Blueprint for Animal Happiness
Scientific evaluation offers objective measure for animal welfare

What is worse: a cow limping on a crippled foot or a cow that is never allowed to graze? A piglet that has insufficient space to play or one that can move around freely but runs a greater risk of being crushed under the unwieldy body of its mother? A chicken with a painful infection or one with weak bones?

Most people are now well aware that animals living in modern farms are not always leading pleasant lives. It is also generally agreed that a sufficient level of welfare should be maintained. But when it comes to making the right choices, practice sometimes proves stronger than theory: for the question of when exactly animals suffer, does not always get the same answer. On the contrary: various parties, such as livestock farmers or animal rights campaigners, may judge a situation in completely different ways.

Nor do all scientific experts agree on this issue. When studying animal welfare, one is faced with different kinds of welfare, each of which is influenced by a range of factors. The picture may become so complex that it may seem impossible to deduce any clear judgements or recommendations from the data at all.

This document seeks to break this deadlock. In the same way climatic experts found one another in an estimation of the consequences of global warming, a multi-disciplinary panel of 22 experts have now sought a consensus on a lucid view on animal welfare, on the basis of which an indication can be given as to what is more and what is less important for welfare. The idea is that, despite differences of opinion on details, there may certainly well be agreement in principle.

The panel of welfare experts reached its conclusions by way of a written discussion. The result is a document which may not answer all questions, but which, thanks to its objective and broadly supported approach, does offer the possibility to set clear priorities — for instance for Dutch livestock farming.

All participating researchers agree that it is probably impossible for the livestock farming industry to house animals without reducing their welfare in one way or another — even a free-range housing system is not a paradise in every respect. But the analysis, which is based on measurable facts, offers a framework to assess animal welfare and clearly shows what the biggest problems are, and which alternatives would lead to the best results.

'Happy'
The welfare of animals is attracting increasing attention from society. A relatively small, but steadily growing number of consumers, when buying eggs or meat, is now choosing welfare-friendly products. Also, animal welfare ranks high on the government's agenda.

But in the absence of generally recognised definitions of welfare, there is a risk that people respond to incidents and to any form of 'suffering'. In order to co-ordinate the debate on welfare and to ensure that welfare measures are based on a consistent foundation, there is a need for a more comprehensive approach to animal welfare. This, at least, was the view of the Dutch Lower House, when in December 1999 it requested the Government to address this issue.

The question whether an animal is 'happy' and whether the production of food causes animal to suffer, is naturally likely to be given philosophical aspects. As animals' 'emotional states' are not directly assessable, people will easily be inclined to place themselves in the animal's position and try to imagine how it 'feels'. From this human point of view, the choice between free-range housing and a battery cage is hardly a question at all. But a chicken is not human

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and it may have different needs. Seen from a human perspective, 'welfare' and 'suffering' in a chicken may well occur in unexpected situations.

In the absence of a clear concept of welfare that is shared by all parties involved, participants in the societal debate tend to use a diversity of definitions. Few will deny that an animal suffers when it is permanently ill, injured or panic-stricken, and that housing systems that lead to such conditions are not preferred. In practice, however, determining how 'happy' an animal is, is more complicated than that. Whereas a livestock farmer may feel that his cows are thriving, animal rights activists may see the same animals suffer.

At the end of the day, each housing system has both pleasant and less pleasant aspects, and comparing the various forms of behaviour, stress and disease is far from simple. Is welfare guaranteed as long as animals are not ill and receive sufficient food and water? Or are freedom of movement, occupation and social contact essential to welfare as well? And what is more important to an animal: more space to stretch its legs or litter on a hard floor?

It is no wonder that there seems to be little agreement as to the question which animal is happier.

This lack of consensus not only hampers the debate among the different parties involved; it also seriously complicates the formulation of lucid, sensible and consistent government policies. A more objective definition, based on observable facts rather than subjective emotions, would be useful to both the debate and policy making.

However, the formulation of an objective definition, let alone a scientifically workable measure, is far from simple. Scientists continue to debate on definitions and causes of animal suffering. Some focus on measurable indicators of animal 'feelings', such as pain, hunger or fear. Others emphasise measurable indicators of the biological functioning of animals, i.e. their ability to survive and reproduce.

Yet, it was thought that, in spite of such internal discussions, there might well be a consensus among welfare scientists, if not on all details, at least on the basic issues.

This belief was what the present scientific debate was basically about. Its aim was to produce a lucid, broadly supported definition of animal welfare; to develop an instrument to weight negative impacts on welfare; and, finally, by using this instrument, to determine when and where animals suffer and how, through taking effective measures, this suffering can be reduced.

In order to achieve such common positions, in the course of this spring 22 prominent animal welfare researchers from seven different nationalities participated in what is known as a 'Delphi game'. In this game, participants state their opinions anonymously. The subject of the debate was not only a general framework to assess animal welfare, but also its application to the housing of cattle, pigs and domestic fowl — the main farm animals in Dutch livestock farming.

Via e-mail and via a moderator participants evaluated and commented on each new version of the draft document. In six rounds the original document was adapted to the joint opinion. This procedure has resulted in a document that is believed by participants to reflect the state of the art in the animal welfare field.

**Evolution**

In order to determine when an animal's welfare is reduced, the scientists took as their starting point the concept of its 'environment of evolutionary adaptation': the environment to which the animal is best adapted, initially as a result of natural evolution and selection, but later on also due to selective breeding. This evolutionary history strongly influences the animals as we know them today: they are equipped, both physically and in terms of behaviour, to deal with this specific evolutionary environment. This equipment forms as it were the blueprint for animal happiness.
This blueprint can be noticed everywhere — despite centuries of domestication, numerous forms of behaviour point back to earlier times. Thus chickens will keep pecking for seed even when the farmer has provided abundant food. And when a domesticated animal returns to its natural environment, it will soon behave in the same way as its wild ancestors used to do, including many behaviours that would seem to have become redundant in the barn, such as food searching, nestbuilding and social behaviour patterns.

Cattle, for instance, when left on their own, would live in herds. They would spend their day grazing and ruminating. Feral pigs, on the other hand, live completely different lives: with their keen sense of smell they constantly explore their environment — usually woodland. Rooting in the soil they collect a variety of food items. When their fat, hairless bodies grow too hot, they cool off in muddy wallowing pools. For resting, pigs will prefer a safe and sheltered place where they build a nest from grass and twigs. Pigs will not soil their nest without a reason. Subtle exchanges of noises and body-contacts ensure a stable social structure, while physical fighting is very rare.

The ancestors of the chicken also had a complex social organisation, which will recur spontaneously in 'modern' fowl whenever they are given the opportunity. They maintain this network by way of proverbial cackling and a rich variety of agonistic and avoidance behaviour, which is partly inherited and partly acquired in early life. Whenever possible, chickens will move about in sheltered surroundings — in the open field they are easily frightened and always alert as natural enemies could be anywhere.

It is thought that to a domesticated animal its historical ‘blueprint’ still determines largely what is the norm — a norm that can be expressed in a long list of needs. The need for food, water and rest, for instance, but also the need for movement, occupation and play.

When an environment fails to satisfy the norm, an animal will try to adapt. Within certain limits this can be done — for natural environments have not always stayed the same either. But when differences become too big, the animal's capacity to adapt may fail. Needs remain structurally unfulfilled, the result being frustration, which presumably indicates negative feelings. In other words, the animal's welfare is reduced.

**Measurable**

A definition of reduced welfare along these lines would bring discussion on the basis of more objective facts considerably closer. For, contrary to feelings, such frustrations can often be measured from the outside — for example when an animal can actually be seen to show abnormal behaviour in its attempt to meet its unfulfilled needs. Also physical reactions, such as increased risk of diseases or rises in the production of stress-related hormones, may serve as indicators of unfulfilled needs.

With such objectively measurable indicators it becomes possible to make more adequate comparisons in terms of welfare taking into account the intensity, duration and incidence of a welfare problem. The higher the incidence of abnormal behaviour, the stronger apparently the frustration; the more animals suffer from diseases, the greater the disparity between reality and the desired state. The longer an animal shows evident signs of stress, the more structural the failure to meet the norm.

But measuring objectively the intensity of some of these indicators remains less easy. Is an aching leg more intense than stereotyped but painless behaviour? Therefore, in practice intensity has to be determined by a variety of biological measures: diseases, injuries, abnormal forms of behaviour or decreases in production being but a few. The intense pain of a lame calf will quite probably weigh heavier than just not being able to behave normally, such as to play and to groom another calf.

When all indicators are combined, they offer a fairly reliable and objective picture of the degree to which animal welfare is reduced. According to the writers, the theoretic model as a
whole makes it possible to compare and weigh complex situations, even when each of them comprises both positive and negative aspects.

Livestock farming
To try the workability of the present model, it was applied to examples in Dutch livestock farming — the housing of cattle, pigs and chickens. The examples were not selected randomly: these three animal species collectively inhabit the vast majority of Dutch housing systems, and account for an estimated three-quarters of all animals kept in the Netherlands, including animals kept as pets and those used for testing in laboratories.

In order to apply the model to these farming sectors, a large number of data were charted first. Thus, to begin with, for all three species the environment of evolutionary adaptation had to be established, in the form of a long list of elementary needs. Many of these needs are already known from scientific research: thus, choice experiments show that chickens are very keen to lay their eggs in nests, so keen, in fact, that they are prepared to endure all manner of discomfort to achieve this.

The next step was an assessment of the various housing systems: the most common systems in the Netherlands were included in the analysis. For each feature —like space, group size, floor or lighting, but also availability of food, water and medical care— it was established to what extent it may impair the fulfilment of needs. Here, too, use was made of existing scientific research: for pigs, to mention just one example, numerous measurements of hormones in blood have indicated which conditions can arouse physical stress.

By integrating and combining all the collected data, the relevant housing systems could then be assessed in terms of reductions in animal welfare. The result of this analysis was recorded in elaborate tables ranking different forms of animal welfare reductions. The tables show, for instance, which design features have the strongest impact on animal welfare, and which types of housing, judged by animal welfare, are preferred. The detailed tables, incidentally, are still largely tentative — as yet they should be seen as a start, based on the opinions of animal welfare experts and not yet corroborated in all respects by scientific experiments.

The tables at the end of this summary are a brief representation of part of the results. The results of the analysis immediately justify a number of conclusions. Thus, it turns out that in the sectors that were studied housing systems are used that may considerably reduce animal welfare. For some sectors it appears that, for the systems studied, the most common type also caused relatively the biggest animal welfare problems. Such conclusions, together with the results in the extended tables, may facilitate societal debates on animal welfare. At the same time they can be used, both by farmers and by the government, to set priorities for improving animal welfare.

Priorities
According to the present ‘blueprint’-model, the ideal housing system does not only provide the animal with proper food, an agreeable climate, protection against enemies and medical care – in short the classical benefits of our domesticated animals. It also offers the variation and richness of the natural environment to which the animals are adapted in the course of evolution. In addition, for optimal welfare the process of selective breeding for production traits should not have gone too far.

In today's world, however, housing and husbandry must also meet economic requirements — it is obvious that in livestock farming animals are kept for production. In the real world, the ideal housing system is therefore probably impracticable. Every conceivable housing system or fence restricts some needs — whether it is the possibility to move, to rest, to eat, to drink,
to shelter, to play, to fight, to impress, to mate, to bear young, to urinate at the desired place or to freely explore the surroundings. Yet, despite these restrictions, it is possible to aim at an optimal degree of animal welfare. To this end, this analysis offers a rough indication for a direction: by and large, housing systems with adequate space to move, litter-covered floors and opportunities for a stable social structure are less harmful to welfare. However, the model also shows that improvement of animal welfare need not by definition lead to free-range systems or extensive, organic farming. Intensive forms of livestock farming may also provide animals with proper welfare, assuming that they meet the most important animal needs. A cow with a daily milk production of dozens of litres, might well be better off with an advanced, automatic milking robot than with a farmer who milks his cows twice daily in the traditional way.

These concrete applications of the theoretical model to assess animal welfare at least demonstrate its practical workability. Identifying basic animal needs and measuring how the frustration of those needs can undermine welfare, may help to detect the most serious welfare problems, to set priorities for the improvement of welfare and to structure the social debate.
Tables 1-3: Per sector the type of housing most common in the Netherlands, and the most serious welfare problem found. In the underlined sectors, the most common type of housing is also judged to be the most harmful to welfare. NB: For a correct interpretation of this table, it is recommended that the underlying tables are studied as well.

### 1. Cattle

<table>
<thead>
<tr>
<th>Sector</th>
<th>Most common type of housing</th>
<th>Most important welfare problems</th>
</tr>
</thead>
<tbody>
<tr>
<td>Dairy cattle</td>
<td>Cubicle house, with more or less stable group of cows; moving freely on concrete, partly slatted floor; separate milking parlour; roughage fed at feeding gate; computer-controlled concentrate feeder; grazing during summer.</td>
<td>Leg problems, lameness; mastitis; behavioural restrictions (e.g. restricted movements due to slippery floors).</td>
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<tr>
<td>Fattening bulls</td>
<td>Pen with 8 to 10 bulls; concrete slatted floor; 2,5 m² per animal.</td>
<td>Lameness; behavioural restrictions, restlessness, stereotypies.</td>
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<tr>
<td>Veal calves</td>
<td>Individual housing during first 6 to 8 weeks; then stable group of 5 to 6 calves, 1.3 m² per animal; wooden slatted floor; food: milk replacer with some roughage.</td>
<td>Behavioural restrictions (qua play); health problems (lameness, stomach lesions, anaemia, reduced vitality); stereotypies (sucking at pen fittings or other calves, urine drinking).</td>
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</tbody>
</table>

### 2. Pigs

<table>
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<th>Sector</th>
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</thead>
<tbody>
<tr>
<td>Pregnant sows</td>
<td>Individually tethered or stalled in a box of 60x200cm; concrete floor, partly slatted, without litter; restricted amount of feed.</td>
<td>Stereotypies; hunger; behavioural restrictions; aggression towards inaccessible, neighbouring sows.</td>
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<tr>
<td>Lactating sows</td>
<td>Sow: Artificially ventilated pens of 200x200cm; partly slatted floor; sow individually tethered or stalled. Piglets: litter of 10 piglets in a pen of 4 m², including the sow stall; heated nestsite of 0,6 m² with some sawdust.</td>
<td>Sow: behavioural restrictions (qua nestbuilding and movements). Piglets: Health problems; abnormal social development; mutilations such as castration and tail docking.</td>
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<tr>
<td>Weaned piglets</td>
<td>Ten piglets (weaned at 4 weeks of age) in pen of 3 m²; slatted floor without litter; semi-dark.</td>
<td>Stress due to early weaning; persistent belly-nosing of penmates in an attempt to satisfy the need to suck; behavioural restrictions (qua play and exploration).</td>
</tr>
<tr>
<td>Finishing pigs</td>
<td>Ten pigs in pen of 7 m²; concrete, partly slatted floor without litter; semi-dark; food permanently available.</td>
<td>Tail biting; behavioural restrictions (qua play, rooting, exploration, using a separate dunging area).</td>
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### 3. Poultry

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</thead>
<tbody>
<tr>
<td>Laying hens</td>
<td>Battery cage: 4-5 hens in a cage; 450 cm² per hen; wire floor; eggs automatically removed.</td>
<td>Behavioural restrictions (qua ground pecking, scratching); abnormal behaviour (qua dustbathing, fear, social stress); health problems (poor plumage, weak bones); possibly chronic pain from trimmed beak.</td>
</tr>
<tr>
<td>Broiler breeders</td>
<td>Housing systems with 7 hens and a cock per m²; partly wire, partly littered floor; laying nests.</td>
<td>Stereotypies or disturbed behaviour (hyperactivity, hunger, aggression, social stress, fear); increased mortality; lameness; possibly chronic pain from trimmed beak.</td>
</tr>
<tr>
<td>Broilers</td>
<td>Barn with 20 broilers per m²; littered floor; sometimes 24 hours light.</td>
<td>Lameness; low activity; sudden death; metabolic disorders.</td>
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</table>