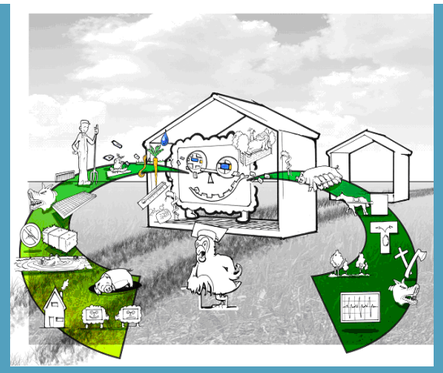
ANIMAL SCIENCES GROUP
WAGENINGEN UR

Visualisation of the scientific framework and semantic modelling



The animal can respond in a number of physical ways, namely with behaviour and physiology. The icons to the right illustrate various welfare disciplines to measure these welfare responses: veterinary medicine, animal science (studying growth and reproduction), consumer demand (studying how hard animals will work for a reward), preference testing, (evolutionary) biology (studying survival and fitness), the study of abnormal behaviour, aggression, and stress-physiological research.

The animal and its environment are subject to change. This is represented in the figure by the road from 'past to future'. Political decision making and developments in the sector determine the 'route'.
The scientist (visualised in the middle by the 'wise' parrot) takes measures of the relationships between input (left) and output (right-hand side), but it is also possible to put this information into a computer model. The 'animal' in the figure can therefore be seen as a computer model. Like an animal, a semantic model also receives input (e.g. a description of a housing system) and generates output (a welfare score) by weighing available information. Furthermore, a model, too, is 'on the road' from past to future: at first the model is in development, later it can be used, and may perhaps be improved with new knowledge that has become available. The figure, thus, represents a multitude of closely related aspects that are of crucial importance for a proper assessment of animal welfare.

The utility of 'semantic modelling'

Techniques and insights from semantic modelling have been useful for developing monitoring programmes for animal welfare, and, more generally, for making ethical and political choices. The enrichment model (RICHPIG), for example, was used to implement the EC directive on enrichment materials in the Netherlands. In addition, the modelling work can indicate directions for new research, and validation studies have generated valuable insights concerning the way we think about animal welfare. For example, welfare researchers showed more consensus about overall concepts (such as housing systems and enrichment materials) than about the weighting of their components. This may appear self-evident, but this is not always recognised. Legislation, for example, often focuses on components (a few cm2 more or less per animal) and this often results in a lot of discussion. More attention to overall concepts, including the possibility of welfare compensation according to the principles of semantic modelling, could improve support for measures aimed at improving animal welfare.

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Semantic modelling of animal welfare

What constitutes good animal welfare has been discussed for years. Animal welfare legislation has been revised regularly. Progressive insights in science lead to increasing complexity of ethical and political decision making. At the same time technological developments facilitate disclosing large amounts of information.

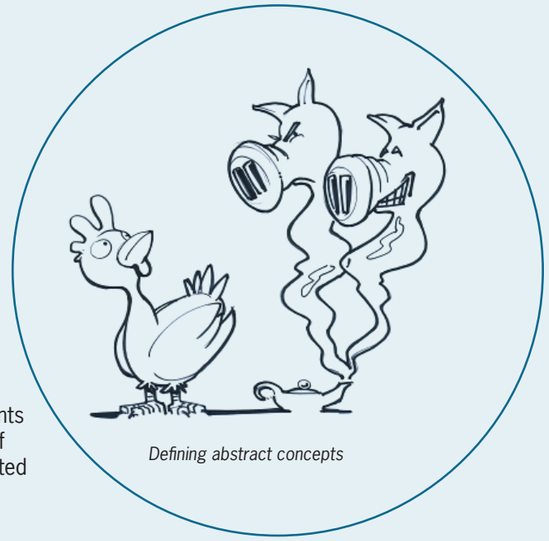
The demand for transparency (e.g. labelling of animal products and decisions to use laboratory animals) and the growing body of scientific knowledge about animal welfare lead to the need for a method that can translate facts into integrated welfare judgements, such that better supported decisions can be made.

Definition

For many years the Animal Sciences Group of Wageningen University and Research Centre has conducted research examining the effects of environmental variables on the behaviour and physiology of animals. The methodology and outcomes of such research may sometimes be difficult to understand for non-scientists. Semantic modelling can help support decision making, e.g. for policy making, monitoring of animal welfare and system design. The word ‘semantic’ indicates that the scientific interpretation of information is of central importance (semantics = meaning). In semantic modelling, generally-accepted scientific knowledge about animal welfare is collected and integrated into an assessment model in a database in a systematic and transparent way, such that the welfare status can be expressed with a score on a scale from 0 to 10.

How are semantic models made?

First, underlying assumptions and value judgements are made explicit. Welfare is defined, for example, as the quality of life as perceived by the animals themselves. Next, an outline is made of the scientific conceptual framework that can be used to interpret and analyse factual statements with biological principles into a model for integrated and quantitative welfare assessment.
Animal welfare is described as a function of the state of the different biological needs of the animals, such as the need for food, water, thermal comfort, movement and social contact.
The final model contains so-called assessment criteria and their weighting factors, both of which are derived from scientific statements collected in the database. The system is calibrated with a number of strategically chosen scenarios, for which welfare scores are calculated with the model.



Defining abstract concepts

All information is collected in tables in a relational database. This makes the assessment process, from premises to final conclusion, not only optimally transparent but also flexible, such that the model can easily be upgraded when new knowledge becomes available.

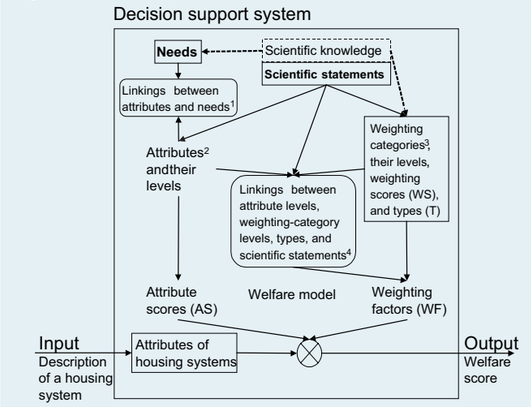
Collecting scientific information

Animal welfare defined as the quality of life
As perceived by the animal itself

Existing models and their validity

Various aspects of animal welfare have been described with semantic models. There are models to assess the welfare status of pregnant sows and laying hens in different housing systems (these models are called SOWEL and FOWEL respectively). There are also scientific publications of models to assess the risk for tail biting (PIGTAIL) and the value of enrichment materials for pigs (RICHPIG). Individual housing for pregnant sows, for example, received a very low score, while various group housing systems had much higher scores.
These assessments were found to correspond with the opinion of an international panel of welfare scientists.
Validation of semantic models does not only include comparing model scores with expert opinion, it also includes systematic (sensitivity) analysis and (new) animal experiments.
Until now semantic models have mainly been applied for welfare assessment in pigs and poultry, but models may also be developed for other species such as fish, pets and laboratory animals.

Figure 1 M4 Description



Structure of the SOWEL model

Visualisation of the scientific framework and semantic modelling

An animal perceives various aspects of its environment. These aspects are shown in the figure below, on the left side. From bottom to top the icons refer to: pen mates, safety, rest, the (in)ability for wallowing (in pigs; dust bathing in fowl; water for fish, etc.), enrichment material, a separate place for dunging (for animals such as pigs which prefer such a place), space, (presence or absence) of aggressive pen mates, the ability to groom, a stockperson (farmer), possibilities for breeding (and e.g. to build a nest), food, water, thermal comfort (a pleasant temperature), hygiene and health. All these aspects can be present or absent in the animal’s environment in various degrees. Subsequently, the animal weighs the incoming information from the environment (incoming through the left eye) against the welfare needs (visualised in the right eye in the figure). Welfare needs are mainly the product of evolution, but are also affected by early-life experiences.