*Ann. Anim. Sci., Vol. 23, No. 4 (2023) 913–925* *DOI: 10.2478/aoas-2023-0053*

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# FROM ANIMAL PERSONALITY TO ANIMAL INDIVIDUALITY IN FARM ANIMALS – A REVIEW*

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**Abstract**

**As a result of the domestication process and systematic breeding, livestock species have been shaped as donors of animal goods for humans. The animals' role so defined, which has remained unchanged for millennia, now faces criticism from intellectuals (posthumanism), pro-animal activists, and increasingly often, postmodern societies. The core aspect of this growing conflict can be described at the level relationship between the personality/individuality of farm animals, animals as persons/nonpersons, and animals as moral subjects/agents. This review aims to discuss these relationships in the context of the current state of ethical reflection and knowledge, and in relation to the future of livestock production. It presents problems of definition and research methodology in the field of animal personality, with particular reference to farm animals, characterises the dilemmas of the moral status of animals in the personality/individuality of farm animals – animals as persons/nonpersons – animals as moral subjects/agents, and discusses the relationship between farm animal personality and animal individuality; moreover, it undertakes to analyse the possibilities of individualised treatment of farm animals at the level of future livestock production. It concludes, among other things, that the concept of "animal personality" in relation to farm animals remains undefined in both research and social spaces. While livestock animals remain moral subjects, some ethical concepts attribute to them a wider range of rights intended for personal moral agents. At the same time, it was noted that an individualised approach to animals appears to be one of the most important aspects in the sourcing food of animal origin in the future, in line with a systematically increasing level of animal welfare.**

**Key words: personality of farm animals, animal individuality, moral status of farm animals**

The last century has seen unprecedented advancement in biological and psychological knowledge about animal life, among the most intense as far as research in basic and applied sciences is concerned (Gartner, 2015). Furthermore, between the publications of such authors as Thomas Henry Huxley, Alfred Russel Wallace, and Charles Darwin and the present day, the distance separating the world of humans and that of animals has diminished radically, and over time, the natural sciences and humanities have increasingly used terms like human animals and non-human animals to point to a key commonality of origin and/or membership of a particular animal species, instead of explicitly distinguishing between "humans" and "animals" (Cartwright, 2000; Benton, 2009). Today, this serves as an expression of the human attitude towards animals as not only "research subjects" but also, and perhaps especially, as a reflection of a sense of proximity along a continuum of biological, cultural, and civilisational evolution (Ramsey, 2013; Dufourcq, 2021; Buskell, 2022).

This "proximity" between human and animal is often accentuated not only in relation to other hominids but also towards vertebrates in general, most of which are domesticated species (Leach, 2003; Zeder, 2017; Herbeck et al., 2022). At the same time, this applies to both companion and farm animals, although the way they are perceived by humans (and the nature of the human-animal relationship in general) is, in this case, uniquely determined by the degree of "animal usefulness" for human needs (Solomon and Hussen, 2018).

Distinctive conflict factors arise at the interface of the "usefulness" of livestock and its "proximity" to humans, which, so far, have been rather marginal – if they have occurred in postmodern societies at all. Meanwhile, progressive scientific research into animal behaviour and cognitive abilities is increasingly reinforcing this conflict propensity, which is reflected in philosophical and ethical proposals, particularly those promoting vegan, or at least vegetarian, lifestyles as an alternative to animal production (Fraser, 2012; Rossi and Garner, 2014).

*Work financed from funds of the Ministry of Education and Science of the Republic of Poland (research subsidy 020012-D015), and by the Minister of Education and Science of the Republic of Poland within the programme under the name "Regional Initiative of Excellence" in 2019–2023 (project number: 028/RID/2018/19, the amount of funding: 11 742 500 PLN).

In this context, concepts and methodologies hitherto reserved exclusively for the description of humans are increasingly being applied to farm animals. A particular example of this is the study of the personality of animals and the discussion about their subjectivity in relation to human moral obligations, which involves the introduction of the term "animal person" (Wise, 1999; Andrews, 2020). The concepts of "animal personality" and "animal person" usually function as separate spaces of interdisciplinary analysis in scientific research. But is there a vital link between them, nonetheless? The answer to a question so posed is not necessarily no. This is especially the case since some animal researchers (de Waal et al., 2014; Rowlands, 2016) and many scholars who propose a posthumanist vision of human-animal relations (e.g., Peter Singer, Tom Regan, Gary Francione) more or less draw attention to the relationship between the various aspects indicative of animal subjectivity, with the notion of "animal personality" and/or "animal person" as specific axes of this approach. The proposals are now no longer focused solely on hominids, but also apply to domesticated animals, including livestock. At the same time, there is a growing and very serious conflict between the public perception of this group of animals and animal production (Regan, 2006; Francione, 2008; Singer, 2011). It seems that today's widespread practice of viewing livestock as primarily a source of consumer products will, in the future – as knowledge advances and people's awareness changes – be subject to even more criticism in the public space than it is today.

Therefore, the fundamental aim of this work was to discuss the relationships within the area of personality/individuality of farm animals – animals as persons/nonpersons – animals as moral subjects/agents relations, in terms of the current state of ethical reflection and knowledge and the context of the future of animal production. To tackle this task, we addressed the following issues, respectively: 1) problems of definitions and research methodology in the field of animal personality, with particular reference to farm animals; 2) dilemmas of the moral status of animals in the personality/individuality of farm animals – animals as persons/nonpersons – animals as moral subjects/agents relationship; 3) the relationship between farm animal personality and animal individuality; 4) possibilities of individualised treatment of farm animals at the level of future livestock production.

**Animal personality – approaches and definitions**

Historically, two approaches to the issue of animal personality can be distinguished: the psychological tradition, in which comparative personality psychologists adapted human personality theory to animal research, and the animal-oriented methodology based on research by behavioural biologists (Koski, 2011). In the first case, the main objective is to understand the similarities and differences in human and animal personality concerning structures, underlying neuropsychological mechanisms, and evolutionary processes based on the Five-Factor Model, taking into account such heritable overarching domains of human personality as extraversion, neuroticism, openness to experience, agreeableness, and conscientiousness (Ashton and Lee, 2007; Fast and Funder, 2008, McCrae and Costa, 2008; Maltby et al., 2010). In this context, some psychologists (Gosling and John, 1999; Gosling, 2001; Gosling and Vazire, 2002; Capitanio and Widaman, 2005; Weiss et al., 2007; King et al., 2008) explicitly characterised animal personality within the psychology of human personality based on the assumption that animal personality exhibits a structural organisation similar to the human one.

In contrast, the biological approach to understanding animal personality traits aims to identify the mechanisms underlying the variability of these traits and the evolutionary relationships that sustain them, based on interdisciplinary research in such research areas as ethology, behavioural and evolutionary biology, and theoretical ecology (Koski, 2011; Kaiser and Müller, 2021). Thus, the biological approach is inevitably based on quantifying the expression of a given animal behaviour, as opposed to the psychological one.

Psychological and biological approaches to animal personality differ on a conceptual, methodological, and practical level. Nevertheless, Koski (2011) claims that there exist some crucial research spaces that may enable interdisciplinary encounters between psychologists and biologists. Among other things, she notes that both groups of scientists pay a lot of attention to genetic research on the inheritance of human and animal personality traits. The links between genetics, brain function, behavioural endocrinology, and personality traits under specific environmental conditions, in the context of interpersonal social relations, are also extremely important for representatives of both research spaces. Indeed, the common interest of psychologists and biologists in the evolutionary nature of personality may foster an understanding of the process of identifying similarities and differences of personality in the animal kingdom. Animal individuality is a factor often emphasized with respect to animal personality; it is noted that it results from the interaction of various combinations of traits regulated at multiple levels, i.e., genetic, physiological, neurobiological, and behavioural (Sih et al., 2004 a, b; Goursot et al., 2019).

Whether the problem of animal personality is examined from a psychological or biological standpoint, its assessment is primarily based on phenotypic behavioural traits. For example, Réale et al. (2007) defined animal personality as individual behavioural differences that are consistent over time and situations. According to Gosling (2008), animal behaviour, along with cognitive abilities and affects (which are generally judged based on animal behaviour anyway), is a key expression of animal personality. A similar definition was given by Koski (2011) who defined animal personality as a consistent behavioural variation of animals.

Defining animal personality in this way makes the concept widely accepted for vertebrates (Gartner, 2015),

although it is now increasingly suggested that personality traits in invertebrate animals should also be considered (Kralj-Fišer and Schuett, 2014; Mather and Carere, 2019).

**Personality of farm animals**

Chronologically, with regard to vertebrates, there is a definite line of research on the personality and cognitive abilities of animals: from humans to other primates, to companion animals, to livestock (Nawroth et al., 2019). By linking the concept of animal personality directly to animal behaviour, researchers become increasingly more interested in the diverse forms of animal response insofar as their behaviour is characterised by consistency over time and situations. Animal personality/individuality so defined focuses human attention not only on the species level but also on individual animals – especially in the context of individual animal welfare, which is indicative of each individual's ability to choose and meet their needs "the way they like most" (Pollo, 2007). Referring to the personality of farm animals, Finkemeier et al. (2018) point out that it is closely linked to their temperament and the way they cope with a particular environment. Hence, studies of livestock personality tend to recognise as a source of personality traits a wide range of behaviours ranging from basic forms of physical activity (walking, lying flat, lying down, standing up, etc.) to behaviours that indicate/may indicate to varying degrees the animals' advanced cognitive abilities and emotional states. Some of these traits are already more or less objectively known and taken into account in animal breeding – e.g., temperament and docility (Adamczyk et al., 2013; Norris et al., 2014) – and more broadly, in animal production – e.g., basic forms of physical activity (Rodriguez-Baena et al., 2020; Fan et al., 2022) – and, in general, with a view to providing animals with the highest possible level of welfare (WQ, 2009; Mellor et al., 2020).

In this regard, it is also worth noting that while animal personality is primarily linked to the animals' behaviour, it is, after all, a natural form of expressing certain internal states of the animal in the Stimulus-Organism-Response system. Besides, as stated in the previous chapter, the term "animal personality" may also cover the animals' cognitive abilities or emotional states (Gosling, 2008). It thus seems justified to examine the personality of farm animals in general in light of the above. This is particularly true for animals that are by far the most important in livestock production: ruminants (mainly cattle and sheep), pigs, and chickens.

For example, studies using personality traits in cattle indicate that these animals have certain abilities at both the physical and social cognition levels (Nawroth et al., 2019). Among other things, they categorise conspecifics and/or humans as "familiar" and "unfamiliar", adjusting their behaviour on a case-by-case basis while exhibiting a fairly wide range of social behaviours from aggressive (e.g., threatening, butting, fighting) to affectionate through allogrooming (Coulon et al., 2011). Moreover, Meagher et al. (2020) found that heifers showed motivation to participate in discrimination learning tasks, but also actively engaged in other aspects of learning related to gaining control of their environment. This demonstrated the existence of individual preferences unique to each individual in this respect. According to Hagen and Broom (2004), heifers are aware of their actions and functioning. As part of their study, "the heifers were placed in a pen, the gate of which could be opened by pressing a panel with the nose, giving access to food 15 m away. They learned to do this and at the time of learning showed an excitement response of increased heart rate and jumping or galloping. This 'Eureka' effect was not shown by controls which just gained access to the reward or by heifers which had learned earlier how to open the gate." Notably, Broom (2006) believes that the existence of the so-called motivational system among animals may be related to the evolution of morality. Indeed, this author notes that a vital aspect of the biological processes underlying morality is the higher brain processes which are used when using all available information to make complex decisions [and which] will be a very important aspect of the biological processes underlying morality. The somewhat flexible nature of cattle decision-making, according to Nawroth et al. (2019), is evidenced by the way they forage and use their previous experience in the face of changing circumstances.

A series of review papers led by Lori Marino regarding pigs (Marino and Colvin, 2015), cows (Marino and Allen, 2017), chickens (Marino, 2017) and sheep (Marino and Merskin, 2019) serves as a kind of summary of previous research on different livestock personality contexts. The above authors generally point out that the complexity of individual personality traits, cognitive abilities, and the emotionality of animals has been underestimated in research on these animals and husbandry practice. Although they suggest the need for further research in this area, in their view, the aforementioned livestock traits should already be examined by determining the extent to which animals can be discussed subjectively ("who") and objectively ("what"). Suggestions by other authors follow in a similar direction. For example, Phillips (2019) has little doubt about the presence of complex personality traits and intelligence in sheep which, in his view, should not be viewed as inferior to human intelligence on an a priori basis since "sheep are as intelligent as they need to be". In contrast, the findings of Goursot et al. (2019) lead them to suggest that taking the multifactorial nature of laterality and personality into account will contribute to a better understanding of pigs' individuality. Kremer et al. (2021), in turn, believe that heifers' affective experience of their housing conditions differs according to individual personality. The above views seem to fit in with a number of questions raised by Buller (2013) ("who meets who on the farm, what do they meet, and how does such meeting matter?"), treating the human/farm animal relations as an encounter between two subjects in a community of "multiple lives" and "individual lives".

Yet Gygax and Nawroth (2019) disagree with the reasoning offered by Lori Marino's team by pointing out the particular need for a critical approach to the study of livestock personality and cognitive abilities, especially given the insufficient number of scientific research on the subject and the extremely high risk of anthropomorphising animals (cf. Forkosh, 2021), which could result in such things as attributing them with excessive cognitive flexibility. Among other things, this type of overinterpretation may result in compromised animal welfare due to the false inference of an increased ability of the animals to cope with new and/or potentially stressful situations (Gygax and Nawroth, 2019).

Finally, in practice, terms like "personality", "temperament", and/or "behavioural syndrome" are often used interchangeably in relation to livestock (Cabrera et al., 2021).

**Between morality and personality of farm animals**

The moral community includes beings towards whom moral agents have certain obligations (Babst, 2011). According to Clarke et al. (2021), inclusion in such a community – one that makes certain claims – is accomplished by recognising the moral status of its member based on whether they have a particular trait or set of traits. The history of morality and ethical reflection shows that inclusion in the moral community has been a process of expanding the set of its members to include one's biological family, group, tribe, nation, race, and gender, through non-human sentient beings (animals), to contemporary proposals for the inclusion of species, ecosystems, the biosphere, and artefacts. This continuous process of expanding the moral community is referred to as the "tower of morality" (de Waal et al., 2006) or the "expanding circle of morality" (Singer, 1981; Torrance, 2013).

One may wonder whether the introduction of a new concept (animal personality) distinguishing a bundle of psychological and behavioural properties of animals brings a substantially new point of reference into ethical reflection, whether it is a morally neutral category, and whether taking into account the results of personality research can change husbandry practice to some extent (Steiner, 2008). To answer these questions, it is necessary to determine the moral status (MS) of subjects with personalities conditioned by specific cognitive abilities. Let us tentatively assume that the ensemble of behavioural, emotional, and cognitive traits – the structural elements of personality – emphasises the subjective nature of living organisms, which is one of the criteria for granting MS (Hagen and Broom, 2004; Broom, 2006; Rowlands, 2012; Monsó, 2017; Nawroth et al., 2019). According to Warren (1997), "the concept of moral status is, rather, a means of specifying those entities towards which we believe ourselves to have moral obligations, as well as something of what we take those obligations to be". One can distinguish seven criteria for identifying the moral status of animals, which relate to their potential internal and external (relational) characteristics (Table 1).

The recognition of moral status based on these criteria gives rise to corresponding moral obligations expressed by moral principles defining our behaviour towards a morally significant being, e.g.: (I) the principle of respect for life, (II) the no-harm principle, (III) the principle of respect for the rights of the moral subject, (IV) the principle of human rights or analogous rights granted to animals, (V) the environmental principle, (VI) the interspecies principle and (VII) the principle of transitivity of respect. MS can be granted based on a combination of several criteria (e.g., sentient and cognitive life subject), and the general moral principles derived from MS attribution are interdependent, i.e., the practical consequences of one principle are explicable in the context of the other principles (Warren, 1997).

The above MS criteria and the moral principles associated with them apply to animal farms to varying degrees. The literature most commonly refers to criteria I, II, and IV; the other criteria mainly concern wild animals (V), animals with high cognitive complexity, e.g., dolphins, chimpanzees (III and IV), and companion animals (VI and VII). Thus, in relation to animal farms, the development of the personality criterion (IV) in the context of contemporary psychological-behavioural research (Shapiro, 2006) proves crucial to analyse.

Table 1. Criteria for identifying the moral status of animals

| No. | Moral community members | MS criteria | Moral principles resulting from MS | References |
|---|---|---|---|---|
| I | Living being | Biological processes | Respect for Life Principle | Schweitzer, 1955 |
| II | Sentient being | Ability to experience pain and pleasure | No-harm principle/animal welfare principle | Bentham, 1789,1998; Singer, 1975 |
| III | Person (personality construed restrictively, in the sense of being a person) | Moral action | Principle of respect for the rights of the moral subject | Kant, 1797, 2017 |
| IV | Personality subject (personality construed non-restrictively – a being of high cognitive complexity) | Complex cognitive abilities, personality | Principle of human rights or analogous rights protecting individuality | Regan, 1983; Donaldson and Kymlicka, 2011 |
| V | Living being as a significant part of the environment | Environmental significance of the given being | Environmental principle | Leopold, 1949 |
| VI | Member of the interspecies community | Social ties with people | Interspecies principle | Callicott, 1989 |
| VII | Being recognised by a moral subject | Being the object of respect | Principle of transitivity of respect | Noddings, 1984 |

The presented outline of the MS criteria shows that the choice of a particular criterion or set of criteria generates different solutions to moral problems. Granting MS based on whether the being in question is a person is the most demanding in terms of obligations to respect the moral rights of the individuals concerned. If this status is attributed to animals (e.g., primates), then by force of the status conferred, we impose certain moral obligations analogous to those that apply to humans. Consequently, animals must be granted rights that exclude such things as slaughtering them for meat, breeding them in captivity, keeping them in zoos, etc. Thus, being a person gives one a strong moral status, which is expressed by a set of inviolable, inalienable, and universal human rights, among other things. This is why animal rights theorists are so keen to try to prove that certain animal species have personhood and get embroiled in endless controversies as a result (DeGrazia, 2002; Cavalieri, 2003). This trend is controversial on the theoretical level (lack of universal agreement as to what cognitive properties are sufficient for personhood) and on the level of practical consequences as it would require a revolutionary change in the relationship towards animals, e.g., a ban on killing animals for consumption (Carruthers, 1992; Gilbert, 2022). Thus, some claim that the language of personhood should be abandoned (due to the vague idea of what constitutes a "person") and that a language of selfhood should be adopted instead (Donaldson and Kymlicka, 2011). Being a subject (a *self*) does not primarily require a list of identifying characteristics (cognitive abilities), but rather a general (common-sense) identification that we are dealing with a being who is capable of cognising and feeling and has needs. In this approach, the biological and psychological knowledge of the personality of farm animals can clarify the characteristics of the subject and help to identify pragmatic implications. The personality profile of a subject (the type of individualisation of an individual) is morally significant because it makes them unique at the level of fundamental traits, e.g., the type of cognition and the coupled emotional system determines the behavioural profile of an organism (Schönfeld, 2006; Waytz et al., 2010; Bermúdez, 2011; Gray et al., 2012; Sorabji, 2018). Taking an individual's personality into account is a way of detailing the species-norm in two ways: it makes the characteristics of the species richer and the behavioural strategies more varied.

The concept of animal personality expands the notion of life subjects by supplementing it with a psychological-behavioural factor and makes it possible to develop a moral principle protecting the moral status of life subjects, namely the no-harm/animal welfare principle. Treating farm animals in line with these moral principles would require the establishment of a species-norm (helped by statistical methods, animal sciences experiments, and interpretive experience) to which specific husbandry practices would need to be adapted, e.g., based on what farm animals prefer and what they avoid; their behavioural, nutritional, and social needs, etc. In this case, the nature of the concept of species-norm is both descriptive (biological characteristics of a standard teleonomic structure profile in relation to individual traits within a species, produced by natural and partly artificial processes) and normative, delineating appropriate breeding practices and moral actions (e.g., animal welfare actions) (Nussbaum, 2006). Therefore, if individuals develop typically for the representatives of their species, then what matters most on the breeding level, but also on the moral level, is what individuals of a particular type (e.g., species) need to develop. Animal welfare is determined by the ability to recognise the species-norm and implement standard husbandry practices that meet their typical needs. In this context, the internal differentiation and variability of individuals within a species are largely irrelevant; what matters above all is enabling the development of typical potentialities of the species, enabled by the typical individual-specific traits of that species.

So, how can knowledge of farm animal personality be applied to the use of the species-norm? The first pang of moral intuition points out that not every individual variation is morally relevant, e.g., variable physical characteristics of an individual. What is morally significant, however, is those personal characteristics (sets of traits) that affect their subjective status, which is determined by a set of coupled mental properties (cognitive, emotional, behavioural). For moral agents, a set of such properties collectively referred to as personality, is a signal that a given life subject is more individualised than other living beings of lower cognitive complexity, and that a given life subject expresses its individuated needs, experiences, emotions in distinctive ways (Sytsma and Machery, 2012). Personality has moral significance because it enables one to experience the world subjectively and specifies the individuality of the organism. One implication of recognising this standpoint as valid is to nuance the application of the species-norm: the norm should not be made "coarse-grained" by taking into account only the typical distribution of species traits, but it should also include provisions on the different developmental stages of the animal and individual intra-species variations. Also, attention should be paid not only to the distinctiveness of behavioural characteristics, the individual variation of animal expression (e.g., their specific response to stimuli), but the use of this dissimilarity should also be a standard in the practice of rearing and breeding, which is actually happening sometimes. It seems crucial to change the perspective in describing farm animals, i.e., a transition from averaging a given characteristic for a group of animals (e.g., feeding group) to an individualised approach (individual A differs in terms of a given characteristic from individual B, and this is even different in the case of individuals C and D). Thus, although the individualised approach to livestock does not lead to recognising them as persons, it still includes them in sets of individual traits that constitute the "personality" of animals. While until recently such a perspective was technically impos-

sible to implement in practice on a large scale, this is now rapidly changing.

**Individuality of farm animals**

*Variation of behavioural traits – from the general to the specific*

From the point of view of assessing animal performance traits, applying an individualised approach to livestock is not new – it is the essence of breeding work based on measurements of trait markers in individuals and/or their offspring (Rasmuson, 2010). In contrast, with regard to the behavioural characteristics of animals, the practical applications of knowledge about the individual predispositions of farm animals remain unclear. For example, it has been noted that individual-specific variation in a sows' responsiveness to the distress calls of piglets exists (this indicates the degree of caregiving exhibited by sows). However, despite the development of behavioural tests to determine this trait, these are hardly used in practice (Nowicki and Schwarz, 2010; Nowicki et al., 2012). On the other hand, there are examples of long-term systematic breeding work involving behavioural traits in animals (such as temperament and/or docility in cattle), although these traits are generally not included in selection indices for individual animals (Adamczyk et al., 2013).

This negligence in animal behaviour analysis directed to individuals is due to such things as the tendency to average the values for the group/population and to treat "outlier" behaviour mainly as "noise in the system" (cf. Slater, 1981). Meanwhile, the high variability in things like physical activity, nutrition, or social and reproductive behaviour in animal populations represents more than the abovementioned "noise". Thus, the description of the behaviour of a group of animals should not be based mainly on averages; rather, more attention should be paid to the individual behaviour of each animal – especially when there is considerable individual variability within the given group of animals (Slater, 1981; Benus et al., 1987; Adamczyk, 2011; Neave et al., 2018; Green et al., 2019; Nogues et al., 2020).

Considering the scope of research on farm animals carried out to date, that which concerns pigs – a species with particularly well-recognised individual behavioural predispositions (especially concerning agonistic behaviour) – appears to be the model example. Ultimately, in this case, the reasons for behavioural variation were somewhat explained by the introduction of the term animal personality in relation to pigs (while emphasising the importance of this variation), and over the last 30+ years, many studies have been conducted on their personality, identifying links between their personality traits and behavioural and physiological responses (O'Malley et al., 2019). Prunier et al. (2020) note that it is personality traits, in interaction with environmental stimuli, that determine whether some pigs are willing to bite others and whether this behaviour is agonistic. In this context, Ruis et al. (2000) also pointed to the existence of different personality types in female pigs. However, it appears that personality type does not always play a key role in the amount of fighting between individual pigs and thus has a role in shaping the structure of the animal group (Melotti et al., 2011).

The results of research by Hessing et al. (1994), as well as the results of using the so-called backtest, where the response of individuals is the result of their individual strategy to cope with a stressful situation (Iversen et al., 2017), also point to the high individualisation of pigs' behavioural responses. Perhaps this is precisely due to the unique characteristics of their so-called personalities. The answer to this question is of particular importance in view of the fact that the intensity of agonistic behaviour in pigs kept under rearing conditions is considered to be a particularly important factor in reducing the welfare of these animals. This problem has been studied since the 1950s and is still of interest to researchers (Peden et al., 2018).

Examples of a very extreme type of agonistic behaviour leading to poor welfare include attacks by animal subgroups (gangs), which lead to the death of the attacked individual. In pigs, this takes the form of several individuals from an established social group attacking and killing a member of a group that already has a stable hierarchy. It has been found that gang aggression is neither related to the genetic lineage of the pigs nor dependent on the type of feed and occurs independently of sex. This type of behaviour has never been studied before because it was thought to be very rare (Camerlink et al., 2020). Nevertheless, it has been shown that, despite their seemingly marginal nature, these behaviours have a significant impact on animal performance on farms where they occur since they lead to mortality in growing pigs (Camerlink et al., 2020). The above observations may be evidence of the role of individualised yet infrequent personality traits predisposing some animals to leadership in so-called pig gangs that attack individuals lower in the hierarchy. At the same time, there is still no answer to the question of what accounts for the different, individual formation of the behavioural traits that make up the animal's personality.

An animal's previous experience of socialisation, or lack thereof, is often cited as the cause of the varied behavioural response associated with aggression in later life (Salazar et al., 2018; Morgan et al., 2014; Camerlink et al., 2019). While analysing the agonistic behaviour of piglets, Camerlink et al. (2018) noted that properly socialised individuals choose to engage in combat more quickly, but are also able to resolve the conflict quicker, suggesting better individual skills in assessing the opponent; incidentally, similar results have also been reported for early socialised heifers (Bouissou et al., 2001). This variation in the population indicates that pigs have the ability to resolve herd hierarchy issues without escalating aggression and that their previous fighting experience enhances their ability to judge opponents later in their lives. Pigs that were grouped with strangers and thus had to establish dominance relationships were able to wrap up fights in a shorter time (Camerlink et al., 2017).

Genetic predisposition, ontogenetic development, early life environment (including parental care), social environment, and nutrition have all been identified as sources of individual variation that can lead to divergent personality traits in animal populations (O'Malley et al., 2019). Individualised phenotypic behavioural traits are systematically shaped over the course of an animal's "life history" – this is de facto their "personality", construed as a characteristic set of predispositions/temperament and acquired experiences of an individual (Sih et al., 2004 a, b; Cabrera, 2021). It is worth pointing out that paying closer attention to the individualisation of animal behavioural traits can benefit both animal welfare and the production results obtained, especially in the case of livestock. To that end, animal personality should not only be learned but also consciously shaped by breeders and/or stockpersons in the early stages of the animals' lives – e.g., in the context of combining litters of piglets into groups before weaning, which results in lower levels of agonistic behaviour once other groups are formed after weaning (Pitts et al., 2000; Ko et al., 2020), or the extremely important socialisation problem of dairy calves subjected to early separation from mother cows (Johnsen et al., 2016).

*Analysis of farm animal individuality in practice*

Both the perception of livestock as beings with individual characteristics and the individualisation of human attitudes towards animals are problems of human-animal relationships (HAR) at the farm level, in a broad sense (Amiot and Bastian, 2015; Halachmi and Guarino, 2016). These include direct human contact with the animal in question (including at least visual, auditory, and tactile contact, and above all, handling) and communication through today's advanced technologies – mainly using livestock precision farming methods (Werkheiser, 2018; Mota-Rojas et al., 2020; Grandin, 2021). Adamczyk (2018) claims that in this context the nature of the degree of HAR individualisation with respect to cattle is determined by objective factors (e.g., at the level of global and local economic and environmental factors) and subjective factors (e.g., human knowledge and skills and human perceptions of/attitudes towards animals). It seems that such factors can also occur in the case of HAR concerning other livestock species (Hemsworth, 2018; Mota-Rojas et al., 2020).

Despite the complexity of the HAR issues (especially in intensive/industrial animal husbandry), there are increasing technical possibilities to identify individual animals and to know and treat them in an increasingly individualised and objectified manner in a production setting; however, this depends on the species/group of animals and the scale and nature of their husbandry/farm-level rearing (Fan et al., 2022). Furthermore, the nature of livestock precision farming methods not only favours viewing animals in an objective and individualised manner but also offers the possibility of 24/7 real-time monitoring of animals, which is crucial for long-term permanent observations and analyses of animal personality traits (Werkheiser, 2018; Simitzis et al., 2022). It is worth mentioning in this context the work of Cabrera et al. (2021), who conducted a comprehensive review of studies assessing the personality of animals at different stages of their development, including their metamorphosis during reproductive maturation. The conclusion of their study states that while individual animal personality traits appear to be consistent across life stages, they change when individuals go through periods of significant developmental change (i.e., metamorphosis and/or reproductive maturation). Therefore, short-term analyses (including, for example, observations during short-term audits) may lead to the false belief that a behavioural trait stable at one life stage will remain so in the long term.

According to Schillings et al. (2021), the following among today's livestock precision farming are particularly promising: image-based technology (e.g., using 2D/3D cameras, computer vision, optical flow, infrared cameras); sound techniques (e.g., using microphones or sonars); sensors (e.g., using accelerometers, pressure or infrared sensors, bolus), radio-frequency identification (RFID) and wireless technologies. These techniques help recognise individual traits of specific animals, and when supported by advanced machine learning methods (mainly artificial neural networks and/or deep learning), make it possible to obtain a comprehensive, individualised picture of an animal in real-time (Chen et al., 2021) – both at the level of practice and organisation of animal activities (e.g., automatic cow milking, individualised feeding) and the creation of profiles for particular traits of individual animals in time and space (Halachmi and Guarino, 2016). At the same time, the range of traits used to describe animals is also steadily increasing – originally collected and analysed primarily in terms of performance, they are increasingly often supplemented by non-performance traits (e.g., behavioural ones), which are crucial for the comprehensive assessment of negative ("freedom from...") and positive ("freedom to...") welfare of individual animals within the Five Domains Model (FAWC, 2009; Mellor et al., 2020; Rault et al., 2020).

In husbandry settings, individual animal description is increasingly taking place in a broader relationship than HAR, namely the human-environment-animal (HEA) relationship (Hemsworth and Coleman, 2011). In this context, environmental parameters/indicators of animal welfare are also added to the above-mentioned HAR data collection and analysis techniques, which are additionally monitored and evaluated, or may be in the future (mainly in terms of ambient temperature; relative humidity; air quality – concentration of carbon dioxide, ammonia, methane, dust; but also noise and quality of lighting) (Islam et al., 2021). Moreover, ultimately, as a kind of backdrop to the farm/flock/individual operation, more and more attention is being paid to Big Data analyses based on the Internet of Things, additionally taking into account the socio-economic environment of the farm in question (Neethirajan, 2020; Paraforos and Griepentrog, 2021).

Table 2. Prospects for individual assessment of livestock behavioural traits and emotional states using livestock precision farming techniques

| Traits/Area of analysis | Measurements | References |
|---|---|---|
| Recognition of animals, physical activity | - using non-invasive visual animal biometrics to recognise individuals and their physical activity (cattle);<br>- using drones (in goats), standing-lying sensors (in pigs), RFID and ultra-wideband tracking system (in poultry) for the monitoring of animal activity;<br>- using acoustic techniques for effective and accurate discrimination of individual dairy cattle. | Mainau et al., 2009; Quwaider et al., 2010; Yajuvendra et al., 2013; Thompson et al., 2016; Zhang et al., 2016; Van Der Sluis et al., 2019; Vayssade et al., 2019; Kumar and Singh, 2020 |
| Nutritional behaviours | - monitoring of ingestive behaviours in free-ranging cattle, goats, and sheep using acoustic monitoring techniques;<br>- sound-based monitoring method to detect short-term feeding behaviours of broiler chickens by recording pecking sounds;<br>- image analysis and binocular vision techniques developed to monitor feeding in pigs and poultry;<br>- RFID systems used to monitor feeding patterns in pigs, turkeys, and laying hens;<br>- drinking behaviour monitoring using RFID and/or accelerometers in pigs and cattle;<br>- camera-based systems to monitor drinking behaviour in pigs and chickens. | Tu et al., 2011; Kashiha et al., 2013; Navon et al., 2013; Maselyne et al., 2016 a, b; Aydin, 2016; Chelotti et al., 2016; Li et al., 2017; Adrion et al., 2018; Roland et al., 2018; Xiao et al., 2019; Williams et al., 2020; Yang et al., 2020; Schillings et al., 2021 |
| Social behaviours | - monitoring of sows' nursing behaviour using video analysis;<br>- monitoring of agonistic behaviours of cattle based on sensors;<br>- monitoring of social interactions in cattle using image segmentation and tracking methods;<br>- using accelerometers to estimate locomotor play in calves;<br>- using local positioning sensor network to monitor proximity interactions of individual dairy cows within large herds monitoring;<br>- calf-cow relations measurement using contact logging devices. | Swain and Bishop-Hurley, 2007; Boyland et al., 2013; Luu et al., 2013; Guzhva et al., 2016; Yang et al., 2019; Foris et al., 2019; Chopra et al., 2020 |
| Reproductive behaviours | - oestrus monitoring in cows based on individual vocalisations and caller identification or with proximity loggers;<br>- monitoring of reproductive status in ewes using RFID technology and in pigs;<br>- monitoring of reproductive status using sensor-based systems in sow farrowing. | Manteuffel et al., 2015; Alhamada et al., 2016; Pastell et al., 2016; Corbet et al., 2018; Liu et al., 2018; Röttgen et al., 2020 |
| Abnormal behaviours and those indicative of distress and/or a disease of the animal | - monitoring of coughs in cattle and sneezing in poultry using sound-based technologies;<br>- distress and/or signs of pain monitoring in pigs, poultry, and sheep using facial recognition;<br>- image processing to detect asphyxia in sows during parturition or to predict feather damage in poultry;<br>- tail biting or fighting monitoring in pigs using depth sensors, 3D cameras, and computer vision;<br>- detecting excessive mounting of pigs using image analysis;<br>- using acoustic techniques to detect claw lesions in dairy cows. | Schön et al., 2004; Lee et al., 2011; Viazzi et al., 2014; Lee et al., 2015, 2016; Nasirahmadi et al., 2016; D'Eath et al., 2018; Okinda et al., 2018; Carpentier et al., 2018, 2019; Chen et al., 2019; McLennan and Mahmoud, 2019; Volkmann et al., 2021 |
| Positive and negative emotionality | - electronic systems for locating livestock in time and space (GPS, RFID and wireless technologies);<br>- facial expressions, position of the ears, expression of the eyes (e.g., eye white area in cattle);<br>- sounds/vocalisations in the individual animals;<br>- heart rate variability;<br>- thermal imaging;<br>- skin conductance (electrodermal activity);<br>- electrocardiography;<br>- electroencephalography;<br>- electromyograms;<br>- respiratory rate analysis;<br>- olfactory and chemical sensors. | Paul et al., 2005; Frondelius et al., 2015; Battini et al., 2019; Green et al., 2019; Neethirajan et al., 2021 |
| Cognitive abilities | - visual animal biometrics as the coherent set of methodologies and computer vision-based models for the analysis of individual behaviours based on morphological image patterns and biometric characteristics;<br>- using machine learning algorithms system to individually adjust the complexity level of the task to each member of the group in the context of environmental enrichment of dairy cattle. | Fernandes et al., 2015; Mandel et al., 2016; Kumar and Singh, 2020 |

Central to the individualised characterisation of livestock is the study and practical use of the relationships between data collected and data analysed in real-time which, when viewed from different perspectives on a given problem/animal trait, enables a more objective assessment of the current level of individual animal welfare against the background of their "individual life history" (Akhigbe et al., 2021), but also the emergence of the so-called expert systems that take this information into account (Ravisankar et al., 2014; Shahzadi et al., 2016). In practice, such analyses have so far mainly concerned data closely linked to animal performance (e.g., heat detection, individualised feed dosing, early detection of diseases), but real-time monitoring of behavioural traits of individual animals (e.g., physical activity, location of the animal, rumination rate) is also used for this purpose (Schillings et al., 2021; Fan et al., 2022). Consequently, it is to be expected that as practical technical possibilities increase, so, too, will the number of recognised complex characteristics of individuals and even social relations between them in the group/stock (this trend is confirmed by the information in Table 2). Indeed, there is a good chance that, over time, the increasing knowledge of farm animal personality will be accompanied by the possibility of applying it to farming conditions using objective methods of data collection and analysis. The benefits will accrue both to animal (including improved animal welfare) and human activities (management of individuals/groups/herds, control of sustainable food production and certification of animal products).

## Conclusions

The growing conflict between the "proximity" and "usefulness" of farm animals in postmodern societies is being played out on many levels, particularly within the relationships of personality/individuality of farm animals – animals as persons/nonpersons – animals as moral subjects/agents. Existing concepts of the transition from the biological-psychological level (animal personality) to the ethical and legal space of moral agent (animal person) are among the many contemporary proposals for defining the moral duties of humans towards animals, including farm animals. The mutual incompatibility of these proposals in the context of the still insufficient number of in-depth analyses of animal personality issues means that in practice (contrary to the claims of those advocating the attribution to them of a broader range of rights intended for personal moral agents) these animals remain moral subjects – humans are their owners able to make use of certain animal goods, while at the same time seeking to ensure that animals are treated as humanely as possible. The changing ethical sensitivity of societies should induce those currently involved in animal production to respect animal welfare at more than a minimum level (also in relation to environmental conditions), including in terms of positive welfare.

While the use of the term "animal personality" in relation to farm animals is not firmly established either in the research or social spheres (in practice, it is sometimes used interchangeably with the term "temperament" and/or "behavioural syndrome"), more attention should be paid to animals as individuals endowed with one-of-a-kind behavioural traits. Getting to know animals in this way (and not as a result of averaging a description of traits for a group/population) and monitoring and analysing their "individual life history" (using modern techniques, among other things) is, and will remain in the future, one of the most important opportunities for optimising human-animal relations in animal production – especially under intensive rearing conditions. Therefore, an individualised approach to animals seems to be one of the most important aspects in the sourcing food of animal origin in line with a systematically increasing level of animal welfare.

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Received: 14 XII 2022
Accepted: 21 IV 2023