of dairy farming they hold; and their interpretation of the concept of 'naturalness' in terms of dairy farming. For the most part these questions seek to build on results from largely quantitative methods used in previous research, but different approaches are needed here to gain the depth of understanding required.

Qualitative research is often used to inductively – or deductively – construct meaning around models or theories (Tavakol and Sandars, 2014a; b; Braun and Clarke, 2022); hence qualitative methods will be used to address the third and fourth research questions, where we seek broader understanding. However, quantitative methods can sometimes play a role alongside qualitative methods. Combining appropriate qualitative and quantitative methods to form a mixed methods approach can draw on the strengths of both, providing additional insight where results agree, differ or add meaning (Meissner et al., 2011). Hence, because people are already known to express views about dairy cow housing and access to pasture, we use a mixed methods approach to address the second research question. A conceptualisation of this approach is laid out in Figure 8, which also summarises the methods and analysis used to address each research question, detailed in subsequent chapters.

Before commencing all areas of study, ethical approval was received from the University of Nottingham School of Veterinary Medicine and Science's Research Ethics Committee (no. 1860 160930).

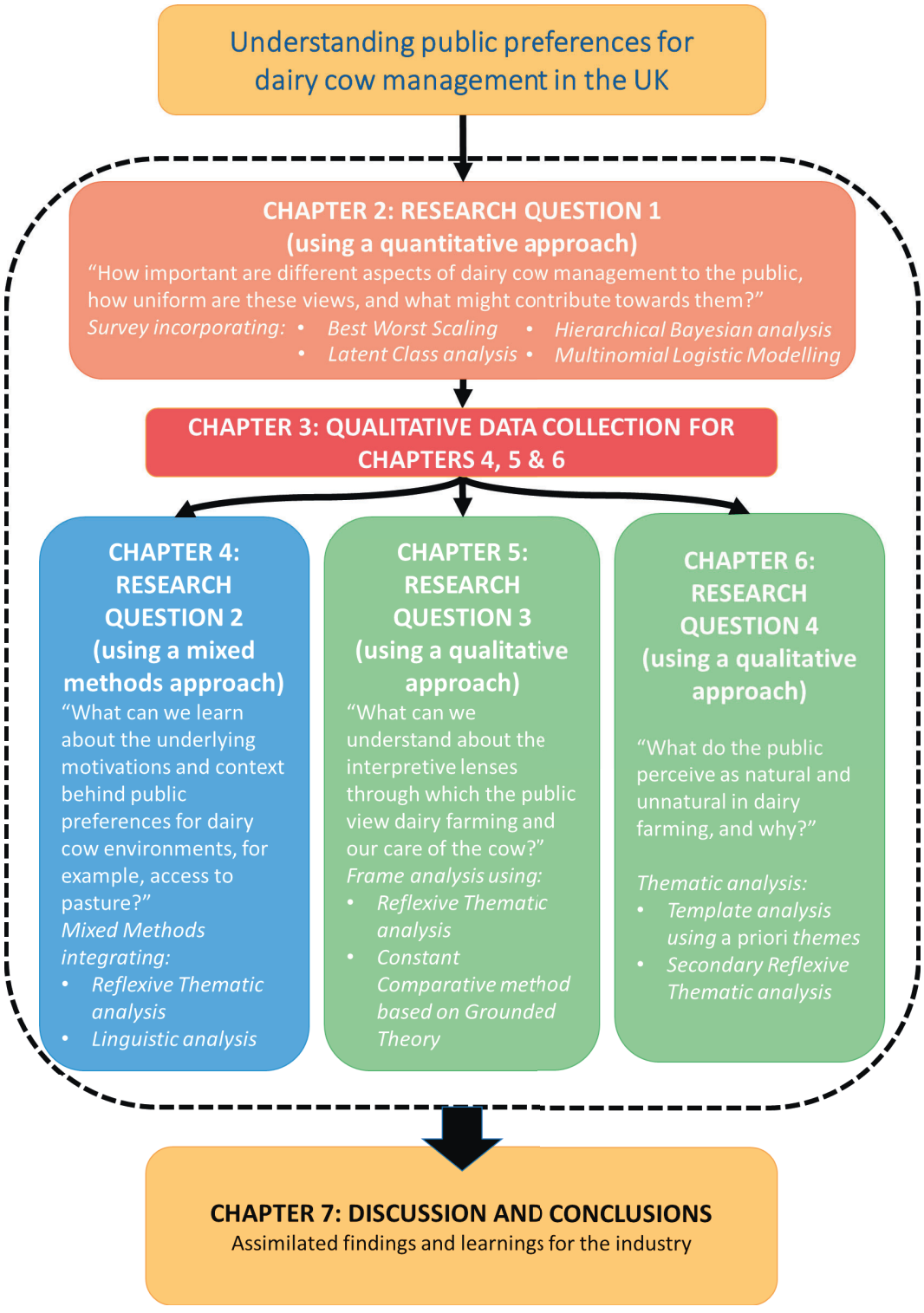

Figure 8. Conceptualisation of the approach used in this thesis

"This has been my debate with milk, 'cause obviously there was a lot of media attention about the fact that farmers were getting paid very little for their milk from the supermarkets…

And I started buying the more expensive milk with that in mind – and then I'm caught between that actually, at the end of the day is that extra money ending up with the farmer or is it just ending up with the supermarket profits?

In an ideal world I'd like to be able to think that I could go to different shops and do my shopping so that I use more local, but unfortunately, with time and trying to juggle fulltime work with parenting and everything else, you end up going for the convenient option which is to go into one shop and being able to get everything.

But yeah, it has been something that's bothered me, the whole milk thing."

Participant in 60 face-to-face interviews, conducted across the UK between November 2019 & February 2020 (see Chapter 3)

Chapter 2: Preferences for different aspects of dairy cow management and milk production

2.1 Introduction

2.1.1 The quest for sustainable production

As identified in Chapter 1, farm animal production methods adopted globally since the second world war have led to more efficient farming which uses less labour and resources, and produces an abundance of safe, affordable and accessible food (Capper et al., 2009; Godfray et al., 2010; FAO, 2017). However, this evolution has raised concerns about an increase in 'factory farming', a term used over 50 years ago (Harrison, 1964) but still employed today to mean livestock managed intensively with perceived or actual negative societal, environmental or animal welfare outcomes (Fraser, 2001; Lusk et al., 2007).

The way in which the global dairy industry manages its cows amid growing economic and environmental sustainability pressures (Peters et al., 2016; Röös et al., 2017) and reconciles these with social sustainability concerns (von Keyserlingk et al., 2013; Britt et al., 2018), is the topic of much debate, not least because of the lack of consensus around what constitutes 'good management'. It is discussed in Section 1.4.2 that two key stakeholder groups – farmers and the public – often hold conflicting perspectives, particularly on animal welfare. For example, Vanhonacker et al. (2008) reported differences in opinion between citizens and farmers about whether farm animals were able to engage in natural behaviour. The beef and pig farmers questioned in Spooner et al. (2012, 2014b) prioritised biological health and protection from natural hazards for their animals, whereas the citizens in Spooner et al. (2014a) wanted farm animals to have a natural life. A similar disconnect between farmers and agricultural advisors, and 'lay citizens', was identified by Cardoso et al. (2018) regarding expectations for dairy farming standards; the farmers and advisors interviewed placed most importance on biological functioning and lay citizens instead referred to affective states and naturalness. Survey findings show European citizens have clear expectations that farm animal welfare should be protected (Eurobarometer, 2016),

and it was the opinion of Britt et al. (2018) that societal preferences will continue to impact food – including dairy – production as future generations become increasingly displaced from ancestral connections with farming. This phenomenon, coupled with a growing range of alternatives to dairy foods (Graham, 2019), suggests new threats to the future viability of dairy products.

2.1.2 Determining public preferences

The case for taking action to address both image and underlying practices of dairy farming, as well as the benefits or properties its products promote, may be evident (Duffy et al., 2006; Ellis et al., 2009); but exactly which aspects are most important to the public, and therefore are priorities for the industry to tackle, remains unclear. In many studies, the public express broad and sometimes vague concepts of good farm animal management such as 'animal welfare', and 'naturalness' or natural behaviours (Lusk and Briggeman, 2009; Bazzani et al., 2016). Others have determined support for specific features such as: outdoor access (Lusk et al., 2007; Mulder and Zomer, 2017); reduced stocking density (Liljenstolpe, 2008; Vanhonacker et al., 2008) and improved bedding or flooring (Hall and Sandilands, 2007; Krystallis et al., 2009). Specifically regarding dairy production, Ellis et al. (2009) concluded that the general public align good dairy cow welfare most closely with aspects like appropriate feeding, good stockmanship, cleanliness, and plenty of space or freedom to roam; whereas von Keyserlingk and Weary (2016), referring to Cardoso et al.(2016) and Schuppli et al. (2014), maintained that the public was unanimous in its expectation that cows should have access to pasture. While these studies report their results based on the mean of their participants' responses, others have identified sub-groups with heterogenous preferences regarding, for example, meat production (Meuwissen et al., 2007; de Jonge and van Trijp, 2013), cow-calf separation in dairy cows (Busch et al., 2017), and pasture-based milk production (Weinrich et al., 2014; Kühl et al., 2017). These differing preferences have been explained by a range of factors including: socio-demographics, experiences and knowledge (Kendall et al., 2006; Cornish et al., 2016); belief in an animal mind (Knight and Barnett, 2008); and wider values (Boogaard et al., 2011). However, the relative importance that individuals place on various features of a dairy cow's environment or her management has not previously, to our knowledge, been

examined; nor has their heterogeneity of preference, and the characteristics that might affect any differences.

In attempting such an exercise, Likert-type scoring, which is common in eliciting preferences, has the potential to be limited by lack of score differentiation and social desirability bias (Cohen and Neira, 2003; Bertram, 2006). An alternative method is best worst scaling (BWS) which repeatedly presents differently-ordered subsets of the items to participants and asks them to select just the 'best' and 'worst' – or 'most' and 'least' – options, compelling them to trade off items against each other. This method has been found to improve predictability (Adamsen et al., 2013) and has been used in fields ranging from consumer behaviour (Jaeger et al., 2008; Mueller and Rungie, 2009) to healthcare (Najafzadeh et al., 2012), food safety (Erdem et al., 2012), food labelling (Ellison et al., 2017) and dairy farmer preferences (Hansson and Lagerkvist, 2016), but not previously for this subject with the public.

2.1.3 Focus of research

Therefore, this study set out to present of a number of different attributes relating to dairy cow management through the novel application of the BWS method in an online survey of members of the UK public. Through this, a relative ranking of cow management attributes according to their importance in the eyes of participants could be identified, alongside any heterogeneity of preference and associated characteristics. Thus, this aimed to answer the first research question: ***"How important are different aspects of dairy cow management to the public, how uniform are these views, and what might contribute towards them?"***

2.2 Methods

2.2.1 Data collection

We worked with marketing research company Made In Surveys (MIS) (Lille, France; https://en.misgroup.io/), which has one million panel members globally and 160,000 in the UK, to gather quantitative data to address this first research question. Between 6 and 13 April 2018, MIS invited its UK members to participate in an online survey. It

aimed to recruit socio-demographically diverse citizens aged 16 years and older from across the UK to participate, with those completing the survey receiving points toward vouchers as a standard incentive practice used by this marketing research company. Although many surveys set age parameters at 18 years and older, 16- and 17-year-olds were included in this survey due to emerging generational differences in attitudes toward food and animal ethics (e.g., Patel and Morrison, 2018; Food Standards Agency, 2020) and as discussed in Section 1.2.

The most important yet challenging demographic to secure within the sample was a representative number of participants who live rurally, as this has been shown to have one of the most significant impacts on attitudes towards farm animal welfare (see section 1.5). Furthermore, only around 18% of the population is estimated to live in a rural area in the UK – 17% in each of Scotland and England, and approximately a third in both Wales and Northern Ireland (ONS, 2013; DAERA, 2020; RESAS, 2021; StatsWales, 2021; Defra, 2022). The data MIS holds regarding its panellists contain an indication of the rurality of each panellist's location, therefore it was possible to select for this attribute. To secure a representative number of rural citizens with a precision of ±2% and confidence level of 95% from an adult population of 53 million in the UK, of which just 18% are rural, a total sample of 1,418 respondents would have been needed. After adjusting for nonresponse or nonparticipation, the target sample size was increased to 2,000. Other demographic factors were compared against the national population once the data were returned. Compliance with General Data Protection Regulation 2016/679 was explained to participants in the survey introduction.

2.2.2 Survey development

The online survey was created in Sawtooth Software Lighthouse Studio v9 (Sawtooth Software Inc, 2008; www.sawtoothsoftware.com) in a format suitable for execution on the Made In Surveys (MIS) platform. In this way, the MIS platform facilitated panel members to access the survey, then returned the anonymised responses. The survey questions are contained in Appendix 1 and a tabular summary of the variables included is in Appendix 2.

2.2.3 Best worst scaling

Best worst scaling (BWS) was the discrete choice methodology used to present a range of cow management attributes to participants within the survey. Introduced in the early 1990s (Louviere and Woodworth, 1991; Finn and Louviere, 1992), BWS forces a trade-off by requiring participants to choose the two items that are 'best' and 'worst', or 'most' and 'least', from a subset of (most commonly) four or five items presented to them repeatedly in different combinations. The approach produces both a rank and an interval scaling of the items indicating their relative importance, for both individual participants and for the sample as a whole.

Lighthouse Studio was used to create a partially Balanced Incomplete Block Design (BIBD) for the BWS exercise according to methods previously described by Sharma (2000). Subsets of the attributes identified for inclusion were presented in a repeated 'tests' which were balanced in (i) factor frequency, (ii) positional frequency and (iii) orthogonality to satisfy optimal design characteristics, following an approach defined by Orme (2009). This means that the attributes were presented an equal number of times in different combinations and orders across a total of 12 tests, with five attributes in each test (Orme, 2005 – the test can be seen within the survey in Appendix 1). Given the anticipated range of experiences and knowledge of dairy farming among the participants, it was important to anchor them in an environment to which they could all relate equally. Therefore, a supermarket aisle was selected as the setting, although steps were taken in the framing of the question to eliminate bias due to diet, purchasing habits and concerns over the accuracy of the information provided. Respondents were asked to select the 'most' and 'least' important attributes in each set when asked:

"You are in a grocery shop, walking through the aisle for milk, dairy and plant-based alternatives. More information than usual has been provided about the different types of cows' milk on display. This has been supplied by a trusted food assurance scheme. Irrespective of whether you are buying any milk or not on this occasion, you have time to spare, so you read the information provided. You will now see a series of questions. Each includes five pieces of information about the cows' milk on display. Which feature

is the MOST important and LEAST important TO YOU in each set of five, if price is not an issue? There are 12 questions in total."

2.2.4 Attributes

Thirteen themes related to farm animal or dairy cow management identified from scientific literature and other available reports were judged to be relevant to the research, and were therefore included as attributes in the BWS exercise. These were: i) outdoor access including fresh air, daylight and sun (Vanhonacker et al., 2008; Kühl et al., 2019); ii) choice of environment and activity (Schuppli et al., 2014; Spooner et al., 2014a); iii) grazing or access to pasture (Spooner et al., 2014a; Cardoso et al., 2019); iv) length of access to grazing, usually in days per year (Kühl et al., 2017; Darwent and Leaver, 2018); v) scale and 'corporatisation' of the farm (Lassen et al., 2006; Lusk et al., 2007); vi) individual care and avoidance of commoditisation of the animal (Vanhonacker et al., 2010; Cardoso et al., 2019); vii) space allowance or restriction and confinement when inside (Harper and Henson, 2001; te Velde et al., 2002); viii) nutrition and diet (Ellis et al., 2009; Schuppli et al., 2014); ix) comfort, especially when lying (Vanhonacker et al., 2010; Cardoso et al., 2019); x) health & welfare (Schuppli et al., 2014; Eurobarometer, 2016); xi) mother/offspring separation (Ventura et al., 2013; Hötzel et al., 2017); xii) mechanisation and technology (Boogaard et al., 2008; Cardoso et al., 2019); and xiii) behavioural enrichment and ability to investigate surroundings (Vanhonacker et al., 2010; Bergstra et al., 2017). The decision was made to exclude the term 'naturalness' because it has a wide and complex range of definitions which are open to a number of interpretations (Siipi, 2008; Nuffield Council on Bioethics, 2015), and therefore it does not lend itself to use in a survey with necessarily succinct descriptions. However, we have explored 'naturalness' in depth within Chapter 6.

Some previous studies have indicated a number of participants are more interested in eating quality, or environmental and social impact of food than the welfare of the animals. As a result, four additional 'non-cow' attributes were added to provide alternatives for participants for whom cow management or welfare is of less interest. These were: i) locally-produced milk (Wolf et al., 2011); ii) the taste of milk (Meuwissen and Lans, 2004); iii) a fair price paid to the farmer for milk (Ellis et al.,

2009); and iv) the milk's carbon footprint (Vanclay et al., 2011). The price of milk as an end product was deliberately excluded to avoid implying this was a 'willingness to pay' (WTP) exercise (see the limitations of WTP exercises in Chapter 1, Section 1.4), however this aspect was controlled for in the framing of the question by asking which feature was most and least important "if price is not an issue".

All attributes were phrased in a consistent form in an attempt to mitigate any criticism of terms being presented positivity or negativity, and phrased succinctly to fit within the BWS structure. The 17 different attributes and the abbreviations we used are laid out in Table 3.

2.2.5 Values, attitudes and experiences

In addition to the BWS exercise, other data relating to values, attitudes and experiences were gathered during the survey. All variables included are summarised in tabular form in Appendix 2.

The extent to which respondents believed dairy cows have awareness, can recognise cause and effect, and experience emotions, thoughts or feelings, was found to be material to views on farm animal welfare (see Section 1.5) and was therefore included. This was determined based on a set of six questions taken from Busch et al. (2017), which was in turn adapted from Hills (1995). Other questions included: how rural or urban were the areas in which the respondent had mainly lived (to confirm the sample identified by MIS and percentage of participants with rural experience included); their connection with farming or the dairy industry; whether they had visited farms and, if so, how long ago; experience of keeping pets or animals; dietary preferences; and type of milk or alternative they consumed at typical milk consumption opportunities. An indication of pre-existing knowledge of dairy farming was ascertained through three multiple choice questions relating to dairy cows based on Vanhonacker et al. (2007) and Ventura et al. (2016). The respondents were also asked to rate their own knowledge of dairy farming compared with the average UK citizen on a sliding scale of -5 to +5.

Table 3. The 17 attributes tested in the best worst scaling (BWS) exercise, which were presented in subsets of five within 12 differently ordered combinations

"This milk…"	Abbreviated attribute
is from cows managed indoors that can walk into open outdoor yards at any time	Yards
is from cows that choose their own timetable and habitat, inside and out	Choice
comes from cows that graze outdoors most of the year[a]	GrazeM
comes from cows that graze outdoors for at least a couple of months each year[a]	Graze2
comes from small farms where just the family manages the cows	Family
is from farms where the farmer knows each cow's individual history and character	Individual
comes from farms where cows roam freely when indoors	Roam
is from cows fed a diet designed to meet their individual nutritional needs	Diet
is from farms that prioritise the comfort of their cows above everything	Comfort
is from farms ranked top in the UK for health & welfare	H&W
comes from cows that keep their calves beside them for several months	Calves
is from farms which use the latest technology and automation	Tech
is from cows given brushes and toys so they can express their natural curiosity	Toys
comes from farms local to your area	Local
tastes better than other cows' milk	Taste
guarantees a fair price to the farmer	Price
has a lower carbon footprint than other milk and plant-based alternatives	Carbon

[a] these attributes were prohibited from appearing together

Following observations from Boogaard et al. (2011) about the role of values in acceptance of modern day farming practices, an indication of participants' value orientations was obtained using the Schwartz Portrait Value Questionnaire, validated internationally and through its use in the European Social Survey (Davidov et al., 2008). This presents 21 short descriptions of a person's behaviour and asks respondents to state for each, on a 6-point Likert-type scale, how like that person they are ranging from "Not like me at all" to "Very much like me". The 21 descriptions relate to 10 different values identified by Schwartz. Centred scores for a respondent's own values are computed by taking the mean scores for the items that index each value then deducting the mean score obtained across all 21 questions (Schwartz, 2003a, 2012).

2.2.6 Statistical Analysis

2.2.6.1 Hierarchical Bayes framework

The BWS responses were analysed using a hierarchical Bayes framework, a random utility theory approach which is based on the method of paired comparisons (Thurstone, 1927) and commonly used for discrete choice experiments. The underlying hypothesis is that the utility or 'worth' of option 1 over option 2 is indicated by how often option 1 is selected in preference to option 2. The more times option 1 is selected at the expense of option 2, the stronger the preference for option 1 compared with option 2, which results in not just a ranking but also a scale of importance – which Thurstone calls a "*distance*" between two alternatives. A choice is assumed to have an underlying value, or utility, to respondents. When applying this to a set of options, it is assumed that individuals have an underlying subjective scale behind their choices and the utility allocated to each item represents where each item is on that scale (Louviere et al., 2013). This can be expressed as:

$$U_{xn} = V_{xn} + \varepsilon_{xn}$$

where: U_{xn} is the unidentified utility that individual *n* associates with choice option or item *x*; V_{xn} is the observable component of utility that can be estimated from behavioural data; and ε_{xn} is the random error component which follows a Gumbel distribution (Louviere et al., 2002).

As described in Shortall et al. (2017), the probability (*P)* that a person will choose item *i* as the most important from a set of *K* items be expressed as:

$$P_i = \frac{e^{Ui}}{\Sigma e^{UK}}$$

where e^{Ui} is the antilog for the utility for item *i* and e^{UK} is antilog of the utility scores for each item in the set of *K* items. Conversely, the probability of choosing item *j* as the least important in the set of *K* items can be expressed as:

$$P_j = \frac{e^{-Uj}}{\Sigma e^{-UK}}$$

where e^{-Uj} is the antilog for the negative utility for item j and e^{-UK} is antilog of the negative utility scores for each item in the set of *K* items. Finally, the probability that a

person will choose items *i* and *j* as most and least important respectively, is the probability that the difference in utility between *i* and *j* is greater than the difference in utility between any other pair in a set of *K* items. This probability (*P*) can be expressed in conditional logit form (*i* is chosen best and *j* is chosen worst) as follows:

$$P_j = \frac{e^{U_i - Uj}}{\Sigma_{m=1}^{K} \Sigma_{l=1}^{K} e^{Ub - Uw} - K}$$

where *m* is the most important choice and *l* is the least important choice.

2.2.6.2 Hierarchical Bayesian Analysis

A hierarchical Bayesian (HB) estimation within Sawtooth Software's MaxDiff program was used to calculate individual scores under the logit rule (Sawtooth Software Inc, 2008). Using this approach, HB analysis gave an overall ranked and scaled score for each attribute across the whole sample.

2.2.6.3 Latent Class Analysis

To identify underlying groups which ranked the attributes in a similar way within the overall sample, latent class analysis (LCA) was conducted (Sawtooth Software Inc, 2008). LCA is a measurement model through which individuals can be classified into groupings, or latent classes, based on their pattern of answers from a set of categorical variables – in this case their ranked and scaled attributes from the BWS exercise. This analysis identified underlying groups of participants who expressed preferences similar to each other but different from other groups, and estimated utility scores (with logit scaling) for each group (Orme, 2009). Between two and seven latent class grouping options were considered. While positive but diminishing gains in a Bayesian information criterion (BIC) goodness-of-fit test indicated that five or six latent class groups both presented optimal solutions, six classes gave a better differentiation of preferences between groups. Therefore, a class membership, or group allocation, from the six-class latent class solution was allocated to each respondent based on the maximum probability of their membership of that class.

2.2.6.4 Multinomial Logistic Modelling

Multinomial logistic modelling (MNL) in Stata 15.1 (StataCorp LLC 1985-2017; www.stata.com) was used to build a model in a forward stepwise approach,

expressing relative risk ratios (RRR) of an individual belonging to Latent Classes 2, 3, 4, 5 or 6 against that individuals belonging to Latent Class 1. The model was intended to draw out maximum differences between the six latent class groups in terms of related socio-demographic, attitudinal, experiential and value-orientated characteristics. The moderate nature of Latent Class 1's relationship with most of these characteristics, as opposed to the more extreme relationships exhibited by some of the other classes, provided an informative baseline against which more subtle differences between the groups could emerge. Therefore, when testing for results from the model, using Latent Class 1 rather than any of the other classes as a reference provided most insight to the characteristics of the individuals allocated to the different groups.

The multinomial logistic model can be described as:

$$log\left(\frac{\pi_i^{(s)}}{\pi_i^{(t)}}\right) = \beta_0^{(s)} + \beta_1^{(s)} x_i, \qquad s = 1, \ldots . t - 1$$

where the probability of the *i*th respondent being in class s rather than class t is estimated by contrasting each of the response categories with its reference category. In this, the parameter $\beta_1^{(s)}$ is interpreted as the additive effect of a 1-unit increase in x on the log-odds of being in category s rather than category t.

2.3 Results

2.3.1 Respondent characteristics

A total of 2,054 completed survey responses were received over the one-week period. The primary focus was to obtain a sufficient number of participants with rural living experience to broadly reflect national data. The results showed 16% had mainly lived in rural areas, while a further 9% had lived in a mix of areas including rural. Without using a clear definition of rural living from national data and specifying the same during the sample, it was not possible to judge rurality any more specifically than this, so this was deemed sufficient.

Table 4. Socio-demographic breakdown of respondents completing the online survey

Variable	Sample results (n=2,054)
Age	Mean 45.94 years, range 16-86 years
	Percentage in each age category – 16-24: 10.91% (ONS 2017: 13.47%); 25-34: 21.03% (16.74%); 35-44: 16.71% (15.58%); 45-54: 18.62% (17.27%); 55-64: 14.30% (15.54%); 65-74: 14.69% (12.30%); 75+: 3.73% (10.10%)
Gender	Male 43%, Female 56%, Other <1%, Prefer not to say <1%
Region	North West 13%, North East/Yorks 13%, East Mids 9%, West Mids 11%, East/East Anglia 9%, S East/London 23%, South West 9%, Wales 5%, Scotland 7%, NI 2%
Children	Responsibility for children – No 41%, Yes now 30%, Yes used to 29%, Other <1%
Area	Mainly lived in – Urban 38%, Suburban 34%, Rural 16%, Mix of places but not rural 2%, Mix of places including rural 9%, Other <1%
Income	Household take-home annually – <£20k 29%, £20-40k 35%, £40-£60k 16%, £60-£100k 8%, >£100k 2%, Prefer not to say 10%
Education	Highest achieved – School 28%, College diploma 16%, Degree 32%, Postgraduate 13%, Vocational/skilled 9%, Other 1%, Prefer not to say 1%
Ethnicity	White 90%, Mixed 2%, Asian 5%, Black 2%, Other <1%, Prefer not to say 1%

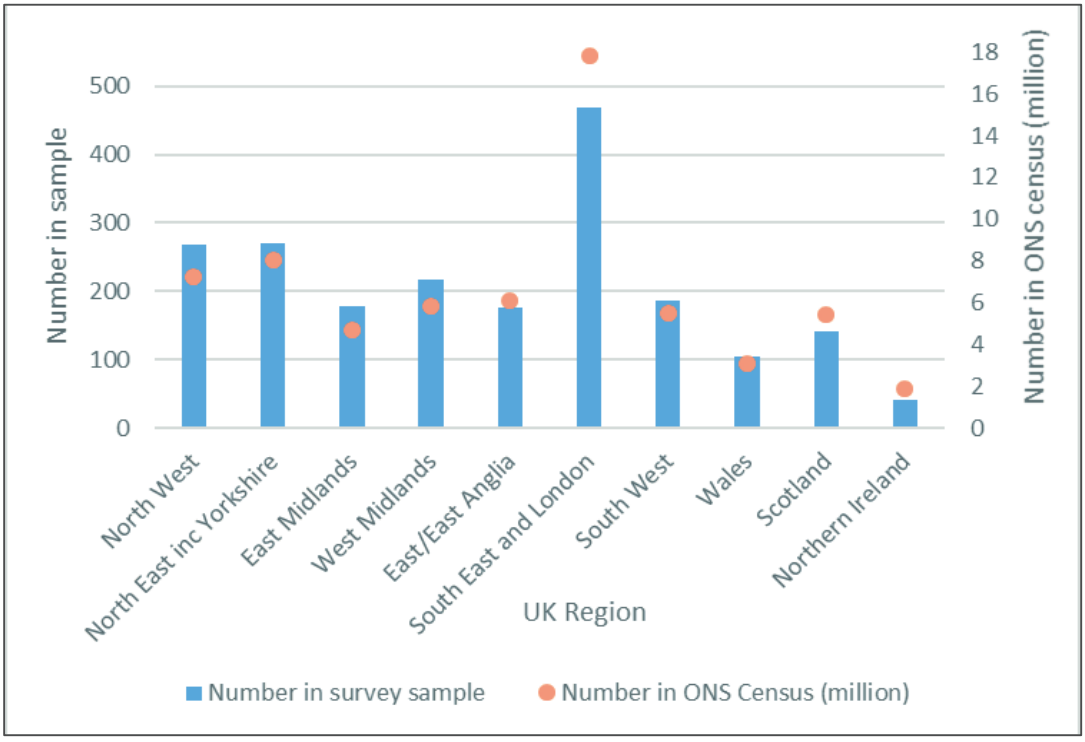

Figure 9. Comparison of sample and ONS populations by region (ONS, 2012)

A summary of the sample characteristics is contained in Table 4. In reviewing against other national socio-demographic data, the sample was under-represented in the youngest and oldest age groups, and over-represented in the 25-34 age group, but otherwise broadly reflected national data on age (ONS, 2017a). The sample contained more women than men (56% to 44% respectively of those who declared a gender, which was all bar five), compared with 52% to 48% in the general population (ONS, 2017a); this was a statistically significant difference (P≤0.001). Ethnicity within the sample was less diverse than nationally, as 90% of sample participants said they were white, while nationally, 86% declared they were white in the 2011 census (ONS, 2017b); again, this was statistically significant (P≤0.001). Geographical spread was broadly representative of population in each region (ONS, 2012 – see Figure 9).

2.3.2 Ranking the attributes by relative importance

The mean fit statistic for the whole sample was 0.490, indicating that the BWS MaxDiff exercise had been completed to a good level of internal consistency within the sample as a whole. The mean preference scores for each attribute, calculated from the HB analysis of the sample responses to the BWS exercise and scaled for relative importance, are presented in the second column of Table 5 and in Figure 10 in order of ranked importance. There was no significant difference in score between the three attributes ranked top for importance, which were: "*This milk comes from cows that graze outdoors most of the year*" (abbreviated as GrazeM in Table 5); "*This milk comes from farms ranked top in the UK for health & welfare*" (H&W); and: "*This milk comes from farms that prioritise the comfort of their cows above everything*" (Comfort) (*P* = 0.72 and *P* = 0.57 respectively). The scores for these three attributes were significantly higher – by almost 20% – than the next nearest attribute: "*This milk guarantees a fair price to the farmer*" (Price).

Attributes relating to the behavioural enrichment of the cow and use of technology *("This milk comes from cows given brushes and toys so they can express their natural curiosity"* (Toys) and: *"This milk comes from farms which use the latest technology and automation"* (Tech) respectively) emerged as the least important attributes.

Table 5. Overall ranking and hierarchical Bayesian (HB) scores for the 17 attributes alongside individual HB scores for each underlying latent class

Overall Ranking	HB[a]	Abbrev. attribute	Class 1 (Welfare)[c]	Class 2 (Grazing)[c]	Class 3 (Taste)[c]	Class 4 (Farm Price)[c]	Class 5 (Cow Comfort)[c]	Class 6 (No Preference)[c]
	Class size (% of sample)		18.3%	15.6%	15.2%	18.9%	14.8%	17.2%
1	10.70	GrazeM	9.56	**16.83**[b]	10.44	10.59	10.45	6.18
2	10.64	H&W	**17.76**[b]	5.28	13.43	9.30	9.91	**7.34**[b]
3	10.61	Comfort	15.02	11.12	7.24	8.44	**15.97**[b]	6.60
4	8.85	Price	12.43	5.00	11.98	**15.29**[b]	2.05	5.71
5	7.63	Yards	7.40	11.48	5.58	4.91	10.16	6.49
6	7.12	Calves	7.53	8.85	3.73	5.66	11.02	5.59
7	6.35	Graze2	5.71	10.63	6.39	5.36	4.92	5.72
8	5.92	Choice	5.67	7.94	1.76	2.43	12.43	5.77
9	5.18	Diet	5.78	4.11	6.60	3.09	5.24	6.35
10	5.07	Local	1.60	1.93	4.08	13.63	0.93	5.34
11	4.39	Taste	1.05	2.97	**14.67**[b]	2.07	0.66	5.69
12	4.29	Roam	3.64	5.71	3.90	3.14	4.99	6.24
13	3.82	Family	1.91	3.05	2.56	8.21	2.47	5.07
14	3.63	Individual	1.85	2.76	1.76	4.93	3.75	5.63
15	2.99	Carbon	2.19	1.25	3.94	1.80	1.28	5.85
16	1.47	Toys	0.52	0.41	0.41	0.44	3.50	4.77
17	1.34	Tech	0.39	0.69	1.53	0.72	0.29	5.65

[a]Hierarchical Bayesian score indicating scaled ranking by importance; [b]Most important attribute in each class is identified in **bold;** [c]Each class name is in (brackets) in the column heading

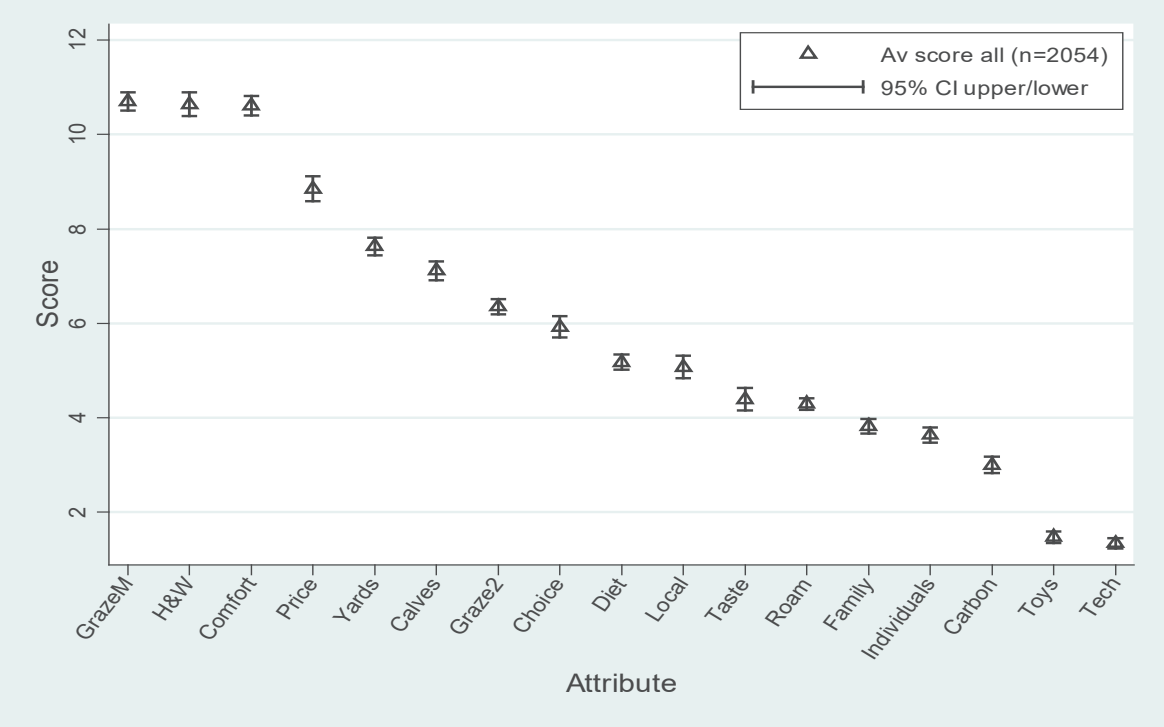

Figure 10. The 17 attributes in order of declining ranked importance after hierarchical Bayesian analysis (n=2,054)

Next lowest – although twice as important as the previous two items according to the scaled scores – was: *"This milk has a lower carbon footprint than other milk and plant-based alternatives"* (Carbon), with attributes relating to size of the farm and the individual level of attention given to the cow (*"This milk comes from small farms where just the family manages the cows"* (Family) and: *"This milk comes from farms where the farmer knows each cow's history and character"* (Individual) respectively) scoring next lowest for importance.

2.3.3 Latent Class groups

The six groups identified through latent class analysis of the whole sample's individual HB scores all prioritised different attributes (Table 5), with the exception of Latent Class 1 and Latent Class 6, which both selected H&W as most important. The groups were relatively evenly distributed within the sample with the numerically largest (Latent Class 4) comprising 18.9% of the sample, and the smallest (Latent Class 5), 14.8%.

2.3.4 Multinomial Logistic Regression model

The multinomial logistic model identified 13 socio-demographic, attitudinal, experiential and value-orientated characteristics that were significant predictors of class membership and hence, potentially, dairy cow management or milk production priorities. These were: age; gender; education; experience of pets or animals; a previous visit to a farm; knowledge of dairy farming; dietary choice; milk consumption choice; the level of belief in 'a dairy cow's mind'; self-rated knowledge of dairy farming; and the three values of achievement, universalism and tradition. Only three of the 10 values in the Schwartz Portrait Value Questionnaire were included due to multicollinearity (Schwartz, 2003a). The RRRs showing the relative likelihood of an individual in Latent Class 2, 3, 4, 5 or 6 having certain characteristics compared with Latent Class 1 are summarised in Table 6.

Table 6. Relative Risk Ratios (RRR) of belonging to Class 2, 3, 4, 5 or 6 against belonging to Class 1, for variables included in the multinomial logistic model

	Class 2: Grazing		Class 3: Taste		Class 4: Farm Price		Class 5: Cow Comfort		Class 6: No Preference	
	RRR	95% C.I.	RRR	95% C.I.	RRR	95% C.I.	RRR	95% C.I.	RRR	95% C.I.
Age *(compared with being 16-24 in Class 1)*										
25-34	1.28	0.62-2.62	1.15	0.63-2.08	1.55	0.81-2.95	0.64	0.35-1.16	1.16	0.66-2.05
35-44	1.94	0.94-4.00	1.06	0.56-2.00	1.51	0.77-2.96	1.07	0.58-1.94	1.04	0.56-1.91
45-54	3.40***	1.67-6.91	1.29	0.68-2.47	2.42**	1.25-4.71	1.28	0.70-2.33	0.82	0.43-1.56
55-64	3.60***	1.73-7.48	1.38	0.70-2.71	2.77**	1.41-5.45	0.69	0.35-1.35	0.58	0.28-1.19
65-74	4.87***	2.34-10.16	1.90	0.97-3.74	3.11***	1.56-6.17	0.67	0.33-1.36	0.26**	0.11-0.63
75+	4.70**	1.62-13.66	2.79*	1.01-7.68	5.12***	1.95-13.48	0.88	0.26-3.00	0.51	0.14-1.90
Belief in a dairy cow's mind	0.94	0.74-1.20	0.49***	0.38-0.64	0.72**	0.57-0.91	2.57***	1.99-3.32	0.45***	0.34-0.58
Dairy cow knowledge *(reference: fewer than 3/3 correct answers)*	1.05	0.65-1.69	1.85*	1.15-2.98	1.84**	1.20-2.83	1.05	0.62-1.77	0.86	0.48-1.55
Rurality *(reference: has not lived in rural areas)*	0.66*	0.45-0.96	0.73	0.49-1.08	1.38	0.98-1.94	0.89	0.60-1.31	0.73	0.47-1.13
Type of milk consumed *(reference: does not mainly drink cows' milk)*	1.41	0.68-2.92	1.19	0.60-2.34	1.76	0.83-3.71	0.46**	0.26-0.82	0.67	0.36-1.24
Dietary preference *(reference: restricted diet, e.g., vegetarian)*	0.69	0.41-1.14	0.77	0.44-1.34	0.82	0.49-1.37	0.33***	0.21-0.52	0.62	0.36-1.07
Education *(reference: not university-educated)*	0.76	0.54-1.06	0.90	0.65-1.27	0.70*	0.51-0.97	0.62**	0.44-0.89	0.75	0.53-1.07
Experience with animals *(reference: has no experience)*	0.70	0.42-1.15	0.50**	0.31-0.80	0.60*	0.37-0.96	1.10	0.62-1.94	0.38***	0.24-0.62
Self-rated dairy cow knowledge	1.06	0.98-1.14	0.99	0.92-1.07	1.08*	1.00-1.16	1.02	0.94-1.10	1.30***	1.20-1.41
Gender *(reference: female)*	1.30	0.94-1.81	1.77***	1.27-2.49	1.07	0.78-1.47	0.84	0.59-1.21	2.21***	1.55-3.16
Farm visit experience *(reference: has visited a farm in the past)*	1.13	0.77-1.66	1.15	0.78-1.69	1.04	0.71-1.52	1.25	0.83-1.89	1.98***	1.33-2.94
Achievement	1.12	0.91-1.37	1.28*	1.05-1.58	1.01	0.84-1.23	1.11	0.90-1.37	1.26*	1.01-1.56
Tradition	1.16	0.95-1.40	1.04	0.85-1.27	1.23*	1.02-1.48	1.07	0.88-1.30	0.93	0.76-1.15
Universalism	0.65***	0.51-0.84	0.52***	0.40-0.67	0.62***	0.49-0.79	0.88	0.68-1.14	0.36***	0.28-0.48

The reference class used was Class 1: Welfare; all RRR figures are expressed relative to Class 1

Key: *P<0.05, **P<0.01, ***P<0.001; RRR=Relative Risk Ratio; 95% C.I. = 95% confidence interval

2.3.5 Characterising the Latent Classes

With each latent class selecting a different attribute as its most important, the classes were named after their most important attribute. Latent Classes 1 and 6 both had H&W ranked highest, but in Latest Class 6, scores awarded to each attribute were much closer together and showed no significant prioritisation. For this reason, Latent Class 6 was named the 'No Preference' group and Latent Class 1, the reference class against which the predominant characteristics of the other five classes were estimated, was named the 'Welfare' group.

Because all other classes had a lower RRR than the Welfare group for the value of universalism (i.e., wanting to 'make the world a better place'), members of the Welfare group had the highest probability of including respondents orientated towards universalism, which indicates qualities such as broad-mindedness and tolerance. Equally they were low in their orientation towards achievement. They were very likely to have visited a farm at some point, most likely to eat an unrestricted (likely omnivorous) diet, and also the most likely to have had a university education.

By contrast, Latent Class 2 was labelled the 'Grazing' group after its members' highest-prioritised attribute. This group was a third less likely to live in rural areas (RRR 0.7) than the Welfare group and was therefore judged to be the most urban/suburban group in the sample. The Grazing group was also the joint-oldest group, particularly with over-45-year-olds who were between 3.4 and 4.9 times more likely to be in the Grazing group than the Welfare group.

Members of Latent Class 3, named the 'Taste' group because the taste of milk was their most important attribute, were half as likely to believe in a 'dairy cow's mind' (RRR 0.5) as those in the Welfare group, 1.8 times more likely to be male, and half as likely to be orientated towards universalism (RRR 0.5). They scored joint highest for dairy knowledge and were 1.8 times more likely to have got all three multiple choice questions correct, i.e., were more knowledgeable about dairy farming, than those in the Welfare group.

Latent Class 4, which was called the 'Farm Price' group because of its highest-ranked attribute, was similar to the Grazing group in that it generally contained older

members; over-45-year-olds were between 2.4 and 5.1 times more likely to be in this group than in the Welfare group. They were also the most likely to be traditional (with higher scores for 'traditionalism – RRR 1.2), and they had the joint-highest level of dairy knowledge alongside the Taste group (RRR 1.8). They were almost a third less likely (RRR 0.7) to have had a university education than the Welfare group, and much less likely (RRR 0.6) to have had a pet or other animal at any point. While 'rurality' was not found to be significant, the RRR and 95% CI suggested most rurality might lie within this group.

Latent Class 5, named the 'Cow Comfort' group after its top-ranked attribute, was characterised by being most likely to have members with a strong belief in a dairy cow's mind. In fact, out of the whole sample, those having this strong belief were over 2.5 times more likely to be in the Cow Comfort group than the Welfare group. However, they were half as likely to consume cows' milk as those in the Welfare group (RRR 0.5) and two-thirds less likely to have an unrestricted diet (RRR 0.3) – meaning this group contained the highest proportion of vegans and vegetarians. They also had the lowest likelihood of having had a university education (RRR 0.62 compared with the Welfare group, the group with the greatest likelihood of a university education).

As noted earlier, the final class – Latent Class 6 – was named the No Preference group as its members showed very little contrast in preference between the 17 attributes, with the difference in scores between their most and least important attributes just 2.57, compared with the other groups who had score ranges from 14.26 (for the Taste group) to 17.24 (for the Welfare group). Yet those in this group were characteristically distinct. They were less than half as likely to believe in a dairy cow's mind as the Welfare group (RRR 0.4). They had the lowest experience of pets or animals (RRR 0.4)) but they rated their dairy knowledge the highest of all groups (RRR 1.3), were more than twice as likely to be male than the Welfare group (RRR 2.2), and were more likely than the Welfare group to have never visited a farm (RRR 2.0). As with the Taste group, they were strong on achievement (RRR 1.26), and were almost two thirds less likely to be universally-minded than the Welfare group (RRR 0.4), suggesting more narrow-mindedness and 'particularness'. The six citizen groups and some of their associated characteristics are depicted in Figure 11.

Figure 11. Summary of the six 'citizen' groups

2.4 Discussion

The novel application of BWS means this is the first study, to our knowledge, to have identified a relative ranking of importance among citizens for specific aspects of dairy cow management and milk production. Furthermore, it is the first to determine heterogeneity of preference in underlying latent classes – or 'citizen groups' – and the indicative characteristics of members of these groups.

2.4.1 Preferred attributes

Grazing outdoors most of the year, cow comfort, and health & welfare were all ranked of equal top importance in this study. The priority placed on grazing was expected as dairy cow access to grazing is already a well-established priority for the public, expressed both in research (Ellis et al., 2009; Ventura et al., 2016; von Keyserlingk and Weary, 2016) and campaign group literature (WSPA, 2010; CIWF, 2011; Darwent and Leaver, 2015), and often cited alongside a belief that it improves cow welfare. This raises questions about the direction of travel of UK dairy farming because despite indications that a decade ago at least, over 90% of UK dairy farms included grazing as part of their feeding and management regime (March et al., 2014), access to grazing is

thought to be on the decline in the UK and Europe (March et al., 2014; van den Pol-van Dasselaar et al., 2014).

However, while concepts of health & welfare (Lusk and Briggeman, 2009; Kühl et al., 2019) and animal comfort (Vanhonacker et al., 2008; Cardoso et al., 2019) have received support from the public in previous research, their equal standing with grazing in this study in terms of shared top ranking was unexpected – especially given the strength of preference for grazing and pasture access expressed in aforementioned research. The additional finding that only one of the six underlying and broadly equally-sized citizen groups awarded top importance to grazing means that for this sample of UK citizens at least, preferences for dairy cow management are certainly not all about grazing.

Other attributes of relatively high importance included the ability for cows to have outside access even though they live indoors, to choose their own timetable and habitat inside and out, and to keep calves with them for several months. These findings are consistent with previous research: the citizens or public in both Spooner et al. (2014a) and Schuppli et al. (2014) supported cows being able to have their feet on pasture or earth, with Schuppli et al. (2014) further establishing that both 'lay citizens' and those affiliated with the dairy industry wanted cows to access fresh air and sunshine, and to choose their environment whether inside or out. Concerns around timings for cow-calf separation have also been well-established (e.g., Ventura et al., 2013; Busch et al., 2017; Hötzel et al., 2017).

2.4.2 Less important attributes

However, attributes identified as less important were revealing too. The low relative importance placed on milk from small family farms did not reflect concerns from the public that larger scale dairy farms negatively impact cow health & welfare, the quality of milk and the naturalness of the animal' circumstances (Miele, 2010; Cardoso et al., 2016). Nor were concerns evident over the level of personalised care an animal receives (Miele, 2010), with farms where the farmer knows each cow individually also ranked relatively low.

Of the four 'non-cow' attributes explored in this research (i.e., a fair price paid to the farmer, carbon footprint of the milk, taste of the milk, and locally-produced milk), milk that guarantees a fair price to the farmer was most important, and fourth-placed overall. The reasons for its prioritisation are not immediately clear. Boogaard et al. (2011) found Dutch consumers would be willing to pay more for milk to support a higher quality product and in Benard and de Cock Buning (2013), it was acknowledged by both farmers and citizens that the ability to provide better welfare was linked to the income farmers received. In our study, three of the underlying citizen groups identified through LCA (the Welfare, Taste and Price groups) placed a high relative importance on a fair price to farmers. The priorities and characteristics associated with these groups may imply motivations are linked to a notion of fairness for not only for the cows but also for the farmer working with the cows, or to enabling the farmer to produce better milk, or to supporting rural communities and traditional ideals. It would be helpful to use further methods to unpack the notion of fairness in particular. An alternative explanation is that the price paid to farmers was at the forefront of participants' minds because of publicity surrounding farm-gate milk price in the media, although this issue peaked in prominence two years before the survey took place (BBC News, 2015).

The scaled rankings identified for each of the underlying citizen groups provide further insight to importance of the different attributes in relation to each other, and the differences in priorities. For example, the Welfare group rated health & welfare almost twice as important as it rated grazing outdoors most of the year, but the Grazing group rated grazing most of the year over three times more important than health & welfare. These quantitative differences in preference between the groups illustrate that the top priorities for the whole sample were formed not from homogenous views, but from a combination of strong and differing preferences expressed by individuals within the underlying citizen groups.

2.4.3 Defining characteristics

The characteristics found through the multinomial model to be the strongest indicators of membership of a particular citizen group were coherent with previous research and with each group's priorities. Belief in an animal mind, as described by

Knight and Barnett (2008) and Busch et al. (2017), was strongly exhibited in the Cow Comfort group, which prioritised attributes that could be connected with a cow's behavioural wellbeing such as choice about her environment or staying with her calf. As suggested by Boogaard et al. (2011), personal values were also significant. For example, the Welfare, Grazing and Cow Comfort groups which prioritised cow-related attributes scored highest for universalism, indicating an interest in fairness and making the world a better place for others (including animals); the Taste and No Preference groups, which did not prioritise cow attributes, scored highest for achievement which suggests more self-interest. The socio-demographic and experiential characteristics identified as significant indicators were consistent with reviews conducted by Kendall et al. (2006) and Cornish et al. (2016), namely that age, gender, education, dietary and milk consumption choices, pet ownership, experience or knowledge of farming, and rurality are all linked to attitudes towards animal welfare.

While use of BWS was successful in establishing ranked preferences and identifying the underlying heterogeneity in the sample, the necessary brevity of the attribute descriptions gives rise to speculation about how participants interpreted and understood each attribute, or how the presentation and wording of the attribute influenced prioritisation or trade-offs. Some attributes could have been assumed as 'givens' – already delivered under a farmer's duty of care to his or her animals, hence were traded off in favour of attributes seen as currently unmet needs. Miele (2010) observed that for the vast majority of focus group participants in her study, issues such as hunger and thirst were considered very important but were also problems that "should not exist anymore in a 'civilised' Europe". Visits to farms reported in Boogaard et al. (2008) and Ventura et al. (2016) satisfied some concerns of the participants but raised other concerns in areas they had previously assumed to be satisfactory. Hence, in this study, it is possible that participants inadvertently downgraded attributes that nonetheless held great importance for them. Furthermore, some attributes could have been seen as proxies or enablers of others. For example, some may believe grazing delivers improved health & welfare, or better cow comfort or a more suitable diet, hence prioritising grazing will prioritise some associated attributes by default. Despite this, the identification of latent classes linking different rankings with specific

characteristics such as dairy knowledge, rural experiences and values, gives some indication of the possible frames through which these attributes may have been interpreted. More research to clarify the reasons behind the choices made by different groups of participants would be worthwhile.

Given evidence of a disconnect between the dairy industry and other stakeholders' priorities (Vanhonacker et al., 2008; Cardoso et al., 2019), this research suggests a number of priorities the industry could seek to address. These could include: better communication of how the industry is meeting cows' needs and public expectations around these aspects (e.g., delivering cow comfort, or cow health & welfare); targeted product marketing based on key attributes of importance (e.g., grazing or a fair price for farmers); or adaption of current farming practices to address aspects of most concern (e.g., outdoor access for cows which otherwise remain indoors). However, the questions remain as to what meanings people have constructed around these attributes and what practice and process interventions on-farm would deliver them, subjects we intend to investigate in a following study. As a minimum, the benefits of this study come from improved understanding and better "*anticipating societal debates*" (Vanhonacker et al., 2008).

2.5 Summary

We know the public value animal welfare, naturalness and grazing, but neither the relative importance of specific aspects of management, nor the diversity of views underlying these headline preferences, had been established. Therefore, in this study we set out to establish which aspects of dairy cow management the public prefer, how uniform these views are, and what might contribute towards them. We asked 2,054 survey participants to rank 17 attributes relating to dairy cow management and milk production through the novel application of best worst scaling. Hierarchical Bayesian analysis of the results revealed three attributes of equal 'top' importance: (i) access to grazing; (ii) cow health & welfare; and (iii) cow comfort. However, underlying differences in preferences were identified in six approximately equally-sized 'citizen groups' within the sample. Each citizen group expressed significantly different priorities from the other, and each had different indicative socio-demographic,

attitudinal, experiential and value-orientated characteristics. These results suggest the public have diverse priorities, but it is not clear whether this is due, in part, to their understanding of the attributes and what they are perceived to deliver. We will explore this further in subsequent chapters.

"It always used to make me smile when I drove to work up the A45 working in Solihull actually and I started at half-7, and at certain times of the year you'd be driving along and the cows are heading for milking and they're literally walking in a line across field – there's no one there, they know it's milking time. And it used to make me smile, 'Ah you're off to work as well'. I like that idea of it that they're in a field and, right, it's time to be milked now…"

Participant in 60 face-to-face interviews, conducted across the UK between November 2019 & February 2020 (see Chapter 3)

Chapter 3: Qualitative data collection

3.1 Approach to data collection

Following the completion of the quantitative study described in Chapter 2, data were collected for the studies to address the second, third and fourth research questions, as summarised in Chapter 1, Figure 8. All three approaches were wholly or partially qualitative, and face-to-face interviews were determined the optimal method of data collection, being a method suited to eliciting a broad and rich range of insights from participants rather than the more consensual outputs focus groups can generate (Gill et al., 2008; Ng et al., 2018).

A semi-structured interview technique was judged optimal so that topics could be approached in an intuitive order – yet would also enable the interviewer to keep track if the interviewee addressed scripted topics out of order. The semi-structured format also provided interviewees with the opportunity to ask questions, interpret questions in their own way, and introduce novel components to uncover a wider range of meanings (Braun and Clarke, 2013). A semi-structured interview guide was developed to aid data collection and was informed by While and Barriball (1994) and Ng et al. (2018). In particular, the script was structured to first put participants at ease by discussing recent food shopping experiences, an activity almost all were likely to have taken part in, then progressively focused in on specific topics. Five pilot interviews with colleagues were undertaken to test and adjust the interview script before interviews started. The main adjustments concerned the running order of the script, the addition of prompts, and adjustment of the interview technique used to elicit the information required. In recognition of the three different but linked research questions being explored, a technique was also introduced to articulate 'breaks' between topics which meant that participants could reset their focus. The final interview script is contained in Appendix 3. Elements specific to the three following studies are discussed within their respective Chapters 4, 5 and 6.

3.2 Identifying and recruiting participants

The results of the quantitative study described in Chapter 3 identified six characteristically different and approximately equal-sized citizen groups with different preferences for dairy cow management (see Section 2.3.3, Table 6, Figure 11). As these citizen groups represented a diversity of priorities for dairy cow management and milk production, we engaged Made In Surveys (MIS) (Lille, France; https://en.misgroup.io/) to recruit a subsection of people from this quantitative sample, ensuring the six citizen groups were broadly equally represented across this new sample. Additionally, as rural living experience was identified in previous studies as an important factor in preferences for farm animal welfare (e.g., Boogaard et al., 2006, 2011; Kendall et al., 2006; Vanhonacker et al., 2007, 2010; Cornish et al., 2016), and as confirmed within our quantitative study (see Section 2.3.5 and Table 6), a second goal was to secure approximately half of participants from rural areas. MIS gauged whether panel members currently lived in urban, suburban or rural areas through a short screening questionnaire sent out to determine initial interest in participating. Lastly, a range in ages and geographical locations was requested due to: the impact of age on preferences, as found in Kendall et al. (2006) and Cornish et al. (2016) and again confirmed in our quantitative study (see Section 3.3.5 and Table 6); and established differences in political, economic, social and health indicators as well as personality across the UK regions (Rentfrow et al., 2015).

A 'data saturation' approach (Glaser and Strauss, 1967) is typically referenced when defining sample size in qualitative studies. However, this approach, which determines with each consecutive observation whether new information is still being acquired, until the point of 'saturation' where no new information is being obtained and thus no further observations are needed, is designed to work specifically with grounded theory methods (Malterud et al., 2016). As our aim was to collect sufficient data to inform three separate studies employing different methods of analysis, saturation was not a suitable option and the 'information power' approach was adopted instead. Named after the power calculations used to determine sample size in quantitative studies, information power seeks to apply a similar principle – to ensure the sample is sufficiently large to inform the study aims (Malterud et al., 2016). According to these

principles, the higher the information power of the sample, the smaller it needs to be for adequate analysis and subsequent peer-reviewed publication – and vice versa.

A number of factors indicate information power, such as the breadth of the research question, the specificity needed if a purposive sampling approach is used, how open-ended the questions are, and whether inductive reflexive thematic analysis is being used (Braun and Clarke, 2022). Despite the face-to-face nature of the interviews which would normally provide high information power, several factors lowered this power. These included: the broadness of the research question in each study (especially to address the third research question – see Chapter 1, Section 1.5); the specificity required in the intended purposive sampling approach; the use of open-ended questions; and the application of inductive reflexive thematic analysis (Braun and Clarke, 2022) through all studies. Thus, through observing the guidelines laid out by Malterud et al. (2016), a relatively large sample was indicated. To establish this in absolute rather than relative terms, 50-60 interviews has been indicated as standard in large qualitative samples (Britten, 1995), but analysing more than 50 interviews can also present challenges (Ritchie et al., 2003; Vasileiou et al., 2018). As the interview script sought to answer the three different research questions, it was decided to plan for collecting data from 60 interviews, but to monitor diversity of participants and breadth of data as interviews progressed. In the event, all 60 interviews were carried out due to difficulties securing interviews with rurally-based participants, many of which therefore took place later in the schedule, and challenges obtaining representation from one of the six citizen groups in particular.

As well as the identification of potential participants from the quantitative sample, all participant recruitment and enrolment was also carried out by MIS to ensure anonymity until the interviews were booked and imminent. Purposive sampling (Etikan et al., 2016) was used to ensure maximal variation within the sample in terms of the demographics stipulated. Almost 100 potential participants were approached initially with drop-outs mainly due to lack of availability on the available dates. During recruitment, it proved challenging to obtain an equal split of the six citizen groups identified in Chapter 3; this may have been due to the distinct characteristics of those within some of the groups. However, the final sample had seven from the least-

represented group and 15 from the most. In terms of rural living, again it proved a challenge to secure sufficient numbers due, firstly, to generally low numbers living in such areas (fewer than 20% nationally, as explained in Section 1.2.3), and to differences between the type of area participants stated they lived in on the MIS screening questionnaire, and what they stated in the post-interview questionnaires, which also asked for the type of area they had lived in previously. A further complication arises when attempting to compare 'rurality' with Office of National Statistics figures, where there are eight rural/urban definitions. However, we decided that any rural living, past or present, would be valid, and so the final sample had 42% (25/60) 'self-declared' as either living in a rural area or having lived in a rural area at some point, with 58% being urban or suburban.

MIS handled all contact with interviewees before meeting, ensuring they received an information sheet detailing their anonymity in any outputs, remuneration for participating, how their data would be handled, and the study's compliance with General Data Protection Regulation 2016/679. Participants then provided written consent that they could be audio recorded and that their interview data could be used for research purposes. Each participant was told they would receive £50 upon completion of both the interview and a short post-interview survey collecting basic details about their characteristics, experiences and dietary preferences.

3.3 Interviews

Interviews took place between November 2019 and February 2020. The interviews averaged an hour but ranged from 25 to 90 minutes in length. I (Amy Jackson) conducted all interviews in person with only the participant present, and had no direct contact with any participants before the interviews. Interviews initially took place in private meeting rooms in urban areas which could be easily reached by a number of participants, but as the interviews progressed, it became necessary to travel further afield with interviews taking place in local cafés or participants' houses. Participants were interviewed only once. The interviews were transcribed by a professional transcriber from the audio recordings using the intelligent verbatim method (McMullin, 2021), then checked against the recordings and field notes during analysis.

Any inaudible comments were rectified or deemed immaterial and therefore did not require checking with participants. Interview recordings and transcripts were anonymised with identifying details stored securely and password-protected for data protection purposes.

3.4 Qualitative sample characteristics

Socio-demographic and other information was gathered from the final sample group of 60 through post-interview questionnaires, collected on a tablet using SurveyMonkey (Momentive Inc., San Mateo, California; www.momentive.ai). Key aspects relating to the final sample are summarised in Appendix 4. Additional to this summary, half the sample (30/60) were educated to graduate or post-graduate level; 46% (28/60) were professionally or clerically employed, 37% (22/60) did not work for reasons including retirement, education or children, and the remainder were skilled or unskilled manual workers. Ethnically, the sample was 90% white (54/60), and 10% (6/60) Asian, Black or mixed race, or preferring not to say. Over three-quarters (47/60) said they had no connections with farming or the dairy industry, with a further 17% (10/60) saying they did but only through distant family or friends. Concerning diet, the majority (85%, 51/60) said they ate 'most things', 12% (7/60) were vegetarian, one was dairy-free and one was vegan; only two did not consume cows' milk, but 10% (6/60) mainly or exclusively consumed plant-based 'milk'.

While a qualitative sample is not expected to be representative of the wider population in the same way as a quantitative sample, it is worth noting that the sample had a gender balance of 34 women to 26 men (57% to 43% respectively) compared to the wider population which comprises 52% women and 48% men (ONS, 2017a). Ten percent of the total stated they were ethnically non-White, which meant the sample was less ethnically diverse than the wider population, in which 14% identify as non-White (ONS, 2017a). However, the 63% of the sample which was found to be economically active (i.e., contributing to the national economy) was comparable with Office of National Statistics (ONS) data, where 64% of the national population within the same age ranges was found to be economically active (ONS, 2022a).

3.5 Positionality

Within qualitative research and analysis, the interviewer and those undertaking analysis are themselves research instruments, and their positionality affects the data gathered and its interpretation (Bourke, 2014; Darwin Holmes, 2020). While I am not a farmer and do not come from a farming background, I have practical and theoretical understanding and experience of farming. I was aware of the potential within face-to-face interviews to influence responses through a social desirability bias effect (Nederhof, 1985; Larson, 2019). While I am actively involved with the UK farming industry, I consciously focused on maintaining outward neutrality during the interviews and avoided responding to any questions in a way which may have indicated background or personal views. I was also aware of the need to avoid interpreting interviewees' experiences with cows through my own as these needed to be understood from the participants' own perspectives.

"His *view would be that he's giving them shelter and he's giving them everything they need and I would say, 'Yeah, but you're not giving 'em…'; he'd say, 'Oh yeah, I'm giving them access to fresh air.' And I'd say, 'Yeah, but you're not giving them access to fields and grass and the herding bit.' And he would say, 'Yeah, but I am giving them…'*

But it's not the same… this to me is equivalent to a human being put in a prison cell and given access to the exercise area once a day or it could be adlib, but I would doubt it would be adlib on this, but being given access to walking around a concrete yard, and you might have some social areas where you could play pool but you've also got your cell. So that to me is not ideal…"

Participant in 60 face-to-face interviews, conducted across the UK between November 2019 & February 2020 (see Chapter 3)

Chapter 4: Preferences for different dairy cow environments

4.1 Introduction

4.1.1 A growing disconnect

As discussed in Chapter 1 (Section 1.2), global production of milk has doubled over the past 50 years (Ritchie and Roser, 2019). Yet dairy farming in high income countries faces scrutiny over its practices, especially those believed to affect the welfare of the cow (Olynk Widmar et al., 2017; Placzek et al., 2021). A particular concern is the impact of different living environments – chiefly how long the cow spends inside housing or out at pasture (Ellis et al., 2009), which is usually a factor of the dairy farming system adopted. Dairy farmers often maintain that welfare is more dependent on management than system (Shortall, 2021; Smid et al., 2021), and animal science has identified both positive and negative welfare outcomes in systems that graze or house dairy cows (European Food Safety Authority (EFSA), 2009; Arnott et al., 2017; Mee and Boyle, 2020). However, we found grazing was important to the public in our study described in Chapter 2, and the public have been found to strongly favour dairy cow access to pasture in both scientific research (Boogaard et al., 2008; Schuppli et al., 2014; Kühl et al., 2019) and popular surveys (Webster, 2015; Blythman, 2017).

Dairy cow management systems vary from farm to farm, but can be broadly grouped into three system types: grazing, with cows predominantly at pasture; composite, incorporating a mixture of grazing at pasture and feeding inside sheds; and housing, where cows are kept in sheds year-round (DairyCo, 2012). While this categorisation was developed for herds in the UK where composite systems are most common (March et al., 2014), dairy farming globally also reflects these categories to a greater or lesser extent, for example with grazing systems predominant in New Zealand (Luo and Ledgard, 2021), housing most common in the US (USDA, 2008) and Canada (Barkema et al., 2015), and varying balances of the three in different parts of Europe (van den Pol-van Dasselaar et al., 2020). Despite the public's stated preferences for access to pasture, a progressive trend has been observed across both North America

and Europe for farmers to move cows off grazing land and into housed systems (March et al., 2014; Robbins et al., 2016b; van den Pol-van Dasselaar et al., 2020; Smid et al., 2021). Key in such a deviation from public preference could be differences of opinion about what good farm animal welfare means, with farmers and veterinary surgeons judging quality of care by health, nutrition and biological function (Vanhonacker et al., 2008; Spooner et al., 2012, 2014b) and the public instead viewing access to pasture as symbolic of good welfare and appropriate natural living (de Greef et al., 2006; Boogaard et al., 2011; Cardoso et al., 2019). As described throughout Chapter 1, this divergence risks placing the dairy industry at odds with societal expectations, threatening its future viability.

4.1.2 Bridging the gap

Weary and von Keyserlingk (2017) argue that in the interests of its own survival, the dairy industry needs sustained engagement with the public, to listen to concerns and be prepared to make changes to accommodate expectations. However, farming audiences have resisted both engagement and change on contentious issues (Benard and de Cock Buning, 2013; Weary and von Keyserlingk, 2017; Ritter et al., 2020). While people are more likely to reject opinions that conflict with their world view (Nickerson, 1998), research into intergroup relations suggests providing more information about the experiences and motivations of a group can change attitudes and increase empathy towards its members, which in turn improves tolerance for the group's perspectives (Stephen and Finlay, 1999; Klimecki, 2019). This raises the question of whether current understanding of public preferences for dairy farming systems remains too narrow, with research typically focused on features and 'headline' rationales rather than the experiences and motivations underlying the preferences. For example, both our first study described in Chapter 2, and Kühl et al. (2019) identify that respondents prefer cows to graze – yet we do not know what is understood by this preference or what outcomes it is believed to deliver; and while the public associate grazing cows with ideal living or optimal welfare in Cardoso et al. (2016) and Boogaard et al. (2010), how they formed those views is not explored. Gaining insight to these aspects could explain not just what public audiences prefer, but also why they feel this way and what they hope it will achieve. This in turn would offer opportunities

to persuade the dairy farming community to engage proactively in concerns they can better understand, empathise with or even share with the public.

4.1.3 A mixed methods approach

In considering how to obtain insight into these areas, two different approaches are suggested. First, qualitative research is often used to construct meaning around models or theories (Braun and Clarke, 2013; Tavakol and Sandars, 2014a; b), and thematic analysis of qualitative data in particular offers an opportunity to investigate and explain public preferences for different dairy cow environments. By contrast, quantitative methods create objective and generalisable results (Tavakol and Sandars, 2014a; b), and the application of quantitative linguistic analysis (a computerised method of analysing the frequency with which words in different categories appear within text or transcribed speech) to qualitative data, such as text or transcribed speech, allows word use to be linked to a range of underlying psychological processes (Tausczik and Pennebaker, 2010). Categories within linguistic analysis include functional words (e.g., pronouns, adverbs); punctuation (e.g., commas, question marks); and a range of specific topic areas (e.g., style and tone, words relating relationships, etc.). The degree to which each is used can be correlated to states or behaviours – for example, the use of positive emotion words and social process words (e.g., family, friends) have been found to be linguistic markers of extraversion (gregariousness and outgoing personalities) (Chen et al., 2020); and words associated with negative emotions, cognitive processing, and psychological distancing (where people step back from a situation in order to reduce stress or anxiety) have been associated with the period immediately following a disaster (Cohn et al., 2004).

While either the qualitative approach using thematic analysis, or the quantitative approach using linguistic analysis, could address this research question, combining qualitative and quantitative methods to form a mixed methods approach has the potential to draw on the strengths of both, providing additional insight where results agree, differ or add meaning (Meissner et al., 2011). Mixed methods approaches have been applied successfully to areas such as climate change communications (Chapman et al., 2016) and antimicrobial use (Doidge et al., 2021), where they have added depth and context to results.

4.1.4 Focus of research

Therefore, within this study we aimed to apply a novel mixed methods approach using thematic and linguistic analysis to address our second research question: ***"What can we learn about the underlying motivations and context behind public preferences for dairy cow environments, for example, access to pasture?"***

4.2 Methods

4.2.1 Study design

This study used a convergent mixed-methods design (Fetters et al., 2013). The same qualitative data collected from interviews were analysed both quantitatively and qualitatively, and then merged for the interpretation of results. An understanding of public opinions, attitudes, and experiences of dairy farm systems was developed through qualitative analysis; differences in the underlying style and tone of the participants views on different dairy farm systems was identified through quantitative analysis. General details about data collection, sample characteristics, ethics and positionality are all contained in Chapter 3.

4.2.2 Specific data collection

In the interview guide (described in Chapter 3 and contained in Appendix 3), descriptions of three different dairy farming systems (DairyCo, 2012) were introduced. For simplicity, a scenario describing a composite system where the cows spend winter in housing (albeit with an outside yard in this scenario) and summer outside grazing was described as 'Mixed'; a scenario describing a housed system where the cows lived in the same housing but year-round was termed 'Housed'; and a scenario describing a fully grazed system where the cows grazed outside year-round and only came inside for milking was called 'Grazed'. Each scenario was delivered using a verbal description and an artist's sketch of the system (Appendices 4 and 5). Descriptions of the systems and associated features were kept broad to maintain focus primarily on the location of the cow. Interviewees were asked general perceptions of the three scenarios including: preferred options for cow comfort and welfare; what was surprising,

uncomfortable or familiar; what they understood the cow's experiences to be; and why the farmer might farm in these different ways. During pilot interviews, the scenarios were presented in the order Housed, Mixed then Grazed. It was found that the Mixed scenario was the most complex for interviewees to assimilate, and the Housed scenario was the most impactful, both of which had a bearing on how well participants were able to retain information they had already received and take on board new information about the next scenario in line. As it was important that interviewees were clear the cow housing in the Mixed scenario was the same in the Housed scenario – all that changed was the length of time the cows remained in the housing – the Mixed scenario was finally placed first, followed by Housed, then Grazed, which meant the simplest scenario was placed last.

4.2.3 Qualitative analysis

Analysis of interview transcripts was aided by NVivo 12 (QSR International; www.qsrinternational.com) software. Data included for analysis related to the discussion of the three scenarios in the interview script (Questions 3, 3a, 3b, 3c in Appendix 3, alongside use of the scenario sketches and descriptions). Reflexive thematic analysis was used to uncover themes that elucidated how participants processed the information in each scenario, how they explained their reactions and what assumptions they made (Braun and Clarke, 2013, 2019). Analysis took a critical realism perspective to discovering meaning within the data through qualitative analysis (Maxwell, 2012) – in other words, despite different dairy farming systems existing in the real world, we aimed to construct subjective 'truths' about them from the perspectives of the interviewees. Coding was inductive and included both semantic and latent codes. The coding approach was shared with colleagues, who also test-coded several interviews for comparison, and reviewed proposals for grouping codes with shared meanings so they could be formed into candidate themes. Codes were arranged and rearranged repeatedly into different organising concepts with consequent adjusting of the candidate themes until a coherent narrative was developed that worked across groups of codes (Saldaña, 2015). The themes were again shared with colleagues to allow critical feedback and enhanced reflexivity (Smith and McGannon, 2018). A theme represented a central organising concept, and a sub-

theme, a specific element within this. These were used to create a theoretical 'map' (Figure 12), relating back to participants' reflections on the Mixed, Housed and Grazed scenarios themselves, or to features that could be associated with each, such as the cow being inside or out, or eating grass or 'non-grazed' feed.

4.2.4 Quantitative analysis

Linguistic Inquiry and Word Count (LIWC; http://www.liwc.net/) software was used to determine whether linguistic differences existed in the ways interviewees expressed their views about the Mixed, Housed and Grazed scenarios. LIWC offers over 90 language categories of words against which text can be analysed. The program searches for target words which match its pre-defined, validated dictionaries, and calculates their frequency across a range of linguistic and psychological process categories. LIWC software also contains algorithms which create four summary variables, calculated on a scale between 1 and 100 based on large comparison samples (Pennebaker et al., 2015b). In preparation for analysis, spoken texts relating specifically to each of the three scenarios (Mixed, Housed and Grazed) were separated out for each participant. Dialectic words were corrected to standard English to ensure they would match the LIWC dictionary, and data fragments judged insubstantial in content and length were discarded. To reduce risk of observations with low word count disproportionately influencing results, we removed all data from participants with fewer than 130 words in one scenario or more (based on Valenti et al., 2021). This left 49 observations from the original 60. A majority of LIWC word categories were judged irrelevant for this analysis due to their area of focus or their unsuitability for analysing abbreviated data fragments. Ultimately, 13 word categories alongside the four summary categories were selected for analysis; meanings and examples for these are summarized in Table 7. Data relating to each scenario were uploaded to the LIWC software, and mean and median values of the relative frequencies of word categories for all participants' texts for each scenario were calculated in Stata 16 (Stata SE/16.1, Stata Corp., College Station, TX, US; www.stata.com). Statistical analysis was then conducted in SPSS Statistics 28 (IBM SPSS Statistics for Windows, Version 28.0. IBM Corp., Armonk, NY, US; www.ibm.com). The probability of significant differences ($P \leq 0.05$) between ranking for the Mixed, Housed and Grazed scenarios by the same

Table 7. Explanation of the candidate variables used in the quantitative analysis, adapted from Pennebaker et al. (2015a;b) and Tausczik and Pennebaker (2010).

Variable	Explanation
Summary variables	
Analytical thinking	Scored from 0 to 100 using percentiles. A high score reflects a more formal way of thinking; a low score reflects a personal, narrative style of thinking.
Authenticity	Scored from 0 to 100 using percentiles. A high score indicates an honest, personal style, whereas a low score indicates a guarded, distanced style.
Clout	Scored from 0 to 100 using percentiles. A high score reflects a more confident style, whereas a low score reflects a more tentative style.
Emotional tone	Scored from 0 to 100 using percentiles. A high score indicates a positive tone, and low score indicates a negative tone.
Word category variables	
Cognitive processes	Count of a broad range of words spoken by an interviewee indicating thinking and cognitive processes e.g., cause, know, ought; an overarching category that includes certainty, differentiation, discrepancy and tentative below.
Certainty	Count of words reflecting certainty spoken by an interviewee e.g., always, never.
Differentiation	Count of differentiation words spoken by an interviewee that distinguish between concepts or entities e.g., hasn't, else, but.
Discrepancy	Count of discrepancy (or aspirational) words spoken by an interviewee e.g., should, would, could.
Tentative	Count of tentative words (denoting uncertainty) spoken by an interviewee e.g., maybe, perhaps.
Drives	Count of words spoken by an interviewee that represent drives and needs, including achievement, power and reward; an overarching category that includes achievement, power and reward below.
Achievement	Count of achievement words (denoting optimism) spoken by an interviewee e.g., success, better.
Power	Count of power words (denoting hierarchy or authority) spoken by an interviewee e.g., superior, bully.
Reward	Count of reward-based words spoken by an interviewee e.g., take, prize, benefit.
Negations	Count of negations spoken by an interviewee, suggesting rejection or inhibition e.g., no, not, never.
Negative emotion	Count of negative emotion words spoken by an interviewee e.g., hurt, ugly, nasty.
Positive emotion	Count of positive emotion words spoken by an interviewee e.g., love, nice, sweet.
Perceptual processes	Count of perceptual process words spoken by an interviewee, concerning senses and perceptions e.g., look, heard, feeling.

participant was evaluated using the Friedman test for non-parametric related samples. Variables showing significant differences underwent a post-hoc pairwise comparison test, with the subsequent application of Bonferroni's correction.

4.2.5 Integration of qualitative and quantitative results

To assess the 'fit' of the data, both quantitative and qualitative results were presented in a table showing the possible convergence, complementarity, expansion, and divergence outcomes. Convergence is where qualitative and quantitative analysis gives similar results, thus enhancing credibility of the findings (Morgan, 2019). Complementarity refers to when quantitative and qualitative results cover multiple, non-overlapping aspects of a topic. Expansion is when qualitative and quantitative analysis provides both a central overlapping and a broader non-conflicting interpretation (Fetters and Molina-Azorin, 2019). Finally, divergence is when quantitative and qualitative analysis lead to different or conflicting interpretations.

4.3 Results

4.3.1 Qualitative results

Two central themes relating to perceptions of the three systems were developed from the data. The first was Dual Visions, in which participants had both a Domestic Vision and a Wild Vision for the cow. The second was Confessed Ignorance in which participants used various strategies to overcome a lack of knowledge about the cow's needs; these were captured in the sub-themes of accessing Salient Memories, Anthropomorphisation, and Deferring to Others. Anonymised data excerpts have been provided to illustrate the themes and sub-themes that were developed.

4.3.1.1 Theme 1 – Dual visions

The dairy cow was constructed by many participants as both a domestic animal bred by humans and therefore reliant on them, and a wild creature with roots in the natural environment. Rather than being seen as wholly domesticated or wild, she encompassed aspects of both. This made her hard to categorise and – consequently – hard to define in terms of her needs.

Participant 1: "See the trouble with this one is that you never think of cows as wild animals, if you follow, do you know what I mean? I don't think of it, not as a domestic animal, but not as a wild animal like the Dartmoor ponies or something."

Participant 42: "I just think because they are… they're wild animals, aren't they really…they're not like lions and tigers but they've gotta be outside to get the best, I would imagine, from the grass, the pasture…They're not domesticated either, they're sort of in between, aren't they?"

Sub-theme – Domestic Vision

Integral to the domestic vision of the cow was participants' understanding that the cow's life was dependent on humans, and therefore humans (mainly farmers) bore a responsibility for her wellbeing. She was owed care, management and protection when needed. This manifested in a range of perspectives about the optimum environment for the cow. Part of the domestic vision for the cow was the healthcare she was owed by the farmer. A number of participants thought the cow could be more proactively cared for inside housing, as there she was under the eye of the farmer. One reason interviewees believed farmers would opt for the Housed scenario was to have better oversight of the cow.

Participant 23: "…farmers can check up on the animals better if they're more confined, like checking their health, wellbeing, any injuries or stuff."

Participant 1: "…in that [Grazed] *scenario…if they don't take them anywhere when they're calving then they could die in that corner, the mother and baby can die."*

Indeed, it was observed by one participant that while the activities that took place within the building in the Housed and Mixed scenarios were largely unknown, the structure did represent care, attention and supervision for the cow.

Participant 22: "[The Grazed scenario] *is, I suppose, more organic and live or die based on what is happening in these spaces, so there might be a black box* [in Mixed and Housed] *but I do believe that within the black box there's vet visits and things like that…"*

Most participants believed the cow could be better protected from a wide range of dangers including wild animals, people, traffic, pollution and the weather when she was inside, and this was part of the farmer's duty to her care.

> *Participant 42: "…these* [Grazed scenario] *cows are gonna suffer, it doesn't matter how big they are, they're gonna suffer because they don't seem to have any sort of protection at all here apart from going into the milking parlour."*

> *Participant 16: "..there are quite a lot of badgers around, you know, on the farm or in the area and farmers are not very keen on killing the badgers on purpose. It's possible, so that's why they would keep animals inside, for protection."*

The farmer was also seen to be broadly responsible for the cow's nutrition as part of domestic duties, but this was especially the case when she was not being grazed. 'Non-grass' feeds were perceived by many as being less nutritious or desirable than fresh grass, containing chemicals or being of poorer quality, and were distributed at the behest of the farmer rather than when the cow wanted them.

> *Participant 6: "… if the farmer's physically feeding them, there's probably a limited supply of food for them at any one time, whereas if they're outside, if they're a bit peckish they can just eat a bit more grass."*

> *Participant 40: "I would've thought happier…getting good nutrients, cows would produce good milk, which of course they probably will be getting from chemicals in their feed, but it's unnatural, isn't it?"*

For some, the term 'comfort' was interpreted as emotional wellbeing or space to move, but was also seen as a domestic construct associated with access to the dry and warm with beds to lie in.

> *Participant 36: "…that it's comfortable, they've got enough... it's not just hard floor, they've got probably straw, anything they need, they've got that little bit of space to wander round."*

Participant 50: "I would imagine for them to have a nice place to sleep, I think cows eat hay or they lay in hay and straw, a comfy bed, comfy place to stay in the winter like a barn, stuff like that."

A number of participants commented on the 'artificiality' of milking the dairy cow, which was seen as part of her domestication, and the length of milking time was perceived by several interviewees to vary according to the scenario in which they were living.

Participant 48: "I mean you could argue that milking them with a machine is unnatural, but they have to be milked. …how else, other than normal calf production, which wouldn't be any good for a farming business, the cows wouldn't get milked, so it has to be, yeah."

Participant 4: "[In the Housed scenario] *…it's a case of there's a machine on there all day every day …because they're just more intensely milked, aren't they? …cows are milked naturally in* [the Grazed scenario]*;* [in the Housed scenario] *they are just banged up to the machines and they're just away all the time. Yeah, they're on for more hours than they are in* [the Grazed scenario]*."*

While some felt being milked might be a positive 'release' from full udders, a number of participants raised concerns that milking was a negative experience, and felt cows would be happier if they could fully escape sight of the milking facilities. Therefore, in the Housed and Mixed scenarios, the milking facilities, as an integral part of the housing, were intrusive and constantly reminded the cow of a potentially distressing experience.

Participant 45:" I don't like the idea that everything is all in one place and they're all together – I think I prefer [the Grazed scenario] *over* [the Housed] *just because the milking station is separate from their living station, and I think particularly if the milking process is in any way stressful or not a process that they like then I'd like to think that that was a very isolated part of their daily life."*

Finally, mastitis was associated with milking by several participants, and in turn with being kept in unsanitary conditions inside rather than a cleaner environment out in a field.

> *Participant 58: "…the fact that they can get infection on their udders…whereas I think that obviously good welfare for them would be you would expect having the chance to go outside and obviously seeing a clean environment for them…"*

Sub-theme – Wild Vision

The cow's wild heritage was recognised by most participants. This was expressed in several ways encompassing the cow's autonomous life with her own kind as well as her need to have fresh air, space and exposure to the elements. As part of her wild persona, most participants believed the cow needed to be in contact with weather and 'nature'. Allowing cows outside was important in satisfying an inherent need for naturalness, allowing contact with sun and clean air, plants and other creatures, and space to roam and be free; but from this she had better welfare and nourishment; the Grazed scenario or Mixed scenario in the summer were seen to offer those opportunities.

> *Participant 60: "Sun, exercise, and just being in nature, rather than cooped up, not seeing much daylight type thing."*

> *Participant 28: "I think [Housed is] cruel to the animals because it's in their nature to …chew the cud, to go into the field and chew the cud, and be in the sunshine as well. To be in that small space in a yard, that's not natural, it's against a cow's nature."*

> *Participant 24: "So she's out in the weather, she's got a choice of plants that she can eat, it could be the grass but there are other herbs and stuff that grow that she's got a choice of eating, sometimes you see them nibbling on tree leaves as well. There's the ability to roll…"*

Space was an important factor in the cow's wildness, giving her freedom and autonomy to go where and do what she wanted.

Participant 32: "I just think in [the Grazed scenario] the cows would be happier. Yeah, I just think in terms of welfare it's got to make a difference that they have freedom to roam, whereas if they're indoors for most of the time and just have a smaller space to wander about in that seems less…it is less natural."

Participant 55: "I'd still far rather they were able to be outside and free roaming and grazing and doing what they want and being less structured than being confined all the time."

The provision of an outside yard made the Housed scenario more acceptable for some, but did not compensate for the cow being unable to access a bigger area, or go to pasture and graze.

Participant 43: "…[the Housed scenario] to me is equivalent to a human being put in a prison cell and given access to the exercise area once a day or it could be ad lib*, but I would doubt it would be* ad lib *on this, but being given access to walking around a concrete yard, and you might have some social areas where you could play pool but you've also got your cell. So that to me is not ideal."*

The feelings were less pronounced with the Mixed scenario; while the yard was seen to improve the quality of the housed winter period, summer access to pasture reduced its importance.

Participant 28: "I think it would fit the UK climate better that they could be indoors during the wintertime, especially if it's icy and snowy. But yeah, I mean the yard is fine so long as they're allowed in the field…"

Cows were recognised as an autonomous species with a social hierarchy and evolved relationships which mirrored those of humans but were distinct from them. Cows could better express their innate 'intraspecies' social behaviour in an outside environment.

Participant 5: "I'd imagine she's quite happy in the fresh air with her … friends."

Participant 22: "I would like to see them with space to roam, to be social."

Participant 55: "…that opportunity for them to have space and to be social in the outside… sounds like they're all friends and having a chat in the garden or something, doesn't it, personally would be preferable to me."

Summary – Reconciled Duality

Acknowledging the duality of the cow, most participants found that the Housed scenario alone did not meet the needs of the cow, as it deprived her of her need to be 'wild' when oversight and protection were not needed. However, her parallel domesticated status meant she required protection and oversight, and many also felt she would be vulnerable if outside constantly. Participants therefore deduced that the wild and domestic needs of the cow could be best met within the Mixed scenario, which could provide an optimal balance.

Participant 6: "So to me [Mixed] *… it covers both angles, so they're being looked after all year round then I think."*

Participant 11: "…they've got the best of both worlds, their natural environment in the summer and out of the elements and well looked after in the winter."

Participant 21: "…a good compromise for the British climate, that the cows can't be out all the time, so for their welfare, it's probably better that they're indoors for winter. They probably wouldn't survive outdoors, at least not in northern climates. So, I think that's a perfectly reasonable way of giving the cows the best that they can get."

Participant 53: "Six months inside, six months outside, it's that halfway point, isn't it?"

4.3.1.2 Theme 2 – Confessed Ignorance

Many participants, when pressed, confessed to a lack of knowledge about dairy farming, the cow's needs and her optimal environment when asked to explain their preferred scenarios.

Participant 2: "99% of us really have no clue what happens with our food really and what processes it goes through and how most of the animals are … we all assume we've got basic levels of basic laws and regulations around welfare and things, but I imagine even those laws are governed not just by welfare but by economic factors as well."

Participant 17: "…where they're out all the time just makes me wonder about what is actually best for cows. That might not be being outside in all weathers. It's not something that I know about either way really and it might well depend on the type of cow. So that could be something that works out well in terms of welfare or doesn't, I'm not sure."

Several strategies were therefore employed by participants to overcome this absence of knowledge, each of which had a bearing on preferences for different scenarios.

Sub-theme – Salient Memories

One way of managing lack of knowledge was to weigh up the scenarios against salient memories. These included childhood memories but also impactful imagery which generated subjective emotional reactions to the three scenarios. To illustrate, almost all interviewees referred to having seen a cow or cows for themselves, mostly in surrounding fields from car windows, on walks or – less frequently – during visits to farms. Half could recount childhood experiences of cows and farms, with a few specifically mentioning growing up or working on a farm and some recalling one or more encounters with a particular farm or farmer. Specific news or documentary items about cows were brought up by a third of interviewees, and some mentioned animal rights or campaign group materials or activities they knew about. The majority of interviewees referred to a fictional TV or radio program, book, film or image that included dairy farming. When referring to personal experiences, the preferred scenario usually involved grazing or access to pasture with cows visibly in fields as opposed to cows in barns, although the physical structure of the shed or milking area was sometimes part of this familiar vision.

Participant 9: "I suppose [the Mixed scenario is] *the one that I've been brought up with…So the one that I would most identify with."*

Participant 18: "And [the Grazed scenario]*, I suppose I've seen some farms where this is how things are, where they are kept out in the open field most of the time, and as you pointed out, they just go in for the milking."*

Conversely, many participants were particularly unfamiliar with the concept of leaving dairy cows outside in the winter, as in the Grazed scenario. This led to expressions of surprise or disbelief, and conclusions from many that the practice was likely to be harmful to the cows or part of a commercially unviable enterprise. In turn this created reservations about the Grazed scenario among those who might have otherwise supported it.

Participant 21: "…it's somebody who's got possibly high principles and is looking for a niche market…"

Participant 22: "[The Grazed scenario] *is an idealised version and somebody who's an ex-boy band star who has plenty of money can maybe indulge himself … but as a self-sufficient exercise, I don't think* [the Grazed scenario] *would work."*

Participant 30: "I just feel uncomfortable about the fact that they would be out all the time, it doesn't seem right."

The Housed scenario was also unfamiliar to some, but many were aware of it without having had personal experience. Instead, these interviewees felt familiarity with the scenario through media such as TV reports or campaign footage and other 'second-hand' portrayals. They were universally unfavourable towards it, some expressing strong emotional reactions, and it was commonly associated with how dairy farming might be in 'other' countries, such as the US. The system this scenario represented therefore appeared notorious rather than familiar.

Participant 25: "… I've heard about some battery cow farming where they're barely allowed to move and not allowed out at all. I don't know if any of those exist in this country, but I hope not."

Participant 27: "I mean I saw on TV, you know sometimes it happens that I've seen on TV, so that's why I go this kind of a little bit more thinking of these kinds of barns. Yeah, basically, the cows, they're always inside."

Sub-theme – Anthropomorphisation

A second strategy to overcome ignorance about the cow's needs or optimal environment was to speculate through anthropomorphisation, which generally employed a subjective or emotional narrative and was mostly critical of the Housed scenario.

> *Participant 10: "It's like telling us to stay in … 24 hour…Would we like to have that happen to us? I don't think the cattle would like it."*
>
> *Participant 45: "I just think we wouldn't like it, would we, if we had to sleep in our kitchens or sleep in the toilet or feed in the toilet…"*

The perception of a closed environment suggested to many – even with these interviews taking place before the global COVID pandemic starting March 2020 – there would be smell, humidity and disease inside the cattle housing from too many bodies in one space and not enough air, such as people experience in stuffy rooms or on crowded transport.

> *Participant 14: "…germs do tend to disperse more in the open air than they do when there's a lot of animals – doesn't matter whether they are cows or people – in a small room. I do a lot of theatrics and if one person in a play gets a cold, everybody gets a cold or flu ..."*
>
> *Participant 7: "I was thinking about people when I said if the thing is kept indoors for too long and it's breathing in stale air and it's living… a big group inside a tight pen, they're picking up sweats, respiration from all the other creatures, and again, disease will spread. Compare a tight pen to a cramped train for commuters."*

Many interviewees rationalised what it might be like to be inside all the time from the perspective of insufficient freedom to move around, and being unable to change your surroundings or who you spend time with.

> *Participant 35: "I'm thinking if I was stuck in a room all year and wasn't allowed out, I'd go mad. They must feel better to be outside and have a little bit of freedom rather than having to stay in a particular pen or being told move from that side to that side."*

Participant 49: "…just like if we were put in a room with people, you might have a farmer sitting at the side of that person for 5 minutes, but you don't spend six hours sat at side of them, whereas they would in there…"

It appeared that housing *per se* was not the problem for many, as a number commented on their own appreciation of the warmth and safety of their homes, or how they sometimes simply did not want to venture out e.g.:

Participant 23: "…there's days where we don't wanna go outside so why do the cows have to go outside?"

Instead, it was the permanency and lack of choice which, some felt, might affect the cow's mental health as it would affect theirs, or even create a type of institutionalised depression.

Participant 16: "Yes. I think they definitely are mentally happier if they go outside and fresh air. No amount of room if you open all the windows in the house, it still doesn't feel the same as being outside, isn't it?"

Participant 8: "Learned helplessness, so they've kind of learnt not to want more. So, if you opened up the field to them, they wouldn't go because it is just not even on their radar to attempt it."

Sub-theme – Deferring to Others

The last strategy faced with an absence of knowledge was to defer to others – because they knew better or because it was in others' hands whether preferable outcomes could be achieved in each scenario. As this absolved the participant of the responsibility of choice, no clear preferences for Mixed, Housed or Grazed systems emerged and this is where the Housed scenario was most likely to receive (albeit lukewarm) support and the Grazed scenario least censure for lack of shelter. Those to whom participants deferred included the farmer, who was acknowledged by many as the main carer for the animals and the one most invested in and therefore most likely to make optimal choices of environment for the animals.

Participant 21: "I think the gut reaction for most people would be to say oh well, this one is the worst, [Housed]*, because they're indoors all the time, but I think if it's well-managed they should all have equal comfort and equal welfare."*

Participant 43: "…most farmers I would think, they love their animals, especially the small farmers, they know their animals, they don't have to look at the ear tags to know which animal's which, they know when the animal was born, and they were probably raised on the farm or when they brought it in. So yeah, they love their animals, and they want to keep them in the best possible conditions for the animal and for them."

However, this could also take a more negative tone when participants acknowledged the power of the farmer to be the key determinant of welfare – good or bad – and irrespective of system.

Participant 6: "You don't know what the farmer's like, so – you might have the loveliest farmer that keeps them indoors all the time and then you might have a horrible one that doesn't really care about them, but they've got the option of being outside."

Participant 41: "At the end of the day it's gonna be the farmer's own perception of what he's gonna do, how he's gonna do it and I suppose as long as he's within guidelines that they've got that's the way he'll do it."

Other participants deferred responsibility for optimising the cow's living conditions to authority figures such as supermarkets or regulators, whether governmental or voluntary e.g., farm assurance schemes – although there were varying degrees of trust in these.

Participant 31: "…it doesn't bother me 'cause I know in all scenarios they're all looked after. 'cause they have to in this country… 'cause our standards of farming is usually one of the highest in the world. As far as I know, the Red Tractor, Soil Association, and that."

Participant 52: "…most farmers are OK…they wouldn't stay in business long, I don't think, because they're tied in with like [supermarket A], [supermarket B]*, they're chosen, aren't they? And inspected by them, possibly. Oh, and what's Defra* [government department]*, what do they do?"*

It was particularly identified by some participants that the decisions made by retailers may not always be optimal in terms of the cow's environment.

Participant 13: "I think it would take the supermarkets to drive a demand for better welfare rather than the farmers because if they have very low profit margins, they are not going to want to eat into those profit margins and possibly make a loss by buying more land and giving the cows more freedom."

The last entity participants deferred to when they were not sure of what to make of a scenario was the cow herself. This led to noticeable support for the concept of cow agency or choice within the interviews. If the cow was left to decide, she would know best what was good for her. In fact, participants said that while the Mixed scenario allowed the 'best of both worlds' or a good 'halfway house', the ultimate scenario would be one in which the cow could always decide which environment she was in – which for a couple of participants, meant the Housed scenario.

Participant 15: "I think yeah, the cow's choice should be the most important thing. So, if there is a way of getting that set up and it's through the cow's choice, I think that sounds like the best thing and I think I'd be happy with that trade-off against human contact. Yeah, just that the cows have the choice, I think that's quite an important thing."

Participant 12: "…having that option to get outside, being able to eat when they want, having that time to move around in the space, I would see that as good welfare."

Participant 54: "…that's why I found [Housed] *a bit more attractive … it'd be nice for them to have an autonomy I suppose to come and go…. obviously with the farmer they've got some kind of part of the process, but I think it's important that they do have their choice to come and go as they please."*

4.3.1.3 Visual summary

After consideration of the qualitative results, we were able to propose a visual summary of how the public might make decisions about the appropriateness of a dairy farming system containing different periods of housing and grazing. Figure 12 describes a multi-faceted thought processes, illustrating both positive and negative relationships to all three systems as summarised in the Mixed, Housed and Grazed scenarios.

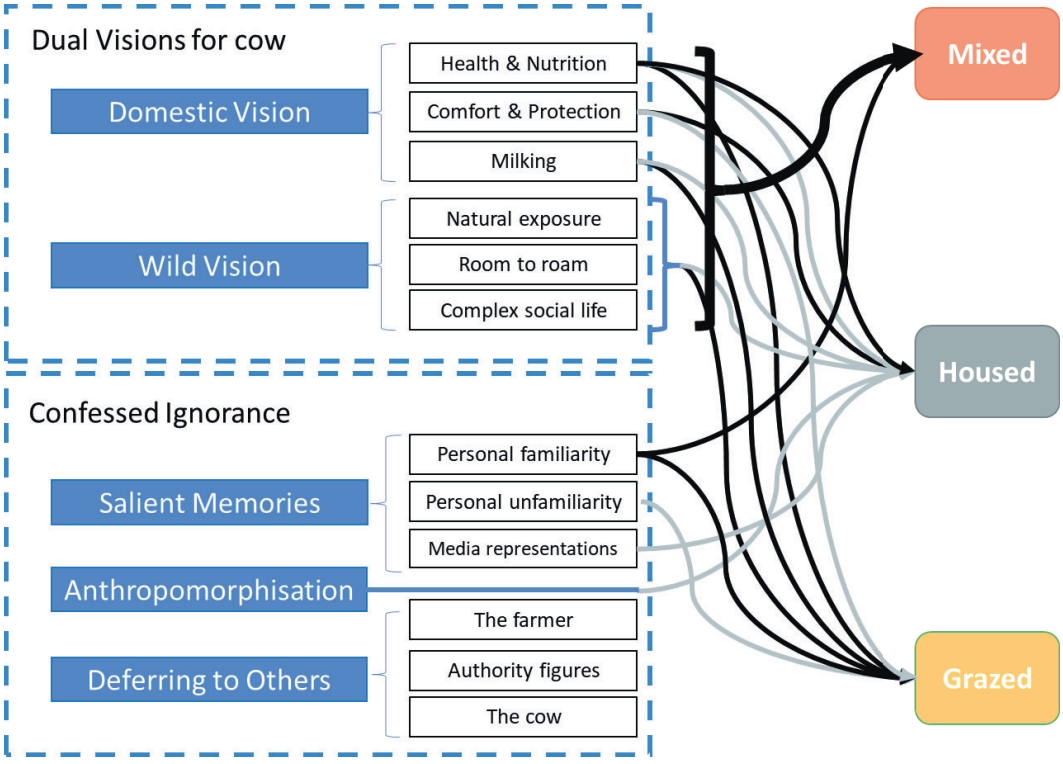

Figure 12. Visual summary showing interpretation of three scenarios, with positive (dark) & negative (light) relationships between scenarios and theme components

4.3.2 Quantitative results

Linguistic analysis of transcribed speech relating to each scenario augmented the qualitative findings within the data. Of the four summary variables calculated algorithmically by the LIWC software, three showed significant differences when analysing text from the transcripts relating to the different scenarios. These variables were: Analytic thinking, indicating a formal versus narrative style of thinking; Clout, indicating confidence versus tentativeness; and Emotional tone, indicating positive

versus negative emotion (Pennebaker et al., 2015a). Of the variables calculated from word counts, four of the 13 initially identified as relevant to the research question showed significant differences when analysing text from the transcripts relating to the different scenarios. These were the use of: Negation words, indicating inhibition; Cognitive process words, indicating the application of thinking; Discrepancy words, indicating aspiration; and words indicating Achievement. The mean and median scores for these variables are summarized in Table 8, where significant relationships, identified through a post-hoc test, are also identified.. Relationships where the high or low scores for each variable related to the Mixed, Housed and Grazed scenarios are illustrated visually in Figure 13.

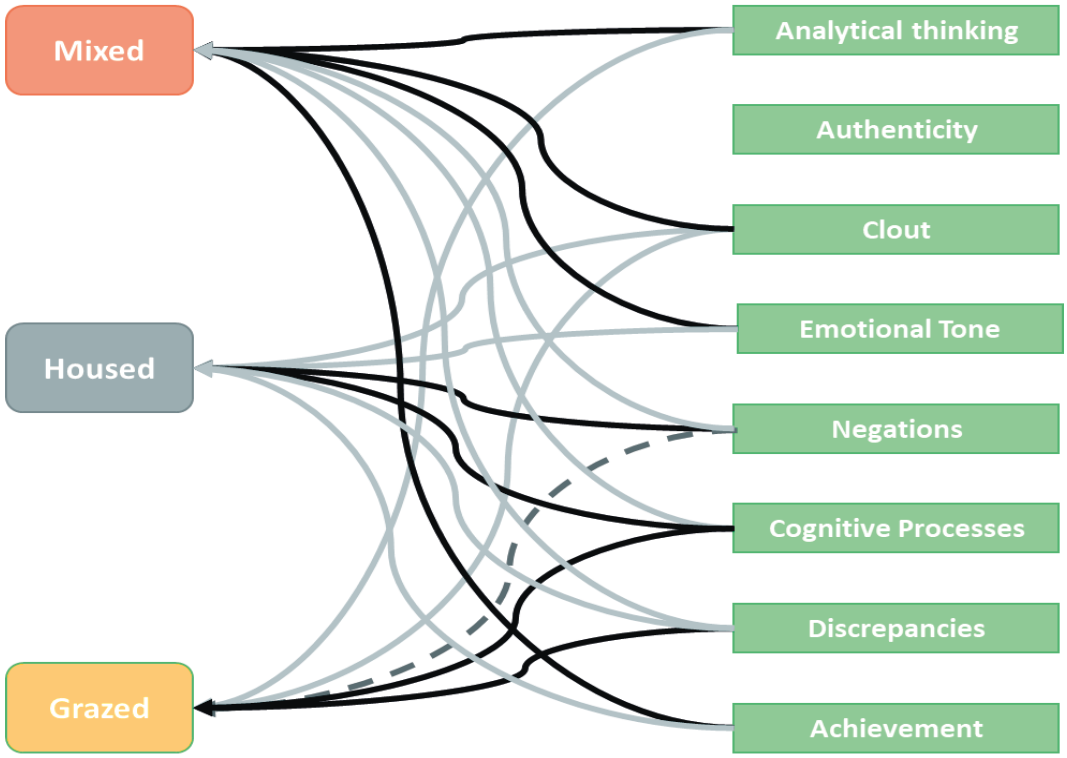

Figure 13. Visual summary of the linguistic analysis of speech relating to the three scenarios, showing significant high scoring relationships (dark), significant low scoring relationships (light) and one significant mid-score relationship (dashed)

Table 8. Mean and median scores for the Mixed, Housed and Grazed scenarios, with Friedman and pairwise post-hoc test results (Bonferroni correction applied)

Language variables	M (mixed housing/grazing)		H (fully housed)		G (fully grazed)		P value	Post hoc test significant relationships P≤0.05
Summary words	**Mean**	**Median (IQR)**	**Mean**	**Median (IQR)**	**Mean**	**Median (IQR)**		
Analytical thinking	36.27	35.45 (22.96-48.71)	27.90	26.19 (16.08-38.90)	27.78	24.58 (17.11-39.69)	<0.01	M-G
Authenticity	57.16	54.89 (40.89-75.43)	58.32	62.75 (44.97-73.19)	53.94	55.41 (42.32-69.62)	NS	
Clout	44.83	42.58 (34.84-55.48)	34.60	32.86 (25.28-39.62)	37.12	37.18 (25.81-47.77)	<0.001	M-H M-G
Emotional Tone	74.19	82.87 (58.54-90.18)	58.72	58.62 (40.35-77.21)	61.90	62.02 (44.83-85.64)	<0.01	M-H
Word categories	**Mean**	**Median (IQR)**	**Mean**	**Median (IQR)**	**Mean**	**Median (IQR)**		
Negations	1.68	1.68 (0.80-2.38)	3.43	3.37 (2.52-4.28)	2.68	2.68 (1.61-3.60)	<0.001	AP
Cognitive processes	16.25	15.58 (14.52-17.45)	18.24	18.53 (15.20-20.21)	19.00	18.12 (16.49-20.42)	<0.001	M-H M-G
Discrepancies	3.13	3.19 (2.13-4.08)	3.08	3.37 (1.93-3.99)	3.79	3.56 (2.75-4.94)	<0.01	M-G H-G
Achievement	1.19	1.14 (0.64-1.65)	0.65	0.48 (0.32-0.94)	0.92	0.76 (0.42-1.39)	<0.05	M-H

M-H = probabilities different between Mixed housed/grazed scenario responses and Housed scenario responses; M-G = probabilities different between Mixed housed/grazed scenario responses and Grazed scenario responses; H-G = probabilities different between Housed scenario responses and Grazed scenario responses; AP = probabilities different between all pairs of scenario responses; NS=Not significant.

4.3.3 Integrated results

The integrated quantitative and qualitative results indicated potential convergence, complementarity, expansion, and divergence between the qualitative and quantitative results (Fetters and Molina-Azorin, 2019; Morgan, 2019). Convergent results were observed in four areas: the cow's perceived domestic and wild duality was logically addressed by the Mixed scenario; this was further confirmed through optimism expressed towards this scenario; the subjective manner in which views of the Housed and Grazed scenarios were formed matched indications of informal and narrative thinking; and verbal negations reflected the unpopularity of the Housed and – to a lesser extent – Grazed scenarios. Expansion results were also observed in four areas: familiarity with the Mixed scenario and its 'halfway house' status meant it required least cognitive effort to understand; similarly, familiarity with this scenario appeared to give respondents more confidence when discussing it; by contrast, lower confidence when discussing the Housed scenario could be explained by lack of personal experience; and the subjective judgement of scenarios appeared to be associated with strong positive or negative emotional reactions. Only one divergent result was observed: this concerned lower support for the Grazed scenario yet a high discrepancy score, suggesting most aspiration. This contradiction was interpreted as recognition that being at pasture at all times should be optimal for the cow – yet lack of care and oversight detracted from this support. No complementarity results were identified. These integrated results are summarized in Table 9, and examined in more detail within the discussion.

Table 9. Integration of qualitative and quantitative results, suggesting convergence, complementarity*, expansion and divergence in participants' views of the three scenarios

	Qualitative results	Quantitative results
Convergent results	The Mixed scenario is concluded by participants to best address the cow's domestic and wild duality	Analytical thinking score is highest for the Mixed scenario
	Views on the Housed and Grazed scenarios are partly formed through salience and anthropomorphisation, which are subjective mechanisms	A low Analytical thinking score indicates more narrative, informal language used to discuss Housed and Grazed scenarios
	The Housed scenario is unpopular across most themes and their components; the Grazing scenario attracts both support and reservations, and the Mixed scenario is widely supported	The Housed scenario has the highest Negations score, Grazed has a medium score and the Mixed scenario the lowest
	The Mixed scenario is concluded to best address the cow's domestic and wild duality	The Achievement score is highest for the Mixed scenario
Expansion results	The Mixed scenario is most personally familiar, and intuitively a good 'halfway house'; the Grazed and Housed scenarios are, respectively, largely unfamiliar and known mainly from media representations	Cognitive processes score is low for the Mixed scenario and higher for both the Housed and Grazed scenarios
	The Mixed scenario is personally familiar	The Mixed scenario is spoken about with the greatest Clout (confidence) as shown in the highest score
	Views on the Housed scenario are partly formed through media representations – which are 'second-hand' portrayals	The Housed scenario is spoken about with least Clout (confidence) as shown by the lowest score
	Salient memories and anthropomorphisation, through which the Housed scenario is rejected, and the Mixed scenario supported, are subjective vehicles which aid decision-making	The Mixed scenario has the highest Emotional Tone score (indicating positive emotion) and the Housed scenario the lowest (indicating negative emotion)
Divergent results	The Mixed scenario is supported; the Grazed scenario is caveated by its failure to deliver on the domestic vision, particularly protection and oversight, which detracts from support	Score for Discrepancies is highest for the Grazed scenario, suggesting high aspirations or expectations

**No complementarity found*

4.4 Discussion

In our analysis, we uncover unique insights into understandings, motivations and thought processes behind preferences for different types of dairy farming systems involving varying amounts of housing and grazing. Both Dual Visions and Confessed Ignorance themes identified through qualitative analysis are original to this field, and have been expanded by the novel application of the mixed methods approach encompassing reflexive thematic analysis and linguistic analysis. To our knowledge, this is the first time such insights have been elicited, and the findings suggest how communications or farming systems could be adapted to address a range of concerns. We will now discuss the findings within the context of the three scenarios.

4.4.1 The Mixed scenario

A key factor in support for the Mixed scenario, representing a system housing cows for winter months and grazing in the summer, is how it reconciles the domestic and wild personae of the cow in the Dual Visions theme. Different aspects of managed domesticity or autonomous wildness have been well-studied within scientific and popular literature, for example: exploring the social relationships between cows (Young, 2017; de Freslon et al., 2020); concepts of naturalness in farm animals (Musschenga, 2002; Špinka, 2006; Beaver et al., 2019); and the domestication of the cow to become a co-worker with people (Porcher and Schmitt, 2012; Hansen, 2014). However, our theme appears most appropriately reflected in concepts captured in *Zoopolis: A Political Theory of Animal Rights* (Donaldson and Kymlicka, 2011). Within this theoretical approach to animal rights, animals are domesticated, wild, or liminal (living on the peripheries of humans but not with them). In our study the cow is seen as simultaneously domestic and wild which, according to the theory, this would mean she is a domesticated 'co-citizen' as if living with humans, having rights, consideration, inclusion in decisions, and agency; but she is also a sovereign wild animal with her independent social structures, habitats and customs. Certainly, the perception of the farmer's duty of care to the cow and her rights to a certain standard of living echoes this concept – yet her standing in human society appears more akin to 'wardship' than 'co-citizenship', where cows are treated humanely but have no real say in wider

society (Donaldson and Kymlicka, 2011, p101-102). It is also posited that dairy farming is especially problematic to this theory of citizenship due to the perceived negative effects on the animal from her work meeting human needs (Donaldson and Kymlicka, 2011); this might explain our participants' desire to see the cow as wild and afford her contact with the elements and natural environment as a compensation for her efforts.

Thus the tension between meeting the needs of the Domestic Vision and the Wild Vision leads to support for the Mixed scenario, reflected linguistically in it receiving the highest score for Analytical thinking (Pennebaker et al., 2015b). Additionally, the linguistic analysis results for the Achievement variable confirm the Mixed scenario is most associated with language indicating optimisation, 'better' or 'best'.

Support for the Mixed scenario as the optimum environment for the cow is also evident within the Confessed Ignorance theme, for which the mixed method results indicate heuristics and emotions at play. Heuristics, or cognitive biases, are mental shortcuts which people employ when they need to make either rapid judgements or decisions when there is a lack of information (Kahneman et al., 1982), and can be considered as an antithesis to logic. The low Cognitive Processes score for the Mixed scenario supports the premise that this scenario carries cognitive ease (Pennebaker et al., 2015b) and is likely to be chosen by participants as a good intuitive 'fit' for the cow.

The effect of a sequence has been examined in a number of psychology-related studies, finding that when a sequential array is offered, people tend to opt for the central choices – those 'in the middle' (Nisbett and Wilson, 1977; Rodway et al., 2012; Nadler et al., 2015). While this effect has mainly been studied in terms of positionality of the options on offer, the 'centrality' of the Mixed scenario sitting between the other two scenarios could play a role. Similarly, the sub-theme of salient memories, suggesting a link between the personal familiarity of the Mixed scenario and the confidence with which it is discussed – as expressed through the high Clout score (Pennebaker et al., 2015b) – is another heuristic at work. Familiarity and salience – or prominence and memorability – have been found to increase likelihood of an option being selected; this effect is hypothesised to stem from evolutionary learnings where familiarity is less likely to lead to harm, thus it becomes a heuristic for minimising risk, and focusing on the most pertinent options is more resource-efficient (Kahneman et

al., 1982). Lastly, emotion is found to play a role with the Mixed scenario attracting the highest Emotional Tone score. A higher score indicates an upbeat, positive style, whereas low values are associated with greater anxiety, sadness or hostility (Pennebaker et al., 2015b). This positive emotion could be reinforced by positive subjective memories of the Mixed scenario, as this was the most familiar.

4.4.2 The Housed Scenario

By contrast, the Housed scenario, representing systems which house dairy cows year-round and do not include grazing, is least favoured across all results. This is consistent with studies examining public preferences for dairy farming which find that systems incorporating grazing are almost always preferred by the public by some significant margin (Schuppli et al., 2014; Weinrich et al., 2014; Hötzel et al., 2017). Here, while the protection, comfort and oversight afforded by the Housed scenario is appreciated within the Domestic Vision sub-theme, the lack of access to a natural environment appears an unacceptable trade off to many participants across both main qualitative themes. This converges with this scenario having the lowest score for Achievement, and the highest for Negations which is associated with fear and anxiety (Hargitai et al., 2005), as well as contradiction, denial, and simply 'saying no' (Tausczik and Pennebaker, 2010). This scenario also has the lowest score for Emotional Tone, indicating negativity and low mood (Pennebaker et al., 2015b).

Another linguistic variable for which the Housed scenario scores more poorly is Analytical thinking, showing it is discussed in a more informal, narrative style (Pennebaker et al., 2015b). The high score for Cognitive Processes (words such as 'cause', ought' and 'know' which signal deductive language (Pennebaker et al., 2015b)) and low for Clout (confidence) integrate with the negative views of the system arising from the Confessed Ignorance theme to suggest that participants struggle to make sense of the Housed scenario and appear to cast around for different ways to understand it. The qualitative results indicate little personal familiarity with this scenario, so participants form their views instead from other sources, including media representations.

Anthropomorphism is a device they also use to process the Housed scenario; but while anthropomorphism has been defended in literature as a means through which those with less knowledge can form connections with animals (Buller and Morris, 2003; Daston and Mitman, 2005), it has also been cautioned against as an overly sentimental and subjective way of assessing welfare (Wynne, 2004; Serpell, 2019). Here, it played a powerful role in filling knowledge gaps with personal experiences of closed environments and lack of outside access.

4.4.3 The Grazed scenario

The Grazed scenario, representing dairy farming systems which maximise grazing and have little or no housing for cows, is less popular than the Mixed scenario but more favoured than the Housed. Through the Wild Vision sub-theme, participants are extremely supportive of the cow's access to the outdoors environment and exposure to nature, but are also confused and concerned about the danger this might place her in at times. While public perspectives of dairy farming systems where cows remain outside all year have not been widely examined in literature, there is evidence from New Zealand – where this system is predominant – of some societal discomfort with issues such as poor body condition at times when grass growth is poor or stops, lack of shelter, and exposure to excessive mud (Fisher, 2020; Kelly, 2021). This system is not that common in the UK (March et al., 2014) but concern about the concept behind it is evident in converged results showing personal unfamiliarity with the cow being kept out year-round alongside a higher score for Negations than the Mixed scenario, and a low score for Analytical thinking, indicating informal, narrative speech. As with the Housed scenario, Grazed attracts a high Cognitive Processes score, which again indicates difficulties understanding the concept. The Grazed scenario is the one area where a divergence arises in the integrated results. While Discrepancy can highlight lack of understanding or knowledge through use of qualifying words such as 'probably', 'should', 'would' or 'could', thus is consistent with the personal unfamiliarity expressed in the qualitative analysis, Vaughn (2018) observes that Discrepancy relates strongly to 'hopes' and can be associated with aspirational rather than actual situations. This suggests that participants might find the Grazed scenario aspirational even if it is not familiar or seen as practically achievable, meaning that it

may have the potential to match or better the Mixed scenario in favourability, if the perceived barriers could be overcome.

4.4.4 Other results and observations

Another novel finding within the qualitative analysis is the Confessed Ignorance about the cow's wants and needs. Previous studies (e.g., Cardoso et al., 2016; Kühl et al., 2019) have assumed a reasonable level of confidence in participant responses. However, our mixed methods approach challenged interviewees to explain their views in more depth and linguistically analysed their responses to reveal both admissions of ignorance and explanations of the strategies used to form views. This indicates the powerful role heuristics are likely to play in expressed preferences about dairy farming systems.

The Deferring to Others sub-theme within Confessed Ignorance has not yet been discussed due to its system-neutrality. However, it merits brief reflection. It suggests some participants do not have a strong preference, prefer not to exert one, or feel unable to – especially when 'Others' are retailers, government or authority figures they cannot influence. While deferring to the farmer could be a vote of confidence, it could also reflect the farmer's ability to ultimately 'make or break' welfare, irrespective of system. We cannot extrapolate this theme to the linguistic analysis results, but it is worth noting that in Maier and Seligman (1976), negative motivational, cognitive, and emotional impacts were associated with a perceived lack of control. Lastly, the concept of the cow being the ultimate arbiter of her own welfare through autonomous choice appears a popular one in our data, but there are few studies of public attitudes towards dairy cow agency or autonomy on-farm. However, in both Schuppli et al., (2014) and Cardoso et al. (2018), members of the public supported cows having a choice of being indoors or out; and from an animal science perspective, both Pow et al. (2014) and Mee and Boyle (2020) found that free-choice hybrid systems combining pasture and shelter might offer welfare benefits to dairy cows.

4.5 Summary

In this study, we set out to use a novel mixed methods approach, using thematic and linguistic analysis, to address our second research question asking what we could learn about the underlying motivations and context behind public preferences for dairy cow environments, for example, access to pasture. Through analysis of interviews from our qualitative sample of 60 people from across the UK, described in Chapter 3, we found participants had a dual vision of the cow, seeing her as both domestic and wild. Therefore, a scenario with housing in winter and grazing in summer both provided protection and naturalness, and was most associated with analytic thinking. Interviewees also confessed ignorance about the cow's needs, either deferring to others' judgement or using familiarity and anthropomorphism to assess the scenarios. This again resulted in most optimism, confidence and positivity for housing in winter and grazing in summer, and most negativity for housing year-round. Grazing was aspirational, but keeping cows outside in winter was confusing and concerning. The results suggest strong support for grazing combined with care inside when needed, and also for cow autonomy. Together these indicate the industry should consider whether grazing or outside access can be introduced into systems that currently house year-round, how both care or protection and naturalness can be achieved more generally in dairy farming, and how better transparency can help people gain a better understanding of how dairy cows live when they are inside.

"I feel generally farmers do care, they do care about their livestock but I think equally farmers are bred into an industry where things are accepted as just being part of a farming life and you can really care about your farm alongside doing things which maybe don't support their… just because you're born into that so it just becomes natural for you.

So a child growing up knows that it's natural that really young cows are taken away from their mums really early on and you don't even engage in that thought process of what's going on for this cow because it's just what you're born and bred into. So the young child might grow up to be a farmer that really cares about his farm and cares about his cows but I have to take this young calf away from their mum because that's the process."

Participant in 60 face-to-face interviews, conducted across the UK between November 2019 & February 2020 (see Chapter 3)

Chapter 5: Interpretive lenses for dairy farming

5.1 Introduction

5.1.1 Perceptions of the public's views of farming

As described in Chapter 1, both consumers and citizens are important stakeholders in farm animal production: the former buy the meat, dairy, eggs and fibre produced from livestock, and the latter provide the social licence that permits farming to utilise land and other resources (Martin and Shepheard, 2012). Since the 1960s and Ruth Harrison's exposé of the industry's intensification in *Animal Machines* (Harrison, 1964), public concern has been growing about farm animal welfare, as demonstrated in surveys (e.g., Eurobarometer, 2016; Stannard, 2021), online campaigns (Rodak, 2020; Wonneberger et al., 2020), changing government policy (Ares, 2019; Institute of Governmental Studies, 2021), and new product development (e.g., Darwent & Leaver, 2015; White, 2021). Yet the views of the public, and particularly those concerning how they prefer farm animals to be managed, can be dismissed by those within the broader farming community. For example, farmers or veterinary surgeons have suggested the public are too uninformed about farming to hold meaningful opinions (Heleski et al., 2006; de Rooij et al., 2010; Sumner et al., 2018; Stevens et al., 2020), disinterested in the realities of livestock production (Benard and de Cock Buning, 2013; Albernaz-Gonçalves et al., 2021), influenced by animal rights advocates (Heleski et al., 2006; de Rooij et al., 2010; Smid et al., 2022), prone to anthropomorphism (de Rooij et al., 2010), and naïve about the economic impacts of changing practices (Ritter et al., 2021). Farmers and farm industry representatives have also expressed frustration across a variety of public media about 'being told how to farm' by those who express opinions despite lacking knowledge of the industry or its technicalities (Foster, 2012; Hoggard, 2017; Morello, 2019).

Yet there are consequences to dismissing public views. While predictions are that global meat and dairy consumption will continue to grow (Ritchie and Roser, 2019), challenges to that position are emerging. As we laid out in Chapter 1, the past decade has seen a boom in the development of alternatives to meat and dairy, ranging from

plant, fruit, fungus or insect-based foods to laboratory-cultured meat fibres (Stannard, 2018; Bashi et al., 2019). These innovations address many of the main barriers identified to adopting a vegetarian or vegan diet, which include reservations about taste, expensiveness and convenience (Fehér et al., 2020; Rosenfeld and Tomiyama, 2020), to the extent that sales growth in this whole sector has been estimated to be as high as 15% per year (Geller, 2020). At the same time, the sustainability of livestock production is increasingly being called into question, with impacts on the environment and animal welfare – a leading component of social sustainability (van Calker et al., 2005) – remaining extremely emotive issues. Both are consistently expressed as concerns in both consumer and citizen surveys (Bashi et al., 2019; Stannard and Randall, 2019), are key reasons for conversion to veganism (Schenk et al., 2018; Kalte, 2020), and have been leading motivators for engagement in activism (Ruder Finn, 2019).

5.1.2 Bridging the disconnect

In their examination of how the dairy industry in particular should engage over such public concerns, Weary and Von Keyserlingk (2017) conclude that if dairy farms are to survive, the industry needs to work constructively with external stakeholders. The challenge, therefore, is to encourage co-operation and mutual understanding despite farmers appearing reluctant to recognise the validity of public concerns and respond accordingly (e.g., Benard & de Cock Buning, 2013). To consider how this seemingly intractable disconnect can be resolved, we turn to conflict resolution principles. Within Deutsch et al. (2006), it is observed that conflict often emerges between groups which – although composed of many and varied individuals – become stereotyped so that the entire group is characterised by same deficiencies (Dweck & Ehrlinger, 2006). The importance of taking the point of view of the 'other' in moving towards conflict resolution or collaboration is also raised (Gruber, 2006). These two principles are brought together by Shmueli et al. (2006) in their discussion of the role of interpretive 'framing' within conflict, where they propose that better knowledge of the interpretive frames that people create to characterise other people or groups, and how they have been constructed, can help us to understand or even influence conflict dynamics.

5.1.3 The use of frames

Frames have variously been described as schemas of interpretation which allow their users to identify and label information (Goffman, 1974), cognitive structures that fill gaps in perception (Bartlett, 1932), 'data-structures' that present stereotyped situations in order to make sense of the new (Minsky, 1975), and interpretive lenses through which people see and represent reality (Entman, 1993). Frames have been used deliberately to convey meaning or position an issue in a particular light, making it more important how something is communicated rather than what is communicated (e.g., Aukes et al., 2020; Stevens et al., 2020). However, frames have also been examined reflectively to understand how people use previous memories, feelings, experiences, associations and other fragments of information to either make sense of a situation or stimulus ('cognitive frames'), or to guide a context-specific interaction ('interactional frames') (Aarts et al. 2006; Dewulf et al., 2009). In the case of the former, analysing the frames people 'hold', literally as frames of reference, can help our understanding of how they make sense of societal issues, for example: how healthcare professionals justify intervention or non-intervention in domestic violence (Virkki et al., 2015); the ways in which young people value public spaces (van Lieshout and Aarts, 2008); and how consumers rationalise the acceptability – or not – of eating meat (Nijland et al., 2018). In terms of farming, the study of frames has been successfully applied to various communications-related challenges, such as how the term 'positive welfare' is construed by different audiences (Vigors, 2019), how veterinary surgeons perceive the problem of poor biosecurity (Shortall et al., 2016), and whether an appreciation of different perspectives can help farmers and the public find common ground on animal husbandry (Benard and de Cock Buning, 2013).

5.1.4 Focus of research

Despite these applications, frame analysis has not to our knowledge been used to examine the lenses through which the public frame farming. Understanding how dairy farming is perceived and the diversity of framing employed might explain why the public feel motivated to comment on practices – and what they hope to achieve by doing so. Hence, in this study we adopt a novel use of frame analysis to address our

third research question: ***"What can we understand about the interpretive lenses through which the public view dairy farming and our care of the cow?"***. We then discuss what knowledge of these frames might mean for the dairy industry and whether it could help to span the current disconnect between the industry and the public, fostering a more collaborative approach to addressing concerns.

5.2 Methods

The sampling strategy and recruitment of participants is discussed in Chapter 3. The completed interview transcripts were uploaded into NVivo 12 (QSR International; www.qsrinternational.com) to assist with coding and analysis of the text. Data included in this analysis related primarily to Q2 in the interview script (see Appendix 3: "If I ask you to think of a dairy farm, what is the first image that comes to mind?", plus associated prompts) but further data were also included from the wider interview where relevant perceptions of dairy farming were expressed and clearly drawn from existing cognitive frames. This was where there were signs that participants were expressing a perception of dairy farming based on cognitive framing, indicated, for example, by expressions of statement, or explanations of 'fact' or 'the way things are'. Responses during which the participant hypothesised or 'thought aloud', forming their response as they spoke based on the interaction with the interviewer, were excluded as this were judged to be interactional rather than cognitive framing.

While frame analysis describes the wider examination of data for the use of frames, it does not proscribe any specific technique. Indeed, Goffman (1974) describes no definitive steps. However, there are commonly two stages employed in frame analysis: identifying the frames used, and then the effects of these frames on those holding them (Björnehed and Erikson, 2018). Here, our initial identification of the frames employed was undertaken through reflexive thematic analysis of the data (Braun and Clarke, 2022), using the constant comparative method (Freeman, 2011) based on grounded theory. We adopted a relativist, constructionist approach, where we a) explored how participants made sense of their reality (Braun and Clarke, 2022); and b) sought to 'co-create' the frames through which they made sense of dairy farming.

Initially, words and sections of speech were 'open-coded' into candidate codes which were discussed with a colleague. The questions: "What is going on here?" and "How do they explain it?" were used repeatedly while coding to retain focus, and code proliferation was avoided by reusing existing codes where possible (Saldaña, 2015). Observations and connections were recorded as the process continued, as was any *in vivo* text (words used in the quote which themselves became a code) that captured a mood or theme. After this first round of coding, these codes were arranged several times into different organising concepts until a coherent narrative was developed that worked across groups of codes. Several minor themes were identified but as we were seeking to identify the key frames through which the participants perceived dairy farming, we discarded those which did not inform this objective. Then as the second stage to frame analysis, the frames were examined to understand what effect they might have on those holding them, and how they might shape the holder's perception of and response to the topic of dairy farming.

5.3 Results

5.3.1 Participant experiences

Within the interviews, almost all participants referred to having seen a cow in real life, and this was almost always outside in the environment (e.g., in surrounding fields, from car windows, during walks) or, less frequently, during visits to farms. Around half had first-hand memories and experiences of cows, farms or farmers from childhood. Three mentioned either growing up or working on a farm, and a further eight claimed contact on more than one occasion with a specific farm or farmer, currently or in the past. A third of interviewees cited specific items they had seen in the news or media, many of which were about the low price of milk paid to farmers (although others raised financial hardships faced by farmers without offering a source). Three-quarters referenced a TV or radio program, book, film or picture that had a connection with dairy farming. A dozen participants referred to animal rights or campaign group activities they were aware of, with seven making specific mention of campaign material they had watched or seen.

5.3.2 Summary of frames

Through conducting frame analysis on interviewee data, we identified that when describing their perceptions of a dairy farm, participants focused almost exclusively on the cow and the farmer. The cow was characterised through three diverse frames, and the farmer two, with the care of the cow at the hands of the farmer a key part of the latter. A number of different but sometimes overlapping narratives within each frame added dimension and meaning. These narratives are summarised in Figures 14 and 15. Anonymised coded excerpts from the interviews are used to illustrate the findings.

5.3.3 The Cow

Interviewees made sense of the cow through three frames characterised as: Enduring Cow; Fellow Cow; and Force of Nature. Half of participants comfortably held two frames at the same time, and a third, all three, suggesting the frames were simply different facets of the same entity.

5.3.3.1 Cow frame 1 – Enduring Cow

The Enduring Cow frame, expressed by around two thirds of interviewees, was characterised in three ways. The data described an acquiescing animal, accepting of her fate, who was committed to her routine work; a participant in a demanding role, deserving of fair treatment and therefore in a transactional relationship; and an exploited and sometimes mistreated 'poor cow' in a job from which she cannot escape. All three indicated elements of endurance, whether of a position she had little say in, a working role which was demanding, or unpleasant treatment.

The acquiescent Enduring Cow was recognised for her suitability for work in the dairy herd and she was admired by some for her aptitude at applying herself. A number of interviewees saw her as well-habituated to her tasks, observed here in a TV documentary:

> *Participant 35: "…to see them coming in…they walk into the barn and they know exactly what they're going to do, they're conditioned if you like to have their two hours milking. If you go to the farm when the farmer's due to pick up for milking, they're all congregating round the gate, they know what's coming."*

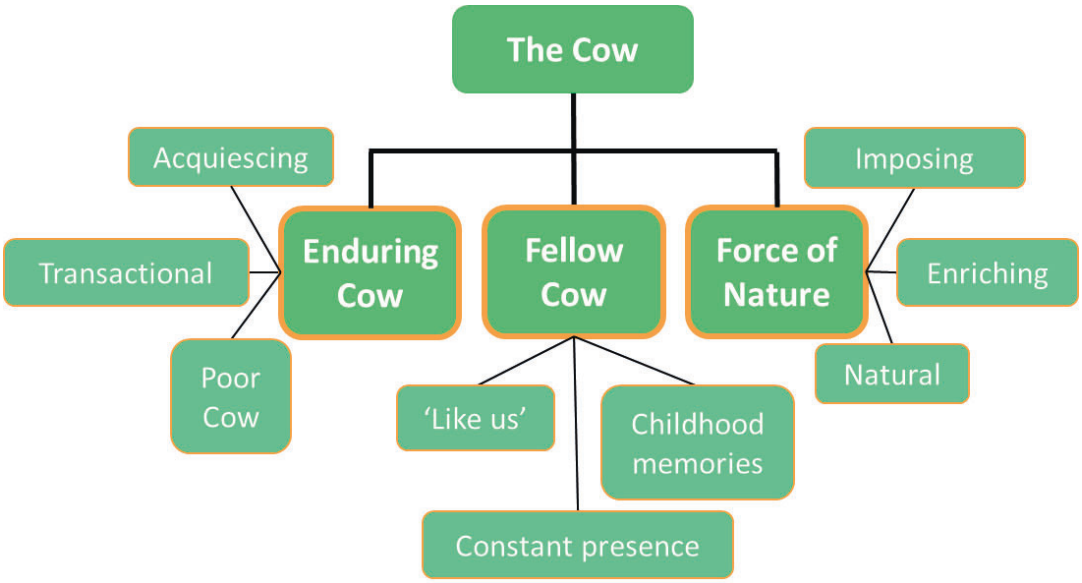

Figure 14. Summary of the different frames for the cow, and the underlying 'narratives' through which the frames were expressed

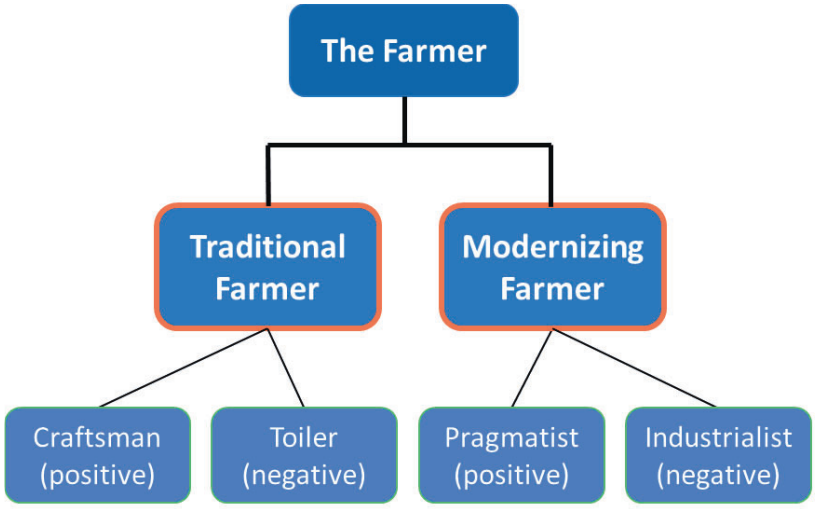

Figure 15. Summary of the different frames for the farmer, and the underlying 'narratives' through which the frames were expressed

The acquiescent Enduring Cow was also characterised as having simple demands:

> *Participant 22: "The lower end of Maslow's hierarchy of needs …They don't need much else. Don't anthropomorphise. They are not humans. They need welfare. I believe animals should have rights, but they don't vote, they don't think about the environment, they don't have these higher-level things."*

However, some participants commented on her ability to adapt to technology such as milking parlours and new robotic milking systems.

> *Participant 53: "Well you can almost train them, well you can, can't you, to know when they're gonna be milked and they walk towards the milking thing and they stand there. It's all automised today, they know when they're gonna be – even when they're in the fields they know and they seem to start moving, don't they…"*

The transactional narrative within the Enduring Cow frame captured a sense of moral responsibility felt by participants on behalf of the cow, recognising that she was enduring work for their benefit and should be recognised for her 'service'. The recompense included kind treatment and gentle handling.

> *Participant 39: "I don't know how responsive they are to humans or how intelligent they are as an animal but I imagine in my head if they're having a nice stroke and they're being talked to … it's a bit more personable … it's making the time or their life a little bit less as though they are on a production line."*

There was also recognition that the cow if the cow was able to trust the farmer or her handler, then that would make her experience at least bearable, if not rewarding.

> *Participant 56: "I think having secure safe bonds is incredibly important, especially when those people are then doing stuff to you, so they're plugging you into things or they're making you go inside 'cause it's snowing or whatever, I think if you've got that trust and that bond then those experiences are gonna be very, very different to if you're afraid of someone or being forced to do something you don't know."*

Through the narrative of 'poor cow', interviewees raised concerns about the Enduring Cow and unpleasant practices she might be subjected to that they had increasingly 'heard of' or had seen – mainly on social media, and found perplexing in light of what they might have previously believed.

> *Participant 31: "…there's a lot of things about local farms or it might be overseas …where they're talking about dairy cows and how they're poorly treated and how the calves are ripped away from the mothers and how the milk has got pus in it and it's disgusting."*

> *Participant 15: "…you can't see behind the scenes whether they're having their calves taken off them, where they're forced to get pregnant until they die just so they lactate…"*

While most references to distasteful dairy farm practices or poor welfare within this frame related to imagined, extrapolated or curated imagery from third parties, the concerns of some interviewees had been corroborated by personal observation.

> *Participant 41: "You see cows in a field and you can see their rib bones but huge stomachs and they're literally struggling to walk because they've got so much milk."*

Discomfort, stress, swelling, strain, exploitation and exhaustion were some of the words used in this characterisation of the Enduring Cow, and anxieties were expressed about routine dairy farming practices such as having to produce a calf every year and artificial insemination.

> *Participant 50: "The cows were just tret [treated] awful, they're artificially inseminated pretty much all the time. The normal lifespan of a cow is 20-25 years and they only live for five because they're constantly pregnant …."*

5.3.3.2 Cow frame 2 – Fellow Cow

Almost three-quarters of participants perceived the cow as 'Fellow Cow' – a colleague, peer or equal with whom they were familiar and had shared life journeys or experiences. The Fellow Cow was characterised through several different narratives: companionable childhood connections; a constant presence around them; and being

'like us' – understanding the cow's life through their own. The cow was heavily anthropomorphised within this frame and many interviewees expressed feelings of a bond with the animal despite more than three quarters being found through the questionnaire to have no connection with farming or the dairy industry.

Personal childhood memories played a significant role in building a feeling of fellowship. Cows in the environment around them from an early age was mentioned by many participants, especially seeing cows in fields during car or train journeys.

> *Participant 45: "… we would've travelled past fields and we always would've seen cows; we were always looking out for cows."*
>
> *Participant 36: "If you're ever driving by you always see black and white cows … just generally seeing them around, they were all round everywhere."*

Some participants had farming relatives and recalled visiting them and their cows as children. Emotional connections formed with cows appeared vivid in childhood accounts. Some were personal and others were the experiences of friends or relatives, which appeared just as relatable.

> *Participant 57: "I was taught how to milk a cow. I must have been probably about five, six, seven years old but I will never forget the feeling… And then the cow is just standing there as if nothing happened. And she just lets you do anything as long as you don't pull too hard."*
>
> *Participant 37: "… my wife, she'll tell you…there's a lovely photograph of her and Jimmy Bullock…and she would go feed Jimmy bull and talk to Jimmy Bullock – but Jimmy Bullock went to the slaughterhouse, you know, and that's the way it goes."*

The Fellow Cow was also a constant and tangible presence beyond childhood, 'always there' as if an anchor despite what else changed. Seeing cows 'dotted' around fields, 'littering' the countryside, or representing the passage of miles or time were common recollections:

Participant 33: "…when I go back to Wales, I don't see the same cows obviously, I think they've long gone, but the same kind of picture is painted in my head as I'm driving back and the kids are in the back seat screaming out, they can see the cows and stuff."

By contrast, the absence of the cow from fields during serious disease outbreaks diminished the countryside and felt like a cultural loss:

Participant 23: "I can remember when the big Foot and Mouth outbreaks were out and when they were burning cows in fields and how different our landscape looked without cows and sheep on the slopes…It wasn't nice and I didn't like it."

Participant 5: "I remember during the Mad Cow Disease, going to the Lake District, and it was quite a peculiar feeling that all the fields were empty, because it enhances our countryside, it's our culture."

'Like us' was a third narrative through which the Fellow Cow was perceived – participants understood her world through anthropomorphised comparisons with theirs. The cow's experiences of issues as diverse as digestive health, giving birth, social life and dealing with the weather were seen as if their own.

Participant 14: "We've all got friends, we've all got colleagues; a farmer knows, he watches them every morning, some don't get on, Ermintrude don't get on with Gertrude."

Participant 6: "I think if a cow is happy then it's going to give more milk, it's like a mother that if she's stressed there is a lot of reasons that she can't breastfeed her child. So I believe that if the cow is happy obviously it's going to produce more milk."

The cow's 'working' life was also expressed as a parallel life to their own.

Participant 11: "It always used to make me smile when I drove to work up the A45 …at certain times of the year you'd be driving along and the cows are heading for milking and they're literally walking in a line across field – there's no one there, they know it's milking time. And it used to make me smile, 'Ah you're off to work as well'."

Cows were described as moving around to their own agenda like humans, as determining where they go and what they do according to their dispositions, social lives and whatever needs were being met. In this way they appeared self-determining.

> *Participant 1: "Because if I look at the cows that I see in the fields, the cows have got different personalities, you can see that, they're often quite spaced out…They move around between different fields of their own volition because the gates are open …that's why you can't tell which field you're going to see the cows in, they're often in one and then all of a sudden they won't be there."*

The introduction of robotic milking was raised by a number of interviewees as being beneficial because of the way it supported the cow's autonomy.

> *Participant 55: "…from the way the cows have their own mind to go and milk, that is natural. That's what cows are meant to do. It's a bit like us … we're not structured to always have the same thing all the time...cows, from a manual milking point of view, they have to go to milk in the morning and the afternoon, whereas now they could be like at lunchtime, 'Ooh, I quite fancy going to have a milk' and they can."*

5.3.3.3 Cow frame 3 – Force of Nature

More than half of interviewees framed the cow as an elemental creature, emphasising her animal state and their inability to fully understand her. This 'Force of Nature' frame was characterised through: imposing scale and aggression; the way she enriched lives, sometimes through sensory stimulation; and how she appeared grounded in the natural world. The Force of Nature frame emphasised a distance from humans which some participants appeared to find intriguing.

First to note is many participants referred to the scale of the cow – especially those to whom a lack of rural living experience made her size seemed even more imposing and 'real'.

> *Participant 17: "I think the first time I saw a cow I was quite daunted by the size of it and great big udders <laughs> and it was all quite real you know? Compared to the plastic farm animals I had to play with but daunting in reality."*

The ‘aggressive’ side of her imposing nature implied unpredictability, and was illustrated in a number of dangerous encounters.

> *Participant 3: “I do remember being chased by a herd of cows on one occasion… And I’m not sure why they were chasing, we were able to get behind this fence and they just wandered off, but I do believe it’s a very dangerous thing to be trampled.”*

This unpredictability was sometimes expressed as individuality and personality. Despite the implicit danger, stories were repeated as factual or amusing anecdotes rather than in fear, as if the experience was integral to being in the countryside or a badge of honour.

> *Participant 1: “There was a story my mother told…she used to go in an evening to get the milkings from the farmer round the corner, so she would be perhaps six or seven at this stage. And there was a cow that they called ‘Dog’ because it was a heifer and it guarded the farm gate and so she would go up, and she would have to go with a stick, because you show the stick, she said, ‘If you’ve got an aggressive cow just brandish a stick, a sizeable stick at it.’ So, she always used to have to find a stick on the way there just in case this cow went for her.”*

The enriching sight, smell, sound and touch of the cow, or the taste of her fresh milk, appeared to form particularly strong or visceral memories for participants.

> *Participant 7: “…it was nice because they would then milk the cows and we could watch them actually being milked and you could drink the milk and it always tasted different because it was fresh from the cow.”*
>
> *Participant 57: “…the udder is so wonderfully soft. It’s like velvet and so warm.”*
>
> *Participant 10: “… I have got memories of hearing those cows mooing when you was at school.”*
>
> *Participant 44: “They smell like butterscotch…”*

A further narrative in this frame was a characterisation of the cow’s embeddedness in nature and the rhythms of the natural world. Through her, watchers appeared to vicariously experience her peace or pleasure.

Participant 40: "We go to Wales a lot. I've seen sheep out and cows and I've sometimes just stopped and looked at them and they seem to be liking it… They seem to be liking it, just a happy bunch of animals, you know?"

Participant 30: "I'd like to think in nice, big open fields sort of grazing away and mooing and in bliss, maybe on a night like this lots of mist coming out from everywhere."

Other interviewees referred to the way cows marked the natural turn of the seasons when herded to or from Alpine pasture, or the symbolism of the cows being let out for the first time after the winter.

Participant 46: "When they [cows] come out in the springtime, to us, it's like new life, like a new lamb, it's like new life to us, it signifies the start of the spring, it signifies to us that all is well."

Participant 32: "…you let them out and they knew this, they'd jump and spring and they'd … it's as if they're happy to be let out."

5.3.4 The Farmer

The farmer was the other dairy farm entity most commonly characterised by participants. He or she was not only described in their own right, but as the keeper of the cow and therefore chief architect of her experiences. Participants identified a Traditional Farmer, and a Modernising Farmer, with almost half of participants expressing perceptions aligned with both frames. However, each of these frames was seen through positive and negative narratives. This duality stemmed from an almost universal acknowledgement among interviewees of the difficult position farmers find themselves in financially with some recognising a potential knock-on impact on the care of the cow. Participants were generally sympathetic to the tough choices facing farmers – but the way in which farmers responded to this financial pressure and whether or not it unduly impacted the cow were distinguishing factors between the positive and negative characterisations of these frames.

5.3.4.1 Farmer frame 1 – Traditional Farmer

Just over half of participants described the frame of the Traditional Farmer, often as a farmer they had seen in children's books, in film and on TV, and sometimes on walks or car journeys. The farmer was imagined as older, male, born and bred a farmer, and often part of a farming family whose forebearers stretched back many generations. As a result, he had an ancestral commitment to the farm.

> *Participant 18: "To put in a twee way, they're custodians of the land and as so many farms are handed down from father to son, they are custodians making sure that they hand it over in an even better condition than when they received it."*

> *Participant 19: "It would be the traditional aspects, it would be the cows in the field, then the cows in the barn, early morning milking, traditional elderly farmers who have had the farm for many generations and methods, tried, tested and almost sort of primitive."*

Dirt, mud, dilapidation and chaos were often connected with the Traditional Farmer, but expressed as an integral and authentic, if unfavourable, aspect of the construct.

> *Participant 10: "I think he was an oldish man is what I remember. …It was a family run farm, it felt like, with quite a dirty farmyard with cows wandering around."*

> *Participant 57: "So it's not very hygienic, obviously, all those flies and ugh, it was horrible. I never enjoyed a holiday there but they are the experiences that I remember and they are still fresh in my memory, like milking the cow."*

The Traditional Farmer was seen to typically run a smaller farm, although when pressed, the definition of this provided by participants varied significantly – particularly in terms of number of cows. It was implied by some that the Traditional Farmer only produced enough on his farm for his and his family's own immediate requirements rather than 'mass farming'; selling product was not a prominent aspect of this frame. It was recognised that the smaller farm might not be financially viable, but the Traditional Farmer and his family might accommodate this by supplementing their income.

Participant 18: "For many people the ideal is someone with a smallholding and five cows or something like that, but most people, you can't make a living like that, so for the people involved, they have to be able to make a living and you read about so many people now who are on a farm but their wife has to work off the farm, so that they can continue farming."

A strong sense of animal care was expressed and recognition of the Traditional Farmer's genuine bond or even love for his cows.

Participant 6: "He's looking after the animals, if they're giving birth, he's got to help to give birth, he's got to look after them and make sure they're clean, feed them, if there's a problem, they will have to call the vets…I think that the farmer treats them as his children and they've probably got names."

The farmer's skill, commitment and 'cow craft' was often expressed in terms of him knowing his cows without having to refer to their ear tags or numbers, therefore knowing the individual animals.

Participant 51: "He'd name all his cows, so that each cow had their own name. So I'd say it was more than a living to him, it was his lifestyle, but he genuinely cared about the animals as well."

Participant 45: Yeah, it's a relationship, I think I would've pictured… just in my mind probably from films and things…they have a relationship with that animal whereas now they're just a number."

While personal handling and management of the cows was a recurring theme in this frame, with little reference to employed labour, it was understood the Traditional Farmer did use machinery, particularly milking machines, but too was often seen as traditional and as an enabler rather than detracting from the positive imagery.

Participant 23: "There is the dairy farm that everybody looks at as idyllic and British with all the cows having individual names like Daisy and Buttercup and coming in for their milking twice a day in a nice, probably herringbone floored stall… you put the machine onto the teats and then the milk gets taken out of the cows."

In such a way, one underlying narrative for the Traditional farmer was positive and nostalgic, as a 'craftsman' or artisan. However, some recognised that their image of the Traditional Farmer might be idealised, and were not oblivious to his shortcomings. For example, while the generational commitment to the family farm was admired, others thought this could trap family members who did not want to be there, or who did not care for the animals.

> *Participant 47: "I know a lot of farms are inherited, they're passed through families and I don't know many people that would choose to go into farming, it's such a difficult life, and as I said, in some cases for little reward."*

> *Participant 20: "… you might have the ancestors which were really passionate about looking after the animals, and it's just kind of been passed down the family and the younger people aren't so passionate about it."*

The frame of the Traditional Farmer was also described as hard work physically and in terms of commitment and time invested.

> *Participant 53: "I think it's hard work, dairy farming. They have to get up, those cows have got to be milked twice a day. They need looking after. I don't know how they make a profit…they've gotta look after them. I think it's hard work, 'cause round here it used to be a lot of farming, but now it's gone. I'm sure farms are dying out in this country; I'm quite convinced of it."*

Underlying financial pressure was a commonly cited reason for this commitment, which was in turn linked to poor prices for milk and the role of the supply chain.

> *Participant 51: "Like I said, everybody has to earn a living but I think the supermarkets have a lot on their shoulders... they want the price to be as low as possible and the person that suffers then is the farmer and then ultimately the animals."*

Wider concern that poor financial viability would eventually impact the animals was expressed by several interviewees, albeit in a non-judgmental manner.

Participant 23: "…the farmer might run out of money and hasn't got enough food to supplement them or his silage has gone belly-up and he isn't able to feed them silage and he can't afford a vet… There are some very distressing things that appear in the papers – farmers that can't cope."

Thus, the negative narrative for the Traditional farmer was more akin to a 'toiler' – someone who needed to strive to maintain the farm in today's tough environment and, as a result, might not be able to fully cater for the cow's needs.

5.3.4.2 Farmer frame 2 – Modernising Farmer

Almost three-quarters of interviewees framed dairy farmers as the Modernising Farmer. In contrast to the Traditional Farmer, the Modernising Farmer was adapting to tough market conditions and poor milk prices rather than have these externalities drive them under. An implicit part of this adaptation was a change in role from practical to managerial.

Participant 39: "…in this day and age, I would imagine it's more about the commercial aspect and how they're gonna manage their buyers, rather than hands-on with the animals, just because I think probably everything's done by pumps and machines and things."

It was recognised that within the Modernising Farmer frame, compromises sometimes had to be made between the care of the cow and surviving or making a profit, and this was broadly accepted by those who understood the challenging nature of the situation.

Participant 12: "I think you've always got that welfare versus profit balance and without knowing enormous amounts about it, it's difficult to know where the ideal balance would be…there's a trade-off, isn't there...."

Participant 54: "I feel like they're under pressure to make a wage and a living, so they've gotta decide what's best for them, what's gonna keep their farm afloat and what's gonna pay their bills might not necessarily benefit the cow."

How this balance was struck, the extent of the compromise between care of the cow and financial imperatives, and the reason behind it, appeared to be key factors as to

whether this frame was perceived in a positive or negative light. Described positively, it was understood that the duty to the cow was maintained as 'doing her right' was in the interests of both the farmer and the animal – although it could be care delivered unsentimentally. Within this generally constructive narrative, the Modernising farmer was accepted as a 'pragmatist'.

> *Participant 12: "I suppose it's in the farmer's interest to look after their animals' welfare, 'cause I guess that way the healthier they are the more they produce, and so I guess it's just the farmer's job to a large extent is kind of tending to that lifecycle…"*
>
> *Participant 33: "So I don't get that warm fuzzy feeling that … he would go running into a field and be stroking the cattle and giving them pets…"*

It was broadly appropriate for pragmatic Modernising farmers to make sufficient money for a decent living rather than for large profits; one interviewee suggested this might be because a responsible farmer would plough surplus profits back into the welfare of the animals.

> *Participant 47: "I think a farmer, if they're making a good living from it, they're more likely to reinvest that and look after their – that's their livelihood – and look after their livestock. I think it's a good circle to set up."*

However, if the cow's welfare was perceived to be traded off too readily or compromised for the sole reason of profit rather than survival or inability to cope, then the Modernising Farmer assumed a more negative persona whose motivations became unsavoury. In this way, the negative narrative surrounding the Modernising farmer was as an 'industrialist', who was utilising the cow for their own benefit.

> *Participant 15: "Trying to get the cows to produce as much as possible, not being particularly fussed if they get ill either, bunging loads of antibiotics in them or if they feel that they're not gonna be producing, they're too old or they're too sick then bunging them off to the knackers' yard as they call it."*
>
> *Participant 32: "…it could even be a businessman, not knowing anything about farming, and all he's wanting is to make as much money and that cow must produce 'x' amount of milk, otherwise another cow must come in its place."*

The Modernising Farmer was generally viewed as having a larger farm relative to the Traditional Farmer, innovative or entrepreneurial, as having employed workers and being more mechanised. To help them cope with their growing managerial role or increased cow numbers, Modernising Farmers were ready adopters of data tools and technology. The modern milking process was characterised by tubes, pumps and wires; a number of interviewees envisaged long lines of cows and conveyor belts, or of them revolving on 'rings' and platforms.

> *Participant 50: "It's obviously that technology with them that's changed quite a bit as well 'cause it used to be just done by maids, doesn't it? But now I think they've got them udder clamps that milk the cows and things like that and they're sterilised and everything like that, and there's a rotation of the cows coming into this thing to be milked for them to then go out and then another cow come in."*

The advent of robotic milking or automated milking systems was a positive, 'pragmatist' development in the eyes of most participants who mentioned them, feeling it was in step with what the cow would choose and therefore supported her agency.

> *Participant 41: "So, the cows went in whenever they wanted to, there was like automatic teats and they were saying the automated process made it kinder for the cows because rather than being pulled in and then… manually getting the milk out, the cows would walk in when it felt natural to them."*

Some of the adaptations Modernising Farmers made to cope with low milk prices were viewed as positive and innovative, in particular, diversification or adding value to products.

> *Participant 37: "…I've seen the Countryfile* [TV programme] *type thing where the farmer's been struggling, the young son has said, 'OK dad, we've gotta do something about this otherwise we're gonna be out of business,' and they've gone over to making cheese… You have to diversify or die."*

However, some of the Modernising Farmer's modifications to the business were characterised in a negative light, as an 'industrialist' approach, with increasing scale or numbers of cows viewed as a retrograde development, lessening the care of the cow.

> *Participant 11: "…if you've got a thousand cows, you're not going to have the personal, semi-personal touch and you've got to rely on more people to do their job properly, you can't check all of them, you can't be in 30 fields at the same time and check that 50 cows over there and that 50 cows over there."*

> *Participant 31: "I think obviously once you get bigger and maybe your priorities are a bit different you either try and detach yourself or you just see it as a business opportunity and you just don't have that emotional connection to your surroundings and to the animals that you're looking after."*

Technology had downsides too, and these were expressed mainly as a loss of connection between the farmer and the cow.

> *Participant 19: "In some respects it felt as though it was making the whole thing clinical and that there was no relationship between the cow and the farmer. The cow was more just an asset which was producing a product and it was … I suppose a bit like when I used to watch, or used to see the production lines of car assembly."*

Increasing cow numbers was also often associated with confining and stocking them more densely, and of the farm becoming more agribusiness, corporation or company – in keeping with the negative 'industrialist' narrative.

> *Participant 42: "... it's gone for me like subsistence farming to profit, to capitalism basically. And as a result, you're seeing these massive industrial units ran by businesses looking for profit and you're ending up with these, like I said before, industrial scale operations with these big farms with big numbers of cattle…"*

Thus, the pragmatic Modernising Farmer might be described as 'a farmer running a business', versus the industrialist 'businessman running a farm', with almost two-thirds of participants evoking the former, just over half the latter, and most of those holding the Modernising Farmer frame describing both positive and negative aspects.

5.3.4.3 Conflict between the farmer frames

While many interviewees framed both cow and farmer in several different ways, within the farmer frames this caused friction, often giving rise to expressions of confusion or distrust which was not apparent within the cow frames. A manifestation of this was descriptions of the Traditional Farmer frame sometimes being dismissed as idealised or unrepresentative because they clashed with the Modernising Farmer frame.

> *Participant 14: "Well, I imagine from what I've seen and obviously Hugh Fearnley-Whittingstall* [celebrity chef] *– he's got his barns with his cows ... I know that's not the real thing because obviously it's more intense than that, but that's what I imagine when you see a dairy farm. But obviously they are more enclosed."*

This led to interviewees questioning whether the positive or negative manifestations were correct – specifically how cows were really kept in modern times, what they were fed or treated with, and who safeguarded them:

> *Participant 55: "…big brands that collect the milk, they're responsible for how the farmer looks after the livelihood of the cow, would they take milk from a farmer that doesn't look after their cows? I don't know the answer to that."*

Even participants who had previously felt confident about their positive perceptions that farmers took of their animals were finding it harder in recent times to be sure.

> *Participant 31: "In some ways it makes me feel a bit sad because I feel that there's quite a growing element of people knocking all farming and doing that across the board without actually thinking, do you know what, it's a very broad spectrum and that a lot of farms are very strong on their welfare and their standards. But a part of me also thinks, well you know, which parts of these are true?"*

5.4 Discussion

5.4.1 Summary

In this study, we set out to understand the frames through which the public characterise dairy farms. The aim was that better visibility of these frames could explain not only why the public offer views on dairy farming despite relatively little knowledge, but also their motives for doing so, and areas of common ground where relationships between the public and dairy farming could be developed. As indicated by Shmueli et al. (2006), simply understanding how the public perceive and interpret dairy farming could help resolve conflict. Three original findings are suggested from the analysis:

1) The frames focus primarily on the cow and the farmer – but mainly in the capacity of how the cow is cared for – indicating that the dairy cow and her care might lie at the centre of perceptions about dairy farming.

2) Despite the general lack of experience or meaningful contact with dairy farming evident from the questionnaires, our participants relate to the dairy cow in a number of diverse ways: as having a moral responsibility for her; feeling a longstanding and instinctive familiarity despite indications of this being based less on substance and more on perceived connections; and respecting or envying her natural connections.

3) The conflict between the different farmer frames and their underlying narratives may give rise to confusion or even distrust about the farmer's motives and their care of the cow, which is a key preoccupation among participants.

Together, these suggest the public judge the dairy farmer (and therefore dairy farming) by the treatment of the cow; also that they feel self-legitimised concern for the cow due to their perceived connections with her. To unpack these interpretations further, we will first explore how the frames identified within this study differ to or bring new insights compared with existing knowledge, and then what the frames might signify for the dairy industry.

5.4.2 Cow frames

The use and exploitation of the cow identified within the Enduring Cow frame is already commonly explored within literature, with public concern about the impact of farm practices or conditions on animal welfare highlighted in Cornish et al. (2016); Kendall et al. (2006) and Vanhonacker et al. (2012) among others. The way in which the cow is seen as a willing participant in an unspoken 'contract' is also identified in Nijland et al. (2018); and the concept that animal use in farming is acceptable provided the animal is fairly treated is supported by the principles of the 'human-animal contract' expressed by the Food Ethics Council (2001), and more latterly in the ethical approach of 'New Contractarianism' described in Hölker et al. (2019).

The two other frames for the cow are less evident in studies of dairy farming, and for this reason, their various elements offer more novel insights. These include the sensory aspects of the cow within the Force of Nature frame, which were suggested by visitors to dairy farms in Boogaard et al. (2010). Also within this frame, the enrichment the cow provides to the human lives around her, conveying a sense of tranquillity and peace, is reflected in Hassink et al. (2017) and even in the recent emergence of 'cow cuddling' where farms offer the public opportunities to be comforted by embracing a cow (Gormly, 2021; Pullman, 2021). Concepts that the cow is self-determining and generally 'like us', indicated within the Fellow Cow frame, have been examined in literature previously, but chiefly through the study of the human-animal bond between cow and the farmer or her handler, and the interaction of the cow with the machinery, processes, environment and 'work' of the farm. Examples of this include the cow's 'collaboration' in the work of the farm (Porcher and Schmitt, 2012), and the use of technology, ostensibly improving outcomes for man and animal yet causing increased alienation (Holloway, 2007; Hansen, 2014). However, the relationship between the cow and members of the public, who are largely removed from this dynamic, has not been examined in the same way, yet is of interest because of the way in which people with little or no direct contact with cows might extrapolate or perceive a connection from other frames of references. Kaarlenkaski's (2014) study of entries to a writing competition from those who were both familiar with cows and those who were not, found portrayals of cows as active participants of human–animal

interaction throughout, suggesting some narratives incorporated actual experience of working with cows, but others were imagined or extrapolated from other stimuli (Kaarlenkaski, 2014).

In common with 'imagining' rather than 'knowing' the cow, anthropomorphism – where human traits are attributed to non-human entities – is evident across the Fellow Cow frame. Such perceived connections appear to have been extrapolated from and reinforced by the overt visibility of cows in fields, and the way in which people have entwined their lives with the cow, feeling familiarity through shared life experiences in childhood, the daily commute, holiday fun, etc. Anthropomorphism is not a new concept in philosophy or animal study, whether expressed by Aristotle in the 4th century BC (Aristotle, 2007), in the Romantic era of the late 18th & early 19th centuries (Oerlemans, 1994), or in various published works throughout history (Franklin, 1999). Despite this, anthropomorphism is commonly dismissed in livestock farming today – by farmers as sentimentalism (Stevens et al., 2020) and by animal researchers as lacking scientific basis (Wynne, 2004). Its use in the branding and marketing of dairy products can also be problematic in creating a falsified image of how foods are produced (e.g., Stevens et al., 2013). However, anthropomorphism is also defended by others as an attempt by those with less knowledge to form connections with animals, and they suggest its judicious use offers opportunities for the public to build conceptual bridges with animals and think 'with' them rather than just 'about' them (Philo and Wilbert, 2000; Buller and Morris, 2003; Daston and Mitman, 2005).

Finally, the contrast between the perceived familiarity of the Fellow Cow and the 'otherness' of the Force of Nature has echoes in Ingold (1988), Jones (2003) and Berger (2007). They observe that the evolution of modern farming has transformed our relationship with livestock: while we have increased the usefulness of farm animals by enrolling them into our food systems and farm structures, this has changed them from autonomous and elusive beings into mere units of production. These authors suggest that deep down, we still want our connections with animals to be on their terms, not ours, to experience their primitive connections with nature. Yet in our efforts to 'know' them we have turned them into artefacts. In our study, expressions

of the cow's ubiquity and the anthropomorphic desire to bond with her, yet the reverence felt for her symbolic, cultural and natural importance, indicates a similar tension – even if it is not consciously recognised by interviewees who hold these frames simultaneously.

5.4.3 Farmer frames

Many facets of the farmer frames we identified reflect previous studies. For example, the perception of kindness towards animals in the Traditional Farmer frame was found to be important in Ellis et al. (2009), Miele (2010) and Weary & Robbins (2019), and the sense that animals on smaller farms have a better quality of life, better care and better chances to be managed as individuals is reflected in Lassen et al. (2006), Lusk et al. (2007) and Miele (2010). This association between attentive husbandry and the Traditional Farmer 'type of farming' has also been leveraged in marketing through the use of fictitious farm names which suggest smaller operations which execute more 'personalised' management of animals (The Week, 2017).

Equally, similar concerns around the Modernising Farmer have been raised by Boogaard et al. (2011) in their identification of unease within the public about the use of living beings for economic gain and progressive increases in farm size. The ambivalence with which the adoption of automation by the Modernising Farmer was seen by our participants was typical of the positive (pragmatist) and negative (industrialist) narratives within the farmer frames. Concerns that technologies such as robotic milking could detach farmers from their cows was also identified in Boogaard et al. (2011) as well as Schillings et al. (2021), but equally the positivity about potential animal welfare benefits that could arise echoed findings in Pfeiffer et al. (2021). Participants who had seen actual robotic milking on farms or on TV appeared largely supportive of the technology, reflecting the findings in Millar et al. (2002), which concluded there was more support for robotic milking technology among those with a better knowledge of the topic.

However, the most novel finding in the farmer frames was the way in which conflicting frames and their underlying narratives appeared to create confusion and distrust, leading many interviewees to doubt their formerly established views about farmers'

motives and activities. For example, the Traditional Farmer, as described by a large number of interviewees, was stereotyped and nostalgic; many admitted this 'craftsman' narrative was likely to be idealised – yet it was strongly held within this frame, possibly due to the lasting effect of childhood imagery from TV or books (see Tversky & Kahneman (1974) re. anchoring effect). Conversely, while the Traditional Farmer was judged to have stronger bonds with the cow and thus deliver better care – echoing the bonds some participants themselves appeared to be seeking through the Fellow Cow frame – his lack of viability in the modern world as identified through the 'toiler' narrative, was acknowledged as a welfare risk for the cow and thus reduced the confidence placed in him about his ability to care for the cow.

Similarly incompatible narratives surrounding the Modernising Farmer frame caused uncertainty, even among those with more prior exposure to farming. On one hand, interviewees expressed positive personal experiences of innovative or expanding farmers using technology pragmatically to develop their farms without unduly compromising the welfare of the cow. These narratives jarred with powerful negative perceptions of the 'industrialist' on the other hand, which appeared to reflect social media and documentary imagery they had seen, underlining commoditisation, exploitation and suffering of the cow. While positive first-hand experiences may have played an important role in framing, negative portrayals, while second-hand, carry more salience (Richey et al., 1975) and therefore were hard for interviewees to ignore. The deciding factors for whether the Modernising Farmer was seen as 'good' or 'bad' appeared to mainly rest on the motives of the farmer and the consequences on the cow. This resonates with Weary and Von Keyserlingk (2017), who propose that the moral high ground which many farmers adopt: "*I take care of the animals, the animals take care of me"* (Rollin, 1994) is undermined in the eyes of the public when the narrative changes to: "*I provide care to the extent that this benefits me financially"*. Either way, these clashes undermine efforts by the dairy industry to explain its practices and generate trust, and risk imbuing it with a sense of fickleness.

5.5 Summary

We set out to understand the interpretive frames the public use to construct meaning around dairy farming and the care of the cow, with the aim of using these insights to help build bridges between dairy farming and the public, and create more empathy and understanding within the industry for public views. We found participants focused mainly on the cow and the farmer as being the key actors in dairy farming. They framed the cow in three different ways: an enduring creature; a 'fellow', similar to and sharing common experiences with participants; and a force of nature, imposing and connected to the natural world. Farmers were depicted as traditional and 'modernising', but in both positive and negative lights which together gave rise to confusion about how well the farmer actually looked after the cow, presenting farmers in a conflicting light. These findings suggest the public feel a significant connection to the cow, which could explain why they feel entitled to have a say in how she is kept. It also shows that both traditional (or old-fashioned) and progressive farmers can be seen in a good or bad light, and that this is determined largely by their treatment of the cow. However, it also highlights the effect of personal experience, where interactions with actual farmers are memorable and impactful, and generate more positivity. The development of these frames and their associated insights should prove particularly valuable in encouraging the dairy farming industry to see the world through the eyes of the public, recognising their interest as legitimate and better understanding their motivations.

"There's an absolutely amazing dairy farm… the cows take themselves off, where there's music, the one side of the road they actually go under the road, stand themselves on a circular thing that goes round, finishes milking and off they go.

And I've often just driven there and watched it 'cause it's amazing! And they seem so happy…Yeah, so that's not natural…it's progression and it appears that it's as near as it can to being natural and having welfare of the cows and comfort of the cows."

Participant in 60 face-to-face interviews, conducted across the UK between November 2019 & February 2020 (see Chapter 3)

Chapter 6: Naturalness and unnaturalness in dairy farming

6.1 Introduction

6.1.1 What is 'natural'?

"…the terms natural, unnatural and nature are often used as placeholders for a range of different values or concerns that are meaningful and important to people." (Nuffield Council on Bioethics, 2015)**.** Here, in his foreword to the report summarising the Nuffield Council's nine-month investigation into the meaning of 'naturalness', Roland Jackson captures just one of the obstacles to determining what people mean when they use the term. That he further observes "*…there are noticeable differences between the ways the idea of naturalness is invoked by scientific organisations compared to the other groups…"* illustrates the challenge to finding answers.

Within science, 'natural' can relate to any element of the physical universe including matter, forces, energy, and chemical and biological entities including humans and their society (University of California Museum of Paleontology, 2022). Within the living sciences, however, natural is often taken to mean wholesome or anything not made, influenced by or tampered with by humans and therefore retaining its integrity, but is also acknowledged as a socially constructed concept, interpreted differently and complicated to define (Hoogendoorn et al., 2021). This breadth of definition is evident in studies across fields such as ecology preservation and restoration (e.g., Angermeier, 2000; Ridder, 2007), food (e.g., Román et al., 2017; Rozin et al., 2012), and plant and animal breeding and biotechnology (e.g., van Haperen et al., 2012; Verhoog, 2003; Zwart et al., 2015). That the public also define naturalness differently from scientists, as observed by Jackson (Nuffield Council on Bioethics, 2015), or even conceptualise it as 'we know it when we see it' (Román et al., 2017) is problematic given a growing desire among consumers and citizens to see the integration of 'naturalness' into livestock farming (e.g., Placzek et al., 2021; Sweeney et al., 2022). Thus, it becomes important to establish what we do know about use of the term if dairy farming systems are to adapt to meet this expectation.

6.1.2 Naturalness in farming

In Fraser et al. (1997), it was first proposed that three ethical concerns surrounding animal quality of life could be expressed in an overlapping model incorporating functional health, behavioural wellbeing, and natural living (or 'naturalness') which utilises the animal's inherent adaptations and capabilities. Since then, a number of studies have found different audiences in livestock farming perceive animal welfare in different ways according to their emphasis on each element. Interpretation by (Beekman et al., 2003) that the public's desire for 'naturalness' in farm animal systems translated as chickens foraging, cows grazing and pigs rooting in mud was later subsumed into a broader summary of welfare 'ideals' by de Greef et al. (2006) as the public concentrating on 'icons' like space, straw, and outdoor access while farmers focused on regular care, scientists on biological parameters and animal protection organisations on animal nature and maximal care. Te Velde et al. (2002) indicated that while farmers and citizens see welfare as physical health, nutrition and protection, citizens additionally prioritise freedom to move around and fulfil natural desires. Lassen et al. (2006) also underlined the importance of naturalness to the public, observing their desire for animals to be able to use their inherent instincts by accessing the outdoors, moving freely and socialising with others of their kind.

Since then, the issue of naturalness has been aired repeatedly in studies examining public perceptions of livestock farming. Access to 'natural conditions' is a common theme, usually denoting an outside environment but spanning the animal's 'wild state' to simple access to natural food and light, all of which allow the animal to express its behavioural adaptations and instincts (Spooner et al., 2014a; Clark et al., 2016; Yunes et al., 2017). 'Natural' interventions to improve farm animal welfare include reduced stocking densities and provision of enrichment materials, suggesting space and boredom are key considerations (Clark et al., 2019), and smaller farms have been identified as more natural (Miele, 2010; Spooner et al., 2014a). Compromising naturalness for the sake of the animal's health is not necessarily acceptable either (Spooner et al., 2014a; Clark et al., 2016)

Finally, in the study from Stevens et al. (2020), it was noted that 'natural' had broad and rather vague meanings, but was nonetheless used by opposing parties in

arguments over the validity of certain farming practices. Use of the term felt intuitively right to each – yet the lack of definition made the other's assertions hard to challenge. However, as in Chapter 1 (Section 1.4.1), it was found that those in farming defined the term differently from the campaign groups criticising them. In such a way, lack of understanding and structure around the term 'naturalness' acts as another barrier between farming and its stakeholders.

6.1.3 Naturalness for dairy cows

Specifically in dairy farming, methods of mating or breeding involving a bull rather than artificial insemination, and rearing a calf on a cow (Boogaard et al., 2008, 2011), have been viewed as natural to the public, as has a cow's ability to move, drink, rest and eat when desired or graze year-round (Boogaard et al., 2010, 2011). Space to roam, natural food and exposure to fresh air and the elements is also natural, while confinement in barns is considered unnatural, causing stress and disease (Schuppli et al., 2014; Cardoso et al., 2016; Hötzel et al., 2017). The ability to express maternal behaviours is important too, and loss of naturalness is thought to lead to the 'objectification' of the animal (Hötzel et al., 2017). Pasture is preferential in terms of naturalness, for not just allowing the expression of affective states but also the physical act of grazing (Cardoso et al., 2019). Pasture-based systems are largely perceived by the public as more natural and therefore better for cow welfare (Boyle and Mee, 2017) and lack of naturalness has been found to be the predominant reason for the low acceptance rates of housing dairy cows year-round (Kühl et al., 2019). Some aspects of cow management which are not in themselves natural but mimic or support naturalness, such as cow mattresses, back-scratchers and on-demand feeders (Boogaard et al., 2008) have also received positive responses from the public.

6.1.4 Focus of research

While these findings offer some direction, they are derived from studies which set out to ask different questions, for example around public perceptions of cow-calf separation or access to grazing, or the social acceptance of dairy farming. For this reason, references to – and definitions of – naturalness are ancillary to the findings, not the focus, and our knowledge of how naturalness is defined, and why, remains

intuitive rather than structured, and broad rather than specific. As these studies provide few signposts towards the underlying rationales for items being deemed natural or unnatural, they also lack insight into whether there are any circumstances under which 'unnatural' interventions might nonetheless be accepted as beneficial, and vice versa. Without a better understanding of these aspects and tangible signals from which the industry can work, it would be speculative – if not risky – to adapt dairy farming systems with the aim of improving perceptions of naturalness. Hence in this study, we set out to answer our final research question: ***"What do the public perceive as natural and unnatural in dairy farming, and why?"***.

In determining an approach, qualitative methods are well placed to elicit the insights necessary to develop new theories and explanations that might answer this question (Braun and Clarke, 2013; Tavakol and Sandars, 2014a; b). However, rather than taking an inductive approach, previously established meanings of naturalness in other industries (e.g., as in Coyle and Fairweather, 2005; Siipi, 2008; Nuffield Council on Bioethics, 2015) offer an opportunity to develop *a priori* definitions for naturalness to support the deductive analysis of relevant qualitative data, thus facilitating the identification of a broader range of meanings for naturalness within this context. Such an approach would then allow the subsequent application of thematic analysis to these results to develop underlying rationales (Braun and Clarke, 2013).

6.2 Methods

6.2.1 Analytical approach

As our aim was to identify and explore specific aspects within dairy farming that denote naturalness or unnaturalness in the eyes of the public, we opted for a critical realist ontology, which aims to establish an objective 'reality' rather than a range of subjective interpretive meanings (Braun & Clarke, 2022, pp.175-176). This search for a received view signifies 'post-positivism,' which acknowledges that a 'truth' exists, but also that there is never one single objective 'truth' (Braun & Clarke, 2022, pp.177-178).

Before data collection commenced, a codebook approach was identified as optimal for applying previously-determined categories of meanings as a framework for analysis

(Braun & Clarke, 2022, pp. 242-244). Within the codebook approach, we elected for template analysis (King, 2012) because its initial use of *a priori* codes reflects the research question to develop evidence of patterns, then reflexively creates themes from those patterns (Braun and Clarke, 2022). In this way, at one level the *a priori* codes offer the opportunity to elicit a wider range of examples of naturalness and unnaturalness than might normally be identified, then at another, the subsequent use of thematic analysis elaborates more reflexive themes which might indicate some of the underlying rationales for these views.

6.2.2 Identifying a framework for *a priori* coding

Studies analysing the breadth of the meanings applied to naturalness by the public are limited. Notably, they include an exploration of how New Zealand citizens perceive nature in the context of biotechnology (Coyle and Fairweather, 2005), interpreting understandings among the public that nature is: wise; traditional; pure; complex; and balanced. The aforementioned Nuffield Council on Bioethics (2015) project is another pertinent piece of work, researching public views of naturalness in relation to science, technology and medicine, and from that developing attitudinal themes expressing: "*neutrality towards nature's value; the wisdom of nature; natural purpose; disgust and monstrosity (of novel technologies); and God and religion*". While both pieces of research offered a potential framework for *a priori* coding in our analysis, a third study (Siipi, 2008) – reviewing a wide range of published works contextualising naturalness in bioethics and environmental ethics – was considered to provide the most novel, detailed and applicable framework for initial coding purposes with the potential to draw out new elements in our data. Additionally, it had already been successfully applied in ascertaining perceptions of naturalness in transgenic and non-transgenic crops (Mielby et al., 2013).

Siipi (2008) identifies three main categories of naturalness and unnaturalness: History-based (examining the amount of human intervention an entity has had in its development); Property-based (naturalness and unnaturalness of an entity's current properties compared with an 'ideal' reference); and Relational (naturalness and unnaturalness of a relationship or an entity in a particular context). Each category has sub-categories, and she also categorises the entities being assessed for naturalness

and unnaturalness as: objects, including beings or 'things'; and events, including human actions and behaviours, and 'states of affairs'. Thus we used this model as a starting point from which to analyse our data.

6.2.3 Data collection

Recruitment of participants and data collection are broadly described in Chapter 3. To support the use of a template based on these definitions for analysis, the data gathered needed to contain appropriate breadth and content, hence the semi-structured interview guide (see Appendix 3) was adapted to include questions with the opportunity to elicit a range of data in these areas, if it existed. As an example, the guide included questions that could elicit history-based or relational reasons, such as participants' earliest memories of a cow and how that might differ to how they see cows now; and questions related to property-based reasons, such as words used to describe 'natural', and how 'natural' and 'non/unnatural' terms would be applied to farm animals and their management or care. While data were primarily drawn from Q4 in the interview script (see Appendix 3: "How would you describe 'natural'?" and associated prompts) that covered naturalness, other references to naturalness which identified associated entities or rationales were also included.

6.2.4 Adaptation of the framework and coding approach

Analysis of interview transcripts was aided by NVivo 12 software (QSR International; www.qsrinternatonal.com). In the first cycle, data were coded according to a framework using Siipi's (2008) basic categories, with confirmatory coding on several transcripts by a colleague for comparison. In the context of the naturalness and unnaturalness in dairy farming, only certain entities were found to be relevant and the framework was adapted accordingly. The modified framework is summarised in Table 10, cross-referenced against the sub-categories described in Siipi (2008), and we will now summarise the main changes.

Within Siipi's list of possible entities which could be regarded as natural or unnatural, human actions and states of affairs were combined in our framework due to the potential for a 'state of affair' (or situation) to have been caused by a human action but not stated so overtly by the participant. Although behaviours were taken to mean

an unintentional and unplanned human action within Siipi (2008), these were interpreted as cow behaviours within our analysis, as no unintentional human behaviours were described in our data, but many cow behaviours were. 'Objects or beings' became the third and last category of entities; however, the only objects or beings in our data related to naturalness and unnaturalness were the cow herself, and her feed.

In terms of the reasons for naturalness and unnaturalness, content for some of the sub-categories developed by Siipi were not present within our data. Most of the History-based reasons for naturalness and unnaturalness proved irrelevant – possibly due to the original framework being developed for bioethical and environmental ethics purposes. While one category which was evident in our data (HC1 – historical independence from humans) had several associated sub-categories identified by Siipi relating to the nature of the human-caused change (for example, the time and effort humans have put into change, or the degree of change generated), we elected to use the broader 'parent' category as the detailed subcategories were neither evident in the data, nor material. All Property-based reasons were found in our data – including the category describing actions which are biological or genetically coded within humans (P2) – as were the Relational reasons with the exception of the first (R1 – 'Yuck'), which describes emotional revulsion for an entity, as none of our data contained sufficiently extreme responses to be coded against this.

Additionally, data were coded for 'valence', discussed in Dragojlovic & Einsiedel (2013), indicating whether the naturalness and unnaturalness in question was seen as positive or negative – if a reaction was expressed, or evident in the data. As naturalness was largely seen positively, particular attention was paid to where naturalness was identified as delivering a potentially unfavourable outcome (for example, words such as "unacceptable" or "unhygienic" were used, or phrases indicating the participant did not like the consequences or felt they were too extreme, cruel or unkind); this was then coded as a negative valence.

Table 10. Framework for *a priori* coding, developed from Siipi (2008)

Reason category	Siipi code/Reason sub-category	Entities applied to	Critical question when coding	Response	Conclusion
History-based	HC1 Historical independence from humans	All entities	*How dependent on humans is it for its origin or history?*	More Less	It is more unnatural It is more natural
Property-based	P1 Accordance with an historic ideal	All entities	*How similar are its current properties compared with those of an historically ideal or 'wild' model?*	More Less	It is more natural It is more unnatural
Property-based	P2 Accordance with intrinsic actions	Human actions	*How similar are their actions to those which are biological or genetically coded for humans?*	More Less	It is more natural It is more unnatural
Property-based	P3 Application of technology	Human actions	*To what extent do humans use technology to perform the action/to what extent is technology involved?*	More Less	It is more unnatural It is more natural
Property-based	P4 Proximity to the norm	All entities	*To what extent do the entity's properties or function deviate from the mean or functional normality?*	More Less	It is more unnatural It is more natural
Property-based	P5 Actions deviating from nature or God's will	Human actions	*To what extent do human activities deviate from human nature and purpose, including working in harmony with nature and God's will?*	More Less	It is more unnatural It is more natural
Relational	R2 Familiarity	All entities	*To what extent does it occur frequently enough to be common and familiar?*	More Less	It is more natural It is more unnatural
Relational	R3 Telos	Cow behaviours objects/beings (i.e., the cow)	*To what extent is a living entity's wellbeing promoted and encouraged to flourish?*	More Less	It is more natural It is more unnatural
Relational	R4 Meeting moderate needs	All entities	*To what extent are only moderate needs met and excess avoided?*	More Less	It is more natural It is more unnatural

Similarly, as unnaturalness was mostly seen as negative when a view was expressed, we focused on instances where unnaturalness was expressed in a beneficial light (for example, the participant admitted the practicality or other benefits of the entity, used positive words and phrases such as: "…then that would be OK", noted the cleverness of technology or indicated that something manmade might be more comfortable or safe), as this indicated where naturalness was traded off for 'unnatural' interventions that were acceptable and reasonable in the eyes of the public.

6.2.5 Thematic analysis

After the coding was checked and amended where necessary for fit with the modified framework, the resulting topics and their categorisations were analysed alongside the data using reflexive thematic analysis (Braun and Clarke, 2022), with the aim of inductively creating themes which might explain underlying reasons for the definitions of naturalness expressed. This was achieved by examining the topics raised in each 'reason' category and rearranging them repeatedly into different organizing concepts to determine potential themes. This continued until it was possible to create themes that coherently explained why subsets of topics might be regarded as natural or unnatural.

6.3 Results and discussion

6.3.1 Topics for naturalness and unnaturalness

6.3.1.1 Summary

A summary of topics relating to a dairy cow's life and identified within Siipi's framework as 'natural' is contained in Table 11; a similar summary of 'unnatural' topics is contained in Table 12; and the topics where opposing valence suggested naturalness was less acceptable, and unnaturalness more, are similarly summarised in Table 13. Data excerpts illustrating these topics are contained in Appendix 7.

In reviewing these topics, we identified a number of novel results facilitated by the range of different entities highlighted in Siipi (2008), particularly human actions or states of affair, which have not been examined within this context previously to our

knowledge. The detailed breakdown of reasons for naturalness within the Siipi framework introduced further new elements, particularly related to the naturalness of intrinsic human actions (Property-based – P2) and actions deviating from nature or God's will (Property-based – P5); again, no comparative reference for these could be found in literature within this context. However, a number of the other reasons for naturalness or unnaturalness were reflected in literature.

6.3.1.2 History-based reasons for naturalness (HC1)

The definition of naturalness in animals proposed by Yeates (2018) as 'unaffected by man' – for example, wild populations which evolved without human intervention – is analogous to the History-based (HC1) definition. In this category within our data, there were references to unnaturalness through human involvement in the increase in farm size, the application of technology and chemicals to grow feed and rear animals, and the selective breeding of the cow to change her capabilities and appearance. However, it was also acknowledged by some participants that this historical perspective was just that, and what the cow had been evolved from, and how, was largely unknown, e.g.:

> *Participant 36: "I know that cows, like the ones that we have, never existed in the wild, they've been bred to be as they are."*
>
> *Participant 28: "The whole point of cows now in a dairy farm, how they have been bred over the years, I wouldn't know what their original natural environment was for a dairy cow if I am honest."*

As the research question focused on the naturalness of dairy farming now and not the amount of human interference in its evolution, more relevant perspectives were identified within the Property-based and Relational reasons.

6.3.1.3 Property-based (P) and Relational (R) reasons for naturalness

Two of the property-based reasons for naturalness in our study – comparisons against historic ideals (P1), and the application of technology (P3) – were the ones most reflected in the findings of other studies. For example, the systematic review of public attitudes conducted by Clark et al. (2016) summarised naturalness as: "*providing enough space and associated freedom to allow the animals to behave according to their natural instincts*" and: "*having access outdoors and to unadulterated feed*".

Various references made in our data to freedom of movement, a natural environment, and ability to rest, eat and sleep when the cows wanted, were also associated with naturalness in Spooner et al. (2014), Boogaard et al. (2010), Yunes et al. (2017) and Schuppli et al. (2014) – whereas other topics our participants raised, such as natural feed, small scale production, natural light and air, could be found in Miele (2010). As in our study, automated milking systems were seen as relatively unnatural within Pfeiffer et al. (2021) and Boogaard et al. (2011).

References are also made in other research to naturalness as familiarity (Relational – R2) or normalcy (Property-based – P4) – mostly around the familiarity and normalcy of cows being seen in fields, which is where they are most visible and therefore their 'natural setting'. This was most overt within Boogaard et al. (2008) as Dutch citizens' attachment to seeing their 'iconic' cows in fields, but also as a subtext to the symbolic naturalness of cows living outside and grazing found in Cardoso et al., (2019, 2016), Hötzel et al. (2017) and Kühl et al. (2019).

Two other concepts of Relational-based naturalness within our data were partially reflected in other research. 'Telos' (R3) manifested elsewhere as concern over practices which deviated from how the cow would want to live her life, for example unnaturalness of cow-calf separation (Hötzel et al., 2017; Placzek et al., 2021; Sirovica et al., 2022) and cows failing to live their full (perceived) natural lifespan (Boogaard et al., 2010; Ventura et al., 2016). The other reason of 'superabundance' (R4) over moderate needs, present in our data, was reflected in the public's discomfort with cows overproducing, expressed within Boogaard et al. (2010).

As raised under Methods within this Chapter (Section 6.2), valence of natural entities was largely positive, and unnatural entities, largely negative. Topics raised as unnatural but with a positive valence included some milking technologies, especially those which afforded the cow autonomy. By contrast, those discussed as natural with negative valence mainly focused on exposure to winter weather when outside in a natural environment. The juxtaposition of unnaturalness with positivity was comparable to the reconciling of modernity with natural outcomes in Boogaard et al. (2010) regarding, for example, shelter provided outside and cow mattresses for comfort.

Therefore, there is evidence within previous research to support some of the topics found in our data, but not the full breadth of topics gathered. Moreover, locating these topics into this adapted framework offers a novel, more structured way of examining the subject of naturalness in this context.

6.3.2 Summary of themes

Four themes were developed from the topics summarised in Tables 11, 12 and 13, and the associated qualitative data, to explain why naturalness and unnaturalness might be perceived as such within the context of a dairy cow's life. These four themes were: 'Being Cow', indicating the high value placed on the cow being in her natural environment and able to express her innate behaviours; 'Evils of excess', where any superabundance of profit or production was deemed unnatural; 'Benevolent dictatorship' reconciled the perceived naturalness of the farmer's role to care and manage his or her animals with the need for naturalness in the animal's life; and 'All about context' offered an explanation why naturalness was not always beneficial nor unnaturalness undesirable.

6.3.2.1 Theme 1 – 'Being Cow'

Despite acknowledgement of the cow's long period of domestication and the changes that have been imposed on her through time (see History-based unnaturalness – HC1), she was nonetheless regarded as a natural animal that still needed a natural environment to thrive. This ideal of naturalness was expressed through the optics of comparing her needs with those of her historic or wild 'ideal' (as in Property-based naturalness – P1): of being outside in a wild environment, requiring a 'natural' grass or forage diet, to physically graze and harvest her feed, to roam and move freely, to choose her social companions from a larger herd, and to have autonomy over her time and place.

Table 11. Summary of topics identified as 'natural' within dairy farming

Siipi code/Reason	Critical question	Human actions, situations, states of affairs	Behaviours (cow)	Objects (cows & feed)
HC1 History-based: Independence from humans	*How dependent on humans is it for its origin or history?*	-	-	-
P1 Property-based: Accordance with an historic ideal	*How similar are its properties compared with those of an historically ideal or 'wild' model?*	Feeding a natural (grass) diet/allowing grazing Allowing exposure to the elements Providing the cow with autonomy of time & environment Minimising intervention Mimicking the calf drinking when milking Allowing the cow to roam (without boundaries)	Acting as a herd & socialising at will Foraging & picking at grass Roaming & moving freely, sheltering where needed Being enriched (through life outside)	-
P2 Property-based: Accordance with intrinsic actions	*How similar are its current properties compared with those of an historically ideal or 'wild' model?*	Farming & having 'dominion' over cows Caring for and tending to the cow Advancing & innovating (e.g., growing farms, using data)	-	-
P3 Property-based: Application of technology	*To what extent do humans use technology to perform the action/to what extent is technology involved?*	Not using machines to milk (hand milking instead) Feeding only grass/plant matter (not adulterated feed) Undertaking (hard) manual work (not machine-assisted)	-	-
P4 Property-based: Proximity to the norm	*How similar are their actions to those which are biological or genetically coded for humans?*	Farmers need to make a living Farmers care for cows Cows are on farms/provide milk for humans Cows are outside	-	-
P5 Property-based: Actions deviating from nature or God's will	*Are humans working in harmony with nature or God's will?*	Work with the nature of the cow/have a bond with her Have responsibility to the animal Motivated by the interests of the cow	-	-
R2 Relational: Familiarity	*To what extent do humans use technology to perform the action/to what extent is technology involved?*	Cows being milked (more familiar by hand) Cows in fields (To farmer) cow-calf separation	-	-
R3 Relational: Telos	*To what extent is a living entity's wellbeing promoted and encouraged to flourish?*	Allowing the cow to 'be cow' Letting cows live by their instincts Allowing cows to have their own mind	'Being a cow' Feeling freedom Spending time with who she wants	-
R4 Relational: Meeting moderate needs	*To what extent do the entity's properties or function deviate from the mean or functional normality?*	Making just enough profit for the family or a modest living Receiving practical help from technology/using beneficially Treating for disease only when needed	-	-

Table 12. Summary of topics identified as 'unnatural' within dairy farming

Reason	Critical question	Human actions, situations, states of affairs	Behaviours (cow)	Objects (cows & feed)
HC1 History-based: Independence from humans	*How dependent on humans is it for its origin or history?*	Domestication of animals/creation of cows & dairy farms Growth in farm scale Breeding of unviable, deformed or un-resilient animals Adoption of machinery and technology Use of antibiotics/hormones/chemicals	-	Cows which are distorted or over-produce as a result of breeding
P1 Property-based: Accordance with an historic ideal	*How similar are its properties compared with those of an historically ideal or 'wild' model?*	Taking milk from cows Imposing a structured 'non-cow' regime on cows Housing/confining the cow in a claustrophobic environment Feeding artificially/pushing for yield, growth or pregnancy Slaughter of male calves	Exhibiting institutionalised or stress behaviour Suffering boredom Groomed for dependency on humans	-
P2 Property-based: Accordance with intrinsic actions	*How similar are its current properties compared with those of an historically ideal or 'wild' model?*	-	-	-
P3 Property-based: Application of technology	*To what extent do humans use technology to perform the action/to what extent is technology involved?*	Create artifacts (buildings etc) Milk by machine Use artificial lighting Use chemicals and antibiotics Develop artificial feed	-	Artificial feed
P4 Property-based: Proximity to the norm	*How similar are their actions to those which are biological or genetically coded for humans?*	-	-	-
P5 Property-based: Actions deviating from nature or God's will	*Are humans working against nature or God's will?*	Expanding farms Developing practices which may be advantageous but harmful to nature Exploiting the cow to meet other (personal) needs Being motivated by the market/profit	-	-
R2 Relational: Familiarity	*To what extent do humans use technology to perform the action/to what extent is technology involved?*	Milking/the milking process (cows are only seen in fields) Housing cows	-	-
R3 Relational: Telos	*To what extent is a living entity's wellbeing promoted and encouraged to flourish?*	Cow-calf separation Constraining the cow's natural instincts (e.g., to explore)	-	-
R4 Relational: Meeting moderate needs	*To what extent do the entity's properties or function deviate from the mean or functional normality?*	Making an excessive profit Overproducing, over-growing, over-managing Devolving completely to machinery	-	-

Table 13. Summary of rationales why some topics have been identified as 'natural' yet potentially negative, and some as 'unnatural' yet potentially beneficial within dairy farming

		NATURAL	UNNATURAL
Reason	**Critical question**	**Human actions, situations, states of affairs**	**Human actions, situations, states of affairs**
P1 Property-based: Accordance with an historic ideal	*How similar are its properties compared with those of an historically ideal or 'wild' model?*	Modern animals are naturally less resilient to diseases and hardship	Housing in the winter protects the cow Modern breeds are less hardy so housing is appropriate for them Veterinary care is beneficial
P3 Property-based: Application of technology	*To what extent do humans use technology to perform the action/to what extent is technology involved?*	Human handling can be worse than mechanical	Mechanisation helps get the job done! Machinery can support naturalness by increasing cow autonomy Medicines are ethical/beneficial for welfare when needed Some technology can improve welfare & comfort & cow experience Cow 'telos' be supported by judicious use of machinery/technology

Participant 42: "…a cow would not choose to stay indoors all day if there was a bit of grass outside, and an open door, it wouldn't stay inside; therefore, it's not natural."

Participant 59: "…they're free to feed when they want to feed, they can roam when they want to roam, they can be together when they want to be together. Essentially allowing them to live on demand as they naturally would rather than I guess forcing a daily cycle on them that wouldn't naturally be what they do.

While comparison with an historic or wild ideal was one of the most common methods participants in this study used to gauge naturalness, Musschenga (2002) highlights the shortcomings of this approach, as it assumes the capabilities expressed in wild animals are still present in their domesticated relatives. Instead, he says, the environment in which an animal has developed has significant importance. This reprises well-established challenges with lay views of animal quality of life, discussed in Chapter 1 (Section 1.4.2), where technical concerns of farmers and veterinary surgeons are less important to the public than iconic symbols of welfare. However, the impact of the domestication of the cow was recognised by some interviewees, e.g.:

Participant 16: I guess natural for me feels as though what a species has adapted to experience or to live in. So I guess it's quite natural… yeah, I guess it is quite natural for cows to be milked in a milking pen once a day."

A second perspective for naturalness within this theme concerned the familiarity (Relational – R2) and perceived normalcy (Property-based – P4) of the cow in an outdoor environment or fields, which indicated her optimal and chosen environment to many – although one participant observed that cows in sheds, by contrast, were not so visible and hence they could not be easily imagined.

Participant 44: "…in terms of what is natural for animals like cows then it probably rests on our preconceptions, to a certain extent, of what we've seen throughout our childhood of how those animals are out in the British countryside. They are and have been visible so that was how we picture their natural lives."

Participant 3: "I don't know, I just think it's really peculiar to have cows and not have them in a field. I don't know, maybe it's very biased as to how people think about farming, but obviously there's loads of farms all over England and a lot of those have the cows outside. You wouldn't know though would you, like I said if somebody had a barn full of cows that you couldn't see if they wasn't outside."

Familiarity is a well-known heuristic used by people to make rapid judgements, or decisions in the absence of full information (Kahneman et al., 1982). The theory behind familiarity bias is it stems from evolutionary learnings where familiarity is less likely to lead to harm, thus it becomes a resource-efficient shortcut to minimise risk (Kahneman et al., 1982). Greater familiarity with grass-based systems for dairy farming is likely as it means cows are visible in fields, hence this would be seen as their natural setting. Hötzel et al. (2017), Ribeiro et al. (2016) and Ventura et al. (2016) all allude to the tendency for familiar practices and products to be seen as more natural than those which are novel.

Sympathy for the cow's 'telos' (Relational – R3, in Table 12) provided a third perspective through which the importance of 'being cow' was reinforced. Siipi (2008) explains that naturalness relates to telos because "*entities that move a being closer to its telos are natural to it*". Within the data, participants appeared to have developed their own sense of what we determined to be a cow's teleological needs, expressed as visions of the cow using her own mind, choosing where and what to eat, when she wanted to be milked, and how she simply wanted to 'be cow'.

Participant 14: "I visualised them all in big hills, fields, just grazing all day, just most of the day just in open fields…I just imagine that's what they've always done, that's just their instinct, that's part of them. That's all they do really, that's what they're meant to do."

Participant 38: "… cows, from a manual milking point of view, they have to go to milk in the morning and the afternoon, whereas [through automated milking] they could be like at lunchtime, 'Ooh, I quite fancy going to have a milk' and they can. So that's their natural state, because they can then, they're using their own mind to know what they need to do."

Some concern has been raised around equating concerns about the cow being able to 'live like a cow', with naturalness in terms of her teleological needs; after all there is considerable debate around how telos should be defined (for example as summarised in Browning (2020) and Hauskeller (2005)). However, Browning (2020) accepts that the concept of telos most closely tracks the public's intuitions about welfare, and therefore we, too, interpreted it as such. Hence, we would argue that where interviewees referred to a cow 'being cow' and doing what a cow wants to do, this is sufficiently close to the Aristotelian definition of telos as referred to in Siipi (2008), of: "*…that toward which every being strives… The closer to its telos a being has developed, the more perfect and flourishing it is.*" Therefore, we have attached such ambitions to the concept of telos, and interpreted how we believe it was 'felt' by participants in our study – what allows the cow to flourish. Finally, Browning (2020) warned that when equating teleology with naturalness as others have (see Chapter 1, Section 1.3.1), naturalness does not necessarily lead to good animal welfare; she suggests instead that there should be a focus on the promotion of behavioural preferences and enjoyment.

6.3.2.2 Theme 2 – Evils of excess

The reason for unnaturalness as going beyond the meeting of moderate needs (Relational – R4) is also referred to as 'superabundance' in Siipi (2008). It captures concerns raised by interviewees around over-production of milk, excessive growth in animals, mechanisation of management, large scale farming, and excessive profits at a presumed detriment to the animals.

> *Participant 60: "it gets all more impersonal and, like I said, instead of having hedgerows and smaller fields and three crops they're like, 'Well, we'll do those three fields together and do one crop then it's quicker and easier for us and you're harvesting it all at the same time.' So, it's about money, it's always about money, but for animals it's probably maybe conditions aren't quite as pleasant as they were…."*
>
> *Participant 41: "Well, it's not natural really, is it, producing all that milk every day. Yeah, it's not natural – but it's not natural that we have so many [cows] anyway."*

The unacceptability of excess was also reinforced through the reason of human actions which deviate from nature or 'God's will' (Property-based – P5), where unnaturalness manifested in outcomes people felt deeply uncomfortable about and sometimes believed crossed a natural order, such as excessive expansion of the farm or use of damaging technologies.

> *Participant 53: "I think it depends on the reasons why they're not natural, so where things are genetically modified or battery farming, things like that where it's purely for the human's benefit and not for the animals then that's not OK, that's abusing nature."*

While grass and other 'natural' forages were seen to be consumed slowly and support moderate production, artificial feed – variously described as having chemicals and other additives including plastics or of being of unknown content – was believed to boost production unnaturally, and therefore was a 'use of technology' (Property-based – P3) reason for unnaturalness.

> *Participant 59: "I'd also imagine their feed is probably formulated to make them grow as quickly as possible, as well as possible and quite calorific and intended to fatten them up."*

Finally, under the reason of unnatural properties related to an historic idea (Property-based – P1) there were references to the negative 'states of affairs' on some dairy farms where cows were pushed hard for more productivity and burnt out after only a few lactations as a result.

> *Participant 36: "…as far as I know in most intensive farms, they're only kept for three or four pregnancy cycles and it's quite intensive for them and then they are killed for meat or cat food or whatever. And they live much shorter than their natural lives would be, so they're mostly used for their milk capacity."*

As discussed in Chapter 1 (Section 1.2), over decades, the dairy industry has had to become more efficient, using fewer resources and producing more per unit of input to stay economically viable. In many cases, this has meant intensification through bigger farms and higher yields, with management practices on-farm adapting to manage impacts on animal welfare (Section 1.3.2). The increased productivity that is part of

intensification is an established concern among the public (Chapter 1, Section 1.2), as also seen here where excess is framed as unnatural. This is consistent elsewhere, for example, in the rejection of high-yielding breeds of cow for more moderate-yielding animals (Boogaard et al., 2008), and in preferring farmers to focus on wider aspects of farming such as landscape, rather than production alone (Boogaard et al., 2010). However, the public are not the only stakeholders who have disquiet with such excess. Farmers, too, have expressed reservations about the direction of travel, especially the impact on the animal, saying a cow needs to be a cow and not a 'production machine' (de Rooij et al., 2010); and dairy and animal science students have voiced concerns that demands on the animal should not go beyond their natural capacities (Ritter et al., 2021).

6.3.2.3 Theme 3 – Benevolent dictatorship

The novel inclusion of the rationale that naturalness is something in-keeping with intrinsic human actions (Property-based – P2) meant naturalness was not just examined from a cow-centric perspective, but also from point of view of what participants believed were natural activities for the farmer in looking after the cow. Here, the farmer's power over cows was recognised as a responsibility which owed the cow a reasonable quality of life, but which also took charge of the decisions the cow was unable to make herself.

> *Participant 57:" There is a case of we are the masters, as such, so we are going to take over those, but they should still be given their freedom, that's the naturalness they should still be having. But it is natural for us to have taken over them now, as such."*
>
> *Participant 6: "…it's kind of like having a child, isn't it, you don't want them to be sitting inside all the time, you want them to have the opportunity to go outside and be inside, but if you feel that they need to be protected you'd bring them in. I guess that's kind of how I feel about it."*

The identification of this topic within the data supports the naturalness of the farmer managing the cow. However, there was resistance towards the management being too heavy-handed, which could become another example of 'excess'.

Participant 54: "So that is natural, especially for livestock farmers, they're not really enforcing that much manipulation onto it because they're just controlling the migration or they're controlling the grazing, they're not really doing anything else, they naturally do that."

Participant 53: "It's probably a bit of a balance 'cause for me somehow natural kind of goes along with caring for, that's quite a natural response to another animal as well. So, in some ways even though it's intervening in a way that we wouldn't if humans weren't around it still feels quite a natural thing, so in some ways the animals having a good wellbeing and being looked after still feels natural."

At the same time, the relationship between the farmer and cow was acknowledged in terms of the expectation of 'hands-on' management – including, as the term suggests, the touch of the human on the animal and the need for the farmer to continue being the primary contact for the cow, even with expected increases in use of mechanisation.

Participant 46: "I think cows may be more relaxed with human contact, I think some farmers probably pet them or stroke them, I'm guessing they may do that, you don't really see that bit."

Participant 49: "So, I mean when they have these machines for milking, maybe that's … But then, I don't feel like that's completely unnatural, it's just a way to help, but yeah, if machinery could do all of it and there didn't need to be a farmer, then that would get unnatural."

This perception is echoed in a range of research which seeks to explore the relationship between the farm animal and its handler, for example, that the common notions of stockmanship centre around observing and touching cows (Holloway et al., 2014), and the perceptions that farmers farm because they love animals, with the daily contact with their cows being part of the joy (Boogaard et al., 2010).

To bring these aspects together, the merits of a benevolent dictatorship were first raised by Plato in his most well-known work The Republic (Plato, 1991), where he proposed that the ideal state is one run by philosophers as kings, thereby bringing

perfect knowledge to a system in which they also have to power to rule in the interests of their subjects (Orr, 2017). In this way, it could be proposed that a dairy farmer, who has the absolute power, could utilise knowledge to run a dairy farm in the ultimate interests of his or her subjects, the cows. If the interests of the cow is to have a life which enables her to 'be cow', then according to the views expressed through this study, such an arrangement would accommodate the natural inclinations of both cow and farmer. This type of approach is suggested by one participant when talking about a TV programme showing the installation of robotic milking.

> *Participant 16: "So clearly I don't think farmers have a lot of disposable income but this farm had really gone the extra mile to put things in place which did support the cow, because at the end of the day a farmer makes his livelihood on producing milk and producing meat, if you're born into a farming lifestyle you can't just say, 'Nah, they're gonna stay in the field but I'm not gonna milk them'. And it is natural for cows, cows need to be milked but trying to put things in place to make sure that the cow's welfare was maintained in that."*

Finally, farmers themselves may benefit from being able to farm how they naturally want to; a recent study indicated some farmers experienced 'moral distress' from knowing what was right for their cows, but being unable to implement it because of supply chain demands (Smid et al.; 2022). Hence, in this context, giving farmers 'permission' and the means to farm in ways that meet their needs and the needs of their cows could be seen as natural for both them and their animals.

6.3.2.4 Theme 4 – All about context

Our fourth theme summarises the ambivalence (literally the two opposing feelings – positive and negative) towards naturalness and unnaturalness depending on context, as shown in Table 13. As naturalness is usually seen positively, and unnaturalness, negatively, we examined instances of counter-valence where judgement on the positivity or negativity of the naturalness or unnaturalness was more fluid. Counter-valence was only apparent within Property-related reasons for naturalness, specifically in comparison to an historic ideal (P1), and the use of technology (P3). Firstly, to what extent the cow was perceived to benefit was important in determining whether something unnatural could be viewed positively, for example:

Participant 47: "I should think a clumsy milker – I don't know this – might hurt a cow quite a lot whereas I am sure the mechanical ones do it all in a wonderfully efficient way without necessarily hurting a cow."

Participant 53: "…for humans as well there's lots of ways in which we intervene to make things better and that's great, that's lovely, so even if a cow's fallen and broken its leg then helping getting a vet in or someone to help set it and things like that."

This illustrates one of the primary challenges in prioritising a natural life for farm animals: a number of facets of such a life do not promote positive welfare – for example, exposure to predators or pests, and leaving disease untreated (Špinka, 2006; Mellor, 2015). Equally, humans are fallible, and while the human touch and human eye may be perceived as good stockmanship (see Section 6.3.2.3), the ability for this to support optimal quality of life for the animal depends on the quality and abilities of the individual or manager (Animal Welfare Committee, 2021). However, benefits from some unnatural interventions appeared to be recognised by participants. Vigors et al. (2021), too, found the public were more pluralistic than expected in reconciling naturalness and care (in their case, the managed and therefore 'manmade' health of the animal), considering that welfare was most positive when both health and natural behaviours were optimised.

Next, the way in which unnatural developments enabled naturalness elsewhere went some way towards framing them in a positive light. For example, autonomy for the cow – seen as self-determination and therefore natural from the telos reason (Relational – R3) – could be facilitated through the use of (unnatural) robotic milking.

Participant 38: "From the way it's done, it's unnatural 'cause it's modern, but from the way the cows have their own mind to go and milk, that is natural."

The potential to facilitate naturalness through the use of non-natural technologies has been observed previously in Boogaard et al. (2008) and Beaver et al. (2020). Furthermore, in Beaver et al. (2020) it was suggested that concepts of naturalness were shifting generationally, with younger people finding technological solutions more 'natural' through familiarity (Relational – R2) or normalcy (Property-based – P4). In a

similar vein, if the cow benefitted from an unnatural intervention, this was more likely to be received favourably than if the farmer or other people benefitted.

> *Participant 6: "I think with most things like this it's probably quite a blurred line. I would say if you're need for unnatural intervention is to benefit the animal then that is OK, if you're trying to do it without any concern for the welfare of the animal then that's kind of crossing the wrong line."*

In support of this, it has been established in one study that while the public favour cows being at pasture, in hot weather they accepted or even prioritised cows being placed in more artificial surroundings with shade and fans if it made the cows more comfortable (Cardoso et al., 2018). There is little other comparative literature to aid interpretation of this result, although in the study of perception of risk presented by novel technologies, lack of clear or persuasive benefits (Macnaghten, 2004; Bruhn, 2007) and 'unfairness' (Bruhn, 2007) have both reduced acceptability.

Lastly, the appeal or quirkiness of an outcome can affect its acceptability.

> *Participant 21: "There's an absolutely amazing dairy farm… the cows take themselves off, where there's music, the one side of the road they actually go under the road, stand themselves on a circular thing that goes round* [rotary parlour]*, finishes milking and off they go. And I've often just driven there and watched it 'cause it's amazing! And they seem so happy…Yeah, so that's not natural…it's progression and it appears that it's as near as it can to being natural and having welfare of the cows and comfort of the cows."*

Again, there are no relevant studies examining this phenomenon in this context, although the amount of 'fun' or attractiveness associated with a new technology has been found to increase its acceptance (Bruner and Kumar, 2005).

The four themes and their relationships with different reasons for naturalness are summarised in Figure 16. From these, we speculated that the benefit of the cow was the ultimate goal. Entities that benefitted the cow were largely natural, and were, by association, positive. If benefits for the cow could be achieved in unnatural ways, this, too, was supported, but naturalness that did not benefit the cow was not.

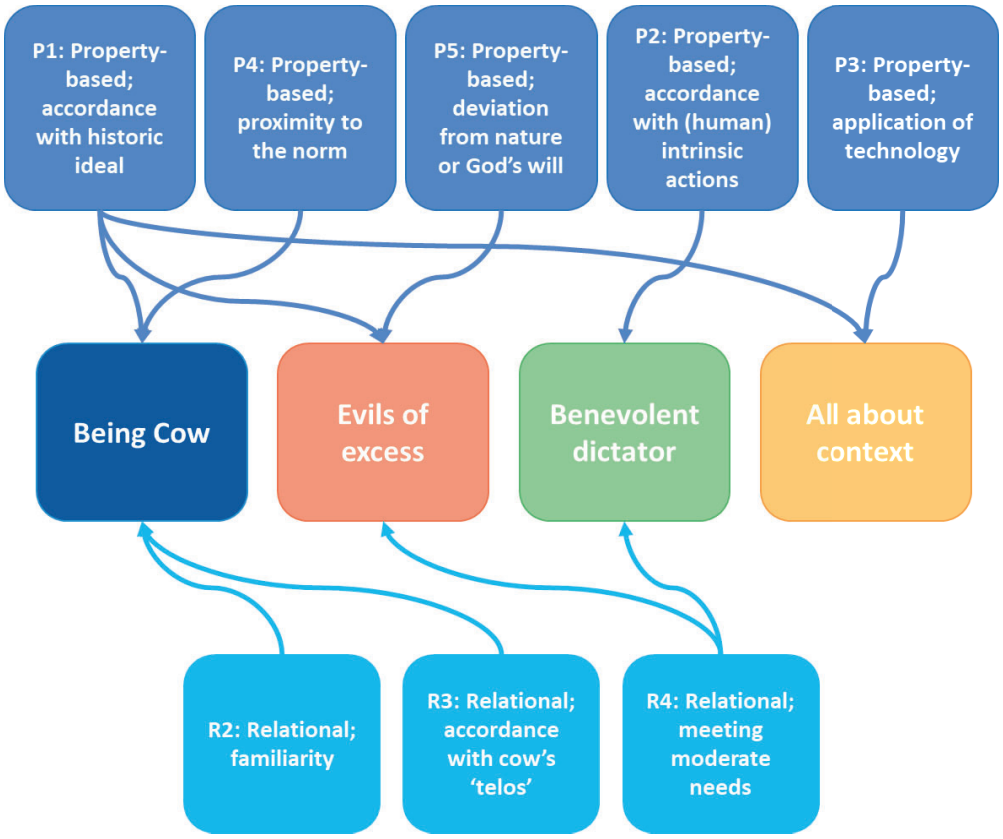

Figure 16. Visual summary of four naturalness themes and the 'reason' categories that relate to them

6.4 Summary

The public often express a desire for naturalness in livestock farming more generally, but a lack of clarity around what 'naturalness' means has hampered dairy industry efforts to respond to societal expectations. While this study confirms that providing outdoor access, grazing dairy cows, and avoiding cow-calf separation are – as expected – signatures of naturalness in dairy farming, it also reveals a far wider set of meanings for the term than previously appreciated.

Farmer-related definitions suggesting dairy farming as a profession and the act of farmers caring for cows and seeing after their interests is regarded as natural presents positive opportunities to build narratives around that concept. While naturalness has mostly been assumed thus far to be the paramount interest for the public, the need to sometimes take unnatural interventions in the interests of the cow also appears an accepted necessity. However, the key in this is the benefit to the cow, the motives of

the farmer, and the benevolence of the 'dictatorship' in supporting the cow's needs and, in particular, her ability to live as a cow inherently should. Creating more familiarity and 'normalcy' around certain production methods could also help people to accept them as more natural.

Lastly, understanding the rejection of excess and overproduction as unnatural is an important learning; while farm expansion may be a necessary development for business survival, rearing and managing animals within the perceived normal boundaries of their productive abilities is a far more comfortable prospect for the public than the unnaturalness of 'superabundance'. While these novel findings offer a less traditional and more 'lateral' view of naturalness, they nonetheless provide communication or system-change opportunities as part of wider dairy industry efforts to improve engagement with the public, and a platform upon which to build further research into this topic.

"But as a child you're brought up to say, 'Oh, look at the lovely cows in the field' and you have this little sort of bubble image of it's all bright and beautiful, and then you see the end result of cows going into rotating parlours and then just going out and it's … <sighs> I don't know if it's bothersome, it's just not what you're brought up to believe."

Participant in 60 face-to-face interviews, conducted across the UK between November 2019 & February 2020 (see Chapter 3)

Chapter 7: Discussion

7.1 Introduction

At the start of the thesis (Chapter 1), we identified that changes to the dairy industry over the past 50 years (Capper et al., 2009; Godfray et al., 2010) have moved its management of the cow out of alignment with societal expectations (Weary and von Keyserlingk, 2017), with the potential to affect the dairy industry's future by either impacting sales in an increasingly competitive and ethically-conscious market (Fehér et al., 2020), or by reducing dairy farming's social licence to operate (Hampton et al., 2020). We identified four research questions that aimed to better determine what the public currently perceive dairy farming to be (i.e., their frame of reference), and how they would prefer dairy cows to be managed.

The approach throughout our four areas of research was to apply novel methods to what was already understood about public perceptions and preferences, so we could obtain clearer insight into how different aspects of the industry are perceived and understood, and understand heterogeneity of view, motivations and psychosocial influences. As can be seen in results of Chapters 2, 4, 5 and 6, each study had overlapping and complementary findings, which allow us to now identify overarching topics within the four bodies of work, and from these go on to determine learnings and possible actions for the industry.

7.2 Assimilation of results

The topics have been summarised in Table 14 along with pertinent observations from the literature review in Chapter 1. The topics identified across the four studies are: the diversity of perspective between and within groups; the dairy industry's direction of travel and the challenges that is creating; care and naturalness as important representations of animal welfare to the public; and the vested interest the public have in the management of the dairy cow. We will explore each of these individually then propose how the industry could address the issues and opportunities they raise.

Table 14. Key topics drawn from an assimilation of results from all four studies

Topic	Chapter	Interpretation of results relevant to topic
Diversity	Chapter 1 (Introduction)	There is diversity in how different stakeholder groups assess animal quality of life, with farmers focused on habit and good intentions, veterinary surgeons (aligned to scientists) focused on biological parameters, and the public valuing icons such as straw, space and outdoor access; this means portrayals of care from farmers and vets may not be seen as such by the public.
	Chapter 2 (RQ1)	The population has characteristically distinct groups with different preferences for how dairy cows are managed and milk is produced; some prioritise aspects of cow management, and others do not, instead placing importance on product quality or fairness, or expressing no preferences at all. There is also diversity in the amount of knowledge and experience of farming, and in the level of belief in an animal mind. This diversity should be accounted for when addressing criticism so that addressing one concern does not detract from another.
	Chapter 5 (RQ3)	The cow is perceived through three diverse frames with a range of underlying narratives, and the farmer through two frames with underlying positive and negative narratives; this indicates breadth and complexity in how both are perceived, and affects how new information relating to both is assimilated.
	Chapter 6 (RQ4)	Naturalness has diverse meanings in the context of the life of the dairy cow, covering not just the cow but farmers and their role too; this offers more opportunity to improve 'naturalness' than previously thought.

Cont…

Table 14 continued…

Topic	Chapter	Interpretation of results relevant to topic
Direction of travel	Chapter 1 (Introduction)	The dairy industry has evolved and intensified due to economic necessity; this evolution has contributed towards a disconnect between the industry and society which may impact the future of dairy farming.
	Chapter 2 (RQ1)	In terms of animal-related priorities, grazing, comfort and health & welfare appear the greatest priorities, and therefore meeting societal expectations regarding these will be important.
	Chapter 4 (RQ2)	There has been a trend towards housing dairy cows year-round; however, this is rejected emotionally and cognitively, and also on the grounds of being unable to meet the dual needs of the cow.
		Extended grazing has been adopted by some farmers in the UK; there is discomfort with cows being outside in the winter, which can be perceived as lack of care and not meeting the dual needs of the cow.
	Chapter 5 (RQ3)	Typically, traditional farmers are perceived to be kinder, and have smaller farms and a better relationship with their cows; by contrast, progressive farmers are regarded negatively if the wellbeing of the cow is compromised for the sake of profits or scale – but can also be seen positively if innovation (for example technology) does not harm or even benefits the cow.
		People connect with cows in a number of different ways and value the sight of them in fields; this is at odds with system change that is moving cows into buildings and out of sight.
	Chapter 6 (RQ4)	Farms and yields are increasing; however, 'superabundance' – manifesting as excess yields per cow, excess growth rates, excess farm scale and excess farm profits – is seen as unnatural.
		It is natural for the farmer to farm, but this is positive or negative depending on the outcome for the cow.
		It is natural for the farmer to have a relationship with the cow – but increasing adoption of technology could disrupt this contact.
		Changes to farming that prevent the cow 'being cow' and acting according to her nature are disfavoured.

Cont…

Table 14 continued…

Topic	Chapter	Interpretation of results relevant to topic
Care and naturalness	Chapter 1 (Introduction)	The industry's measures of farm animal welfare (i.e., still based largely on the Five Freedoms) have largely avoided the adoption of behavioural and naturalness, despite these aspects being valued by the public.
	Chapter 2 (RQ1)	Grazing, comfort and health & welfare share equal top priority overall; in other chapters, health & welfare is perceived as care, comfort is both a construct of care but also of naturalness in terms of freedom and emotional wellbeing; grazing is identified as natural. This underlines the importance of both care and naturalness to the public.
	Chapter 4 (RQ2)	The cow is seen as both domesticated and wild, and therefore needing both care and naturalness.
	Chapter 5 (RQ3)	Farmers are judged positively or negatively by the public depending on their care of the cow.
	Chapter 6 (RQ4)	Of relevance to the balance between naturalness and care are the 'dispensations' where naturalness is seen as detrimental and unnaturalness as beneficial.
Vested interest	Chapter 1 (Introduction)	The public has a shared history and deep connection to cows and the dairy industry.
	Chapter 2 (RQ1)	The priorities of around half of participants were for animal-based attributes, showing an interest in the way in which the dairy cow is managed from a welfare/quality of life perspective.
	Chapter 4 (RQ2)	There are emotional and cognitive reactions to different dairy farming systems, and strong preferences expressed, indicating that people have an interest in the way in which the dairy cow is managed.
	Chapter 5 (RQ3)	The public connect with the cow in a range of different and unappreciated ways, which manifests as interest in how the cow is managed, and the judging of farmers depending on their treatment of the cow.
	Chapter 6 (RQ4)	The public support naturalness but not at the expense of the cow, suggesting a stake in the cow's welfare.

7.3 Discussion of topics

7.3.1 Topic 1 – Diversity

Our research has shown diversity in a number of areas: in comprehensions of what animal quality of life means for different stakeholders; in preferences within the wider population for how dairy cows should be managed and milk produced; in how the cow and the farmer are framed; and in how naturalness is interpreted. However, there are two particular areas of diversity within our area of study for further discussion.

The first is the diversity of preference for dairy cow management and milk production within the population found in our first study (Chapter 2). Lack of access to pasture or so-called zero-grazing systems housing dairy cows year-round has become a prominent topic within the UK over the past decade, adopted early on as a *cause célèbre* by campaign groups (Ipsos/WSPA, 2010; CIWF, 2011a; Tasker, 2011) following a prominent application to build a 'mega-dairy' of 8,000 cows in Lincolnshire, UK, in 2010 (Nocton Heath Dairies, 2010; Holloway and Bear, 2011). While such promotion of an issue can lead to rapid escalation through social media (Stevens et al., 2018; Rodak, 2020), generating a disproportionate focus and eventually hampering progress towards more scientifically-led or balanced outcomes (Lewandowsky et al., 2019), access to pasture has also been researched extensively from a variety of perspectives. Reviews into the health and welfare impact on the cow (as discussed in Chapter 1, Section 1.3.2) have found advantages and drawbacks to both grazed and housed systems (European Food Safety Authority (EFSA), 2009; Arnott et al., 2017; Mee and Boyle, 2020); and the behavioural inclinations of the cow have also been determined as complex, with preferences to go outside dependent on time of day, time of year, weather, access to feed, type of outdoor environment, and distance from the field (Legrand et al., 2009; Charlton and Rutter, 2017; Smid et al., 2017; von Keyserlingk et al., 2018). However, public preferences are more unequivocal with clear support expressed towards grazing cows and giving them access to an outside environment (Schuppli et al., 2014; Hötzel et al., 2017; Kühl et al., 2019; Ly et al., 2021). Adding to the coherency of this message has been the unfamiliarity the public feel with cows in a

housed setting or lack of normalcy around the concept of cows not being visibly in fields, reinforcing a sense of unnaturalness (see Chapter 6).

However, the results of our study described in Chapter 2, suggested that support for grazing is not as unanimous as might be believed. By presenting a wide range of aspects found in dairy cow management and milk production in a form which required participants to trade off priorities, we first established that overall, from this range of 17 attributes, cow comfort and health & welfare were just as important as grazing; but also that only one of the six underlying and equal sized citizen groups placed grazing above all else.

So how do these studies reconcile with the subsequent studies analysing qualitative data? Within our mixed methods study in Chapter 4 examining perceptions of different dairy farming systems with varying access to grazing, the importance of pasture was underlined – but this was also the specific focus of the research and the question asked. The study described in Chapter 5 identified the cow's embeddedness in nature and the outside environment, but as only one of three frames identified; and the study detailed in Chapter 6 reinforced the importance of grazing within the concept of naturalness, but again, within the range of other reasons for naturalness the study was designed to elicit. Hence, returning to the diversity established in Chapter 2, we conclude we should approach the issue of access to grazing through a modified lens where its importance is recognised, but within a more holistic context where it does not surpass or negate other priorities, or take place at the expense of cow comfort and health & welfare in particular.

The second aspect regarding diversity is the different perception farming communities and the public have of what constitutes animal quality of life (Fraser et al., 1997; de Greef et al., 2006; von Keyserlingk et al., 2009). While this disparity is long-established, results of our studies crystalise the challenge faced by the farming industry where it is making empirical advances in terms of animal care outcomes (Chapter 1, Section 1.3.2), but in ways that are a potential mismatch for public concerns. This issue has been best summarised in Weary et al. (2016) where it was proposed that while the modified colony cage for laying hens was an enormous improvement over battery cages in offering hens opportunities to roost, peck and scratch, it may be doomed

because it failed to address the public's primary objection: the use of a cage. Indeed, this has now become reality in the UK where retailers pledged to phase out selling eggs from caged systems (Press Association, 2016) a mere four years after the mandatory replacement of the battery cage with the colony cage (NFU, 2022).

Such failures are well documented in areas outside farming, for example in engineering or IT, when requirement-based project planning omits the end user's needs. Lyytinen and Hirschheim (1988) identified 'expectation failure' as the overriding cause of project malfunction, referring to the inability of a project to meet a specific stakeholder group's expectations (Chua, 2009). This is well-documented in various case studies, such as that of the Taurus software system which the London Stock Exchange attempted to develop in the 1980s and early 1990. This c. £75 million project, which attracted an additional £350 million in investment, was eventually cancelled before a single module was implemented. The reasons have been explained as: "*…powerful interests pushed for Taurus's development despite confusion over the system's purpose and design…There was little understanding of what the system was supposed to do and what stakeholders it should serve. In the end, advocates had an almost superstitious faith in the project, dismissing objections and proposals for modifications…*" (Bergman et al., 2002). Therefore, in livestock farming, adherence to technical or scientific solutions despite continuing public concern over space and freedom and outdoor access (de Greef et al., 2006) could herald failure. Potentially the industry will only start to gain recognition for its efforts when it is able to couch its progress in terms the public can relate to, or actually address the core underlying problem through system change.

7.3.2 Topic 2 – Direction of travel

Growing concerns identified among the public summarised in Chapter 1 are manifested in our research, in terms of the direction of travel the dairy industry is taking across a range of areas. A key area in this is dairy farming systems. While it was estimate that over 90% of UK dairy farms included grazing as part of their management and feeding regime 10 years ago, this is believed to be decreasing (March et al., 2014) and 'zero-grazing' continues to be encouraged as an efficient management regime (e.g., Balsom, 2021). Similarly, extended grazing systems which

keep cows outside most of the year are promoted as viable options for UK dairy farmers (Hennessy et al., 2020; Wilkinson et al., 2020). Given the articulation of support in Chapter 4 for a system that combines naturalness and care, both trajectories have the potential to engender a negative reaction from the public, especially the fully housed system which prompted emotional and cognitive responses of rejection within that study.

Cows are also important culturally, as established in Chapter 5, with participants valuing their visibility in fields and remembering them within childhood experiences. Kaarlenkaski (2014) noted the cultural importance of cows in Finland, and Boogaard et al. (2008) found cows in the Netherlands held a similar significance, with participants believing that dairy farming contributed to the Dutch national culture. This has been so much the case in the Netherlands that a leading processor awarded a premium to farmers who graze their cows, stating: "*The visibility of the cows contributes to social acceptance and the image of dairy farming…A grazing cow is part of the traditional Dutch landscape and enjoys high appreciation from society.*" (Friesland Campina, 2017). Therefore the deletion of cows from UK fields as a product of progress or modernisation risks the loss of a potent and positive reminder of dairy farming, and a backlash at the removal of cultural icon.

Also discussed in Chapter 5 is concern over the rise of the Modernising Farmer who, when viewed using a negative narrative, is believed to run large scale farms and utilise cows as commodities in the name of profits. Furthermore, technology, as a modern artefact, was seen as unnatural within Chapter 6, and only regarded positively if it delivered benefits to the cow. By contrast, the Traditional Farmer – also described in Chapter 5 – is viewed more benignly, as having a smaller farm and offering more individual 'hands on' attention to animals. Nostalgia, described as a generalised positive emotion with bittersweet elements rather than autobiographical memory which recalls specific incidents (Sedikides et al., 2004), is likely to contribute to this warm 'glow' surrounding what is perceived as traditional farming, adding to the appeal of the 'old ways' – and therefore to concerns about the modernisation of the industry.

Despite this, it is clear in Chapter 5 that modernisation can be seen positively provided the farmer prioritises the care of the cow and does not compromise her wellbeing unduly, and provided any technology leads to welfare benefits for the cow or even opportunities for her autonomy. It is also helpful to acceptance if the narrative around the positive Modernising Farmer identifies individuals rather than anonymous, impersonal entities. The explanation for this can be found in Chapter 4, where it was concluded that personalisation through an individual example or case study (Batson and Ahmad, 2009) can create a generalisable 'halo' effect for the benefit of the wider community (Batson et al., 1997).

Finally, the unnaturalness of excess and 'superabundance' identified in Chapter 6 is applied to cows yielding ever more milk, cattle growing ever faster, farms getting ever bigger, and great and greater profits being sought by some farmers. That Britt et al. (2018) predict milk or milk solids production will double in the US and New Zealand by 2067, albeit with improved robustness and longevity, is of concern, as it is hard to envisage the UK public accepting this, particularly with Chapter 5 reflecting concerns about distorted udders making it hard for cows to walk, and Chapter 6 evoking the history-based unnaturalness humans have caused cows through domestication, breeding and feeding developments.

7.3.3 Topic 3 – Naturalness and care

The dual importance of naturalness and care is echoed throughout this thesis, but particularly in both the second and third studies (Chapters 4 and 5), as if domestication is seen by interviewees as a responsibility repaid through care: i.e., man has taken the cow from her natural surroundings, bred her and shaped her (as indicated through the history-based properties of unnaturalness in Chapter 6), and now needs to see that obligation through. Hence the responsibility for caring for the cow in the winter yet letting her experience a natural environment in the summer manifests through support for the mixed grazing/housing scenario in Chapter 4; and through the framing of the Fellow Cow and Force of Nature in Chapter 5. The farmers in Chapter 5 are also judged positively or negatively depending on their execution of care for the cow.

The identification of grazing, comfort and health & welfare as the three overall priorities in our quantitative study (Chapter 2), supports the combined approach of naturalness and care too. Grazing is perceived as natural within Chapter 6; comfort is described as both a human construct in keeping the cow dry and warm, but also as natural elements of emotional wellbeing and freedom to move within Chapter 4; and health & welfare is part of the duty of care also described in Chapter 4.

Naturalness is investigated throughout Chapter 6; however, of note within this is – firstly – the unexpected recognition of the teleological needs of the cow among our participants, and secondly, the trade-off between care and naturalness that occurs where aspects of unnaturalness are seen as beneficial (i.e., they deliver care) and aspects of naturalness are detrimental (i.e., they cause harm). Regarding the former, the positivity towards cow autonomy found in our qualitative data, which is apparent throughout Chapters 4 to 6, suggest that the application of research which seeks to establish the cow's wants and needs (e.g., Charlton et al., 2013; McConnachie et al., 2018; Shewbridge Carter et al., 2021) would be positively received by the public, and could also position Modernising Farmers in a positive light if they afford their cows such opportunities. In a similar way, the use of technology by the Modernising Farmer might be seen as an unnatural development, but could also be one which supports positive opportunities for the cow to act autonomously, according to how she wants to plan her day.

Lastly, familiarity and normalcy have both been mentioned as dimensions of naturalness, as defined by Siipi (2008) and applied in Chapter 6. To draw on this again, it explains why cows housed year-round, invisible., unfamiliar and not 'normal' in terms of where cows are placed culturally in fields in the UK, might seem unnatural, which raises the question whether cows inside would eventually become natural if they were more familiar. However, that then creates another issue raised in Chapters 4 and 5, in that because cows housed year-round are out of sight, people therefore obtain their visual references for this system from campaign videos and news items, not first-hand experience.

To conclude this section, the importance of care and naturalness overall raises significant questions over our continued inability to report how these imperatives are

being delivered in ways the public can relate to – while also satisfying the necessary scientific and husbandry parameters farmers and veterinary surgeons deliver and assurance bodies and food chain customer monitor. As summarised in Chapter 1, Section 1.3.1, multiple models have been proposed to address these very issues (even, for example, the 'two questions' proposed in Dawkins (2008) get to the heart of the teleological question by asking 'does the animal have what it wants?'); yet, with the exception of a subset of AssureWel measures within Red Tractor farm assurance for dairy cows (AssureWel, 2016a), there has been little uptake. In mitigation of this, margins remain extremely tight in animal production and the success of farmers in reducing costs to remain internationally competitive are documented in Chapter 1 (Section 1.2). Hence a key consideration in resolving this is how the added costs of developing meaningful measures, implementing them and then reporting them can be accommodated within an extremely tight financial model, only worsened in 2022 by the impacts of COVID-19, Brexit, and the Russia/Ukraine war (Phipps, 2022).

7.3.4 Topic 4 – Vested interest

This last topic relates to how we opened this thesis in Chapter 1, describing man's deep history and connection with cattle and dairy products. Throughout all four research chapters, this connection is borne out whether through interest in animal-based priorities in Chapter 2, emotional and cognitive reactions to the scenarios in Chapter 4, expressions of the multiple frames for the cow and judgement of the farmer based on treatment of the cow in Chapter 5, or complex and wide-ranging dimensions of naturalness in Chapter 6. Such connections with the cow are found elsewhere in literature, whether as cultural icons (Boogaard et al., 2008), objects of envy living effortlessly in 'the present' (Nietzsche, 2006), alternative narrators of historical events (Fudge, 2017), and subjects of creative writing (Kaarlenkaski, 2014).

It is accepted that a wide range of ethical positions exist towards animals, as we reviewed in Chapter 1 (Section 1.4.8) and as was suggested in Chapter 2 where we found significant differences in 'belief in an animal mind' between the six citizen groups (Table 6). Despite this, it should be assumed that most people do feel, understand, accept or are at least aware of a moral obligation of some type towards animals – morality being defined here as a normative code of conduct in a society

(Gert and Gert). Cochrane (2007), too, argues that sentient animals have capacity for wellbeing; and as humans are the only animal capable of moral agency, we have moral responsibility towards animals to add to or at least not detract from their wellbeing. The question we have within this thesis is whether the vested interest people feel towards the cow is simply an extension of a normal sense of moral responsibility, or whether it is more than that.

We would contend that there is evidence, within this thesis, of the public perceiving a more unique relationship with the cow than with other animals. Through the application of Donaldson and Kymlicka's (2011) political theory of animal rights in Chapter 4, we find a dual vision of the cow: on one hand being domestic and requiring the comforts we or pets might be afforded, but on the other being a sovereign wild animal with independent social structures, habitats and customs. As a result, our relationship with her is one of 'wardship' rather than ownership or equality, and the importance of affording her contact with the elements and the natural environment appears to be a recognition for (or even guilt about) her service. In particular within Chapter 5, we see the cow framed as enduring, a 'fellow', but also a natural force; her parallel life with humans places here within an array of rich personal memories, but as a natural entity, her sheer scale and 'unknowability' are also impressive, and a number of participants reported 'moments' of connection. The therapeutic effects of contact with cows are both established in science (Hassink et al., 2017), and reported in the media (Ktena, 2018; Gormly, 2021). However, a more recent article in the US magazine The Atlantic (Bogost, 2022) is enlightening. Here, the phenomenon of 'cow cuddling' is explained as the calming effect of the bulk and solidity of the animal; that with pets and even horses, the human is in control, but with the cow, people feel a unique vulnerability coupled with the animal's benevolence: "*His body was warm and soft and substantial; and his indifference to me…made me feel as though my problems might be just as small as I was*."

We believe these findings illustrate why the public's relationship with the cow may be more unique than with other animals, and transcends the normal moral responsibilities we feel. It explains the personal interest people take in her life and concern about her need for space and freedom, given her size and connectedness with

nature. It also goes some way to explain why the public might therefore want or even expect a say in her life. However, it does not address the question of how much say external stakeholders – and in particular the public – should have in how the cow lives, especially given the highly specialised and technical nature of the farmer's and the veterinary surgeon's jobs, which lay citizens cannot easily assimilate. This brings us to questions of how we can bring these findings together and make recommendations for the industry's next steps.

7.4 Limitations

7.4.1 Quantitative sample

The key limitations to our studies concern the samples used. In our quantitative study (Chapter 2), data were collected through a marketing research panel where members are 'paid by survey', irrespective of how accurately they complete the exercise. This created the possibility for bias towards people who are more disposed to take part in online research panels, but also for poor accuracy if there is no motivation to complete the survey with care. While the sample (with a few minor exceptions) was broadly representative of the population, there was low overall representation of ethnic groups, which may have been pertinent to dairy attitudes given different cultural backgrounds and dietary habits – although there is little literature on this specific topic in a UK context.

Media stories or marketing could have impacted the results in the quantitative study too. Since the survey was run, media interest has grown over both the environmental impact of ruminant and/or dairy production, and some common practices such as cow-calf separation. This may have resulted in attributes relating to these issues assuming lower importance than if the survey had been conducted in 2022. At the point the survey was conducted, most media coverage over the previous decade had focused on the issue of whether dairy cows graze (Webster, 2015; Blythman, 2017). Furthermore, claims on milk packaging mainly relate to grazing (Darwent and Leaver, 2015; Rodionova, 2017). Hence these influences could explain a heightened support

for grazing within the sample – but not for the equal priority placed on health & welfare and cow comfort, or the different priorities of the five other citizen groups.

The use of UK citizens in the survey could affect the generalisability of the study results elsewhere. However, the concerns, attitudes and preferences – and the demographic groups expressing them – are broadly consistent with previous research from a number of other countries, and Schwartz's values are well-validated across different cultures (Spini, 2003; Davidov et al., 2008); this suggests countries which have similarly developed dairy sectors and levels of consumer affluence may find comparable heterogeneity of preference within their populations.

Finally, while BWS was novel to this area and pivotal in obtaining the scaled rankings central to our results, it can only indicate relative importance, hence the top and bottom-ranked attributes were only most and least important relative to the 17 attributes included in the study, and their wider importance or unimportance in relation to other attributes not included in the study cannot be construed from the results.

7.4.2 Qualitative sample

Regarding the sample used to collect qualitative data, participants for this study were all based in the UK where grazing in the summer is the predominant system for dairy cattle (March et al., 2014). Hence within the study described in Chapter 4, this could have increased preference for the Grazed scenario, or for the Mixed scenario which combined housing and grazing, through both familiarity bias (Park and Lessig, 1981) or familiarity and normalcy contributing towards a perception of naturalness, as described in Chapter 6 (see Siipi, 2008). Furthermore, references within Chapter 5 to the constancy of cows in the environment and opportunities to interact with them may be more common in the UK than in countries where cows tend to be housed year-round. This has the potential to impact the prevalence of both the Fellow Cow and Force of Nature frames described within this chapter. However, other narratives contributing to these frames are not so geographically dependent – for example, an abundance of children's literature globally features farmers and cows (Koller, 2013),

and the ‘cow-cuddling’ phenomenon has been growing mainly in the US and the Netherlands (BBC, 2020; Bogost, 2022).

While efforts were made to ensure the sample interviewed was of an appropriate size and diversity to address the research questions, the nature of the recruitment process and the method of data collection are likely to have favoured those with more flexibility of time to attend an interview – although we attempted to fit interviews around any logistical constraints on the part of participants. As these interviewees were drawn from the original quantitative dataset, participants may have remembered taking part in that survey and this could have influenced their responses, although the two data collection points were two years apart. Furthermore, although the aim was to evenly represent all six citizen groups identified in the quantitative study within this sample to encourage as much diversity as possible within the data, this was ultimately not the case. The group least represented had seven participants within the final sample, and the most represented group had 15. Notably, the citizen group exhibiting most universalism in their values and strongest preference for health & welfare was most highly represented, with the group exhibiting most empathy with the cow and vegan or vegetarian dietary preferences was least represented, so this may have affected the range of data elicited. However, the sample size (60) was large for qualitative data collection (Britten, 1995; Ritchie et al., 2003) to compensate for such requirements, as determined through using the information power approach described in Chapter 3 (Malterud et al., 2016).

While participants from rural populations were actively sought, the definition of a rural population and a person with rural living experience is either subjective, varies depending on who is collecting the data, or difficult to ascertain. Hence we settled for self-declarations of either living or having lived in what the participant deemed to be a rural area. Ethnic minorities were again under-represented within this sample, as was the youngest age group, which may have affected the breadth of data gathered. For example, more ‘generation Z’ (born since 1995) participants might have produced valuable insight as to the framing of dairy farming that is resulting in changing dietary habits (Food Standards Agency, 2020).

During the interviews, the order in which the scenarios were presented in the study described in Chapter 4 was Mixed, Housed then Grazed, which was primarily to sustain maximum attention and comprehension from participants. It is explained in Section 4.2.2 why this order was chosen after the pilot interviews raised the challenge. Nonetheless, the order may have produced an anchoring effect, where people favour the first option presented to them (Furnham and Boo, 2011).

Lastly, our participants were members of the public from the UK; while there will be many similarities in attitude among people from countries with similar climates, economies and dairy sectors, demographic and attitudinal differences are inevitable; results should therefore be extrapolated with caution. The interviews also took place in winter, which could have impacted participants' views of the appropriateness of cows being inside or out in colder months.

7.5 Conclusions

The disconnect between the dairy farming industry and the public over dairy cow welfare is a product of a sector that has evolved to meet modern-day challenges to ensure its survival, but has been unable to reconcile these with changing societal expectations. Addressing this disconnect is not straightforward as animal quality of life is perceived differently by the farming community and the public. The four studies described within this thesis have applied novel methods to uncover new insights to existing understandings of public perceptions and preferences, and offer new opportunities for the industry to 'reset' its relationship with those who consume its products and grant it social licence. However, this will depend on the dairy industry being receptive to the need for such change.

7.6 Next steps

7.6.1 Recognising the threat

In looking how to build on the learnings from this thesis, we can recognise that the challenges the dairy industry faces distil down to changing practices coupled with

changing ‘customer’ expectations (whether that customer buys products or delivers social licence), and difficulties within the industry either recognising this threat for what it is, or adapting (whether communication or system) to address the gap given the public’s vested interest in how dairy cows are managed.

It is understandable that the challenge remains somewhat obscured. In a situation where a product or the way it is produced fall into disfavour, there will usually be an economic response in terms of reduced sales. With food products and farm animal welfare, this is notoriously not the case as welfare has proved a lower priority than health, trustworthiness, quality, and safety across farm animal products in general (Vanhonacker et al., 2010), and – specifically in milk – less important than safety, taste, health and freshness (de Graaf et al., 2016; Lister et al., 2017). Another confounding factor is liquid milk remains sufficiently low-priced to make product substitution with its much higher-priced alternatives unlikely (a 34% price rise for milk over the past 30 years compared with an increase in the Retail Price Index of 225% (ONS, 2022b; c)). Therefore, the dairy farming industry receives exceptionally weak market signals about the acceptability (or not) of its practices, which is likely to be masking the scale of concern.

By contrast, we contend there is clear evidence of dairy farming experiencing a reduced social licence to operate (Chapter 1, Section 1.2) in terms of obstacles to planning permission (CIWF, 2011a), farm incursions or exposés (Jenner, 2022), retailers being pressurised to exclude certain animal production systems (Hickman, 2010), or campaign groups lobbying to introduce new animal welfare legislation (RSPCA, 2022), some of which have been discussed already within this thesis. Therefore, reduced social licence can cause significant disruption to business. Where dairy farming used to escape some of the unfavourable attention foisted on meat production, this is changing, with new questions being raised over practices the dairy farming community assumed were known and accepted – for example, cow-calf separation and artificial insemination (e.g., Levitt, 2019; Jenner, 2022). While the diversity of preference we see within the population for how the dairy cow is managed (Chapter 2) might suggest we should just reconcile to ourselves that not everyone can be kept happy and some are willing just to have tasty milk or appropriately-paid

farmers, half of our sample did prioritise animal-related attributes, and, as discussed earlier in this Chapter (Section 7.3.1), even small minority groups who are committed to a cause can be very powerful in driving and changing public opinion and policy.

7.6.2 Changing the communications approach

Efforts to bridge the gap between farmers and the public through increasing understanding of the other's perspective have met with only limited success. We hypothesise that this is largely because the approach taken has involved the farming community educating and informing the public in the expectation that this will satisfy concerns and lead to acceptance. However, the resolution of this perceived 'knowledge deficit', for example in taking the public to visit farms (e.g., Boogaard et al., 2008; Ventura et al., 2016a; Hötzel et al., 2017), has failed to change minds because it first assumes full knowledge of public concerns, and second, that information will satisfy those concerns in the same way it would satisfy the concerns of a scientist or expert (Brunk, 2006). Therefore, this model is flawed as it ignores diversity of knowledge and objective between those inside and those outside the industry, and can culminate in generating more concerns that it resolves (see above examples).

Another challenge with this approach is the assumption that those outside the industry are the ones who must change – as happened in a frame reflection exercise described in Benard and de Cock Buning (2013), where public participants moved closer to the farmers' views about pig husbandry, but farmers did not reciprocate. Grunig and Grunig's (1992) description of the difference between asymmetric and symmetric, one-way and two-way communication offers some explanation as to the dynamics at play. One way communication emits messages in one direction with no regard for what comes back; two way listens to the views or responses of the other party and responds accordingly, so that communication flows both ways in a dialogue as opposed to a monologue. By contrast, asymmetric communication expects only one party to change; symmetric communication asks both to move position to reach a compromise.

In resolving issues around disparity of view between the dairy farming community and the public, efforts by those in farming to engage appear more akin to attempts at two-way communication rather than symmetric engagement, as the farming industry does not appear to have entered the process expecting to move its position. Becoming more receptive to change takes leadership, and an altered narrative where the *status quo* is no longer defended, and responsiveness, accountability, transparency and proactivity are evident. Within UK farming, this approach was used to address growing criticism over antimicrobial use in livestock farming between 2016 and 2020. During this time, the livestock industry, under the leadership of the Responsible Use of Medicines in Agriculture (RUMA) Alliance (www.ruma.org.uk) and inspired by action already taking place in the poultry meat sector (Griffiths, 2016), accepted the need to address antibiotic use. The industry communicated this receptiveness, developed its own targets, and successfully executed plans to achieve its goals (RUMA, 2020), significantly reducing pressure from regulators and campaign groups along the way (FAO, 2022b). A number of dairy industry organisations could lead such an approach in striking up a new communication with the public, but membership organisations are typically hampered by the need to appeal to a broad church. Levy boards by contrast exist to address market failure issues, of which this is one. However, the best opportunity for leadership may come from a large processor, especially a co-operative such as Arla which has already led an industry-wide move to eliminate bull calf euthanasia (Arla Foods, 2019; AHDB, 2022c). Of course, such an approach demands authentic, tangible change on the part of the industry, which we will discuss next.

7.6.3 System adaptation

The potential for system adaptation to address this disconnect with societal expectations is possibly the most controversial area to broach, as the industry has been focused for decades on developing efficiencies to survive and thrive (Chapter 1, Section 1.2), and system change has been largely based on this rather than addressing public expectations. One reason may be the perceived lack of need given growing dairy consumption; the other may be the lack of appreciation of the concerns, given those in the industry and the public see animal quality of life in different ways (Chapter 1, Section 1.4.2).

However, the focus on productivity is a direction of travel that is leading to practices and outcomes that are seen as unnatural (Chapter 6), and the drift towards more housed or extended grazing systems risks either losing the visibility of cows in fields, an important and positive connection for the public with their vested interest (Chapter 5), or concerns being raised about cows seen outside in winter, and therefore perceived lack of care (Chapter 4).

System adaptations that could be considered include: the reintroduction of grazing to year-round housed systems – or outdoor access of some kind; moderations in yield for the sake of improved resilience and health in the cow; breeding for better longevity, more persistent lactations and longer calving intervals to lower risk and stress to the cow at calving and reduce youngstock numbers; and the adoption of cow-centric infrastructure where the cow can exert her choice. Of course, there are considerable trade-offs to some if not all of these ideas, but changing imperatives – including the urgent need to reduce greenhouse gas emissions – offer the chance to apply some original thinking to the problem.

7.6.4 Addressing animal welfare assessments and labelling

As raised in Section 7.3.3, care (as the public see it) and naturalness (including opportunities for natural behaviour) remain largely absent from dairy cow quality of life or welfare assessments, and from farm animal assessments in general. That these aspects are hard to define, harder to measure, potentially more expensive to introduce into assessments, and more difficult to gain farmer acceptance of, is no coincidence. Yet this leaves the UK dairy industry with the challenge of a growing disconnect with the public and an apparent failure to communicate its performance on aspects close to the public's heart. It is no surprise, therefore, that the public revert to icons such as straw, space and outdoor access as proxies (de Greef et al., 2006) through which good welfare can be determined. It is suggested that the available welfare assessment models are revisited with a view to incorporating additional measures into Red Tractor farm assurance, which covers 95% of UK milk production, so that care and naturalness can be communicated more effectively. For example, this could be assessing farms for allowing expression of natural behaviour (allowing a cow to 'be a cow'), or a choice of environment so that the cow has access to naturalness

while also receiving care and protection from dangers and the elements. There are also examples of new behavioural assessments introduced by specific operators within the dairy supply chain (e.g., Arla Foods, 2021; Waitrose, 2021) to draw from.

Labelling is another contentious issue, with a Government consultation on welfare labelling underway (Defra, 2021). This, and the ongoing debate about method-of-production labelling (Labelling Matters, 2014), suggests there is an appetite for more transparency around how animals are reared and managed, with the key concern remaining access to pasture. There are currently several brands of milk offering a 'pasture promise' (Darwent and Leaver, 2015; www.freerangedairy.org), but these remain relatively niche in terms of prevalence and sales. By contrast, the vast majority of liquid milk sales in the UK are pooled from different farms with a range of production systems, meaning customers will not know for certain how that milk has been produced. It could be argued that those who wish to buy milk from cows that have grazed can do so through selecting these brands or buying organic dairy products, which require grazing in their protocols. However, this misses the point about offering information that empowers people to make choices they feel good about, rather than letting them experience cognitive dissonance about a choice they should ethically be making, but do not for various reasons (see Pirog, 2004; McEachern et al., 2007; McGarry Wolf et al., 2009; Aerts, 2013 in Section 1.4.1), with the end result that they eventually drift away completely from consuming the product (Mayfield et al., 2007). The other risk of resisting changes such as method-of-production labelling is they are implemented in any event, but designed by those with additional agendas, such as campaign groups, or those insufficiently embedded within the industry to appreciate unintended consequences. Adopting a similar approach to the one taken by RUMA (see Section 7.4.3) and proactively introducing a sensible proposal to present method of production in a balanced and factual way would place the industry in control, but would require collaboration from across the industry, not least processors, and a genuine willingness to engage with the issue – as well as change!

7.6.5 Strengthening social licence

Joyce and Thomson (2000) determined that gaining a social licence to operate within the mining sector meant being perceived as legitimate; later, they added credibility and trustworthiness to the list of required perceptions and identified a cumulative, step-like hierarchy among the perceptions with the highest level involving perceptions of trust (Thomson and Joyce, 2008). Concepts of 'co-ownership' at the highest level of social licence were proposed by Boutilier and Thomson (2011). Such an approach is suggested for the UK dairy industry: gaining more robust social licence through a co-ownership approach, recognising the vested interest the public have in the way the cow is managed. Also termed 'reflexive modernity' (Broad, 2016), this strategy moves us away from the idea that only farmers and veterinary surgeons have the legitimacy to input into how the cow should be managed.

In terms of putting such a plan into action, conflict management and resolution approaches, touched upon briefly in Chapter 5, may play a role. These include dispensing with reductionist characterisations through a better understanding of the diversity, nuance and motivations in others' views, then finding common ground upon which to build consensus (Shmueli et al., 2006). Such an approach could be tested and honed through further research, and because this covers area of future policy development and industry resilience, should be considered by Government or levy boards. The deliberative democracy or citizen jury initiatives employed in other countries or on other subjects – for example in determining policies on climate change, health policies or food – offer potential learnings in this area (Henderson et al., 2013; Street et al., 2014; Wells et al., 2021). While results have varied and the approach is in its relative infancy, they provide a model through which farming communities (potentially facilitated by farming unions or, again, levy bodies) and the public could engage. Through this, they could better understand others' perspectives, and co-design workable solutions that address public concerns yet recognise economic and technical constraints. Boogaard et al. (2010) comment on the pluralistic attitude engendered among members of the public when they visit farms for one reason, but end up discussing a broader range of challenges and opportunities, suggesting sustainable animal farming could be co-designed by farmers alongside politicians,

scientists, animal-welfare charities and lay people. Ventura et al. (2013) , too, refer to the potential benefits of a forum bringing farming and non-farming parties together to resolve contentious issues such as early cow/calf separation. Again with reference to the ‘frame reflection’ approach used by Benard and de Cock Buning (2013), this does require the farming community to have recognised the threat and be reconciled to the need for change at the outset.

Observe the herd as it grazes past you: it cannot distinguish yesterday from today, leaps about, eats, sleeps, digests, leaps some more, and carries on like this from morning to night and from day to day, tethered by the short leash of its pleasures and displeasures to the stake of the moment, and thus it is neither melancholy nor bored.

It is hard on the human being to observe this, because he boasts about the superiority of his humanity over animals and yet looks enviously upon their happiness – for the one and only thing that he desires is to live like an animal, neither bored nor in pain, and yet he desires this in vain, because he does not desire it in the same way as does the animal.

The human being might ask the animal: "Why do you just look at me like that instead of telling me about your happiness?" The animal wanted to answer, "Because I always immediately forget what I wanted to say" – but it had already forgotten this answer and hence said nothing, so that the human being was left to wonder.

Friedrich Nietzsche. *On the Utility and Liability of History for Life* (1874).

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Appendix 1: Survey questions as presented

Thank you for taking part in this survey today, which is aimed at those living in the UK aged 16 and over.

Your answers to this survey, which will be anonymous, will help the University of Nottingham understand what is most important to you about how we manage our dairy cows.

The survey should take between 15 and 20 minutes to complete.

Please click the arrow to continue.

Before we start, are you happy to proceed on this basis, or would you like to have more details about the survey and why we are running it first?

- ◯ I am happy to proceed
- ◯ I would like more information before proceeding

First, can you tell us where you source your food from? Please tick all options you have used in the past 12 months.

- ☐ Supermarket (in person)
- ☐ Supermarket (online)
- ☐ Convenience store or corner shop
- ☐ Farm shop
- ☐ Deli or independent shop
- ☐ Homegrown or home-produced
- ☐ Other - please specify

How many times a week does food shopping typically take place in your household?

- ◯ Most days
- ◯ Two or three times in the week
- ◯ Once a week
- ◯ Less than once a week

Which of the statements below best describes your habits when preparing drinks or foods that typically include milk?

- ◯ I always or mostly use cows' milk of some kind
- ◯ I always or mostly use another animal's milk
- ◯ I always or mostly use plant-based alternatives to milk
- ◯ I don't ever use milk or plant-based alternatives

How often do you usually consume or use this milk or plant-based alternative to milk?

- ◯ Several times a day
- ◯ Once daily
- ◯ Every few days
- ◯ Once a week or less

Please now consider the following scenario.

You are in a grocery shop, walking through the aisle for milk, dairy and plant-based alternatives.

More information than usual has been provided about the different types of cows' milk on display. This information has been provided by a trusted food assurance scheme.

Irrespective of whether you are buying any products or not on this occasion, you have time to spare, so you read the information provided.

You will now see a series of questions, each of which includes 5 features presented in the information about the cows' milk on display. Which feature, in your personal opinion, is the most important and least important in each set of 5, if price is not an issue?

There are 12 questions in total.

Please click the arrow to continue.

In the grocery shop, more information than usual has been provided about the different types of cows' milk on display. This information has been provided by a trusted food assurance scheme.

Irrespective of whether you intend to buy any products today or not, which feature, in your personal opinion, is the most important and least important from those listed below, if price is not an issue?

(1 of 12)

Most Important	Least Important	"This milk..."
◯	◯	comes from farms local to your area
◯	◯	is from cows given brushes and toys to help them express their natural behaviour
◯	◯	comes from cows that keep their calves beside them until weaning
◯	◯	comes from farms who always shelter their cows from the sun, wind and rain
◯	◯	is from farms where the farmer knows each cow's history and personality

Click the 'forward' arrow to continue ...

Thank you for completing that section.

We are now going to ask some questions about you and your background.

Please click the arrow to continue...

Please could you tell us your age? If you would rather not say, please enter 0 (zero).

Please indicate your gender.

- ◯ Male
- ◯ Female
- ◯ Other
- ◯ Prefer not to say

In which region of the UK do you live?

- ◯ Northern Ireland
- ◯ Scotland
- ◯ North East England
- ◯ North West England
- ◯ East Midlands
- ◯ West Midlands
- ◯ East Anglia
- ◯ South East England
- ◯ South West England
- ◯ Wales
- ◯ Other, please specify

Do you have - or have you had - long term responsibility for children at any time?

- ◯ No
- ◯ Yes, I do now
- ◯ Yes, I used to
- ◯ Other, please specify

Please indicate how many children you have responsibility for now in each age bracket.

	Number
Less than 2 years old	
2-4 years old	
5-8 years old	
9-11 years old	
12-15 years old	
16 years old and over	

What is the approximate take-home income for your household annually?

- ◯ Less than £20,000 annually
- ◯ £20,000-£40,000 annually
- ◯ £40,000-£60,000 annually
- ◯ £60,000-£100,000 annually
- ◯ Over £100,000 annually
- ◯ Prefer not to say

What is the highest level of education you have achieved?

- ◯ School
- ◯ College Diploma
- ◯ College or University Degree
- ◯ Postgraduate
- ◯ Vocational or skills-based
- ◯ Other, please specify

Which of the following best describes your ethnic background?

- ◯ White
- ◯ Mixed or multiple ethnic groups
- ◯ Asian or Asian British
- ◯ Black, African, Caribbean or black British
- ◯ Other ethnic group
- ◯ Prefer not to say

Do you have - or have you had - long term responsibility for children at any time?

- ◯ No
- ◯ Yes, I do now
- ◯ Yes, I used to
- ◯ Other, please specify

What is your closest link to, or experience of, farming or the dairy industry?

- ◯ I have no links or experience related to farming or the dairy industry at all
- ◯ I have occasionally visited farm/s or dairy sites, but have no other links
- ◯ I have/had friends or non-immediate family in farming
- ◯ I work/have worked in farming or with farmers or the dairy industry in some capacity
- ◯ I have immediate family that farm or I farm/have farmed myself
- ◯ Other, please specify

Just a few more background questions to go.

When did you last visit a working farm? (Please chose the option indicating your most recent experience)

- ◯ I have never visited a working farm
- ◯ More than five years ago
- ◯ Within the last five years
- ◯ Within the last year
- ◯ Within the last month

What is your experience with keeping animals?

- ◯ I own or have regular care of a pet or other animal at the moment
- ◯ I have in the past owned or had regular care or a pet or other animal, but not now
- ◯ I do not and have never had pets or responsibility for animal/s
- ◯ Other, please specify

Which best describes your diet, whether for medical, religious or ethical reasons?

- ◯ Omnivore: I eat most foods including meat
- ◯ Pescatarian: I eat fish but no meat
- ◯ Flexitarian: I am mainly vegetarian with the occasional inclusion of meat
- ◯ Vegetarian: my diet is vegetable and plant-based with no meat or fish
- ◯ Vegan: I eat no meat, fish or animal products, including dairy
- ◯ Dairy-free: I eat no milk, cheese or other dairy, but I do eat meat and/or fish
- ◯ Other, please specify

Thank you for your answers to this section - they are really helpful.

And now we'd like to ask you some questions about dairy cows.

To help us understand your knowledge of dairy farming, please answer the following questions as best you can.

Which of the following do you think is the closest to the number of pints or litres of milk an average UK dairy cow would produce each year?

- ◯ 1,300 pints (750 litres)
- ◯ 6,600 pints (3,750 litres)
- ◯ 13,200 pints (7,500 litres)

Please complete this statement.
Cows most frequently give birth to...

- ◯ A single calf
- ◯ Twins - 2 calves at the same time
- ◯ Triplets - 3 calves at the same time
- ◯ Quadruplets - 4 calves at the same time

Which best describes the biggest part of an adult dairy cow's diet in the UK?

- ◯ Milk
- ◯ Grass or similar plant-based material
- ◯ Grains such as wheat or barley
- ◯ Soya

How would you rate your knowledge of dairy farming compared with the average UK citizen?

	Marginal	Average	Quite good	
No knowledge				Very knowledgeable

To what extent do you believe the following about cows? Please click the button that best matches your beliefs.

	No, I am sure they don't	No, probably not	I have no idea	Possibly, to a limited extent	Yes, probably	Yes, I am sure they do
Cows mechanically respond to instinctive urges without awareness of what they are doing	○	○	○	○	○	○
Cows are able to think to some extent to solve problems and make decisions about what to do	○	○	○	○	○	○
Cows are conscious and aware of what is happening to them	○	○	○	○	○	○
Cow are capable of experiencing a range of feelings and emotions (e.g. pain, suffering, contentment, maternal affection, aggression, fear, frustration, loneliness and boredom)	○	○	○	○	○	○
Cows experience emotions less intensely than humans	○	○	○	○	○	○
Cows have a limited mental ability to see cause and effect of an action	○	○	○	○	○	○

Please note, the above questions were randomly presented but here, 1, 5 and 6 are reverse coded in terms of points to 2, 3 and 4.

What is the last story you recall hearing or seeing about dairy farming in the mainstream news, on social media or from friends?

If you can't remember, please put 'None'.

Thank you for providing that information. This is now the last part of the survey. We would like to understand a bit more about your attitudes and values.

We will briefly describe some people and what is important to them. Please read each description and think about how much each person is, or is not, like you.

Then click the button that best answers the question: "How much is this person like me?"

Please note that the descriptions will be presented as a person of the same gender as you.

The gender of the following portraits reflect the gender chosen in the second question, in this case, a female.

How much is this person like me?	Not like me at all	Not like me	A little like me	Some-what like me	Like me	Very much like me
Thinking up new ideas and being creative is important to her. She likes to do things in her own original way.	○	○	○	○	○	○
It is important to her to be rich. She wants to have a lot of money and expensive things.	○	○	○	○	○	○
She thinks it is important that every person in the world be treated equally. She believes everyone should have equal opportunities in life.	○	○	○	○	○	○
It's very important to her to show her abilities. She wants people to admire what she does.	○	○	○	○	○	○
It is important to her to live in secure surroundings. She avoids anything that might endanger her safety.	○	○	○	○	○	○
She likes surprises and is always looking for new things to do. She thinks it is important to do lots of different things in life.	○	○	○	○	○	○
She believes that people should do what they're told. She thinks people should follow rules at all times, even when no-one is watching.	○	○	○	○	○	○
It is important to her to listen to people who are different from her. Even when she disagrees with them, she still wants to understand them.	○	○	○	○	○	○
It is important to her to be humble and modest. She tries not to draw attention to herself.	○	○	○	○	○	○
Having a good time is important to her. She likes to "spoil" herself.	○	○	○	○	○	○
It is important to her to make her own decisions about what she does. She likes to be free and not depend on others.	○	○	○	○	○	○
It's very important to her to help the people around her. She wants to care for their well-being.	○	○	○	○	○	○
Being very successful is important to her. She hopes people will recognize her achievements.	○	○	○	○	○	○
It is important to her that the government ensures her safety against all threats. She wants the country to be strong so it can defend its citizens.	○	○	○	○	○	○
She looks for adventures and likes to take risks. She wants to have an exciting life.	○	○	○	○	○	○
It is important to her always to behave properly. She wants to avoid doing anything people would say is wrong.	○	○	○	○	○	○
It is important to her to be in charge and tell others what to do. She wants people to do what she says.	○	○	○	○	○	○
It is important to her to be loyal to her friends. She wants to devote herself to people close to her.	○	○	○	○	○	○
She strongly believes that people should care for nature. Looking after the environment is important to her.	○	○	○	○	○	○
Tradition is important to her. She tries to follow the customs handed down by her religion or her family.	○	○	○	○	○	○
She seeks every chance she can to have fun. It is important to her to do things that give her pleasure.	○	○	○	○	○	○

Appendix 2: Variables included the survey

Variable	Categories
Source of food	Supermarket, Online, Convenience store, Farm shop, Deli or independent, Homegrown, Other
Times/week you shop	Most days, 2-3 times a week, Once a week, Less than once a week
Type of milk or alternative consumed	Cows' milk, Other animals' milk, Plant-based alternatives, None
Frequency of consumption	Several times a day, Once daily, Every few days, Once a week or less
Last story heard/seen about dairy farming	*Free text*
Age	*In years*
Gender	Male, Female, Other, Prefer not to say
Region you have mostly lived in	N. Ireland, Scotland, NE England, NW England, E. Midlands, W. Midlands, E. Anglia, SE England, SW England, Wales, Other
Long term responsibility for children	No, Yes now, Yes used to, Other
How many children in each bracket	Less than 2, 2-4 years, 5-8 years, 9-11 years, 12-15 years, 16 plus
Type of area lived most of your life	Mainly: towns or cities, Suburban, Rural, Mix not rural, Mix including rural, Other
Closest links to/experience of farming/dairy	No links, Occasionally visited farm or dairy but no other links, Friends or non-immediate family have farmed, Worked in farming, with farming or in the dairy industry, Immediate family or I have farmed
Last time visited a working farm	Never, More than 5 years ago, Within the last five years, Within the last year, Within the last month
Experience keeping animals	Own/have care of pet/animal now, Owned/had pet/animal in past but not now, Never had responsibility for animal, Other
Which best describes your diet	Omnivore (unrestricted diet), Pescetarian, Flexitarian, Vegetarian, Vegan, Dairy-free, Other
Take-home income for household	<£20,000 annually, £20,000-£40,000, £40,000-£60,000, £60,000-£100,000, >£100,000 annually, Prefer not to say
Highest level of education	School, College Diploma, College/University Degree, Postgraduate, Vocational/skills-based, Other, Prefer not to say
Ethnicity	White, Mixed or multiple ethnic groups, Asian/Asian British, Black, African, Caribbean/black British, Other, Prefer not to say
Level of dairy cow knowledge	Three multiple choice questions presented: a) Number of litres a cow produces annually: 7.5 litres, 75 litres, 750 litres, 7,500 litres, Not sure b) Cows most frequently give birth to: A single calf, Twins, Triplets, Quadruplets, Not sure c) Biggest part of an adult dairy cow's diet in the UK: Milk, Grass or similar, Grains, Soya, Not sure
Self-rated dairy knowledge	Sliding integer scale from -5 to +5 including 0, with -5=no knowledge compared with the average UK citizen, 0=average, 5=very knowledgeable compared with the average UK citizen
Belief in a dairy cow's mind	To what extent do you agree with the following six statements? Scores for a) b) and c): Definitely disagree (1 point), Probably disagree (2), Don't know (3), Possibly (4), Probably agree (5), Definitely agree (6). Statements d) e) and f) are reverse-scored. a) Cows are conscious and aware of what is happening to them b) Cows are able to think to some extent to solve problems and make decisions about what to do c) Cows are capable of experiencing a range of feelings and emotions d) Cows have a limited mental ability to see cause and effect of an action e) Cows experience emotions less intensely than humans f) Cows mechanically respond to instinctive urges without awareness of what they are doing
Values	Methodology as described in (Schwartz, 2003a; b) . 21 'portrait' statements scored as follows then computed: Not like me at all (1), Not like me (2), A little like me (3), Somewhat like me (4), Like me (5), Very like me (6)

Appendix 3: Interview script

Q1. (Warm up question) First of all, can we talk about your last food shopping trip – please can you describe the experience?

Q2. Now I want to turn to dairy farming. If I ask you to think of a dairy farm, what is the first image that comes to mind?

How big is the farm?

Where do the cows live? What do they eat and where do they sleep?

What is the farmer doing?

Where does your image come from (– something you experienced yourself, or saw on TV, or read about)?

Q3. I'm now going to show you three dairy farms you might find in the UK (show pictures and describe the scenarios using the pictures; leave the pictures out for reference – pictures and description contained in Appendices 4 and 5).

Lay out scenarios next to each other

Q3a. I'm interested in your views on all three – do you have any questions about them?

Q3b. What thoughts come to mind?

Make sure all three are considered

Describe how they match or differ from your image?

Was anything familiar, and if so, why?

Describe anything that appealed to you, or surprised you, or made you feel uncomfortable – and why.

Inside / outdoors

Describe what you think a cow experiences when she's inside

What about experiences when she's outdoors?

Grazing

If I said 'graze', what would you understand by it?

Imagine a cow grazing – what do you picture? What is the cow doing? How is she acting?

Welfare

What does 'welfare' mean to you?

How would you describe a cow with good or bad welfare?

How would you score each scenario out of 10 for cow welfare? (1 lowest, 10 highest). Why? What would make it a 10?

Comfort

And what do you imagine by 'cow comfort'?

How would you rate the three scenarios for cow comfort, out of 10 with 1 having least comfort and 10 having most? Why? What would make it a 10?

Summary

Do you think grazing links in any way to welfare, or to the comfort of the cow? Why?

How might the comfort or welfare of the cow impact the farmer or the milk?

Q3c. Now I want you to think about these scenarios from a farmer's perspective. What comes to mind?

Why might you choose these different ways to keep your cows?

If you were running these farms, how would you enhance welfare in each one?

As a farmer how would you improve 'cow comfort' in each?

Q4. Now I want to move on to talk about 'naturalness'. How would you describe 'natural'?

General and food

What words describe 'natural'?

Can you describe the opposite of natural? (Would you call that unnatural or non-natural?)

In context of food, can you tell me about something natural?

Is 'natural' always good? Why? When is it not?

Can you describe any situations when non/unnatural is good?

Farms & farm animals

How would you apply 'natural' and 'non/unnatural' terms to farm animals?

In what ways is the act of people farming animals natural or non/unnatural to you?

Can you describe some features of farming you would call natural and non/unnatural?

Cows

What are your earliest memories of a cow of any kind, real or fictitious?

What are the differences between that cow you remember and cows now?

How natural should a dairy cow's life be

Where is the line?

Describe how we could make a dairy cow's life more natural?

Q5. We're now near the end of the interview.

We've talked about your images of a dairy farm, and how they relate to these scenarios. We've covered what grazing and welfare and comfort mean, a bit about the environment, and have also talked about naturalness.

Is there anything else about dairy cows and dairy farming we haven't covered that you'd like to raise?

Q6. To round this up, could you give me three things that you feel should happen on your ideal dairy farm?

Appendix 4. Verbal descriptions of the three systems, presented as scenarios

Scenario 1

On this dairy farm, the cows are kept inside in open-plan barns during the winter.

During this time, they sleep in beds, in a row, or in an open pen. They lie on sawdust, straw or sand. They have a feeding area, a 'socialising' area, and the milking parlour.

They sometimes have an outside yard or open sides to the barn.

In the summer, these cows spend day and night outside, sleeping in the field, and come in only for milking.

Scenario 2

On this dairy farm, the cows are kept in the same open-plan barns, but all year round rather than just for the winter.

As these barns are the same as in the first scenario, the cows sleep in beds, in a row, or in an open-plan area. As before, they lie on sawdust, straw or sand. They have a feeding area, a 'socialising' area and the milking parlour.

And as before, they sometimes have an outside yard or open sides to the barn.

Scenario 3

On this dairy farm, the farmers keep their cows outdoors all year, day and night, sleeping in the field, and come in only for milking.

So, to summarise

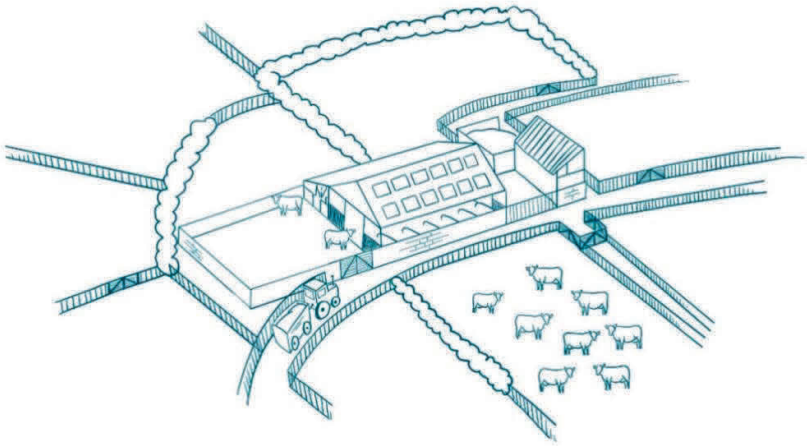
In the first scenario, the cows are inside for the winter and outdoors for the summer

In the second scenario the cows are inside year-round

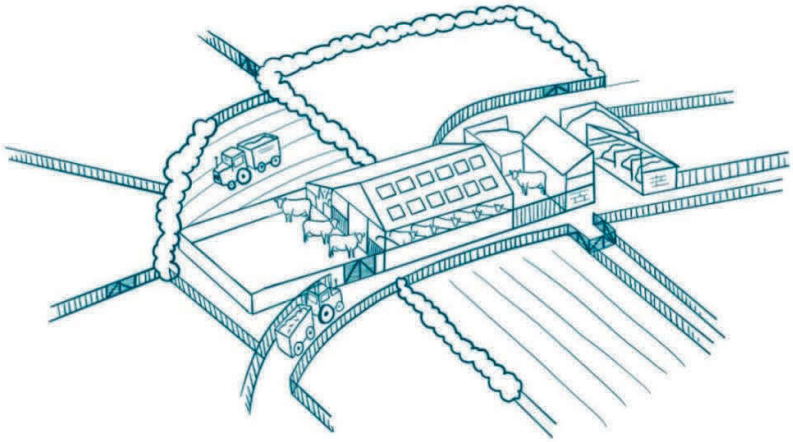
In the third scenario, the cows are outdoors year-round.

Appendix 5. Visual descriptions of the three systems, presented as scenarios

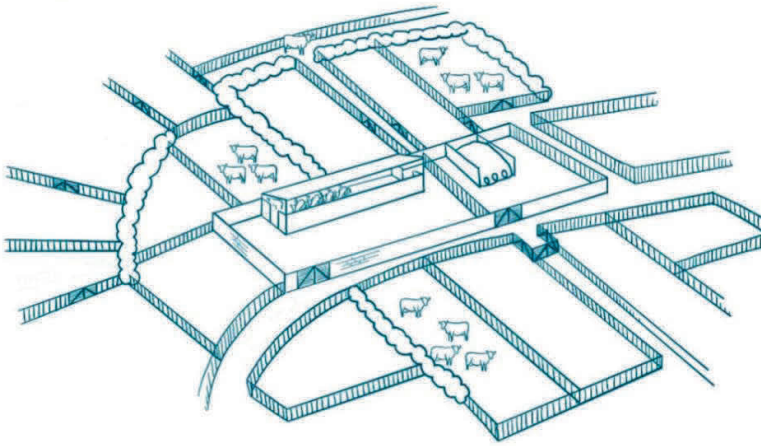
Scenario one



Scenario two



Scenario three



Appendix 6. Key characteristics of qualitative participants

Age	Gender	UK Country/ English Region of Residence	Area Mainly Lived	Area Now Living In	Last visited a farm
19	Female	North West England	Suburban	Suburban	Never
22	Male	North East & Yorkshire	Urban	Urban	>5 years ago
22	Male	North West England	Rural/country village	Urban	1-5 years ago
22	Female	SE England/London	Mix of areas inc. rural	Rural/country village	Never
23	Male	North East & Yorkshire	Urban	Urban	Never
24	Male	West Midlands	Suburban	Suburban	1-5 years ago
25	Female	North West England	Rural/country village	Urban	1-5 years ago
27	Female	East Midlands	Mix of areas inc. rural	Rural/country village	Within the last year
28	Female	East Midlands	Suburban	Suburban	>5 years ago
29	Male	North East & Yorkshire	Suburban	Suburban	Within the last year
30	Female	Scotland	Suburban	Suburban	>5 years ago
31	Female	East Anglia	Rural/country village	Rural/country village	1-5 years ago
31	Female	North East & Yorkshire	Rural/country village	Rural/country village	Within the last year
31	Female	Northern Ireland	Suburban	Suburban	1-5 years ago
32	Male	North East & Yorkshire	Urban	Urban	>5 years ago
32	Female	Wales	Urban	Urban	>5 years ago
33	Female	East Anglia	Mix of areas not rural	Suburban	Within the last year
33	Female	North West England	Suburban	Suburban	Never
34	Female	SE England/London	Suburban	Suburban	>5 years ago
34	Female	West Midlands	Suburban	Suburban	>5 years ago
35	Male	SE England/London	Suburban	Suburban	>5 years ago
36	Male	North East & Yorkshire	Suburban	Suburban	>5 years ago
36	Female	SE England/London	Rural/country village	Rural/country village	Never
37	Female	SE England/London	Rural/country village	Rural/country village	Within the last year
39	Male	SE England/London	Urban	Urban	Never
40	Female	West Midlands	Suburban	Suburban	>5 years ago
41	Male	North East & Yorkshire	Urban	Suburban	>5 years ago
41	Female	SE England/London	Mix of areas inc. rural	Rural/country village	Within the last year
43	Male	East Anglia	Mix of areas inc. rural	Suburban	1-5 years ago
44	Female	SE England/London	Suburban	Urban	>5 years ago
45	Female	SE England/London	Mix of areas inc. rural	Rural/country village	Within the last year
48	Male	East Midlands	Rural/country village	Rural/country village	>5 years ago
48	Female	North West England	Mix of areas inc. rural	Rural/country village	1-5 years ago
48	Male	SE England/London	Urban	Urban	1-5 years ago
49	Male	Northern Ireland	Mix of areas inc. rural	Rural/country village	>5 years ago
49	Male	Scotland	Urban	Urban	>5 years ago
49	Male	West Midlands	Mix of areas inc. rural	Urban	Never
51	Male	SE England/London	Suburban	Suburban	>5 years ago
52	Male	North East & Yorkshire	Suburban	Suburban	>5 years ago
52	Male	SE England/London	Rural/country village	Urban	Within the last year
52	Female	West Midlands	Urban	Urban	>5 years ago
53	Female	SE England/London	Suburban	Suburban	>5 years ago
53	Male	SE England/London	Mix of areas inc. rural	Urban	>5 years ago
53	Female	West Midlands	Mix of areas inc. rural	Suburban	Never
57	Female	East Anglia	Urban	Rural/country village	1-5 years ago
58	Male	North East & Yorkshire	Mix of areas inc. rural	Rural/country village	Within the last year
59	Female	Scotland	Suburban	Suburban	>5 years ago
59	Female	SE England/London	Suburban	Suburban	>5 years ago
60	Male	Northern Ireland	Rural/country village	Rural/country village	Within the last year
62	Female	North West England	Suburban	Urban	1-5 years ago
62	Female	Wales	Urban	Rural/country village	Within the last year
63	Female	SE England/London	Suburban	Suburban	>5 years ago
66	Male	SE England/London	Suburban	Suburban	>5 years ago
66	Male	SE England/London	Urban	Urban	Within the last year
68	Male	Wales	Urban	Rural/country village	Never
71	Female	Scotland	Urban	Urban	Never
71	Female	SE England/London	Suburban	Suburban	Never
71	Female	SE England/London	Suburban	Suburban	>5 years ago
72	Female	Wales	Mix of areas inc. rural	Suburban	Within the last year
75	Male	East Midlands	Mix of areas inc. rural	Rural/country village	>5 years ago

Appendix 7. Data excerpts supporting 'naturalness' topics laid out in Chapter 6

Table 15. Naturalness data related to Table 11

P1: Properties more similar to those of an historically ideal or 'wild' model

Participant 35: "Allowing the cow to eat grass and to graze, as you said, I would call that a very important natural part of dairy farming because it's natural to the cow to graze and to eat grass."

Participant 58: "fresh air, sunshine, the ability to roam around …"

Participant 19: "It's out in nature, isn't it? It's getting daylight, it's getting the weather, whether it's rain, shine, whatever…"

Participant 57: "Animals are allowed to go around the fields and have freedom day and night, if necessary, being given barns or whatever to go into at night and still having freedom of choice to go in and out, as opposed to you're out for 15 minutes and back inside and then locked in is unnatural."

Participant 23: "…reducing the amount of intervention, ensuring the welfare of the animal is always paramount to any other by-product is critical I think… if you paint all the sheds bright pink or if you pipe in Mozart or give them VR headsets or rub their… do they have paws, hooves? I don't know. That shows how much I know. I think that's the wrong way to go, it's about the minimising of intervention I think is the key thing."

Participant 53: "…so with milking I suppose they would only be milked by their calves rather than by machines but I guess we can't massively get away from if we're getting milk from them, but it's just making sure that process is as non-stressful as possible, has the same kind of physical sensation as being latched onto by a calf. Just trying to replicate what natural life would look like for them as best as possible."

Participant 32: "I think that's the natural way to treat them, to let them roam and please themselves."

Participant 30: "The naturalness is just, I think, has got more to do with the environment, the fact that the freedom to roam."

Participant 28: "Just the freedom to roam, the freedom to be outside in a more natural environment, able to socialise although they can do that there. That freedom to roam and be able to be outside and have that open space. To an untrained person that feels more natural to an animal. They are quite large, cows. They need some space."

Participant 60: "Animals don't build their own shelters, they might stand under a tree occasionally… it can stand near a tree or a row of trees. So, they do that instinctively so that is natural, it's like, 'Bloomin' heck it's cold here, I'm getting wet', the trees are there they go and stand by the trees."

Participant 42: "I'm guessing that they spend a lot of their time naturally grazing…so to not be able to eat grass and just be fed maybe … man-made food at prescribed times rather than just this constant chewing grass, might be a bit unusual for a cow. Yeah, not entertainment as such but it's what the cow is … something in the cow's head's telling it to do that all day long…"

Table 15 continued…

P2: Actions more in accordance with those biologically or genetically coded to humans

Participant 57:" There is a case of we are the masters, as such, so we are going to take over those, but they should still be given their freedom, that's the naturalness they should still be having. But it is natural for us to have taken over them now, as such."

Participant 54: "So that is natural, especially for livestock farmers, they're not really enforcing that much manipulation onto it because they're just controlling the migration or they're controlling the grazing, they're not really doing anything else, they naturally do that."

Participant 46: "I think cows may be more relaxed with human contact, I think some farmers probably pet them or stroke them, I'm guessing they may do that, you don't really see that bit."

Participant 31: "L07: "I suppose it is [natural], yes, it's all done for the efficiency of the farm, isn't it really?"

Participant 20: "It's natural in that [machinery] performs the same function (milking), but whether or not it's as comfortable for the animal I don't know, but as I say, it's certainly better for the farmer because he can do so many in one go."

P3: Less use of technology to perform the action

Participant 45: "Yes, you get connected to the animal [when hand milking]. You feel the personal connection with the animal, yes."

Participant 42: "In terms of the food the cows or animals are given, I'd say if ever it's got … if it's just waste from other aspects of food and agriculture then I'd say that's reasonably natural."

Participant 56: "I would feed them on the grass from the meadows from that farm and I wouldn't give them grain because I don't think it's natural to eat grain, so they would eat the hay from that farm."

Participant 53: "…it's a bit harder work for the farmer, but it feels like the farmer's willing to put in the work …he's got to trudge through the snow to go and get them and things like that. So, it's someone who's perhaps appreciating what cows would like more naturally…"

P4: Closer proximity to the norm

Participant 47: "Natural would be being looked after, being fed, shelter when the weather is inclement."

Participant 13: "S02: "Yeah, we've domesticated them. If you let every cow in the country out loose now they wouldn't survive. So they need us as much as we need them. So … yeah, it's probably as natural as it's gonna get, what we're doing now."

Participant 9: "If you back over the centuries, things haven't really changed for a farmer, a natural farmer. He'd have the animals, he'd look after them. Today we have more mechanisms, and it does help. We have tractors and things like that. But as regards to animals, we still have to look after them and that doesn't change."

Participant 16: "I think a cow has evolved to live predominantly outside, to graze outside, to socialise outside and I think because it's evolved to do that that is the norm across most farms. So there is a related aspect but I think the natural part encompasses the fact that that's the way cows have evolved and adapted and are meant to be…."

Table 15 continued…

P5: Closer working with nature or God's will

Participant 36: "But with regard to animals, if we're going to use them for our purposes, we have a responsibility to look after them as much as possible and keep them in as natural a habitat as possible according to whatever animal it is, whether naturally they like to walk, whether naturally they like to be with a lot of their kind or whether they don't."

Participant 10: "It's just that bond, isn't it, you've got a special bond, surely a farmer's got a special bond with… you'd like to think in your head he's got a special bond with his animals and in your head you're thinking the farmer looks after them."

Participant 31: "…If it's just being done for the efficiency of the farm then that's not natural, but if it's being done really for their welfare and their protection then I think that's pretty natural."

R2: Occurring more frequently so is more common or familiar

Participant 17: "..they've always done [milking by hand], haven't they, goes back years…"

Participant 10: "…when you think about farming you automatically go to the family on the farm, the farmer doing the milk, sitting on his little stool milking a cow getting the milk."

Participant 44: "I think for most British children you have that slightly archetypal view of the Friesian cow out in fields eating grass."

Participant 16: "…farmers are bred into an industry where things are accepted as just being part of a farming life … just because you're born into that so it just becomes natural for you. So, a child growing up knows that it's natural that really young cows are taken away from their mums really early on and you don't even engage in that thought process of what's going on for this cow because it's just what you're born and bred into."

R3: A living entity's wellbeing more promoted or more encouraged to flourish (telos)

Participant 49: "I feel like it's more natural so they could roam around and maybe they'd be, 'OK, this is grass and I eat this', and they could be a cow, if that makes sense?"

Participant 38: "… cows, from a manual milking point of view, they have to go to milk in the morning and the afternoon, whereas [through automated milking] they could be like at lunchtime, 'Ooh, I quite fancy going to have a milk' and they can. So that's their natural state, because they can then, they're using their own mind to know what they need to do."

Participant 13: "I think if they're happy and content and they've got everything they need, then that's, in the farming world it's natural."

Participant 44: "… allow for their natural socialisation, rather than socialisation that's going to be definitely affected by being constrained in a small area without a food source."

Participant 43: 2 it's nice to have them outside, maybe that's what their natural environment is or what they're supposed to be doing."

Table 15 continued…

Participant 18: “I think we could have more natural farms where cows could live happy fulfilled lives.”

Participant 6: “I’d still far rather they were able to be outside and free roaming and grazing and doing what they want and being less structured than being confined all the time.”

R4: More about meeting moderate needs and less about excess

Participant 20: “The cows should have the best life they can have without it becoming cost prohibitive without affecting them. At the end of the day farmers have still got to make a profit, still got to make a living for himself, but having said that the animals that are making his living for him should be looked after the best they can without tucking them up in bed at night time and stuff like that.”

Participant 5: “…machinery’s been used for a long time so… I think to go out and do everything by hand would just be a too big a task, I don’t think that would be possible, so yeah, certainly machinery in whatever form it takes certainly has its uses and its benefits in terms of what you can do with it.”

Participant 48: “Only giving animals antibiotics when they need antibiotics is more natural. There is still an intervention there.”

Table 16. Unnaturalness data related to Table 12

P1: More dependent on humans for its origin or history

Participant 33: “Well, I think it’s unavoidable because when you domesticate an animal, you’re not allowing it to live its natural life and build up its immune system, its antibodies and whatever diseases are in that area, because nature survives through the survival of the fittest.”

Participant 15: “…it’s gone for me like subsistence farming to profit, to capitalism basically. And as a result, you’re seeing these massive industrial units ran by businesses looking for profit and you’re ending up with these, like I said before, industrial scale operations with these big farms with big numbers of cattle and that’s unnatural, definitely without a doubt.”

Participant 37: “It looks distorted to me, it looks like they’ve been bred for certain traits…because they’re bred for their milk and so they’re milk producing machines and that’s had an impact on how they appear and you can see some of them really lumbering, particularly if their udders are full.”

Participant 11: “…must be much more chemicals involved, less workers and more machinery involved and stuff like that. It’s definitely become more… future centric…”

Participant 30: “…we used to add all antibiotics and … vitamins, minerals, into their foods, which don’t sound so natural anymore, do they?”

P2: Properties less similar to those of an historically ideal or 'wild' model

Participant 54: “Now, you see, that isn’t natural, the machine … and neither is the hand-based milking because in essence that’s not natural things. It’s natural for the calf to suckle on the mother’s teat, that’s natural.”

Participant 59: “..forcing a daily cycle on them that wouldn’t naturally be what they do… a daily cycle imposed on them. And also having types of foods imposed on them and their space being limited. …then they’ve kind of been forced into a feeding cycle that isn’t natural to them. And it’s probably not – what they eat is probably not what they’d want.”

Participant 51: “I just think it’s not humane to the cattle or to any animal, to keep them caged up. They’re not being natural, they’re not being whatever they call them – free range.”

Participant 22: “but if there’s like a factory where they're just stuck in these milk pumps for hours on end and not really going out and being a wild animal, then yeah, I’d say that’s not right.”

Participant 47: “Recycled air is unnatural.”

Participant 36: “…as far as I know in most intensive farms, they’re only kept for three or four pregnancy cycles and it’s quite intensive for them and then they are killed for meat or cat food or whatever. And they live much shorter than their natural lives would be, so they’re mostly used for their milk capacity.”

Participant 31: “…when a calf is born if it’s a male then quite often they're slaughtered, aren’t they, because they don’t want the males...That seems very wrong to me they only want the female cows…Yes, because if they were all out in the wild, so to speak, that wouldn’t happen, would it?”

Table 16 continued…

Participant 39: "…as a child I remember reading about polar bear syndrome, which is the polar bears in the zoo, where they have a very limited amount of space to roam in, and of course they just go round and round in circles with fake ice, as opposed to in their natural environment… I mean I understand that a cow might not be used to roaming for hundreds of miles, but still just that degree of freedom."

Participant 42: "I expect a bit bored, because they can't graze and I'm guessing that they spend a lot of their time naturally grazing, so it might be a bit unnatural for them to not be able to just graze."

Participant 41: "…they're dependent there for being fed rather than plucking fresh grass themselves."

Participant 58: "imagine it would probably be artificial food or something that's not necessarily grass that they're eating, perhaps pellets of some sort, I guess similar to horse feed from what I can remember having seen. Yeah, it doesn't sounds as appetising I guess for the cows."

P3: More use of technology to perform the action

Participant 2: "The physical building and anything inside that would be unnatural.

Participant 12: "Even shelter, like I said earlier, shelter, a barn for the cattle, it's shelter but it's manmade. A tree isn't manmade."

Participant 10: "That's got to be unnatural, when you think about farming you automatically go to the family on the farm, the farmer doing the milk, sitting on his little stool milking a cow getting the milk, so now it's all machine and you see them, quite big machines…"

Participant 47: "Keeping anything in darkness or in artificial light 24/7 is unnatural. I worked for a government department for 31 years and I am convinced the fluorescent lighting wrecked my eyesight."

Participant 40: "Well non-natural would be pumping medication into animals on a regular basis just in case. …I think in livestock production you want to have healthy animals that are healthy in their own right without you giving something to make them healthy."

Participant 55: "Probably mainly the food, what they're fed on. 'Cause it's probably cheaper to get processed, cheaper foods and stuff which have probably got maybe plastics or bits or stuff in it, so it's probably more expensive for them to feed them fresh produce all the time, so the farmer's probably weighing up how much they can afford to spend on this."

Participant 36: "And to feed them hay and soya all the time I would say is unnatural as well. I don't know when cows started to be fed soya, is that a relatively recent thing? I'm not sure."

P5: Less working with nature or God's will

Participant 33: "So, yeah, so I think the mass farming is not working with nature, the nature of the cow."

Participant 51: "We wouldn't want to be uncomfortable, so why would we expect our animals to be uncomfortable? I'm going back to the biblical point of view, God said to look after every creature, so given that it's to us to look after, and it's like the world, the climate … I think that we don't look after things as God perceived."

Participant 58: “I guess it’s the scale and the trying to meet demand that’s made it more unnatural...”

Participant 53: “I think it depends on the reasons why they’re not natural, so where things are genetically modified or battery farming, things like that where it’s purely for the human’s benefit and not for the animals then that’s not OK, that’s abusing nature.”

Participant 14: “I think they just probably wanted to force produce and … make things quicker, you know, just be a bit more controlling over them … that’s not a natural habitat for it … I can only think it’s more financial.”

R2: Occurring less frequently so is less common or familiar

Participant 52: “BF01: “Yeah, I suppose because I’d never seen them being milked before, I’d only seen them out in the field grazing, I’d never thought about that other side of it with them being milked.”

Participant 24: “I’ve always thought of them being out in the open, in the fields and that sort of thing, as opposed to being closed up under a roof and that.”

Participant 15: “I suppose the size of the groups that the cattle’s in, say if one of these cows is maybe congregating with 300 cattle for example, that in my head might be an unnatural size ‘cause I suppose previously maybe cattle would only maybe tend to congregate in a smaller group of 20/30/40.”

Participant 58: “Yeah, I guess it’s the scale and the trying to meet demand that’s made it more unnatural in the sense that it’s moved away from how things used to be.”

R3: A living entity’s wellbeing less promoted or less encouraged to flourish (telos)

Participant 47: “See, taking their calves away so young is a bit of a bummer whichever scenario you look at it. Some cows aren’t maternal like some people aren’t maternal, but I guess most of them are and it probably distresses them to have their calves taken away from them so young.”

Participant 49: “Probably indoor would be kind of constraining them to certain actions…I feel like inside there’s separate sections and it’s like, OK, you do this now, you go to milk now, OK now you can socialise and now you go to bed, and things like that.”

R4: Less about meeting moderate needs and more about excess

Participant 45: “what’s natural for the cow, I think it all depends on the cow owners, the farmer, the conglomerate or whoever is responsible for the cows. Because if they are a big company and they are only dairy farmers they want to get as much as profit as possible.”

Participant 29: “I guess none of it’s really natural, is it <chuckles> whether it’s the stuff that they’re given to produce more milk or the stuff that’s growing in the field…”

Participant 34: “Some people, as we said, like mad cows, they used to give that type of food ‘cause they wanted the cows to grow bigger, quicker, and make more money out of it. Then in other case you can farm animals like naturally, in normal grass, obviously the cow grows in its normal way.”

Participant 49: “So, I mean when they have these machines for milking…I don’t feel like that’s completely unnatural, it’s just a way to help, but yeah, if machinery could do all of it and there didn’t need to be a farmer, then that would get unnatural.”

Table 17. Data related to Table 13 – topics identified as 'natural' yet potentially negative or 'unnatural' yet potentially beneficial within dairy farming

P1: Properties more similar to those of an historically ideal or 'wild' model

Participant L05: "Well, I think it's unavoidable because when you domesticate an animal, you're not allowing it to live its natural life and build up its immune system, its antibodies and whatever diseases are in that area, because nature survives through the survival of the fittest."

P1: Properties less similar to those of an historically ideal or 'wild' model

Participant BF03: "…they've got the best of both worlds, their natural environment in the summer and out of the elements and well looked after in the winter."

Participant TW02: "…it's kind of like having a child, isn't it, you don't want them to be sitting inside all the time, you want them to have the opportunity to go outside and be inside, but if you feel that they need to be protected you'd bring them in."

Participant L01: "To me it seems more natural, he says with inverted commas, so more linked to the wild ancestors of the cow, but I do know that cows do like being indoors and in the warm, well, the modern breeds do."

Participant BA01: "But then there's probably lots of ways, and for humans as well there's lots of ways in which we intervene to make things better and that's great, that's lovely, so even if a cow's fallen and broken its leg then helping getting a vet in or someone to help set it and things like that."

P3: Less use of technology to perform the action

Br03: "I should think a clumsy milker – I don't know this – might hurt a cow quite a lot whereas I am sure the mechanical ones do it all in a wonderfully efficient way without necessarily hurting a cow."

Participant Pr01: "I guess natural probably is the farmer milking their cow, so doing it manually and … it not being automated, but again, that might be at a cost of the cow's comfort."

P3: More use of technology to perform the action

Participant G02: "Well, if you've got lots of cows to be milked it's better to be using machines or you'd never get round them all… it lets us have it on a bigger scale. 'Cause we're on a bigger scale, human beings, the population has to be fed."

Participant Y01: "Maybe there's some things that do naturally occur, for example, I'm thinking maybe in terms of diseases that are natural but, OK, we don't want all the cows to be diseased so we intervene there."

Participant L08: "Obviously [automation is] unnatural … but then again it's making the cow decide what it wants. If the cow's like 'I'm hungry, I'm going to get some food' if it's 'I want to get milked,' goes and gets itself milked…Voluntary, that's the better word, yeah, it's more voluntary for the cow. It knows it needs to be milked, it goes and gets milked. Even though it's not natural, it's freedom."

Participant NW01: "There's an absolutely amazing dairy farm… the cows take themselves off, where there's music, the one side of the road they actually go under the road, stand themselves on a circular thing that goes round, finishes milking and off they go. And I've often just driven there and watched it 'cause it's amazing! And they seem so happy…Yeah, so that's not natural…it's progression and it appears that it's as near as it can to being natural and having welfare of the cows and comfort of the cows."